Mass Combi Ultra

12/3000-150, 24/3500-100, 48/3500-50

MULTI PURPOSE CHARGER INVERTER

EN

USER'S AND INSTALLATION MANUAL

10000006554/02

MASTERVOLT
THE POWER TO BE INDEPENDENT

OVERVIEW MASS COMBI ULTRA

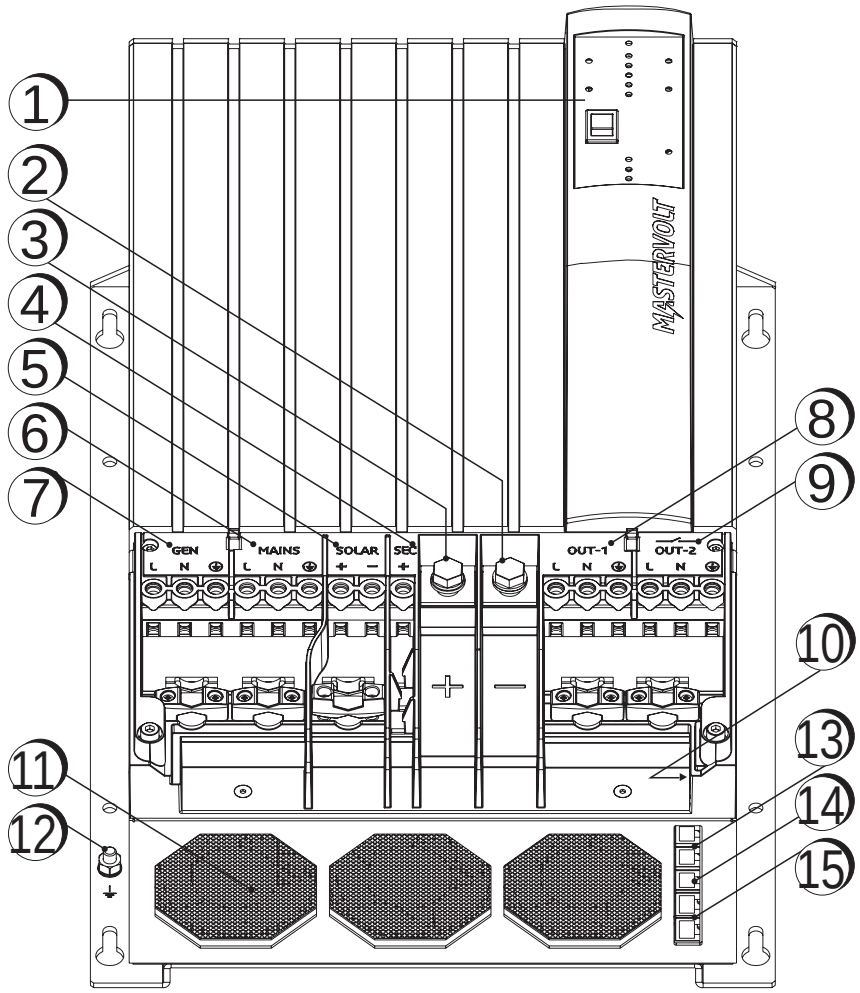


Figure 0-1: Overview of the Mass Combi Ultra

1. Display with front switch	6. Mains AC input terminal	11. Fan (3x)
2. Main battery negative	7. Generator AC input terminal	12. Ground stud
3. Main battery positive	8. AC output 1	13. Sync connector (2x)
4. Secondary battery positive	9. AC output 2 (switched)	14. Temperature sensor connector
5. Solar DC terminal	10. DIP switch units (2x8)	15. MasterBus connector (2x)

TABLE OF CONTENTS:

1 GENERAL INFORMATION

1.1 Product description

The Mass Combi Ultra is a multifunctional charger inverter. It inverts or surpasses energy from mains (shore), AC generator, DC from the battery and a PV installation. It is also able to charge the main battery bank and an optional secondary battery.

1.2 Use of this manual

This manual serves as a guideline for the safe and effective use and installation of the Mass Combi Ultra, also called Combi Ultra further in this manual:

- 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 models:

Part no	Model
38013000	Mass Combi Ultra 12/3000-150
38023500	Mass Combi Ultra 24/3500-100
38043500	Mass Combi Ultra 48/3500-50

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

1.4 Scope of warranty

Mastervolt assures the product warranty of the Mass Combi 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 Combi 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 Combi Ultra;
- possible errors in the manuals and the results thereof.

1.6 Changes to the Mass Combi Ultra

Changes to the Mass Combi 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 Combi 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 Soladin 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 Combi Ultra is constructed as per the applicable safety-technical guidelines.
2 Use the Mass Combi Ultra only:
- for the charging of batteries and the supply of loads attached to these batteries, in permanent systems;
- for the conversion of battery DC voltage to AC voltage.
- connected to a dedicated double pole circuit breaker and RCD.
- with fuses, protecting the Combi Ultra AC and DC wiring;
- 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 Combi Ultra in situations where there is danger of gas or dust explosion or potentially flammable products!

3 Use of the Mass Combi 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 Measures.

2.4 Warning of special dangers

1 If the Mass Combi Ultra is switched off during maintenance and/or repair activities, it should be secured against unexpected and unintentional switching on:
- remove the AC supply
- 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 Combi 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 Combi Ultra in a non-ventilated area, overheating results.
- The Mass Combi Ultra must be provided with an equipment grounding conductor to the AC-input 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, Combi Ultra and wiring. Fuses between batteries and Combi Ultra cannot prevent damage caused by reversed polarity and warranty will be void.
- Protect all 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 Combi 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 Combi 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 5.5, the cabinet of the Mass Combi 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 Combi 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 Combi 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 Combi 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 Combi Ultra should only be undertaken by authorised personnel!

3 HOW IT WORKS

The Mass Combi Ultra is a multifunctional charger inverter. It combines an inverter, a battery charger with secondary (small) charger, an AC transfer switch and a solar charger.

3.1 Principle

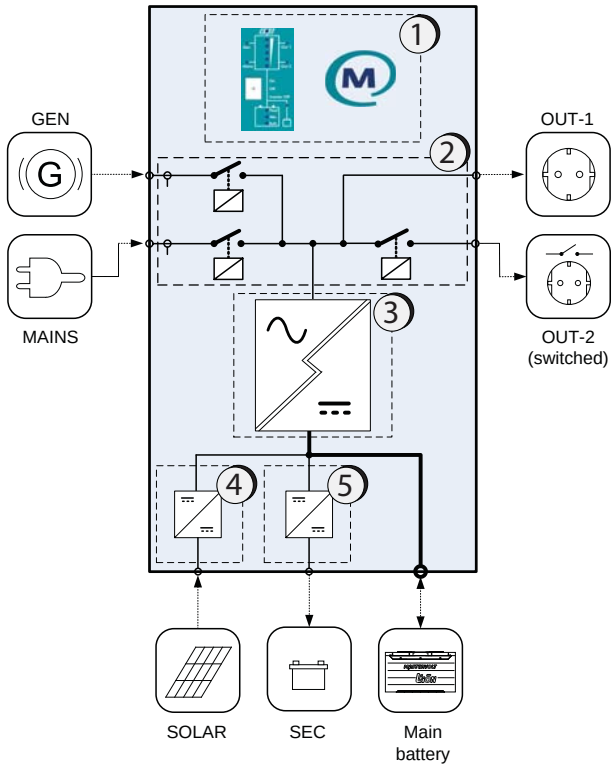


Figure 3-1: Working principle of the Mass Combi Ultra

3.1.1 User interface (1)

The Mass Combi Ultra user interface consists of a front switch with status LEDS and MasterBus communication.

3.1.2 AC transfer switch (2)

This part of the Mass Combi Ultra regulates the AC energy flow through the device. The GENerator and MAINS input are switched, as is OUTput 2. All AC is connected to the inverter (3). If the MAINS plug is disconnected and the Generator is not running, the inverter takes over using battery power to provide AC power.

3.1.3 Inverter/ Main charger (3)

This part converts the AC power to DC for charging of the main battery and it inverts the DC power from the battery to supply AC to Output 1 and 2.

3.1.4 Solar charger (4)

The PV (Solar) input is a high voltage DC input. This voltage is converted to the proper DC voltage for battery charging.

3.1.5 Secondary charger (5)

The secondary battery charger is suitable for a secondary battery set or as power supply. The batteries act as a DC input and DC output for the Mass Combi Ultra. Energy from the other inputs can be converted to DC for charging the batteries. And if necessary the battery DC can be inverted to provide AC power.

3.2 Battery charger

The built-in battery charger is electronically controlled. It is designed for optimal recharging of lead acid (flooded, gel, AGM) and Li-ion batteries. Battery charging via AC or Solar input is accomplished with Mastervolt's 3-Step Plus charging algorithm. With an external AC source connected, the Mass Combi Ultra charger also serves the functions of an AC to DC converter to supply DC loads which are connected to the batteries. Simple, automatic operation is enabled by the microprocessor that is the brain of the inverter/charger combination.

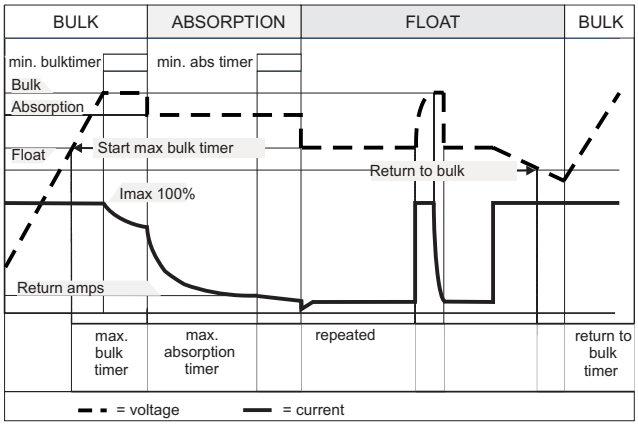


Figure 3-2: Three step Plus charge system

3.2.1 Three step Plus charge system

See figure 3-2. The first step of the three step Plus charge system is the BULK phase, in which the output current of the charger is 100%, and the greater part of the battery capacity is charged rapidly. The current charges the batteries and gradually the voltage rises to the absorption voltage, refer to the specifications. The duration of this phase depends on the ratio of battery capacity to charger current, the loads connected and the degree to which the batteries were discharged to begin with.

The bulk phase is followed by the absorption phase. Absorption charging ends when the battery is completely full. Battery voltage remains constant throughout this stage and the charge current decreases during charging of the battery. With a wet cell battery this stage lasts some four

hours, with gel and AGM around three. Once the battery is 100% full or when the maximum bulk timer has passed, the charger automatically switches over to the float phase.

During the float phase the Mass Combi Ultra switches to Float voltage, refer to the specifications, and stabilises this voltage to maintain the batteries in an optimum condition. Connected DC-loads are powered directly by the charger. If the load is higher than charger capacity, the required additional power comes from the battery, which will be progressively discharged until the charger automatically switches back to the bulk phase. Once consumption decreases, the charger goes back to normal operation of the three-step charge system.

As the Mass Combi Ultra is equipped with a three-step Plus charge system, the batteries can also remain connected to the Mass Combi Ultra in winter. One hour every 12 days the charger automatically switches to absorption to keep the battery working properly and prolong its life span. The three-step Plus charge system is also safe for all the connected equipment.

3.2.2 Temperature compensated charging

The Mass Combi Ultra is delivered with a battery temperature sensor. By installing this battery temperature sensor (for Lead Acid batteries only) the charge voltages are automatically adapted for deviating temperatures. 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. Overcharge and gassing are prevented this way. This will extend the life of your batteries.

3.2.3 Connection of a secondary battery

The Mass Combi Ultra is equipped with a secondary charge output to use for charging a small battery set like a starter battery. If the main battery nominal voltage is 24V, the secondary battery can be 24V or 12V. Maximum output current as power supply or battery charger: 10 Amps.

3.3 Inverter

3.3.1 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.

3.3.2 Energy saving mode (selectable)

In the inverter mode the Mass Combi 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 A4, refer to chapter 6, Configuration.

The Mass Combi Ultra scans the AC outputs with pulses of 230V 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.

3.4 Operation modes

The Mass Combi Ultra is not just a combination of an inverter and a battery charger. Many additional features help to increase the total available AC power. In the next sections, nine different main operation modes are described. Most of these modes can be combined, refer to section 3.4.10. You can enable these modes by means of either front switch, DIP switches or the MasterBus user interface. All modes are enabled by default except for the Gen/Mains supporting mode as there are regulations in some countries that do not allow this. After enabling by the user, becoming "active" of a mode is determined by the Mass Combi Ultra itself based on AC and DC power availability, battery state of charge and configuration (Chapter 6, Configuration).

3.4.1 Generator input mode

See figure 3-3. In Generator input mode, the Generator switch connects and the Mains switch is open (no connection). AC input comes from the generator only.

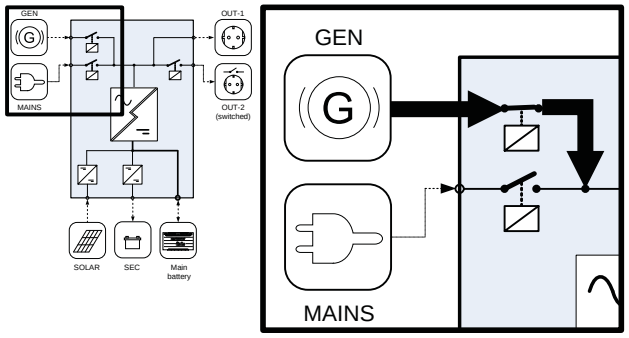


Figure 3-3: Generator input mode

3.4.2 Mains input mode

See figure 3-4. In Mains input mode, the Generator switch is open (no connection) and the Mains switch connects. AC input comes from Mains only

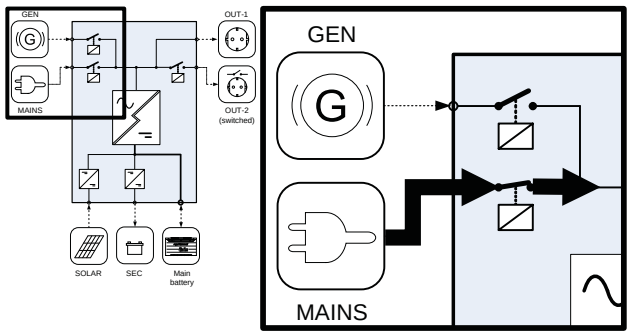


Figure 3-4: Generator input mode

3.4.3 3.4.3 AC Output-2 enabled mode

See figure 3-5. In AC Output mode the switch of Output-2 connects. It can disconnect the heavy loads like electric boilers, to prevent depleting of your batteries.

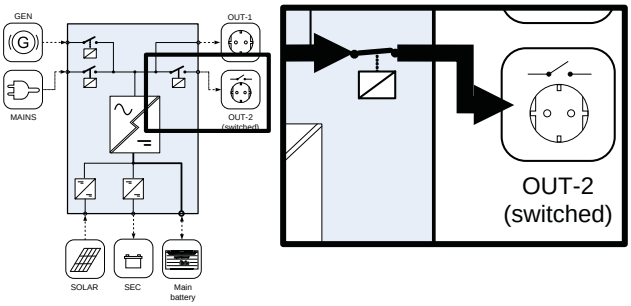


Figure 3-5: AC Output-2 enabled mode

3.4.4 Inverting mode

See figure 3-6. In this mode the Main battery DC voltage is inverted to an AC voltage that is fed into the AC transfer system and always available on AC output-1.

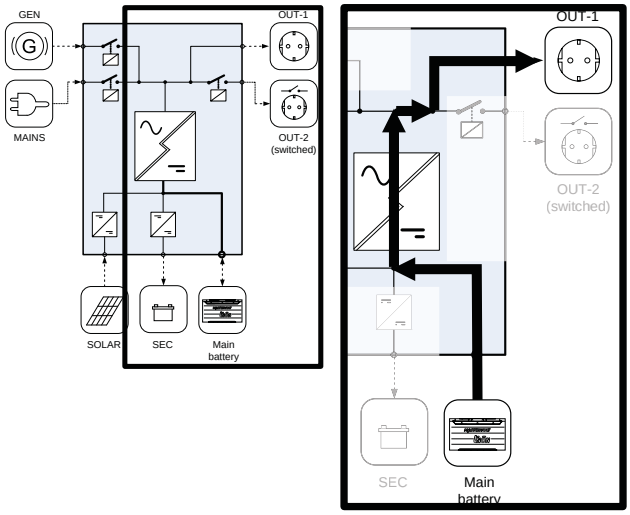


Figure 3-6: Inverting mode

3.4.5 Gen/Mains support

See figure 3-7. If the total demand for energy is in danger of exceeding the maximum available/ allowed power supply, the Mass Combi Ultra can be configured to step in by inverting battery power to AC power. This option is called Generator / Mains supporting mode. Refer to the specifications for information on how much AC power your Combi Ultra model can add.

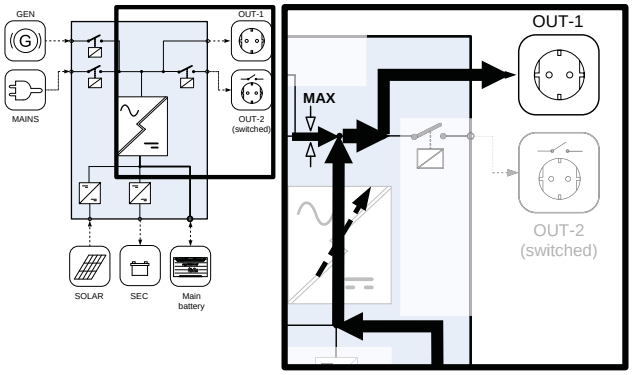


Figure 3-7: Gen/Mains supporting mode

With the Generator / mains support mode enabled, the inverter will operate in parallel with the external AC power source. This means that energy from the batteries is added to the AC-output only. Under no circumstances AC power from the inverter can be fed back into the AC grid. Please mind that several countries maintain different regulations with regard to AC-sources operating in parallel with the AC-grid. This may mean that in some situations the use of the Generator / Mains support function is not allowed. Please acquaint yourself with local regulations on this issue. Never use the Generator / Mains support mode if this is not allowed!

3.4.6 Charging mode

See figure 3-8. In this mode, the AC power from Generator and/or Mains is converted to DC for main battery charging.

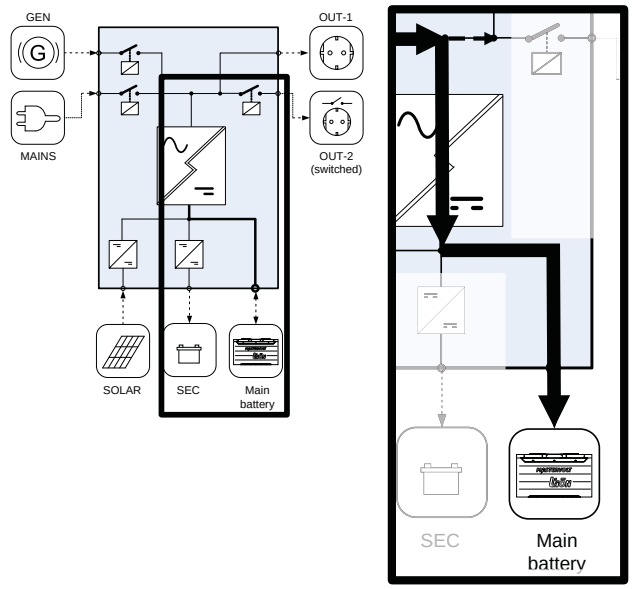


Figure 3-8: Charging mode

3.4.7 Power sharing mode

See figure 3-9. If the available power at the AC-input is limited, and the load connected to the AC outputs increases, the external AC circuit breaker may trip if nothing is done. To avoid this, the Mass Combi Ultra can automatically reduce the battery charger output, and thus the AC power consumption. This Power sharing feature constantly measures the AC input current which is used to supply both the battery charger and the loads connected to the AC outputs.

The Power Sharing level should be set to match the value of the external circuit breaker, which protects the incoming AC wiring. For instance, when the external AC power is limited by a 6A fuse, the Power Sharing level must be set to 6A as well.

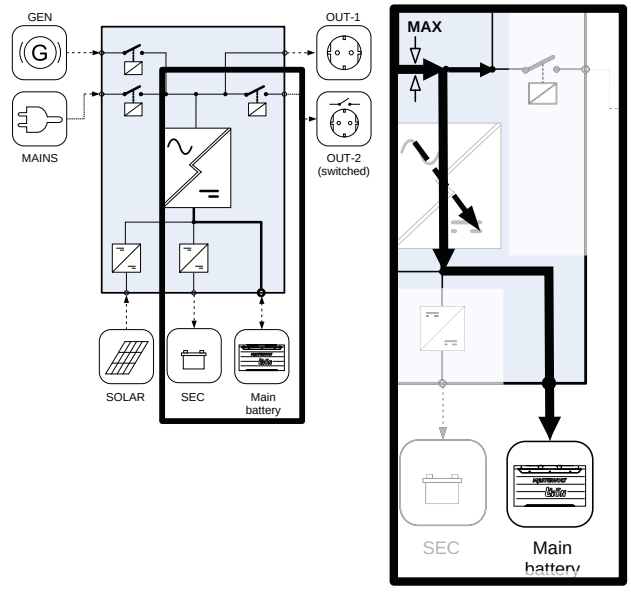


Figure 3-9: Power sharing mode

Example: the Power Sharing level is set to a 6 Amps while the AC outputs consume a total of 4 Amps. This means that 6 – 4 = 2 Amps AC is left over for charging. With 24V batteries this will result in a maximum charge current of approx. 15 A DC.

3.4.8 Solar charging mode

See figure 3-10. In this mode, the DC voltage coming from a Solar panel is converted to DC for battery charging. Refer to the specifications for allowable Solar string voltages. The available solar charge current will be added to the main charger current during the Bulk phase. Available solar charging current during Absorption or Float is preferred over main charger current to utilise your solar panels optimally.

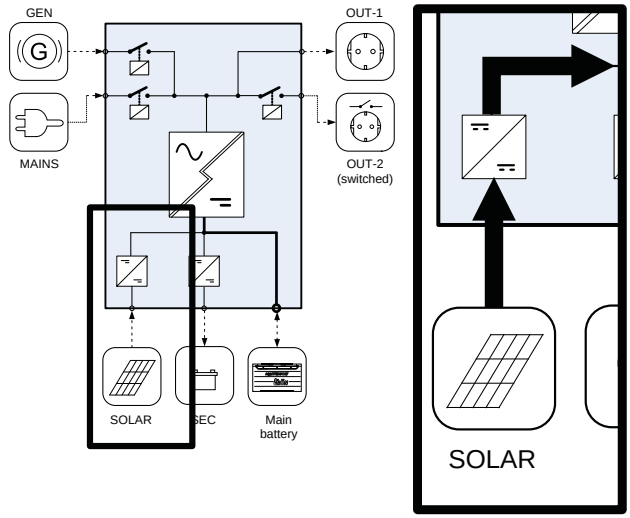


Figure 3-10: Solar charging mode

3.4.9 Secondary charging mode

See figure 3-11. In this mode, the secondary charge output is active either by charging a secondary battery or providing DC power taken from the main battery in the Mass Combi Ultra

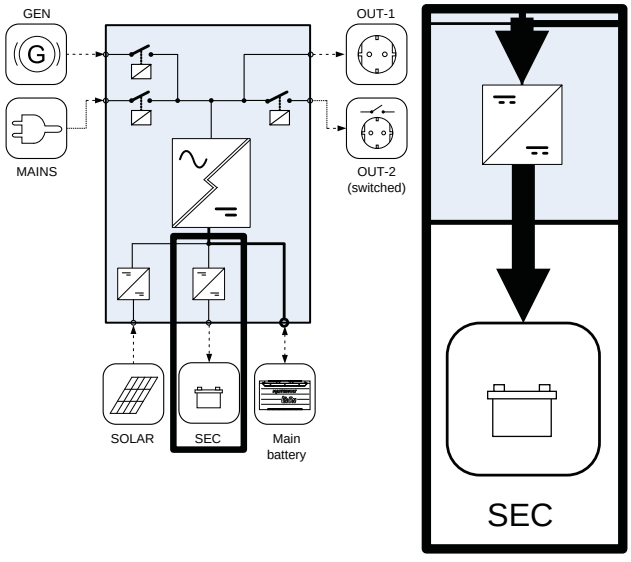


Figure 3-11: Secondary charging mode

3.4.10 Allowed operation mode combinations

The Mass Combi Ultra is multifunctional thanks to the ability of performing multiple operation modes at the same time. Some of the operation modes described before cannot be combined. As you see in figure 3-12, the Generator input mode cannot be combined with the Mains input mode. That is because the generator AC voltage must be in phase (synchronized) with the mains AC voltage, which cannot be guaranteed.

The inverting mode cannot be combined with the Gen/Mains supporting mode

Generator input mode	Mains input mode	AC Output-2 enabled mode	Inverting mode	Charging mode	Solar charging mode	Secondary charging mode	(Gen/Mains) supporting mode	Power sharing mode	
■	✗	✓	✗	✓	✓	✓	✓	✓	Generator input mode
	■	✓	✗	✓	✓	✓	✓	✓	Mains input mode
		■	✓	✓	✓	✓	✓	✓	AC Output-2 enabled mode
			■	✗	✓	✓	✗	✗	Inverting mode
				■	✓	✓	✗	✗	Charging mode
					■	✓	✓	✓	Solar charging mode
						■	✓	✓	Secondary charging mode
							■	✗	(Gen/Mains) supporting mode
								■	Power sharing mode

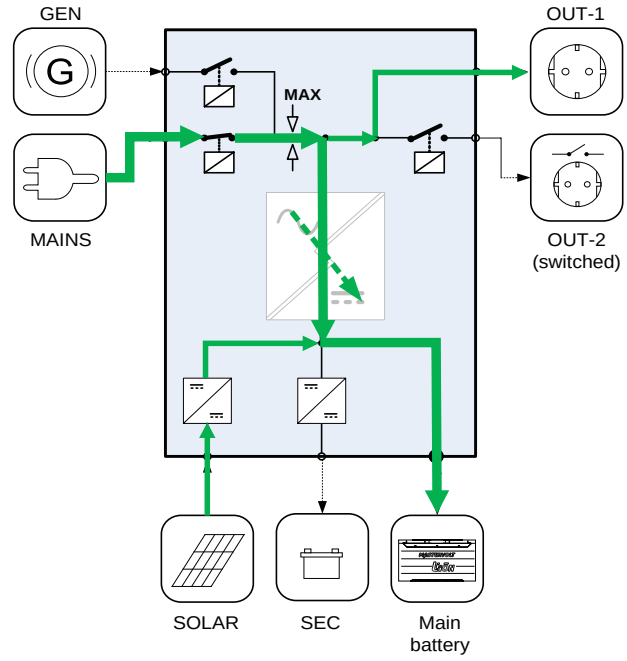
Figure 3-12: Allowed (V) operation and not allowed (X) mode Combinations

3.4.11 Operational example

Figure 3-13 shows as an example the energy flow of three modes combined:

- Mains input mode
- Power sharing mode
- Solar charging mode

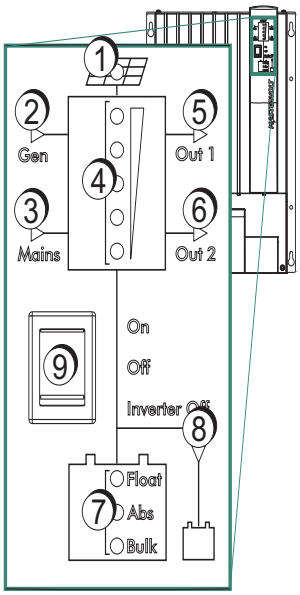
The Mains input is mainly used to charge the battery and also supplies AC power to Output-1. The mains input is utilised maximally as the Power sharing mode is reducing the charging current to the main battery. The solar energy available is used to fill up the main charging current.



Mains input mode	✓
Power sharing mode	✓
Solar charging mode	✓

Figure 3-13: Combined modes example

4 OPERATION



1 Solar charging LED, refer to section 4.1.1.
2 Generator input LED, section 4.1.2.
3 Mains input LED, section 4.1.3.
4 Power bar LEDs, section 4.1.4
5 AC Output-1 LED, section 4.1.5.
6 AC Output-2 LED, section 4.1.6.
7 Charge bar LEDs. During charging: charging state. 4.1.7
8 Secondary charging LED, 4.1.8
9 Main switch. It has three positions: On (up), Off (mid) and Inverter Off (down).

Figure 4-1: Front panel

4.1 LED indicators

See figure 4-1. The operation of the Mass Combi Ultra is displayed by means of LED indicators at the front side of the housing. If the Mass Combi Ultra is activated and as long as none of the red indicators are illuminated, no failure is detected and the unit is operating normally.

4.1.1 Solar charging LED

See figure 4-1 item 1. The illuminating top LED indicates there is a DC input from the PV system. This input is used to charge the secondary battery after converting the voltage.

- On: PV input,
- Off: no PV input,
- Blinking: standby, solar voltage out of range.

4.1.2 Generator input LED

See figure 4-1 item 2. The arrow is illuminated to indicate the AC from the generator is connected

- On: generator input,
- Off: no generator input,
- Blinking: synchronizing,
- Blinking fast: generator input out of range.

4.1.3 Mains input LED

See figure 4-1 item 3 and 4-3. The arrow is illuminated to indicate there is power input from the Mains connection.

- On: mains input,
- Off: no mains input
- Blinking: synchronizing,
- Blinking fast: gen input out of range.

4.1.4 Power bar LEDs

See figure 4-1 item 4. These LEDs have a double function, depending on the mode the Combi Ultra is in.
During charging: charge current (20% of nominal charge current per LED).
During inverting: 20% of nominal inverter power per LE D).
If the upper LED illuminates red, the inverter is in overload.
On: inverting, Off: not inverting.

4.1.5 AC Output-1 LED

See figure 4-1 item 5. The illuminated arrow indicates that AC Output-1 is powered.

4.1.6 AC Output-2 LED

See figure 4-1 item 6. The illuminated arrow indicates that switched AC Output-2 is powered.

4.1.7 Charge bar LEDs

See figure 4-1 item 7. The 3-LED bar has two functions.

- During charging it indicates two items: the walking LEDs indicate charging is present, the highest LED illuminating indicates the charge state (Bulk, Absorption or Float). E.g. in Absorption, next 1-second instances occur: All LEDs off, Bulk LED on, Bulk and Absorption LED on, All LEDs off again, etc.
- During inverting the LEDs are illuminated continuously. Then the ABS LED indicates a battery voltage of 1

4.1.8 Secondary charging LED

See figure 4-1 item 8. The illuminating arrow indicates the secondary battery is being charged.

- On: charging,
- Off: not charging,
- Flashing: error.

4.1.9 Switching on

See figure 4-1 item 9. The only control on the Mass Combi Ultra itself is the main switch on the front of the unit. This switch controls On, Off and Inverter Off (Charger only). Switching the main switch or an optional remote control panel to the “ON” position activates the Mass Combi Ultra.
After switching On, expect a three till five second delay before the unit is activated.
With the main switch in position “On“, the Combi Ultra inverter can also be switched Off and On via MasterBus.
If AC power is available on the AC input and within the specified limits, the Mass Combi Ultra switches On in Charger Mode and will start to charge the batteries. If the AC power from the external AC-source is unavailable or outside the specified limits, the unit switches On as an inverter.

4.1.10 Switching Off

Move the main switch or the optional remote control panel to the “Off” position to switch off the Mass Combi Ultra.

4.1.11 Switching Inverter Off

If the main switch is set to the Inverter Off-position, the Mass Combi Ultra is only able to work as a charger. This means that the inverter mode is disabled. This setting is useful if you want to keep your batteries charged and maintained in case you have left i.e. in the winter time. Now your batteries are saved when the incoming AC-source fails in operation.
If the AC-source is available and the Mass Combi Ultra is operating in the charger mode, the user panel shows the actual status of the system.

4.2 Protections

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

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

4.2.1 Output overload or short circuit

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

4.2.2 Overheating

In the event of overheating the Mass Combi Ultra inverter shuts down, the charger reduces charge current. 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).

As soon as the temperature drops below the factory default threshold, the inverter is powered up automatically or the charger resumes its charge current.

4.2.3 Under and over voltage

The AC-input of the Mass Combi Ultra is, within limits, protected against over and under voltage. See specifications. If the AC-input voltage is out of operating range, the Mass Combi Ultra will switch to inverter mode, disconnecting both AC inputs and it will switch back if the AC-input voltage is within range again. The DC-input of the Mass Combi is also protected against over and under voltage. See specifications. The Mass Combi Ultra switches off if the DC-input voltage is out of range.

4.2.4 Dynamic DC input window

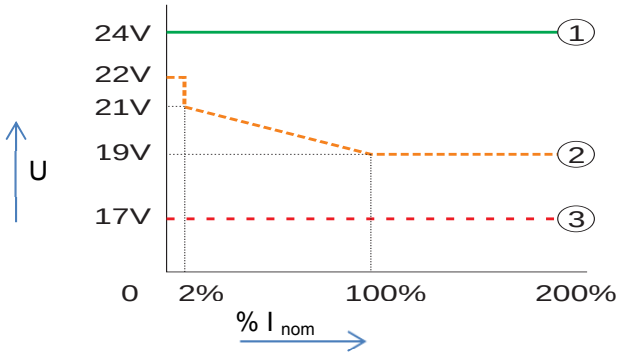


Figure 4-2: Dynamic DC input window

The Mass Combi 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 inverter off at higher voltages with lower currents, your batteries are saved.
Shown in figure 4-2 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 inverter switches On.
(2) Low voltage switch off with delay. Under this line the inverter 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 inverter switches off without delay.

4.3 Operation policies

Via MasterBus configuration, the preferred behaviour of AC in and outputs can be set.

4.3.1 AC input policy

Preference	Description
Mains preferent	Mains input is preferred
Gen preferent	Generator input is preferred
Max fuse preferent	AC source with highest fuse setting
Mains only	No generator
Generator only	No mains

4.3.2 AC Output-2 policy

Preference	Description
Events only	Operation manually
Generator input	Generator input only
Mains input	Mains input only
Gen/mains input	Generator or main input
Always on	Always connected to the loads

AC Output-2 can always be switched On via events. In Events only it can also be switched Off. In the other preferences, for instance Always on, it cannot be switched Off.

4.3.3 Secondary charging policy

Secondary battery charging takes place:

- Activated by the Force sec charge event (section 6.2.3)
- When charging from AC input
- When set to a constant voltage (section 6.1, 6.2)

4.4 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 Combi Ultra. Do not use any liquids or corrosive substances, such as solvents, alcohol, petrol or abrasive components.

4.5 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 Combi Ultra monitoring values. The values with a default value are adjustable

Value	Meaning	Default	Range
General			
Device state	The state of your Mass Combi Ultra		Standby; Inverting; Alarm; Charging; Supporting; Overload; Low battery
Mains fuse	Mains fuse rating	25A	1..30A
Inverter	Option to switch Off the inverter to prevent depleting of your batteries.	On	On, Off
Mode	User mode		Initializing; On; Standby; Inverter off; Charger off
AC in state	State of the AC input		No AC present, Generator, Mains, Poor quality
AC out state	State of the AC output		No AC output, AC out1 only, AC out1&2
Main charger	Main charger state		On; Off
Sec. charger	Secondary charger state	On	Off; On
Solar charger	Solar charger state	On	Off; On
Battery (DC)			
State of charger	Main battery state of charger		Bulk; Absorption; Float; Standby; Const. volt.
Main battery	Main battery voltage		0..16V/0..32V/0..64V
Main battery	Approximate main battery current (minus is discharging)		-500..500A
Battery temp	Main battery temperature		-25..50 °C, if not connected: ---
Sec. charger	Secondary battery charger state		Bulk; Absorption; Float; Standby; Const. volt.
Sec. battery	Secondary battery voltage		10..30V
Sec. battery	Secondary battery current		0..10A
Shunt device	Selected shunt device for the main battery		
Battery SoC	Main battery state of charge		0..100%
AC inputs			
Mains	Mains voltage		0..300V
Mains	Mains current		0..50A
Mains power	Mains power		0..10000W
Generator	Generator voltage		0..300V
Generator	Generator current		0..50A
Generator power	Generator power		0..20000W
AC outputs			
AC output 1	AC output 1 voltage		0..300V
AC output 1	AC output 1 current		0..70A
AC output 1	AC output 1 power		0..20000W
AC output 2	AC output 2 voltage		0..300V
AC output 2	AC output 2 current		0..70A
AC output 2	AC output 2 power		0..20000W
Solar input			
Solar power	Solar DC power		0..500W
Solar	Solar DC voltage		0..100V
Solar	Solar DC current		0..20A

5 INSTALLATION

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

5.1 Unpacking

In addition to the Mass Combi Ultra the delivery includes:

- a battery temperature sensor;
- 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 1.6) whether your Main battery voltage is the same as the DC-input voltage of the Mass Combi Ultra (e.g. 24V main battery set for a 24V input voltage). Also check that the AC output voltage and output power of the Mass Combi Ultra complies with your system and loads.

5.2 Environment

Obey the following stipulations during installation:

- The Mass Combi Ultra is designed for indoor use only.
- Ambient temperature: -25˚C to 60˚C, (power derating above 40˚C)
- Maximum usage/installation height: 2000m
- Humidity: 0-95% non-condensing
- Mount the Mass Combi Ultra on a solid surface, with the connecting cables downwards.
- Make sure that the hot air produced during operation can be discharged. The Mass Combi 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 Combi Ultra.
- Do not locate the Mass Combi Ultra in the same compartment as the batteries.
- Do not install the Mass Combi Ultra straight above the batteries because of possible corrosive fumes

5.3 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. Fix the phase line wire to terminal L, the neutral wire to terminal N and the ground wire to terminal PE, see figure 5-1.

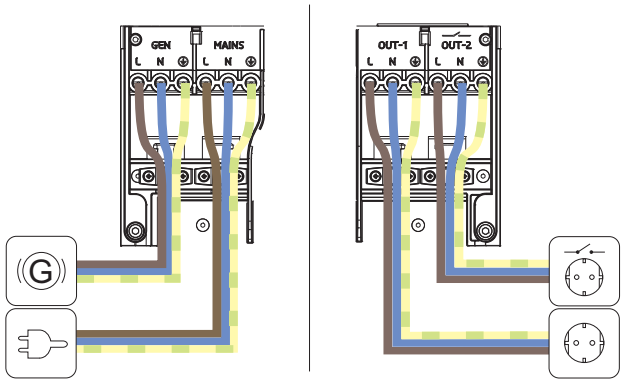


Figure 5-1: AC terminal connections

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

The current entering the Mass Combi Ultra must be limited. Therefore the AC-input must be protected by a fuse in the L cable, as specified below. Maximum rating of the generator AC input fuse: 50A and Mains AC input fuse: 30A. The PE/GND cable cross section must be at least equal to L1.

5.3.2 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 sizes:

DC-Current	Minimum cross section:	
75-100 Amp	25 mm²	AWG 3
105-140 Amp	35 mm²	AWG 2
150-200 Amp	50 mm²	AWG 0
210-280 Amp	70 mm²	AWG 2/0

Use 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 Combi 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.

5.3.3 AC safety grounding

WARNING
The ground wire offers protection only if the cabinet of the Mass Combi 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 12. Connect the earth terminal (PE / GND) to the hull or the chassis with a minimum 10 mm².
In some applications automatic connection between the neutral conductor (N) and earth (PE / GND) is not required or acceptable.

Therefore the automatic connection between the neutral conductor (N) and earth (PE / GND) is disabled by default. For safe installation it is necessary to insert a Residual Current Device (earth leakage switch) of 30mA in the AC in and outputs of the Mass Combi Ultra. Refer to local regulations on these issues!

5.4 Things you need

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

- Mass Combi Ultra (included)
- Battery temperature sensor with cable and plug (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 5.3.1;
- DC-wiring to connect the DC connections of the Mass Combi Ultra to the DC-distribution; see section 5.3.2;
- DC-fuse holder with a DC-fuse, to be integrated in the positive DC-cable. For specifications see section 5.3.2;
- Screws / bolts (Ø 6mm) (with plugs) to mount the cabinet to a surface. Use mounting materials which are suitable to carry the weight of the Mass Combi 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 13mm 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 6mm) with plugs to mount the cabinets to a surface
- Philips screw driver to open the connection area of the Mass Combi Ultra

5.5 Removal of the front lid

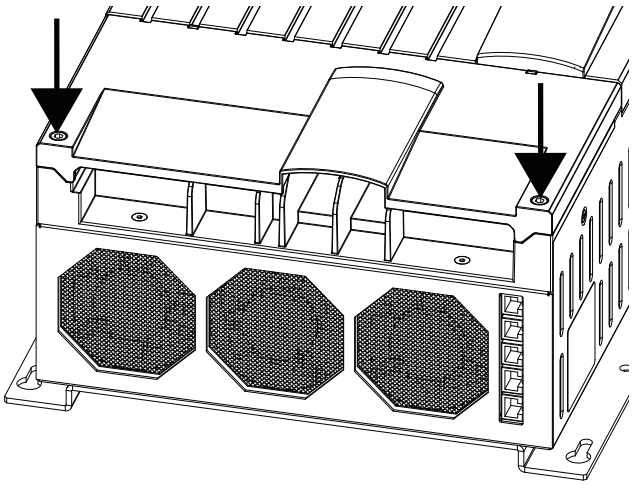


Figure 5-2: Removal of the front lid

Steps:

1 Loosen the two hexagonal socket screws that secure the front cover plate.
2 Lift the front cover plate from the cabinet; see figure 5-3

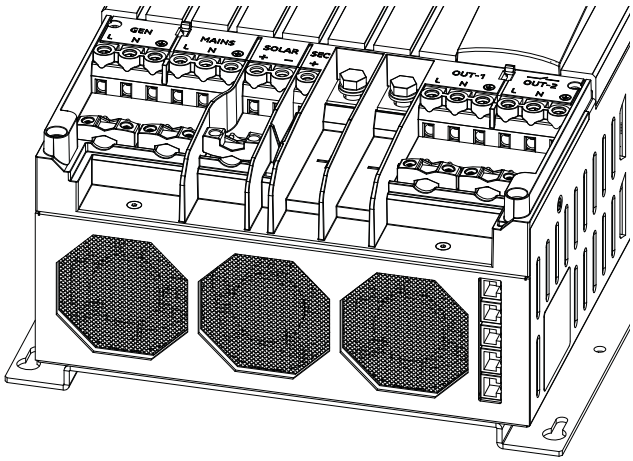


Figure 5-3: Front lid removed

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

5.6 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.

Take the following steps to mount the cabinet:

1 Determine for the four mounting spots on the basis of the outline drawings and 150 mm of free space required below the Combi 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 surface with remaining two bolts.

5.7 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 Combi Ultra, the solar panels, the wiring and/or the terminal connections. Fuses between the batteries and the Mass Combi 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.

NOTE!
Feed the cables through the strain reliefs of the cabinet before you fix the cable lugs to the wire ends.

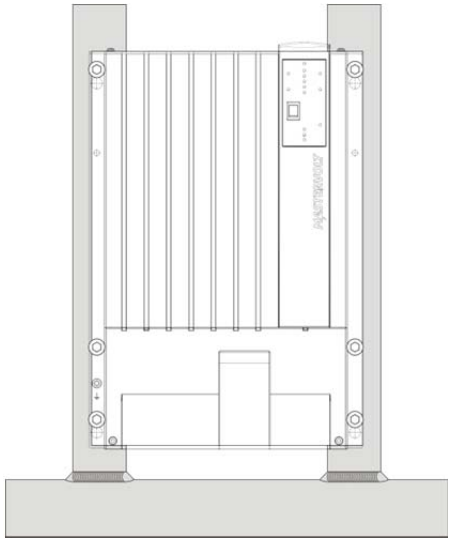


Figure 5-4: Mount the Mass Combi Ultra upright to a solid surface that is part of the construction

5.8 Installation overview

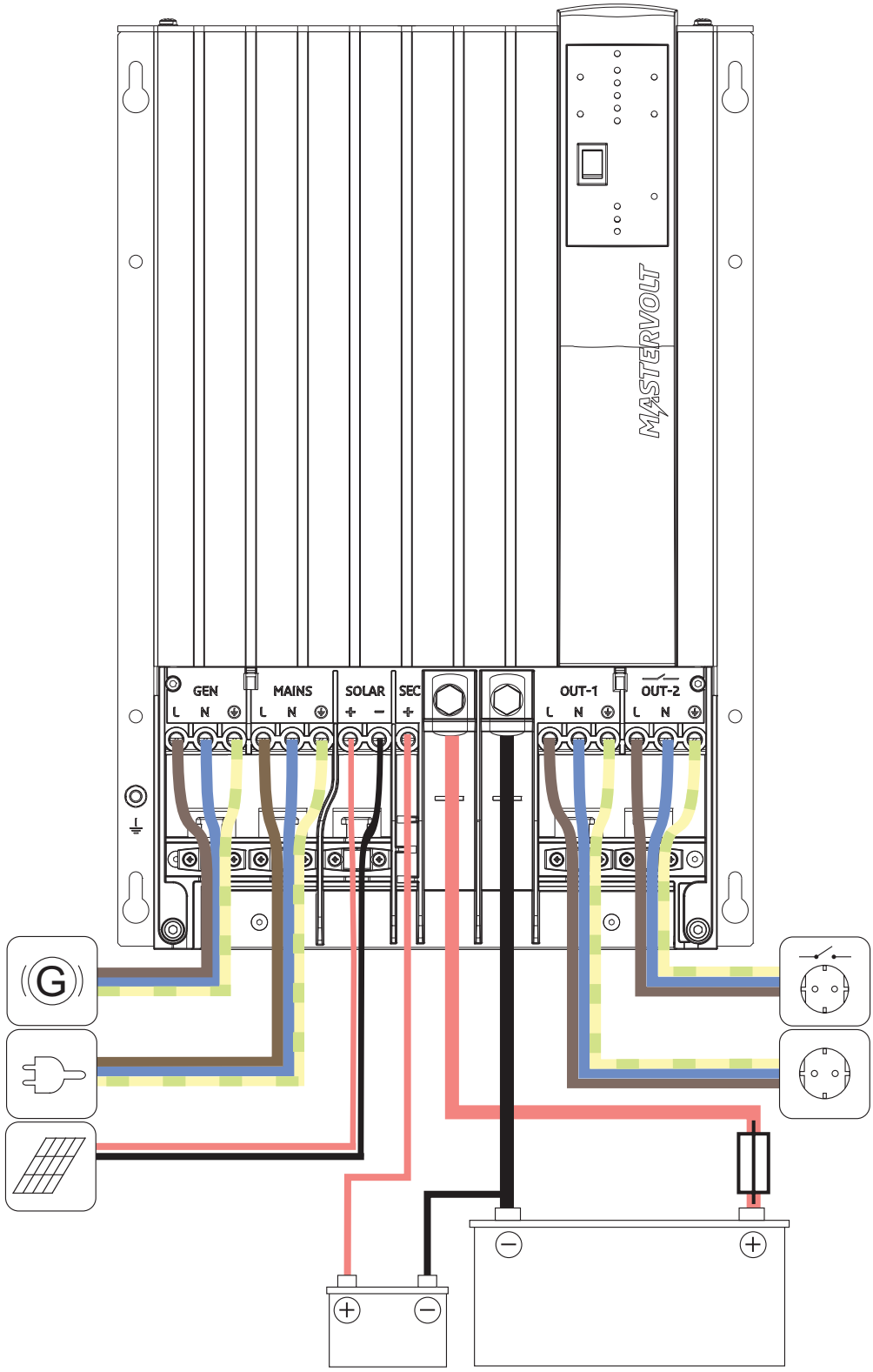


Figure 5-5: Installation overview for one Mass Combi (stand-alone operation)

CAUTION!
Ensure correct polarities, cross sections and fuses for all wiring. An RCD according to local regulations must be connected to output-1 and 2.

5.9 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.

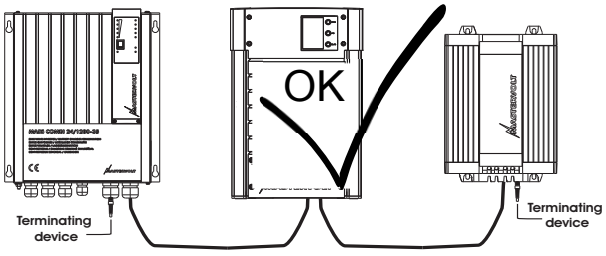
New devices can be added to the existing network easily. Consequently the MasterBus network is highly flexible for extended system configuration. Mastervolt also offers several interfaces like the Modbus interface, making even non-MasterBus devices suitable to operate in the MasterBus network. For central 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.

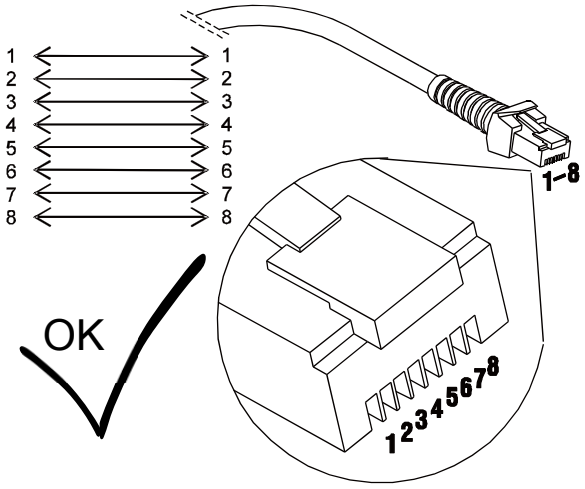
5.10 How to set up a MasterBus network

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:

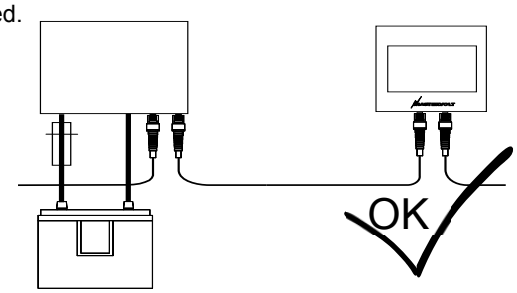
Place a terminating device on both network ends.



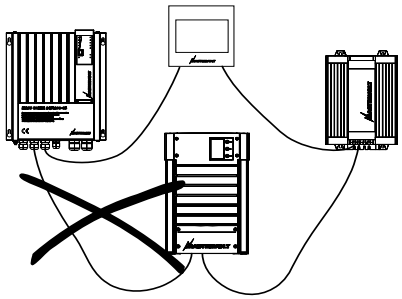
Connections between the devices are made by standard straight UTP patch cables.



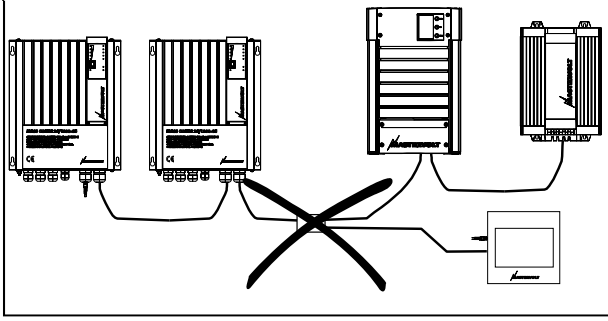
At least one device in the network must be MasterBus powering (see specifications). As all powering devices are galvanic isolated, multiple powering devices are allowed.



Do not make ring networks.



Do not make T-connections in the network.



6 CONFIGURATION

The Mass Combi Ultra is provided with two groups of DIP-switches to adjust the Mass Combi Ultra according to the specifications of the electrical installation, see figure 6-1. DIP-switch settings are 0 for default values. The Mass Combi 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.

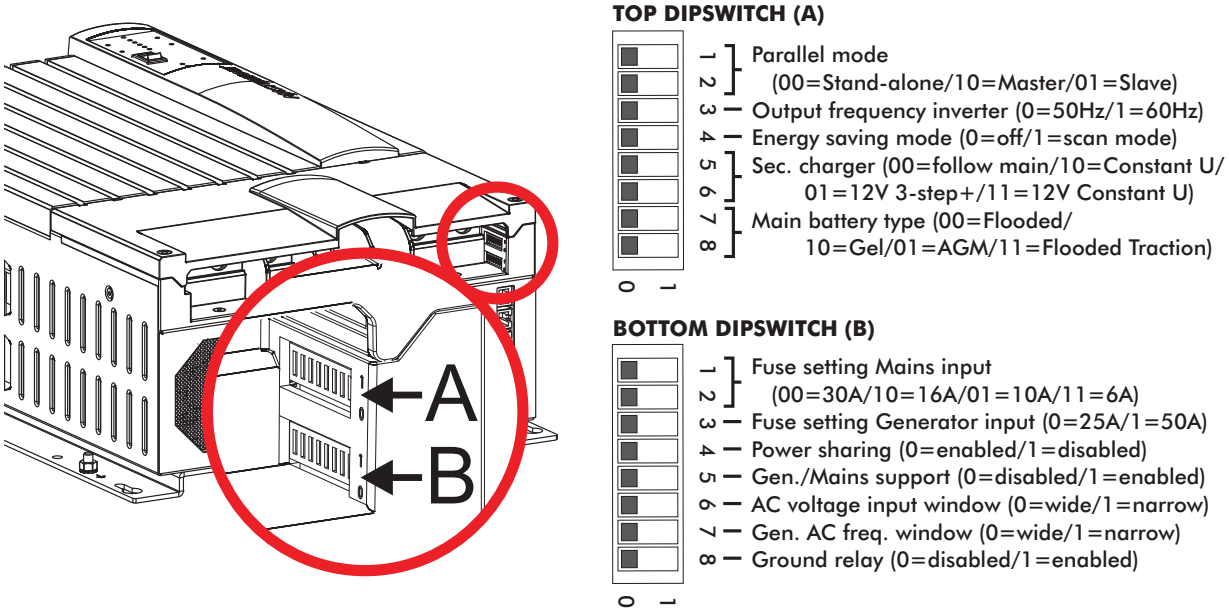


Figure 6-1: DIP-switches and cover print

DIP switch #				
A1-A2 *Parallel connection*	0-0: Stand alone	1-0: Master 0	0-1: Slave	
A3	0: Output AC frequency 50Hz		1: Output AC frequency 60Hz	
A4	0: Energy saving mode off		1: Energy saving mode scan mode	
A5-A6 *Secondary charger*	0-0: Follow main battery	1-0: Constant voltage	0-1: Charge mode 12V 3Step+	1-1: Constant voltage 12V
A7-A8 *Main battery type*	0-0: Flooded	1-0: Gel	0-1: AGM	1-1: Flooded traction
B1-B2 *Fuse Mains input*	0-0: 30A	1-0: 16A	0-1: 10A	1-1: 6A
B3	0: Fuse setting generator input 25A		1: Fuse setting generator input 50A	
B4	0: Power sharing mode enabled		1: Power sharing mode disabled	
B5	0: Generator/ Mains support mode disabled		1: Generator/ Mains support mode enabled	
B6	0: AC voltage input window wide (+/-40 V)		1: AC voltage input window narrow (+/-23V)	
B7	0: Gen AC frequency window wide (+8/-10 Hz)		1: Generator AC frequency window narrow (+/-5Hz)	
B8	0: Ground relay disabled		1: Ground relay enabled	

6.1.1 Ground relay

For safe installation:

- Residual Current Devices (RCD) must be integrated in the AC inputs and AC outputs of the Mass Combi Ultra and
- The neutral conductor (N) of the AC output of the Inverter must be connected to the safety ground (PE/GND) when the Mass Combi Ultra is working as an inverter.

The ground relay function allows you to connect the Neutral conductor (N) of the inverter output circuit to the Safety Ground (PE / GND) automatically when the Mass Combi is working as an inverter. Refer to local standards on this issue.

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
Device name	Name of this particular device in MasterBus. This name will be recognized by all devices that are connected to the MasterBus network.	MCU [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 Combi power MasterBus or not.	Checked	Checked, Not checked
Shunt device select	Select a device in the list, the values of which must be used by the Mass Combi Ultra.	No shunt	Shunt devices in the list
Main charger			
Maximum current	Maximum charging current adjustable.	100A	1..150A/1..100A/1..50A
Method	Charging method selectable.	3-Step +, refer to chapter 3	3-Step+, constant voltage
Battery type	Select the main battery type.	Flooded (Lead acid wet cell)	User defined, Flooded, Gel, AGM, Spiral, MLi, Flooded traction, Nickel Cadmium
Bulk			
Bulk voltage	Maximum Bulk voltage (adjustable if User Defined).	14.40/28.80/57.60V	8..16.00/16..32.00/32..64.00V
Min bulk time	Minimum time that the charger stays in Bulk mode.	2 min	0-600 min
Start bulk time	Voltage at which to start the bulk timer.	13.25/26.50/53.00	
Max bulk time	Maximum time the bulk phase lasts before the charger changes to absorption.	0 min	0-600 min, Max bulk time > Min bulk time
Bulk ret. volt.	Bulk return voltage. If the battery voltage has dropped below this voltage, the charger will return to bulk phase.	12.8/25.6/51.2V	
Bulk return time	Delay time before the charger returns to Bulk after reaching the Return to Bulk voltage.	30 sec	0-255 sec
Absorption			
Abs. voltage	Absorption voltage (adjustable if User Defined is selected.	14.25/28.50/57.0V	8-16.00/16-32.00/32-64.00V
Max absorp.time	Maximum time that the charger stays in absorption mode.	360 min	1-65535 min
Return amps	Charging current at which the charger changes to Float phase.	9.0A/6.0A/3.0A	0.0-25.0
Min absorp.time	Minimum time that the charger stays in absorption mode.	15 min	0-255 min
Float settings			
Float voltage	Float voltage (adjustable if User Defined).	13.25/26.50/53.0V	8-16.00/16-32.00/32-64.00V
Sec. charger			
Maximum current	Maximum charging current adjustable	10A	1-10A

Value	Meaning	Default	Adjustable range
Method	Charging method selectable	3-Step +, refer to chapter 3	3-Step+, constant voltage, follow main
Battery type	Select the main battery type	Flooded (Lead acid wet cell)	User defined, Flooded, Gel, AGM, Spiral, Lithium Ion, Flooded traction, Nickel Cadnium
Inverter			
Voltage	AC voltage	230V	180-260V
Frequency	AC frequency	50 Hz	50Hz, 60Hz
Enable GND rel.	Option to enable ground relay	Not checked	Not checked, checked
Energy save mode	Option to enable Energy save mode	Not checked	Not checked, checked
Scanning below	The Combi starts scanning below this inverted power level in Energy save mode.	10W	10-250W
Dynamic window	Select to base the input window upon battery type default values or upon your own preset values. Refer to section 4.2.4	Use battery type	Use battery type, user defined (Use battery type: dynamic input window still present, but not configurable)
DC high off	High battery voltage for inverter switch off (12/24/48V, user defined only).	16.00/32.00/64.00V	13.00-16.00/26.00-32.00/52.00-64.00V
DC high on	High battery voltage for inverter switch to DC High Off alarm (12/24/48V, user def.)	15.50/31.00/62.00V	13.00-16.00/26.00-32.00/52.00-64.00V
DC low off I=0%	Low battery voltage at which the inverter switches off when the battery current is 0-2% of nominal (12/24/48V, user def.)	10.00/20.00/40.00V	9.50-13.00/19.00-26.00/38.00-52.00V
DC low off I=2%	Low battery voltage at which the inverter switches off when the battery current is 2% of nominal (12/24/48V, user def.)	9.75/19.50/39.00V	9.50-13.00/19.00-26.00/38.00-52.00V
DC low off 100%	Low battery inverter switch off voltage, batt. current 100% (12/24/48V, user def.)	9.50/19.00/38.00V	9.50-13.00/19.00-26.00/38.00-52.00V
DC low on	Low battery inverter switch on voltage at DC Low off alarm (12/24/48V, user def.)	12.00/24.00/48.00V	10.00-13.00/20.00-26.00/40.00-52.00V
DC low off delay	Delay time before inverter switches off on low battery voltage.	30s	0-30s
AC transfer			
AC input policy	Define which AC input to be used under which conditions, refer to section 4.3	Do not transfer	Mains preferent, Gen preferent, Max fuse prefer, Mains only, Generator only
AC out 2 policy	Define under which conditions to use AC output-2, refer to section 4.3	Generator input	Manual mode, Generator input, Mains input, Gen/Mains input, Always on
Generator fuse	Generator fuse value	25A	1-50A
Mains fuse max.	Mains fuse maximum value that can be set in the monitoring tab	30A	1-30A
Mains limit A	Mains fuse value setting	6A	1-30A
Mains limit B	Mains fuse value 10A	Not checked	Not checked, checked
Mains limit C	Mains fuse value 16A	Not checked	Not checked, checked
Power sharing	Power sharing mode option, chapter 3.	Not checked	Not checked, checked
Allow AC support	AC support mode option, chapter 3.	Not checked	Not checked, checked
Gen. high volt.	Generator AC input window	270V	184-275V
Gen. low volt.	Generator AC input window	190V	184-275V
Gen. high freq.	Generator AC input window	65Hz	35-68Hz
Gen. low freq.	Generator AC input window	40Hz	35-68Hz
Generator delay	Time to trigger a Generator alarm		
Mains high volt.	Mains AC input window	270V	184-275V
Mains low volt.	Mains AC input window	190V	184-275V
Mains high freq.	Mains AC input window	65Hz	35-68Hz
Mains low freq.	Mains AC input window	40Hz	35-68Hz
Mains delay	Time to trigger a Mains alarm	10 sec	5-20 sec

6.2.1 MasterBus alarms

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

Alarm	Description
Overload	Combi in overload. The loads exceed the nominal inverter power.
Over temperature	Internal temperature of the Combi is too high.
Battery low	Main battery voltage is too low.
Battery high	Main battery voltage is too high.
Batt temperature	Battery temperature is out of range.
Temp sense error	An error has been detected in the temperature sensor signal.
Sync. error	Two or more Mass Combis Ultra in a multiple configuration do not synchronize well.
Config error	Configuration error, most often in multi Combi installations. Check MasterBus and DIP switch settings.
Install error	Installation error around the Combi Ultra, not inside the unit. Check all connections.
System error	Internal Combi Ultra error. Contact your Mastervolt supplier.

6.2.2 List of event sources

This is the Mass Combi 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 Combi Ultra is in Inverter mode
Charging	The Mass Combi Ultra is in Charge mode
Overload	The inverter current is too large
Low bat	The main battery voltage has dropped below the Low bat value
Alarm	A Mass Combi Ultra alarm has been triggered
Generator input	Generator input is present
Mains input	Mains input is present
ACout 2 enabled	Switched Output-2 is enabled
Sec charging	The second battery is being charged
Solar charging	Solar powered charging takes place
Bulk	Charge phase Bulk
Absorption	Charge phase Absorption
Float	Charge phase Float
External fan	Trigger point to activate an external cooling fan
Supporting	The Mass Combi Ultra is in Supporting mode

6.2.3 List of event commands

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

Event command	Description
Inverter On/Off	Change the Mass Combi Ultra inverter state to On/Off
Charger On/Off	Change the Mass Combi Ultra charger state to On/ Off
Bulk	Changes to charge phase Bulk
Absorption	Changes to charge phase Absorption
Float	Changes to charge phase Float
Mains limit A	Mains fuse value is set to 6A (adjustable)
Mains limit B	Mains fuse value is set to 10A (adjustable)
Mains limit C	Mains fuse value is set to 16A (adjustable)
AC out 2 enabled	Switched Output-2 is enabled
Force Sec charge	Force charging of the second battery

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 Combi Ultra.

1 Tighten all cable glands to ensure the strain relief
2 Check all wiring and connections
3 Close the front cover plate of the connection compartment of the Mass Combi Ultra. Beware that the wiring does not obstruct the cooling fans and air flow.
4 Place the DC-fuse(s) of the DC-distribution to connect the batteries to the Mass Combi Ultra.

WARNING
When placing this fuse, a spark can occur, caused by the capacitors used in the Mass Combi 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 Combi Ultra is ready for operation.

7.2 Decommissioning

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

1 Move the Main-switch of the Mass Combi Ultra to “Off”
2 Remove DC-distribution fuses and/or disconnect the batteries.
3 Remove AC-input fuse(s) and/or disconnect the AC-mains.
4 Open the connection compartment of the Mass Combi Ultra
5 Check with a suitable voltage meter whether the inputs and the outputs of the Mass Combi Ultra are voltage free.
6 Disconnect all the wiring

Now the Mass Combi 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 LEDs at the front of the Mass Combi, see figure 7-1

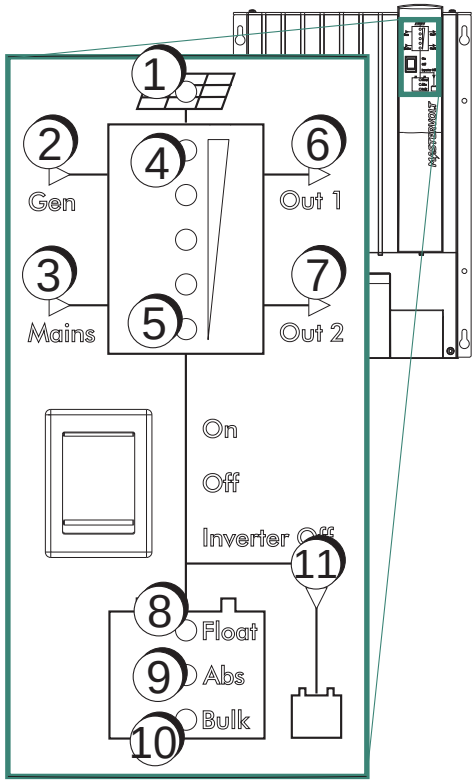


Figure 7-1: Error LEDs

The table 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 Center to solve a problem:

- Article and serial number
- Software version

7.3.1 Trouble shooting table

Illuminating LEDs	MasterBus alarm	Explanation / Possible cause	What to do
Normal operation and warnings			
None		The Mass Combi Ultra is switched off manually.	Switch on the Mass Combi Ultra by means of the main switch.
(1) blinking		Error: solar voltage or current out of range	Check Solar input, refer to input specifications in chapter 9.
(2) blinking slowly (2x/sec)		Inverter is synchronizing voltage and frequency to generator AC.	Wait until the inverter is ready synchronizing. After this, it will activate the generator input.
(2) blinking fast (5x/sec)	MB monitoring: ACin Low quality	Error: generator input voltage or frequency out of range	Check generator voltage and frequency, refer to generator input specifications in chapter 9.
(3) blinking slowly (2x/sec)		The inverter is synchronizing its voltage and frequency to mains AC	Wait until the inverter is ready synchronizing. After this, it will activate the mains input.
(3) blinking fast (5x/sec)	MB monitoring: ACin Low quality	Error: mains input voltage or frequency out of range	Check mains voltage and frequency, refer to generator input specifications in chapter 9.
(4) red	MB monitoring: Overload	Inverter in overload, inverted power exceeds 3500W	Check the load connected. Check the connections.
(10) red	Battery low	Battery voltage low	Stop inverting, start charging
(11) blinking	Error in sec charger		
(10) blinking red		Charging a low battery	
Errors (Mass Combi Ultra shuts down)			
(4) and (10) red, (5) yellow	Overtemperature	Combi too hot. Restart when alarm is over	Check ventilation
(10) red, 8 and 9 yellow	Battery high	Battery voltage too high, Combi restarts when the alarm is over.	Stop charging, check battery voltage setting
(10) red, (8) yellow, (9) off	Temp sense error	Temperature sensor sends a wrong signal.	Check battery sensor and its cable
(10) red, (8) yellow, (9) off	Batt temperature	Battery hot, Combi restart when alarm is over.	
(4) and (10) red	System error, Sync error, Config error	Communication disturbed Configuration wrong	Check multicombi cables and connectors
Permanent errors (manual reset required)			
(4) and (10) blinking fast red	Overload	Number of inverter overload restart attempts exceeded.	Reduce the output loads, increase the input AC, shut Off and On the Mass Combi Ultra.
	System error	Hardware issue	Shut Off and On the Mass Combi Ultra.
(6) and (7) blinking fast	Install error	Installation error	Correct installation, shut Off and On the Mass Combi Ultra.

8 TECHNICAL DATA

8.1 Specifications

Mass Combi Ultra	12/3000-150	24/3500-100	48/3500-50
Article number	38013000	38023500	38043500
Inverter specifications			
Nominal battery voltage	12V	24V	48V
Inverter output voltage	230 V (±2%)	230 V (±2%)	230 V (±2%)
Frequency	50/60Hz (±0.005%) selectable		
Continuous power @Tamb=25˚C, cos phi = 1	3000 W	3500 W	3500 W
Continuous power@Tamb=40˚C, cos phi = 1	3000 W	3500 W	3500 W
Max. peak load	6000 W	7000 W	7000 W
Output waveform	True sine wave, Thd < 1 % under standard conditions		
Max. efficiency	≥ 90%	≥ 92%	≥ 93%
DC input voltage range	10 – 16 V	20 – 32 V	40 – 62 V
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%	11.0V(±2%)	22.0V(±2%)	44.0V(±2%)
Switch off voltage low battery@ load 2-100%	10.5V - 9.5V (±2%)	21.0V - 19.0V (±2%)	42.0V – 38.0V (±2%)
Switch on voltage low battery	12.0V(±2%)	24.0V(±2%)	48.0V(±2%)
Switch off voltage high battery	16.0V(±2%)	32.0V(±2%)	64.0V(±2%)
Switch on voltage high battery	14.5V(±2%)	29.0V(±2%)	60.0V(±2%)
Max. ripple on DC @ full load	10% RMS	10% RMS	10% RMS
Nominal DC current at full load	300A	150A	75A
Recommended batteries	>500Ah	>350Ah	>170Ah
No load, DC drain			
Off mode (hard switched)	0 W	0 W	0 W
Inverter off mode (remote)	4 W	4 W	4 W
Normal operation mode	16 W	16 W	16 W
Battery charger specifications			
Input voltage range	180 – 275 V	180 – 275 V	180 – 275 V
Max. charge current @Tamb=40˚C	150 A @ 14.25V	100 A @ 28.5 V	50 A @ 57 V
Secondary output	Follows main charge (if sec. V < main V) / Fixed (power supply)		
Secondary output voltage	12 V	12V/24V selectable	12V/24V selectable
Charge characteristic	Mastervolt 3-step+		
Battery types	AGM / Gel / MLi / Flooded / Flooded traction / Spiral / NiCad		
Battery temperature sense	Input present, sensor included		
Voltage sense	Only through MasterShunt, else automatic compensation		
Transfer system specifications			
Generator input 1 (switched)	Yes, 50 A	Yes, 50 A	Yes, 50 A
Mains input 2 (switched)	Yes, 30 A	Yes, 30 A	Yes, 30 A
Output 1	Yes, 67 A	Yes, 67 A	Yes, 67 A
Output 2 (switched)	Yes, 50 A	Yes, 50 A	Yes, 50 A
AC input fuses	No	No	No
Transfer speed	Seamless (<1ms)	Seamless (<1ms)	Seamless (<1ms)
Transfer voltage range (adjustable)	184V-275V	184V-275V	184V-275V
Transfer frequency range (adjust.)	35 – 65 Hz	35 – 65 Hz	35 – 65 Hz
Power sharing	Yes	Yes	Yes
Generator/Mains support	Yes	Yes	Yes

Mass Combi Ultra	12/3000-150	24/3500-100	48/3500-50
Parallelling/3-phase			
Parallel stacking	Yes, up to 10 standard from hardware version D		
3-phase configuration	Yes, up to 3 x 3 from hardware version D		
Solar charge regulator*			
Max. solar voltage input	50V	100V	100V
Start-up voltage	15V	15V	15V
Max. solar panel (peak) power	500 Wp	500 Wp	500 Wp
Max. input current	19 A	19 A	19 A
Max. solar charge current	30 A @ 14.25V	15 A @ 28.5 V	7.5 A @ 57 V
MPP Tracking	Yes, full power@25-50V	Yes, full power@35-80V	Yes, full power@35-80V
General specifications			
Dimensions (HxWxD mm)	472x318x178	472x318x178	472x318x178
Weight	15.3 kg	15.3 kg	15.3 kg
Protection degree	IP23 (vertical wall mounting)		
Safety class	Class I		
Grounding	Ground relay standard, includes ground stud (ABYC compliant)		
Operating temperature	25˚C to 60˚C, above 40˚C derating		
Overvoltage category	Gen: OVII; 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 charge state, inverter power, input/output state		
and includes on/off/inverter off switch			
MasterBus functionality			
MasterBus powering	Standard on, selectable		
Overload protection			
Gen & Mains input			
Digital fuse	Adjustable with three preset values		
Frequency monitoring	Relay disconnects when frequency is out of range		
Voltage monitoring	Relay disconnects when voltage is out of range		
Overvoltage protection	Non recoverable protection of the unit		
Output-1 & 2			
Short circuit protection	Yes		
Main & Secondary battery			
Short circuit protection	Yes		
Reversed polarity protection	No		

* From hardware version E onwards.

8.2 Dimensions

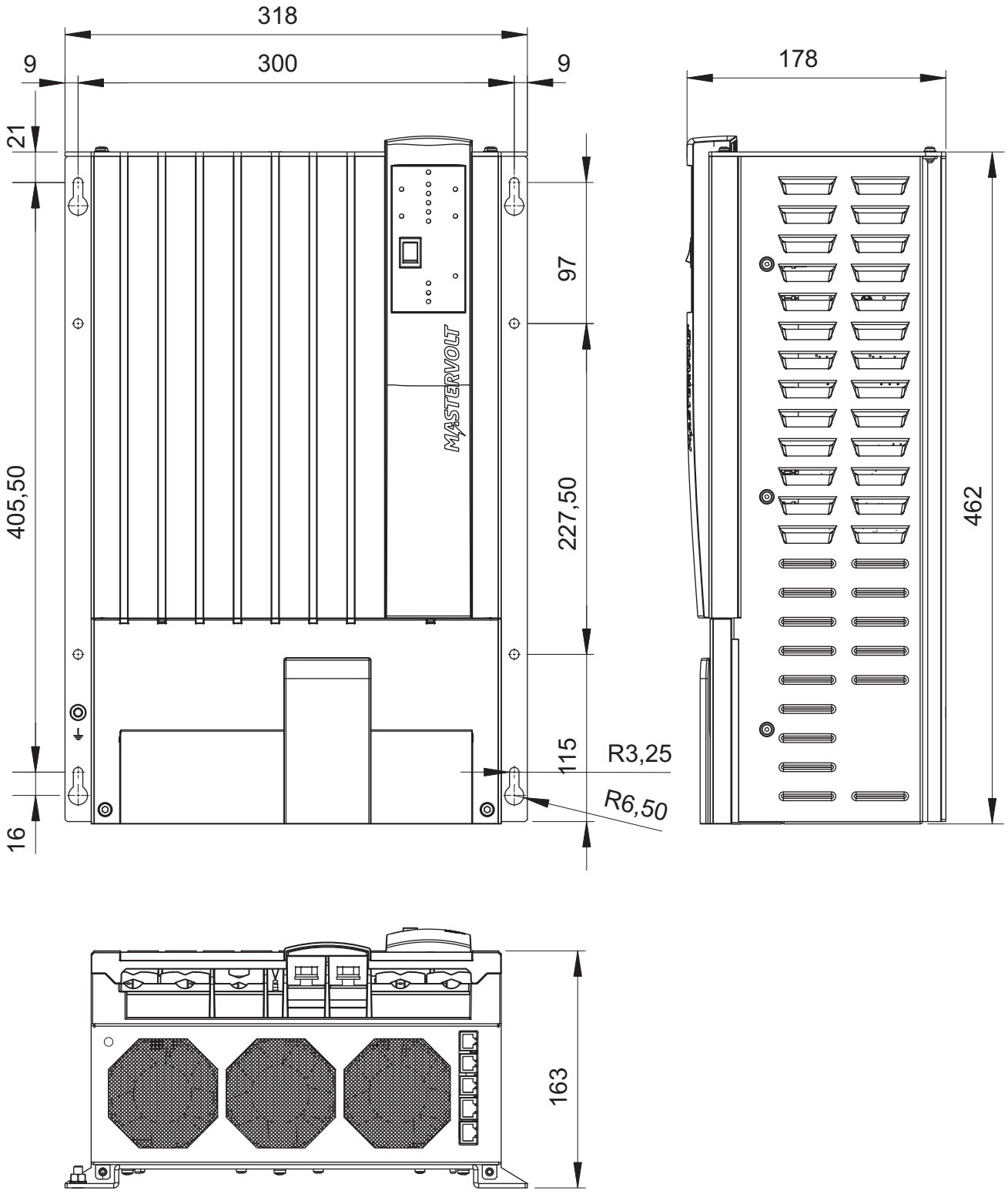


Figure 8-1: Dimensions in mm

9 ORDERING INFORMATION

Part number	Description
77049100	ANL Fuse 100A
77049200	ANL Fuse 200A
77049400	ANL Fuse 400A
607006	ANL Fuse base
701	Battery switch 275A
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
41500500*	Battery temperature sensor, incl. 6 meter / 19 ft cable
41500800	Battery temperature sensor, incl. 15 meter / 49 ft cable
77040000*	MasterBus terminating device
77040020	MasterBus connection cable (UTP patch cable), 0,2m / 0.6ft
77040050	MasterBus connection cable (UTP patch cable), 0,5m / 1.6ft
77040100	MasterBus connection cable (UTP patch cable), 1,0m / 3.3ft
77040300	MasterBus connection cable (UTP patch cable), 3,0m / 10ft
77040600	MasterBus connection cable (UTP patch cable), 6,0m / 20ft
77041000	MasterBus connection cable (UTP patch cable), 10m / 33ft
77041500	MasterBus connection cable (UTP patch cable), 15m / 49ft
77042500	MasterBus connection cable (UTP patch cable), 25m / 82ft
77045000	100m / 330ft 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: 100m / 330ft 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: 250A, peak current: 500A
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 Combi 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

10 CERTIFICATES

10.1 EC Declaration of Conformity

We,

Manufacturer	Mastervolt
Address	Snijdersbergweg 93 1105 AN Amsterdam The Netherlands

Declare under our sole responsibility that product

38013000	Mass Combi Ultra 12/3000-150 / 230V
38023500	Mass Combi Ultra 24/3500-100/ 230V
38043500	Mass Combi Ultra 48/3500-50 / 230V

Is in conformity with the provisions of the following EC directives:

2006/95/EC (Safety directive); the following harmonized standards have been applied:
- EN 62477-1:2012 Safety requirements for power electronic converter systems and equipment

2004/108/EC (EMC directive); the following harmonized standards have been applied:
- EN 61000-6-3: 2007 Emission for residential, commercial and light-industrial environments
- EN 61000-6-2: 2007 Immunity for industrial environments
- EN 61000-4-2: Electrostatic discharge immunity test
- EN 61000-4-4: Electrical fast transient/burst immunity test

2011/65/EU (RoHS directive)

Amsterdam, 31 October 2013

D. Hobbelen
Product Manager Power conversion & storage