

# Mass Combi Ultra

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

INSTALLATION OF MULTIPLE CLUSTERED MASS COMBI ULTRA'S



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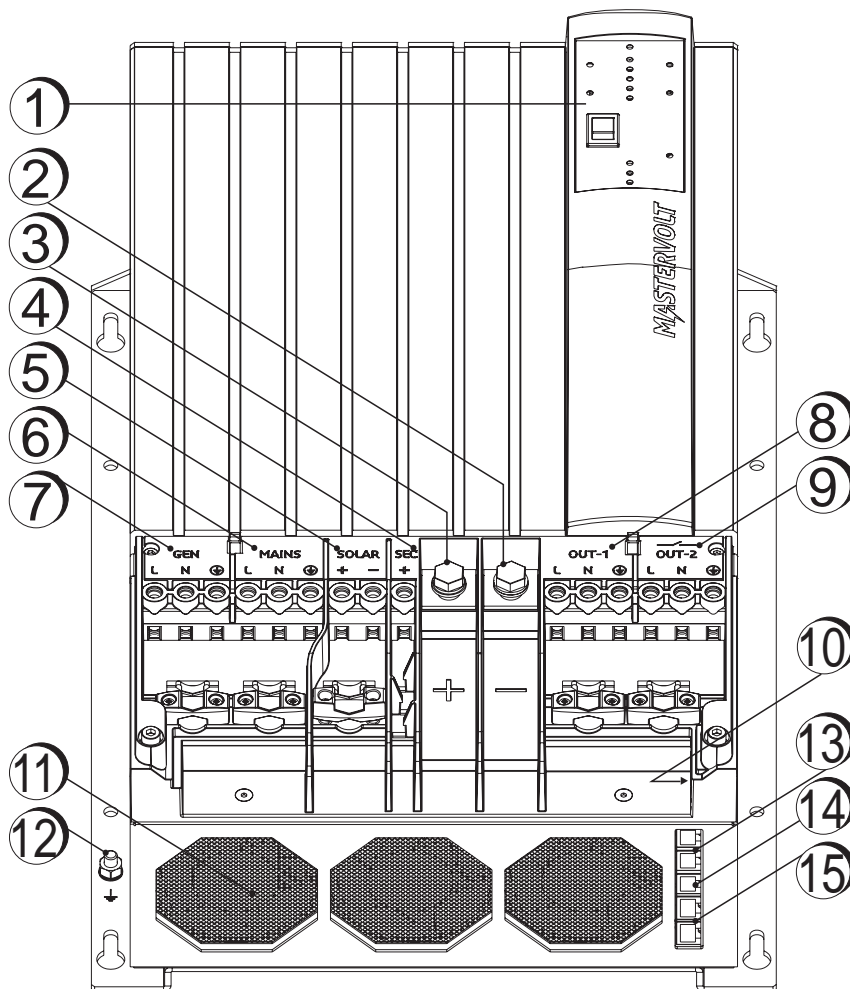
INSTALLATION MANUAL

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## OVERVIEW 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)

Figure 0-1: Overview of the Mass Combi Ultra

# 1 GENERAL INFORMATION

## 1.1 Use of this manual

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This installation manual has to be read in combination with the standard User's manual that is supplied with the Mass Combi Ultra.



### CAUTION!

Read chapter SAFETY GUIDELINES AND WARNINGS of the User's manual that is supplied with the Mass Combi Ultra.

- Every person who works with the Mass Combi Ultra should be familiar with the contents of this manual, and must carefully follow the instructions contained herein.
- Store the manual in an accessible place.

## 1.2 Validity of this manual

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

- a parallel configuration, or
- a three phase configuration, or
- a combined three phase - parallel configuration

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

## 1.3 Purpose of a multiple configuration

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

If more output power is needed than one Mass Combi Ultra can supply, two up to ten Mass Combi Ultras can be connected in parallel.

If redundancy is required, Mass Combi Ultra's can be connected in parallel to maintain reliable power supply if one of the Mass Combi Ultra's fails in operation.

Three Mass Combi Ultra's can be connected in a 3-phase configuration to supply three phase AC power. By connecting more Mass Combi Ultra's in parallel as well, virtually unlimited three phase power can be made available.

## 1.4 General installation guidelines

When using Mass Combi Ultra's in a multiple configuration, the following requirements are applicable in addition to the requirements mentioned in the standard User's manual:

- Only identical Mass Combi Ultra's with the same article numbers may be used in a multiple configuration.
- Maximum number of Mass Combi Ultra's in parallel: 10
- Maximum number of Mass Combi Ultra's in a three phase -parallel configuration: 3 x 3
- Installation and commissioning of multiple Mass Combi 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 Combi Ultra's either side by side or vertically above each other, at least 10 cm / 4 inch free space must be kept the units. If necessary, adequate measures must be taken to avoid one Mass Combi Ultra heating up the other.

## 1.5 Parallel configuration diagram

Figure 1-1 shows a basic installation diagram of two Mass Combi Ultra's in parallel. Mind that only the AC side of the electrical system is shown here.

The generator input (Gen) of only one of the two Mass Combi Ultra's is connected to the AC input line. However, in this situation the Mass Combi Ultra is not able to commence charging under the exceptional circumstances that the batteries were discharged too deep (flat batteries). Only if charging of such flat batteries is required, the generator input (Gen) of the both Mass Combi Ultra's shall be connected to the AC input line (dashed lines).

Both Mass Combi Ultras are supplying AC on output-1 so the outputs are in parallel. The upper L1 serves as AC input line from the generator, the lower L1 leads to the AC loads.

### 1.6 Three phase configuration diagram

See figure1-2. Here three Mass Combi Ultra's are shown in a three phase configuration (only AC is shown). The upper L1, L2 and L3 serve as the input lines from the generator, the lower lines lead to the three phase AC loads.

### 1.7 Multi Combi communication

Within the MasterBus databus communication protocol, Mass Combi Ultra's connected in a parallel 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 power conversion unit.

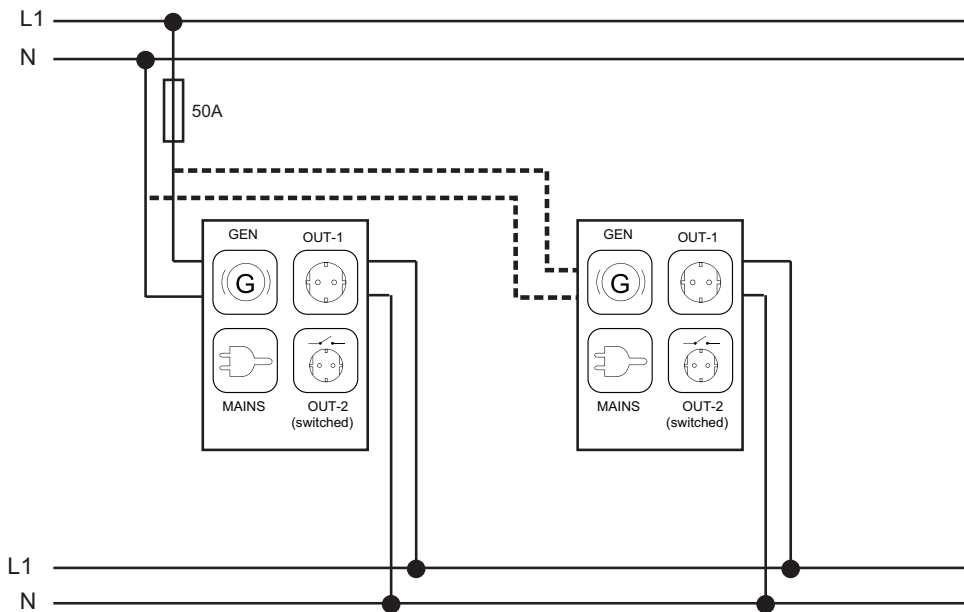


Figure 1-1: Two Mass Combi Ultra's in parallel

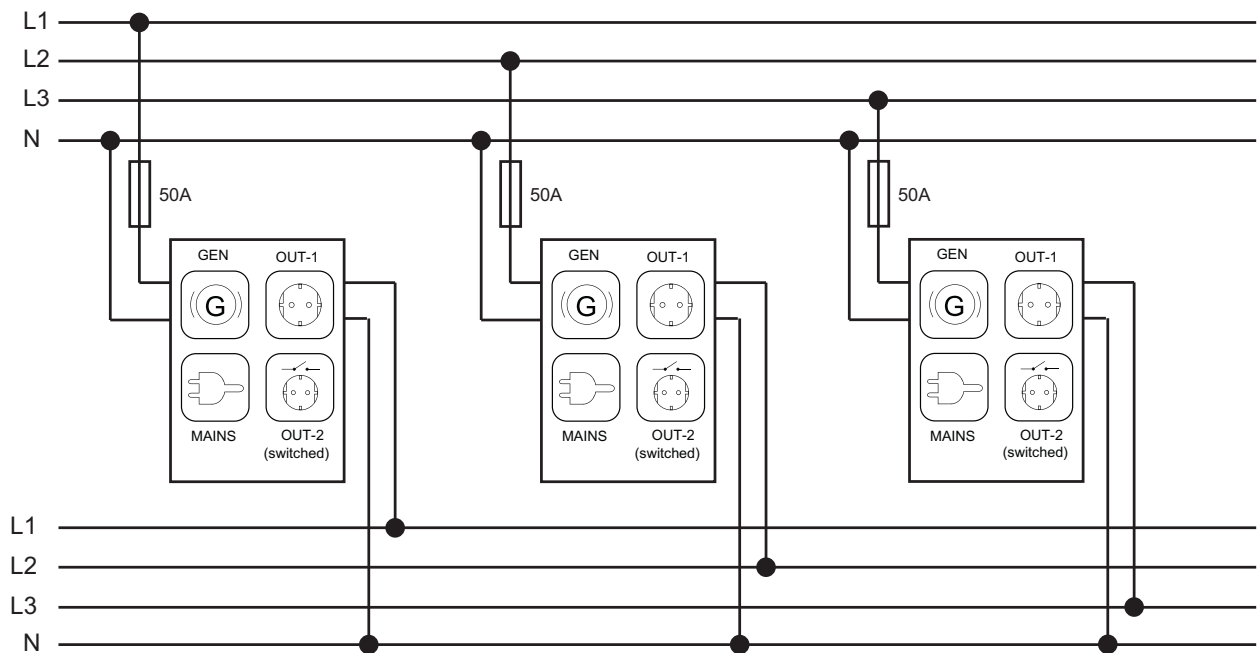


Figure 1-2: Mass Combi Ultra's in a three phase configuration

## 1.8 Synchronization

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



Always connect the sync cables in cluster connections!

## 1.9 Cable dimensions

High currents will pass through the wiring. Therefore all wiring must be correctly sized and fused according to the locally applicable standards

DC connection cables between the DC-distribution and the Mass Combi Ultra's must be of equal length and cross-section. Keep the cable lengths as short as possible!

The table below shows the cable dimensions recommended by Mastervolt.

AC-Current	Minimum cross section:	
0-20 Amp	2.5 mm <sup>2</sup>	AWG 13
20-32 Amp	4 mm <sup>2</sup>	AWG 11
32-48 Amp	6 mm <sup>2</sup>	AWG 9
48-80 Amp	10 mm <sup>2</sup>	AWG 7

## 1.10 Configuration of 6 combis

Shown below is a diagram of 6 Mass Combis Ultra. These are 3 phases with 2 Combis in parallel each. Mind that only the AC side of the electrical system is shown here. This configuration is used to create a three phase AC grid. Refer to section 1.5 for details about the dashed lines between the generator input (Gen) and the AC input line.

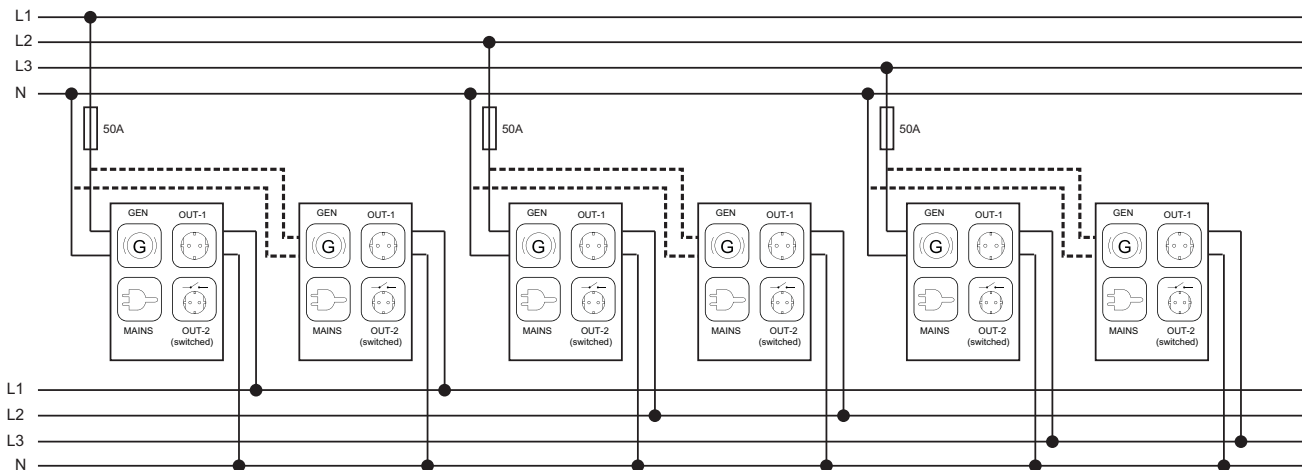


Figure 1-3: a three phase configuration with two Mass Combi Ultra's in parallel per phase.

## 2 PARALLEL CONNECTION

### 2.1 Things you need for parallel connection

Make sure you have all the parts you need to install a number of n Mass Combi Ultras in parallel:

Description	Quantity
Mass Combi Ultra	n
Battery temperature sensor with cable and plug (included)	n
DC-cable to connect the positive DC connection (+) of the Mass Combi Ultra to the plus pole of the DC-distribution. See section Specifications. Maximum recommended length: 2m / 6ft, colour: preferably red or at least a different colour to make a clear distinction between the positive and negative wire from the battery	n
DC-cable to connect the negative DC connection (-) of the Mass Combi Ultra to the negative pole of the DC-distribution; see section Specifications. Maximum recommended length: 2m / 6ft, colour: preferably black or at least a different colour to make a clear distinction between the positive and negative wire from the battery	n
DC-fuse holder with a DC-fuse, to be integrated in the positive DC-cable. See section Specifications.	n
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	nx4
AC cable* to connect the AC input of the Combis to an external power source (e.g. shore connection, generator);	n
AC cable* to connect the external load to Output-1 of the Combi	n
AC cable* to connect the external load to Output-2 of the Combi	n
MasterBus cable between n Combis	n-1
MasterBus terminator	2
Sync cable between n Combis	n-1
Batteries. Refer to Specifications section for details.	x
Appropriate and reliable cable terminals, cable lugs, battery terminals and cord end terminals	x

\* Double insulated three wire cable with wire colours according to the locally applicable regulations. The applicable length and wire diameter depend on the electrical installation

We recommend as a minimum tool kit:

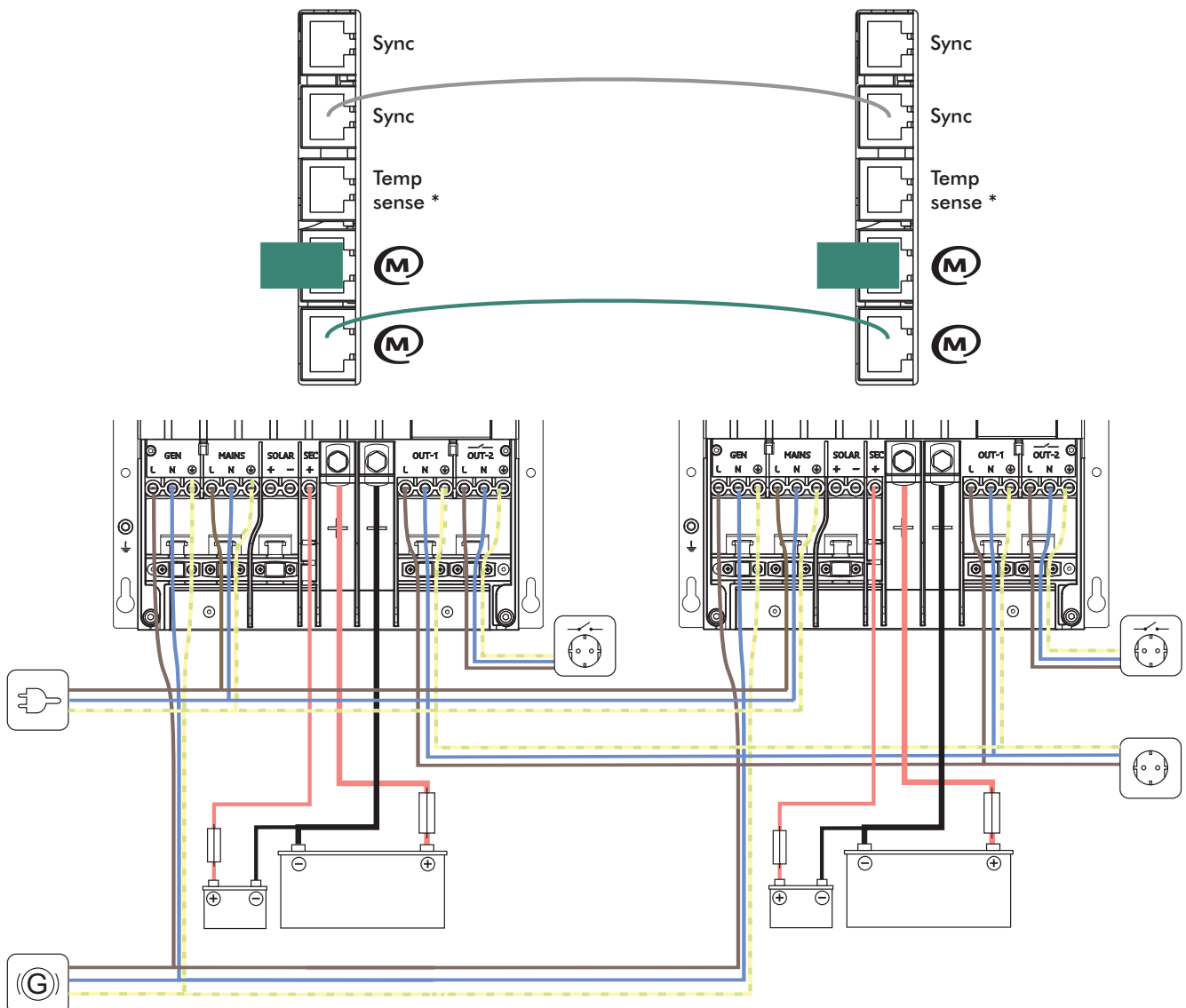
- Socket wrench 13mm to fix the DC-input (battery) cables
- Flat blade screw driver 1.0 x 4.0 mm to fix the screw terminals
- Tools to fix the screws / bolts (Ø 6mm) with plugs to mount the cabinets to a surface
- Philips screw driver to open the connection area of the Mass Combi Ultra

## 2.2 Installation drawing parallel connection

Figure 2-1 shows two Mass Combis Ultra connected in parallel. All corresponding cables must be the same length. In the figure, the AC cables between the generator and the Combis are the same length. Also the battery DC cables are the same length positive and negative and compared to the other Combi.

The connection compartment of two combis is displayed, together with the communication module (figure 0-1, item 13 to 15).

In the MasterBus network, usually a display is installed. In parallel connection, every charger functions individually. Parallel charging is still possible by connecting the charge outputs in parallel to your battery bank.



\*Connection of the temperature sensor is not shown in this example.

Figure 2-1: Two Mass Combi Ultra's connected in parallel

### 3 THREE PHASE CONNECTION

#### 3.1 Things you need for three phase connection

Make sure you have all the parts you need to install p Mass Combis Ultra's per phase in a three phase connection:

Description	Quantity
Mass Combi Ultra	px3
Battery temperature sensor with cable and plug (included)	px3
DC-cable to connect the positive DC connection (+) of the Mass Combi Ultra to the plus pole of the DC-distribution. See section Specifications. Maximum recommended length: 2m / 6ft, colour: preferably red or at least a different colour to make a clear distinction between the positive and negative wire from the battery	px3
DC-cable to connect the negative DC connection (-) of the Mass Combi Ultra to the negative pole of the DC-distribution; see section Specifications. Maximum recommended length: 2m / 6ft, colour: preferably black or at least a different colour to make a clear distinction between the positive and negative wire from the battery	px3
DC-fuse holder with a DC-fuse, to be integrated in the positive DC-cable. See section Specifications.	px3
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	Px12
AC cable* to connect the AC input of the Combis to an external power source (e.g. shore connection, generator);	px3
AC cable* to connect the external load to Output-1 of the Combi	px3
AC cable* to connect the external load to Output-2 of the Combi	px3
MasterBus cable between m Combis	m-1
MasterBus terminator	2
Sync cable between m Combis	m-1
Batteries. Refer to Specifications section for details.	x
Appropriate and reliable cable terminals, cable lugs, battery terminals and cord end terminals	x

\* Double insulated three wire cable with wire colours according to the locally applicable regulations. The applicable length and wire diameter depend on the electrical installation

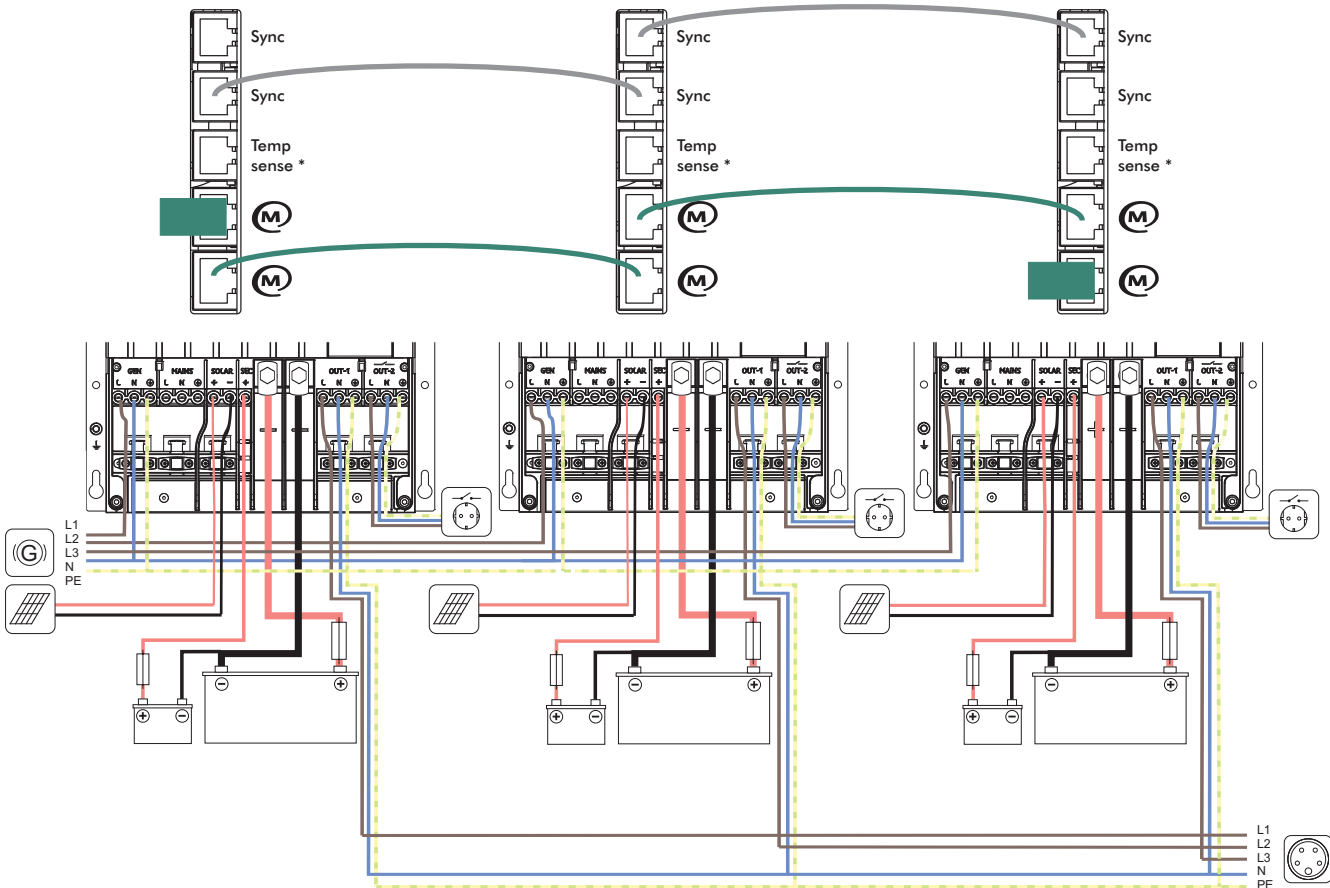
We recommend as a minimum tool kit:

- 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



### 3.2 Installation drawing three phase connection

Figure 3-1 shows two Mass Combis Ultra connected in a three phase configuration. All corresponding cables must be the same length. In the figure, the AC cables between the generator and the Combis are the same length. Also the battery DC cables are the same length positive and negative and compared to the other Combi. The connection compartment of three combis is displayed, together with the communication module. As you see, the MasterBus network has a terminator on both ends



\*Connection of the temperature sensor is not shown in this example.

Figure 3-1: Three Mass Combi Ultra's connected in 3-phase

## 4 CONFIGURATION FOR MULTIPLE COMBI SYSTEMS

The MasterBus name for a multi combi system is "Cluster".

A cluster can be a

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

configuration, with one or more Mass Combi Ultra's in parallel connection per phase.

### 4.1 MasterBus configuration for clusters

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

Value	Meaning	Default	Range
<b>Cluster</b>			
Phase System	Configuration of your energy system.	Single phase	Single phase, Split phase, Three phase
Dev. per phase	Number of Combis in parallel connection per phase	1	1...10
Select devices	Button to enable selection of the other Combis in the cluster. It opens the Phase groups to select the combis connected via MasterBus. If you wish to return to less combis per phase, change the Dev. per phase value and press Select devices again.	Combis connected	Maximum 27 Combis
Cluster topology	State of the topology proposed. If not enough Combis 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 Combis per phase. After cluster activation the phase master and slaves are shown		
Activate cluster	Button to set the cluster to active.		
Cluster state	Indicates the cluster configuration state	Inactive	Inactive, double devices, active

### 4.2 MasterBus monitoring for a three phase cluster

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

Value	Variable	Meaning
<b>Cluster L1 in</b>		
Mains	V	Mains input voltage
	A	Mains input current
	W	Mains input power
Gen	V	Generator input voltage
	A	Generator input current
	W	Generator input power
<b>Cluster L1 out</b>		
AC output 1	V	AC output 1 voltage
	A	AC output 1 current
	W	AC output 1 power

Figure 4-1 shows the monitoring page tabs for a three phase system. Cluster L1 in and out show the values for the first phase in and output. If more Combis are clustered per phase, their values are combined. Notice that Output-2 is recommended not to use in parallel to gain more options in output preferences, refer to the users manual, section AC Output-2 policy. shown in this overview, as it is switchable and therefore the combined output cannot be determined. Cluster L2 and L3 are displayed the same way as Cluster L1. The tab with AC inputs and AC outputs shows the values for the Combi you are looking at.

<b>Cluster L1 in</b> Mains 0,00 V  Mains 0,00 A  Mains 0,00 W  Generator 0,00 V  Generator 0,00 A  Generator 0,00 W	<b>Cluster L2 in</b> Mains 0,00 V  Mains 0,00 A  Mains 0,00 W  Generator 0,00 V  Generator 0,00 A  Generator 0,00 W	<b>Cluster L3 in</b> Mains 0,00 V  Mains 0,00 A  Mains 0,00 W  Generator 0,00 V  Generator 0,00 A  Generator 0,00 W	<b>AC inputs</b> Mains 0,00 V  Mains 0,00 A  Mains 0,00 W  Generator 0,00 V  Generator 0,00 A  Generator 0,00 W
<b>Cluster L1 out</b> AC Output 1 0,00 V  AC Output 1 0,00 A  AC Output 1 0,00 W	<b>Cluster L2 out</b> AC Output 1 0,00 V  AC Output 1 0,00 A  AC Output 1 0,00 W	<b>Cluster L3 out</b> AC Output 1 0,00 V  AC Output 1 0,00 A  AC Output 1 0,00 W	<b>AC outputs</b> AC Output 1 0,00 V  AC Output 1 0,00 A  AC Output 1 0,00 W  AC Output 2 0,00 V  AC Output 2 0,00 A  AC Output 2 0,00 W

Figure 4-1: Monitoring example for a three phase system

#### 4.3 MasterBus specific alarms for multi combi systems

Value	Meaning
Sync error	Synchronization error. The Combis switch to standby, there is no output.
Config error	Configuration error. This alarm is triggered if more Combis 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 Combi Ultra is in alarm, it switches Off together with the other Combi Ultras in the same cluster. This applies for parallel and 3-phase configuration.

#### 4.4 DIP switch settings for two combis in parallel

Dip switch A 1+2 have a combined function for parallel settings of two combis. See table below. Switch A is the upper (right) one. For more combis in parallel connection, MasterBus configuration is necessary.



By operating Dip switches A1 and A2 you will lose all previous cluster configuration!

DIP switch #	A1	A2	Meaning
			<b>Parallel connection</b>
	0	0	This Mass Combi as stand-alone device
	1	0	This Mass Combi as Master device
	0	1	This Mass Combi as Slave device

## 5 OPERATION

### 5.1 Operation of multiple Combi systems

If connected in more phase or parallel configuration, it is important which Combi you selected as the master and which as the slave(s). Operation is done via the main switch on the master. The slave Combis 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.