



# MULTIPLE UNITS

## MASS COMBI ULTRA & MASS COMBI PRO

Parallel or three-phase configurations



INSTALLATION MANUAL

1000007117/04

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## 1 GENERAL INFORMATION

### 1.1 Use of this manual

This installation manual must be read in combination with the standard user manual that is supplied with each unit.



#### **CAUTION!**

**Read chapter SAFETY GUIDELINES AND WARNINGS of the user manual that comes with the unit.**

Every person who works with the Mass Combi Ultra or Mass Combi Pro should be familiar with the contents of this manual and must carefully follow the instructions contained herein.

### 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 or Mass Combi Pro in a multiple unit configuration. This can be a parallel configuration, a three-phase configuration, or a combined three-phase and parallel configuration.

This manual is valid for the following models:

Product code	Model
38013000	Mass Combi Ultra 12/3000-150
38023500	Mass Combi Ultra 24/3500-100
38043500	Mass Combi Ultra 48/3500-50
38513000	Mass Combi Pro 12/3000-150
38523500	Mass Combi Pro 24/3500-100



#### **CAUTION!**

Check the identification label for the device version. The hardware must be version D or later.

**Note:** Most procedures described in this manual are based on the Mass Combi Ultra (MCU). Some of the instructions may not be relevant, or slightly different, for a Mass Combi Pro (MCP).

### 1.3 Purpose of a multiple configuration

There are several reasons for a multiple unit configuration:

- If more output power is needed than one unit can supply, two up to ten MCU or MCP units can be installed in parallel.
- If redundancy is required, units can be installed in parallel to maintain reliable power supply. If one of the units should fail, the remaining units continue.
- Three MCU or MCP units can be installed in a 3-phase configuration to supply three-phase AC power for high-power loads like air-conditioning. By connecting more units in parallel as well, virtually unlimited three-phase power can be made available.

### 1.4 General installation guidelines

When using units in a multiple unit configuration, the following requirements are applicable in addition to the requirements mentioned in the relevant user manual:

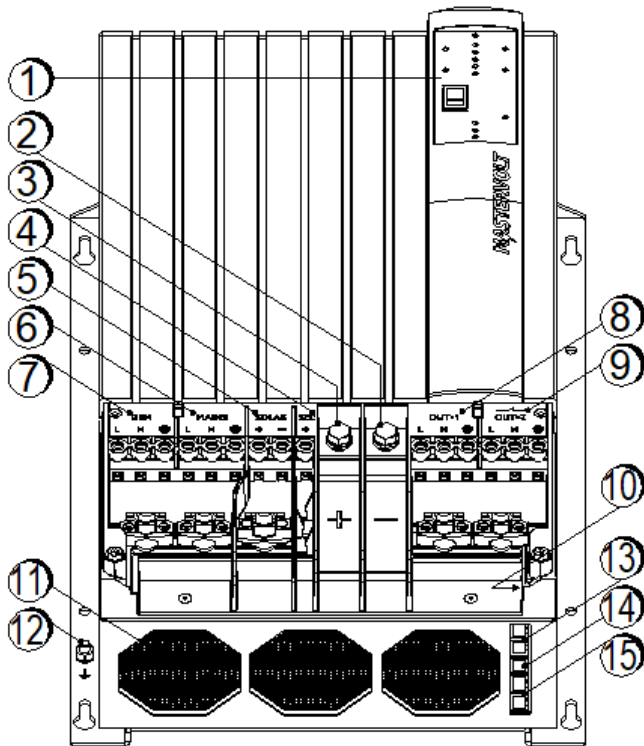
- Use identical MCU or MCP units (with the same product codes) in a multiple unit configuration. Provided that they use the same DC voltage, also a mix of MCU and MCP units can be used.
- Maximum number of units in parallel: 10.
- Maximum number of units in a three-phase parallel configuration: 3 x 3.
- Installation and commissioning of multiple units requires configuration of MasterBus settings in MasterAdjust from a Windows PC connected to a unit via a MasterBus USB Interface. MasterAdjust software is available as free to download software on the Mastervolt website: [www.mastervolt.com](http://www.mastervolt.com). The installer must be familiar with the configuration tool.
- Allow sufficient ventilation to prevent build-up of hot air. When installing multiple units either side by side or vertically above each other, at least 10 cm free space must be kept between the units. If necessary, adequate measures must be taken to avoid one unit heating up the other.
- Keep DC cables to the units all the same length and size. Keep the cable lengths as short as possible!



#### **WARNING!**

High currents will pass through the wiring! The wire sizes stated in this manual are only guidelines. Fusing is based on the size and length of the cable, which in turn depend on the load connected to the unit. Always comply with all local rules and regulations.

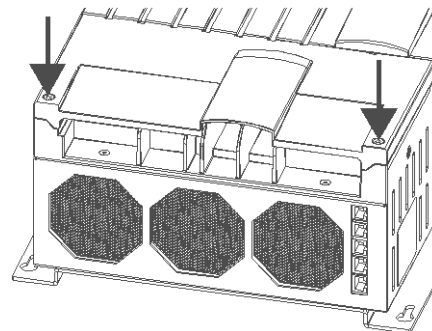
## 1.5 Overview of the Mass Combi



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

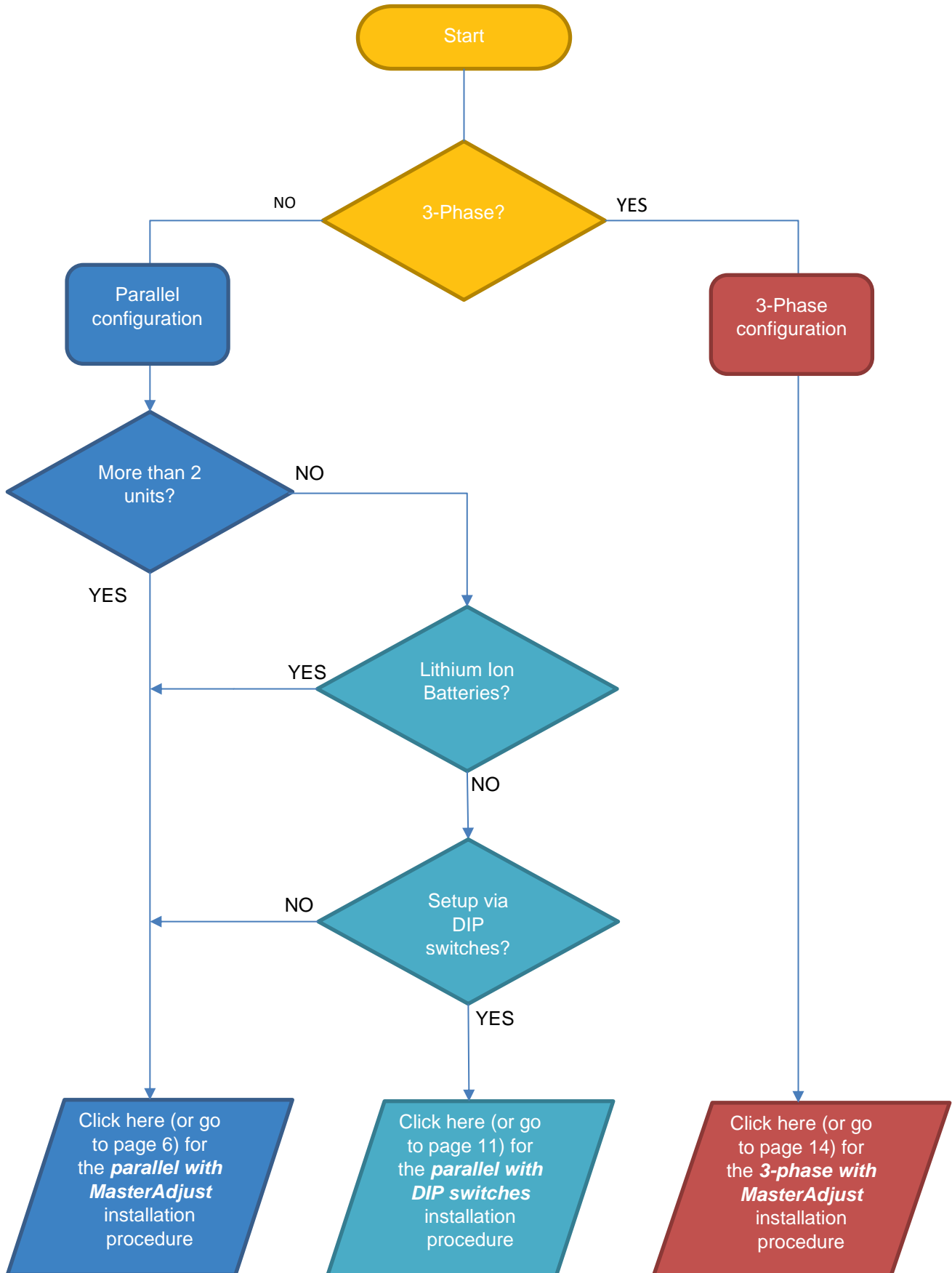
\* MCU 12/3000-150 and 24/3500-100 only

Remove the cover by loosening these two screws:



## 2 FLOWCHART

Use the following flowchart to determine which installation procedure to use.



### 3 PARALLEL CONFIGURATION WITH MASTERADJUST

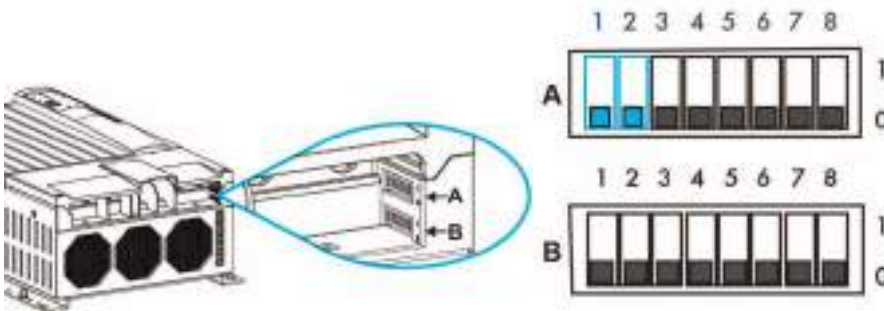
Up to 10 units may be set in parallel with MasterAdjust. Either use identical MCU or MCP units, or a mix of MCU and MCP units that use the same DC voltage. Basic knowledge of MasterAdjust is required.

#### 3.1 Materials needed

Description	Quantity
Multiple units of the same type	n
Temperature sensor with cable and plug (included)	
MasterBus Terminator (included but not always needed)	
MasterBus cables between units (product code e.g. 3 meter: 77040300)	n-1
Sync cables to interconnect all units (product code e.g. 3 meter: 6502000030)	n-1
MasterBus USB Interface (product code: 77030100)	1
Windows based PC with the MasterAdjust configuration tool	1
DC + cable with fuse	n
DC – cable	n
AC cable to connect the AC input of the unit to an external power source	n
AC cable to connect the external load to OUTPUT 1	n
AC cable to connect the external load to OUTPUT 2	n

#### 3.2 Preparations

- Make sure that all power sources (AC and DC) are switched off.
- Make sure that DIP switches A1 and A2 are off on all units.

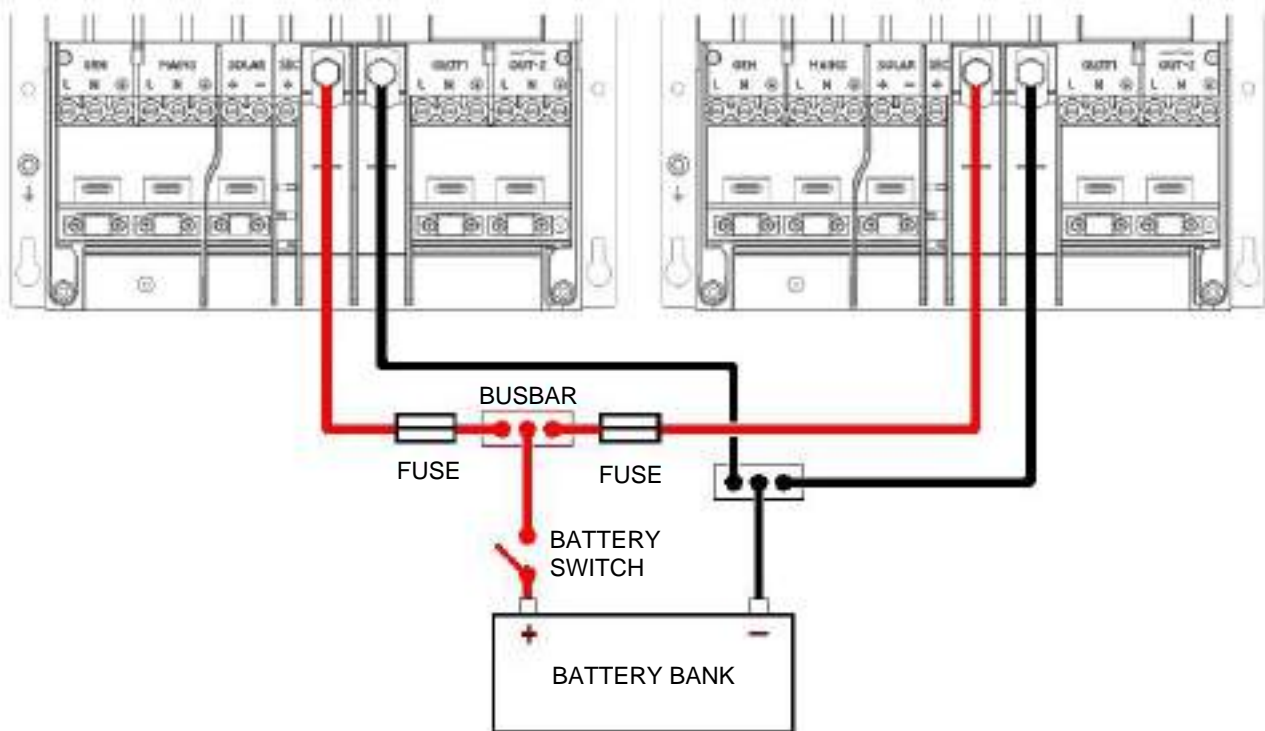


*DIP switch location*

All other DIP switches (B1...B8 and A3...A8) on the Replica unit(s) must match the settings on the Primary unit. For an overview of DIP switch settings, please see the user manual.

### 3.3 DC wiring of parallel units

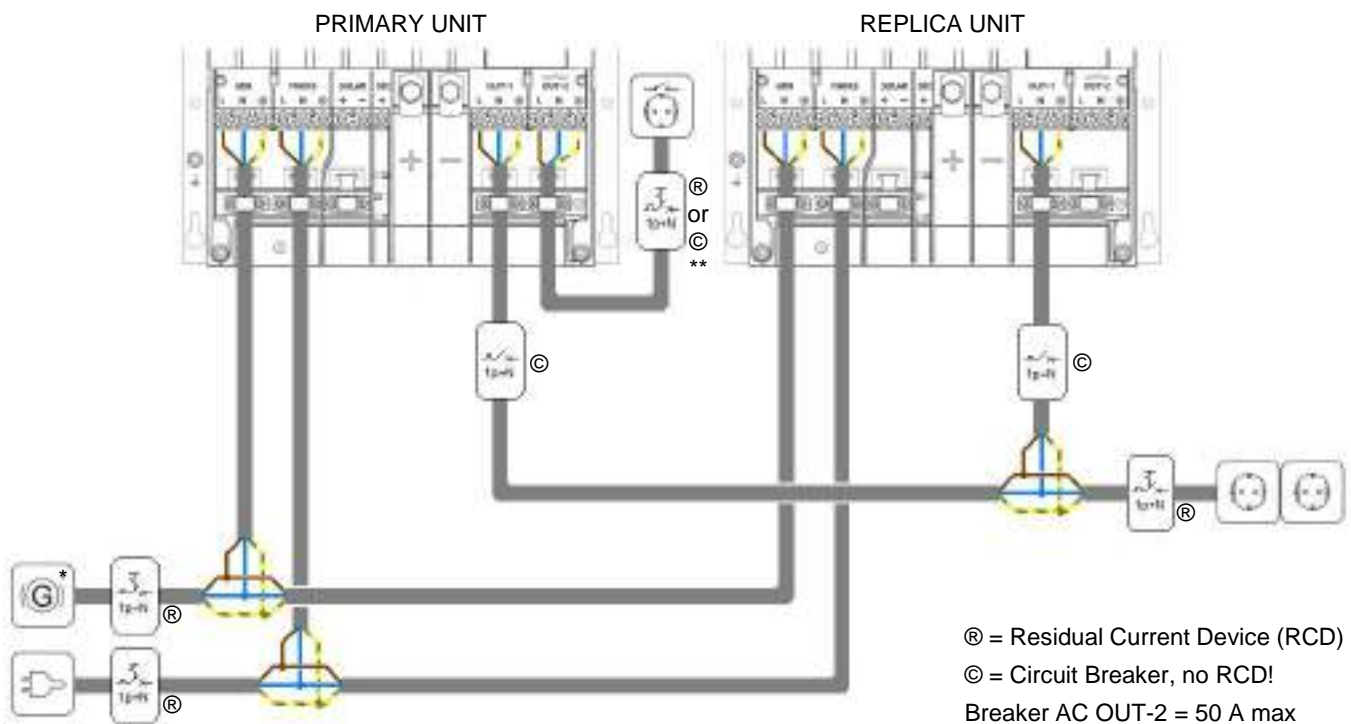
**Note:** Always use the same length positive and negative cables! Be aware that to keep the drawings in this chapter clear and easy to read, the cable lengths have not been drawn in proportion to each other.



Power system	Minimum DC cable cross section	Inline fuse	Recommended battery bank
12V	95 mm <sup>2</sup>	350 A	800 Ah
24V	50 mm <sup>2</sup>	175 A	400 Ah
48V	35 mm <sup>2</sup>	80 A	200 Ah

Indicated cable sizes are for cables from unit to busbar and shorter than 3m. Cables from busbar to battery bank should be twice the diameter. When cables are longer than 3m, the size should be increased to compensate for cable losses.

### 3.4 AC wiring of parallel units



Ⓜ = Residual Current Device (RCD)  
 © = Circuit Breaker, no RCD!  
 Breaker AC OUT-2 = 50 A max

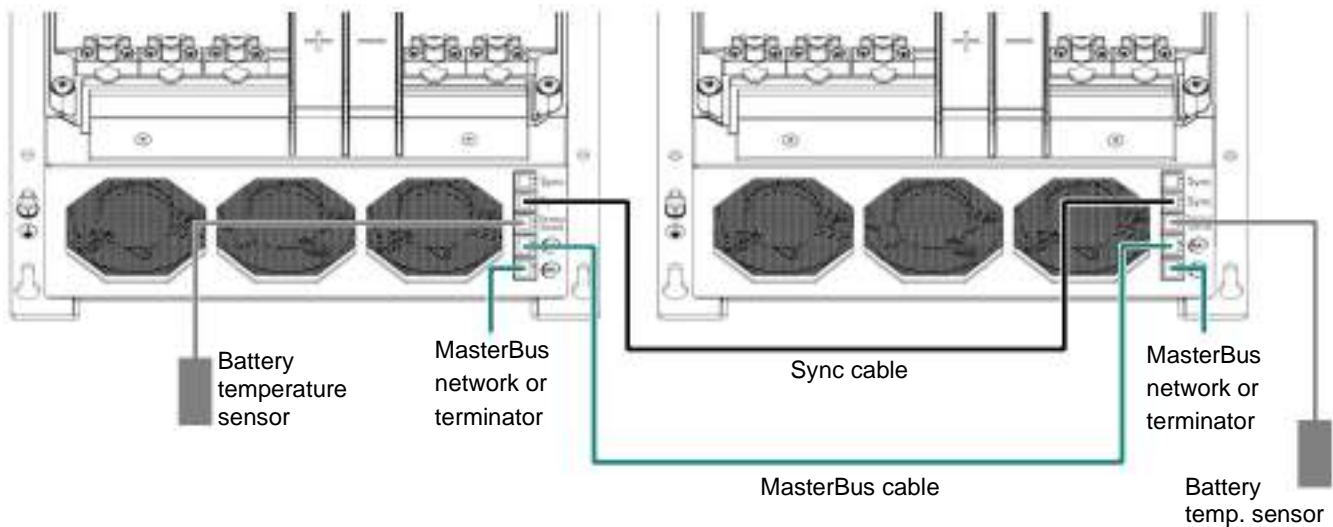
\* Neutral to ground bonding depending on local regulations.

\*\* Use an RCD when "AC out 2 policy" is set to "Always on".

Generator power	AC cable cross section	Breaker size
Max 3.5 kW	2.5 mm <sup>2</sup>	20 A
3.6 – 7 kW	4.0 mm <sup>2</sup>	40 A
7.1 – 10 kW	6.0 mm <sup>2</sup>	50 A
> 10 kW	10.0 mm <sup>2</sup>	63 A

Mains power	AC cable cross section
Max 16 A	3x 2.5 mm <sup>2</sup>
Max 32 A	3x 4.0 mm <sup>2</sup>

### 3.5 Network wiring of parallel units



### 3.6 Configuration with MasterAdjust

#### Pre-commissioning

1. Make sure that the units are switched off.
2. Make sure that all connections are firmly tightened.
3. Install the DC fuses and close the battery switch.
4. Close the covers of all units.
5. Close the AC breaker in AC output 1 of each unit.
6. Switch on all units.
7. If not already available, connect a MasterBus USB Interface to the MasterBus network and to a PC, and open MasterAdjust. Installation or configuration errors may come up in MasterAdjust while the configuration is in progress. This is normal.

#### Configuration

8. In MasterAdjust, check that the units are running the latest firmware (software version). See the Mastervolt Portal for more information.



9. In the device list, in the left pane of MasterAdjust, right-click the Primary unit and select **Login**. The Primary unit is the device that has the AC OUT-2 connection. The other units are called Replica units. Note that in the older MCU and MCP dialog windows Primary is called Master and Replica is called Slave.



10. Select **Installer** and enter the installer code.

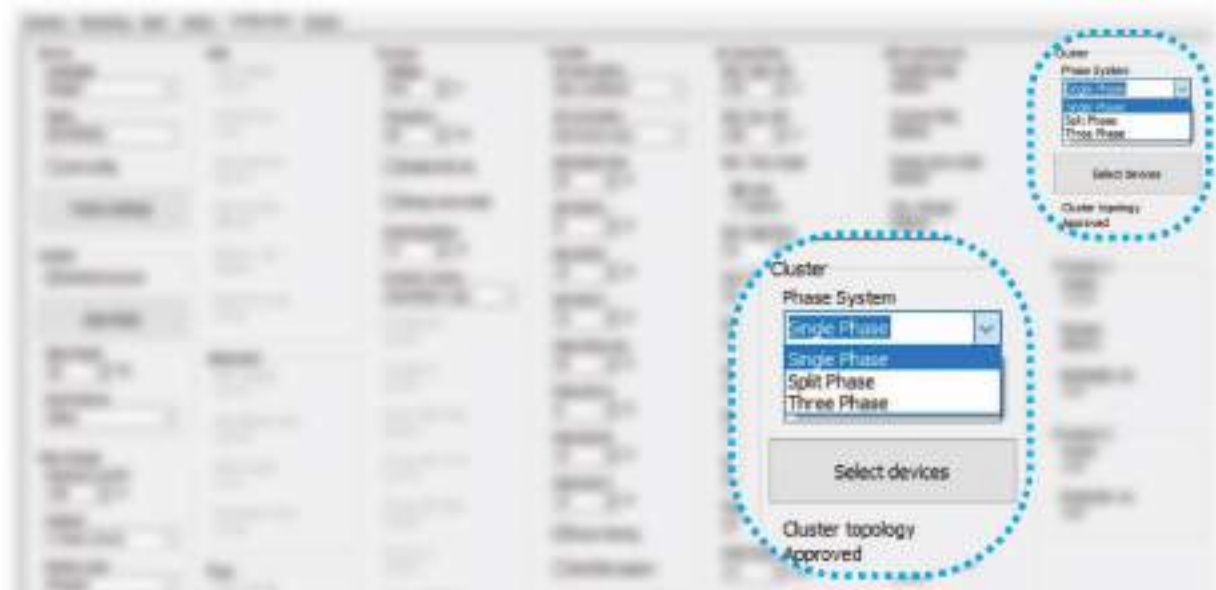


11. Go to the Configuration tab and give the unit a logical name. For example, MCU Primary. Do the same for the Replica units. It's good practice to label them Replica 1, Replica 2 etc.

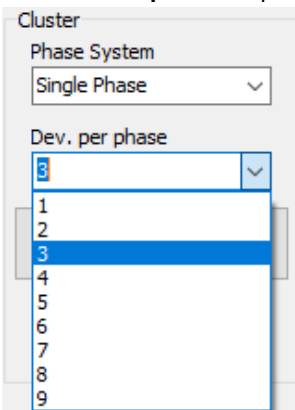
**Note:** battery settings must be configured the same on all units.

12. Return to the Configuration tab of the Primary unit. All settings are done here. However, if Mastervolt Lithium-Ion batteries are connected, all events, like Stop Discharge for example, must be configured for ALL units separately.

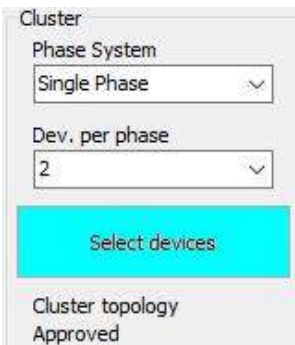
13. From the **Cluster** drop-down list, select **Single Phase**. You may need to maximize the MasterAdjust window or scroll all the way to the right to see this.



14. From the **Dev. Per phase** drop-down list, select the number of units in parallel (Primary + Replica).

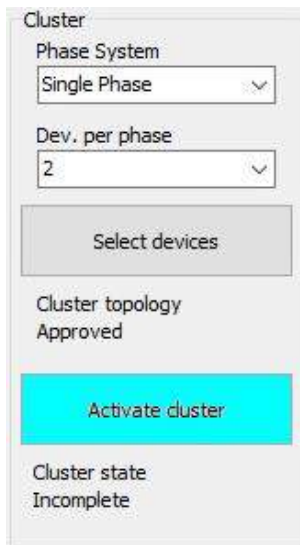


15. Click the **Select devices** button to be able to select the Replica unit(s).



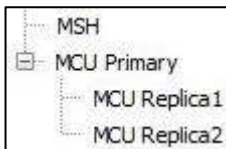
16. Notice the **Cluster topology** and **Cluster state**. Topology monitors the size of the cluster (whether the selected number of units is equal to the selected number of devices). State monitors the configuration state of the cluster.

Click the **Activate cluster** button to finish the cluster configuration.



The screenshot shows a configuration panel for a cluster. At the top, it is titled "Cluster". Below the title, there are two dropdown menus: "Phase System" set to "Single Phase" and "Dev. per phase" set to "2". Below these is a "Select devices" button. Underneath, the "Cluster topology" is shown as "Approved". A prominent cyan button labeled "Activate cluster" is visible. At the bottom, the "Cluster state" is shown as "Incomplete".

In the device list, in the left pane of MasterAdjust, the Replica unit(s) will now be listed under the Primary unit.



### 3.7 Initial start-up

1. Switch all units off and on again.
2. Check that the units are working as inverter.
3. Close the AC breaker in the Mains Input of each unit.
4. Check that the units are working as charger when 230VAC is applied to the Mains Inputs.
5. If applicable repeat this procedure for the generator.

## 4 PARALLEL CONFIGURATION WITH DIP SWITCHES

Two units can be set in parallel with DIP-switches. This can be two identical MCU or MCP units. Provided that they use the same DC voltage, this can also be one MCU and one MCP.

### 4.1 Materials needed

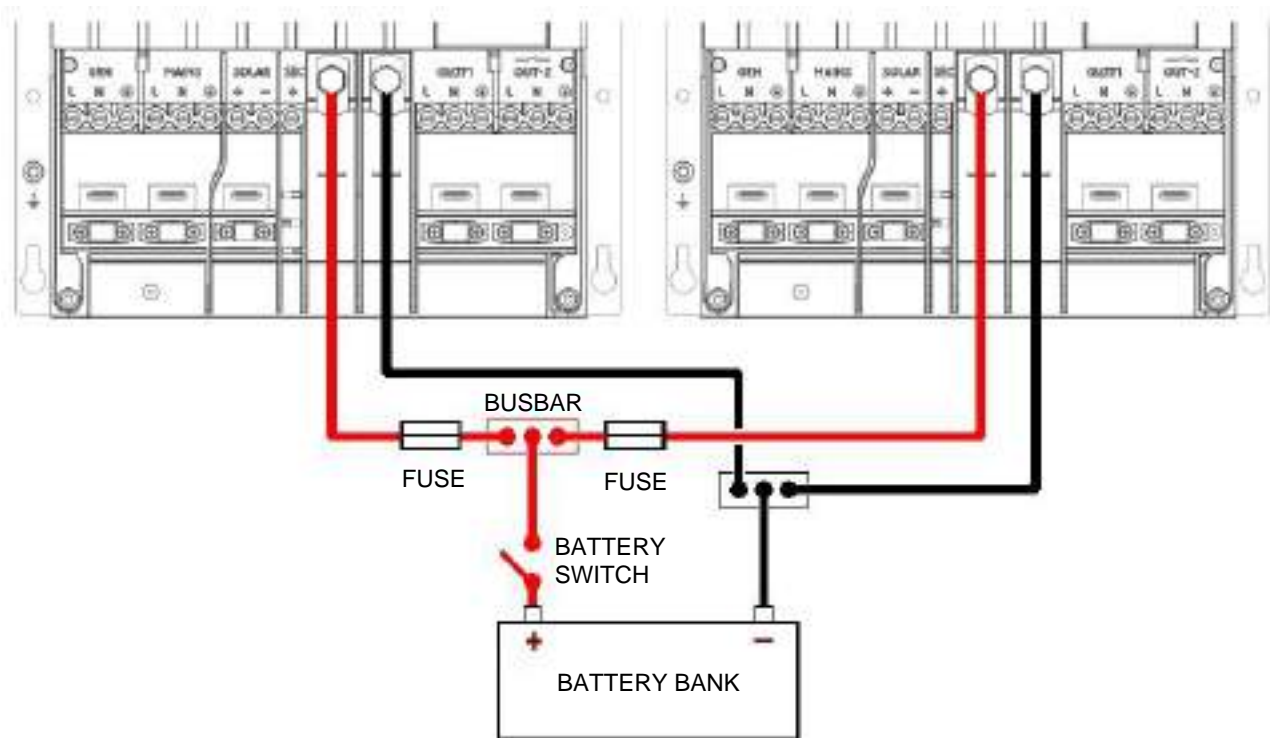
Description	Quantity
Two units	2
Temperature sensor with cable and plug (included)	
MasterBus Terminator (included but not always needed)	
MasterBus cables between units (product code e.g. 3 meter: 77040300)	1
Sync cables to interconnect all units (product code e.g. 3 meter: 6502000030)	1
DC + cable with fuse	2
DC – cable	2
AC cable to connect the AC input of the unit to an external power source	2
AC cable to connect the external load to OUTPUT 1	2
AC cable to connect the external load to OUTPUT 2	2

### 4.2 Preparation

- Make sure that all power sources (AC and DC) are switched off.

### 4.3 DC wiring of parallel units

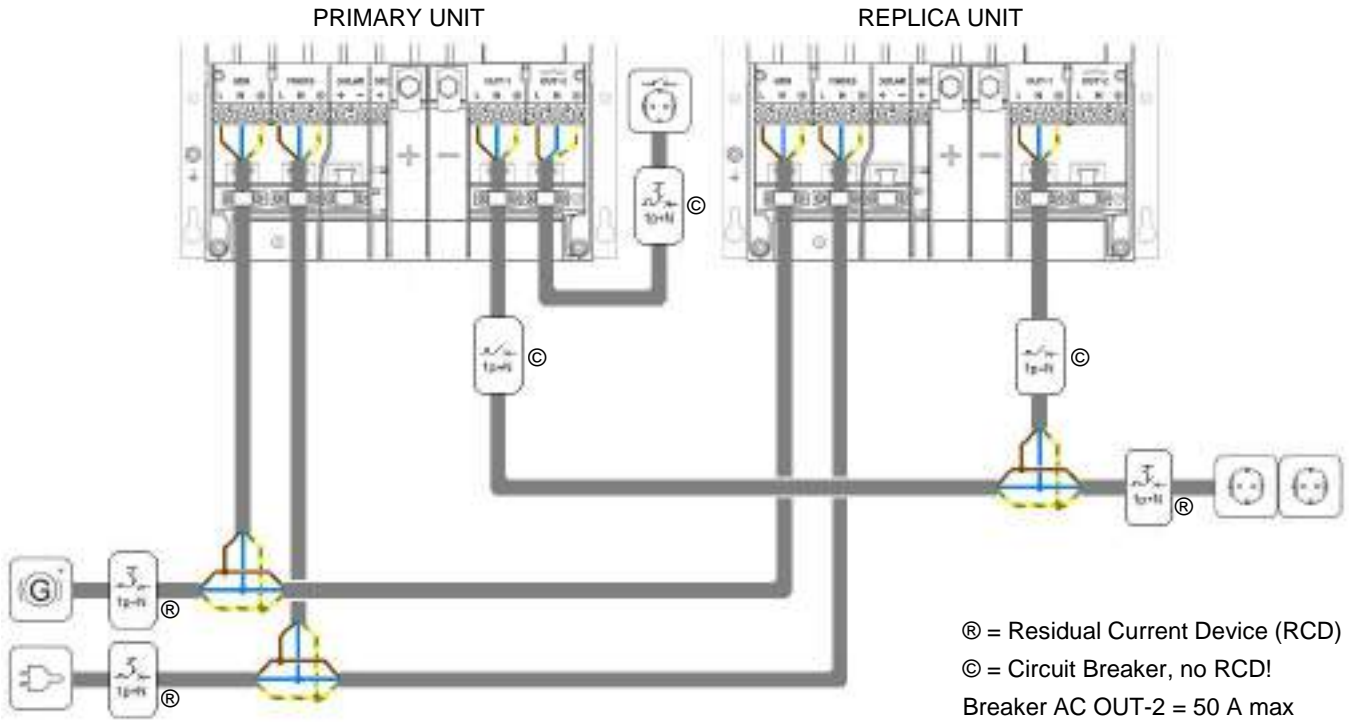
**Note:** Always use the same length positive and negative cables! Be aware that to keep the drawings in this chapter clear and easy to read, the cable lengths have not been drawn in proportion to each other.



Power system	DC cable cross section	Inline fuse	Recommended battery bank
12V	95 mm <sup>2</sup>	350 A	800 Ah
24V	50 mm <sup>2</sup>	175 A	400 Ah
48V	35 mm <sup>2</sup>	80 A	200 Ah

Indicated cable sizes are for cables from unit to busbar and shorter than 3m. Cables from busbar to battery bank should be twice the diameter. When cables are longer than 3m, the size should be increased to compensate for cable losses.

4.4 AC wiring of parallel units

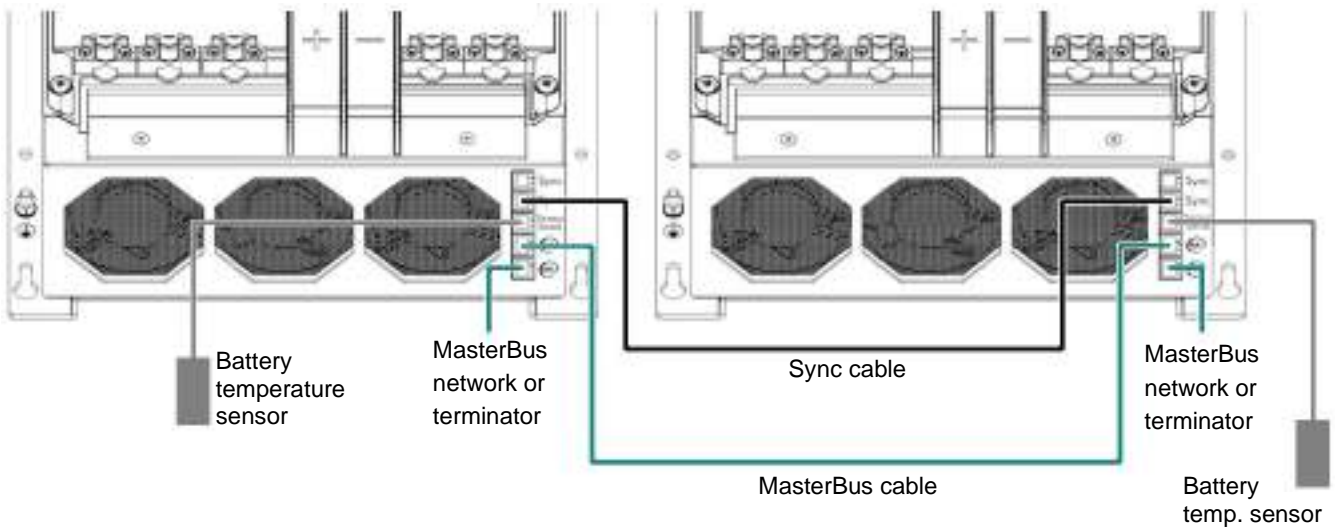


\* Neutral to ground bonding depending on local regulations

Generator power	AC cable cross section	Breaker size
Max 3.5 kW	2.5 mm <sup>2</sup>	20 A
3.6 – 7 kW	4.0 mm <sup>2</sup>	40 A
7.1 – 10 kW	6.0 mm <sup>2</sup>	50 A
> 10 kW	10.0 mm <sup>2</sup>	63 A

Mains power	AC cable cross section
Max 16 A	3x 2.5 mm <sup>2</sup>
Max 32 A	3x 4.0 mm <sup>2</sup>

4.5 Network wiring of parallel units



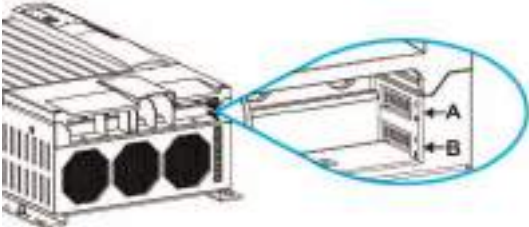
## 4.6 Configuration with DIP switches

### Pre-commissioning

1. Make sure that the units are switched off.
2. Make sure that all connections are firmly tightened.

### Configuration

3. Use a small screwdriver to carefully set the DIP switches of block A:



#### DIP switch location MCU & MCP

On the Primary unit set DIP switch A1 on (position 1) and keep A2 off (position 0).



On the Replica unit keep DIP switch A1 off (position 0) and set A2 on (position 1).



All other DIP switches (B1...B8 and A3...A8) on the Replica unit must match the settings on the Primary unit. For an overview of DIP switch settings, please see the user manual.

## 4.7 Initial start-up

1. Install the DC fuses and close the battery switch.
2. Close the covers of all units.
3. Close the AC breaker in AC output 1 of each unit.
4. Switch on all units.
5. Check that the units are working as inverter.
6. Close the AC breaker in the Mains Input of each unit.
7. Check that the units are working as charger when 230VAC is applied to the Mains Inputs.
8. If applicable repeat this procedure for the generator.

## 5 THREE-PHASE CONFIGURATION WITH MASTERADJUST

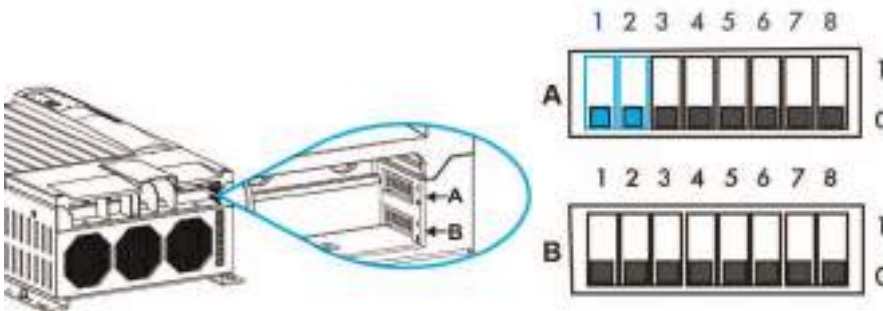
Three identical MCU or MCP units can be set in a 3-phase star-configuration with MasterAdjust. Provided that they use the same DC voltage, this can also be a mix of MCU and MCP units. Basic knowledge of MasterAdjust is required.

### 5.1 Materials needed

Description	Quantity
Three identical units or MCU & MCP with the same DC voltage	3
Temperature sensor with cable and plug (included)	
MasterBus Terminator (included but not always needed)	
MasterBus cables between units (product code e.g. 3 meter: 77040300)	2
Sync cables to interconnect all units (product code e.g. 3 meter: 6502000030)	2
MasterBus USB Interface (product code: 77030100)	1
Windows based PC with the MasterAdjust configuration tool	1
DC + cable with fuse	3
DC – cable	3
AC cable to connect the AC input of the unit to an external power source	3
AC cable to connect the external load to OUTPUT 1	3
AC cable to connect the external load to OUTPUT 2	3

### 5.2 Preparations

- Make sure that all power sources (AC and DC) are switched off.
- Make sure that DIP switches A1 and A2 are off on all units.

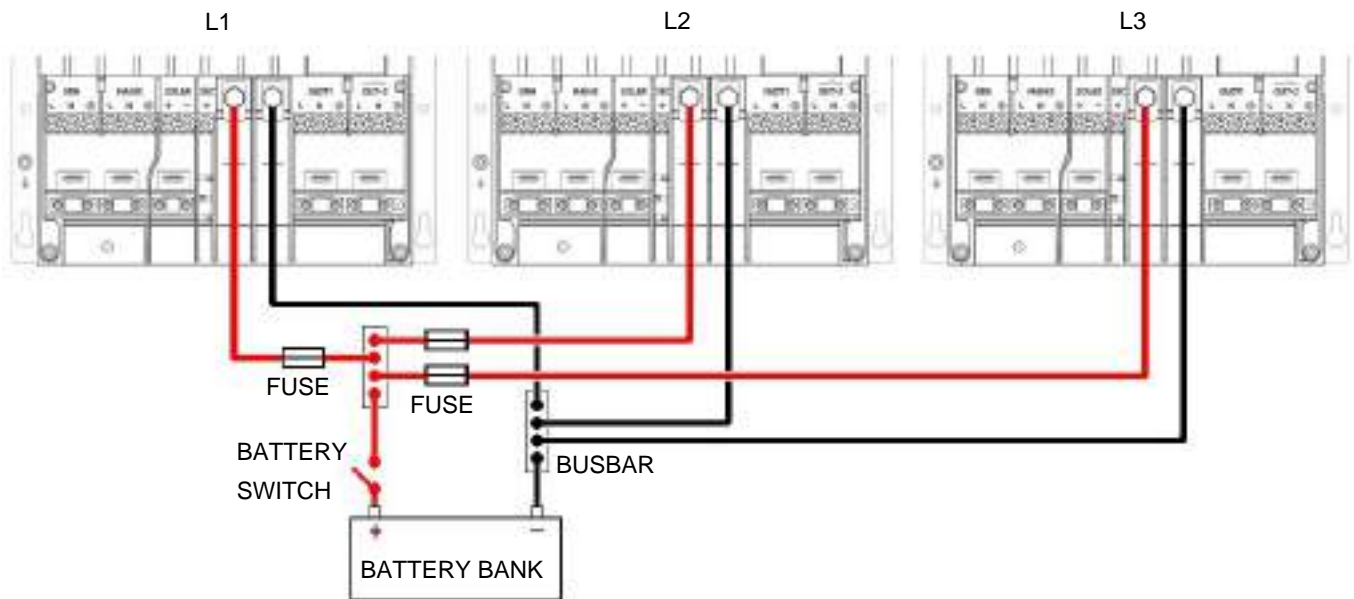


*DIP switch location*

All other DIP switches (B1...B8 and A3...A8) on the Replica units must match the settings on the Primary unit. For an overview of DIP switch settings, please see the user manual.

### 5.3 DC wiring of three-phase units

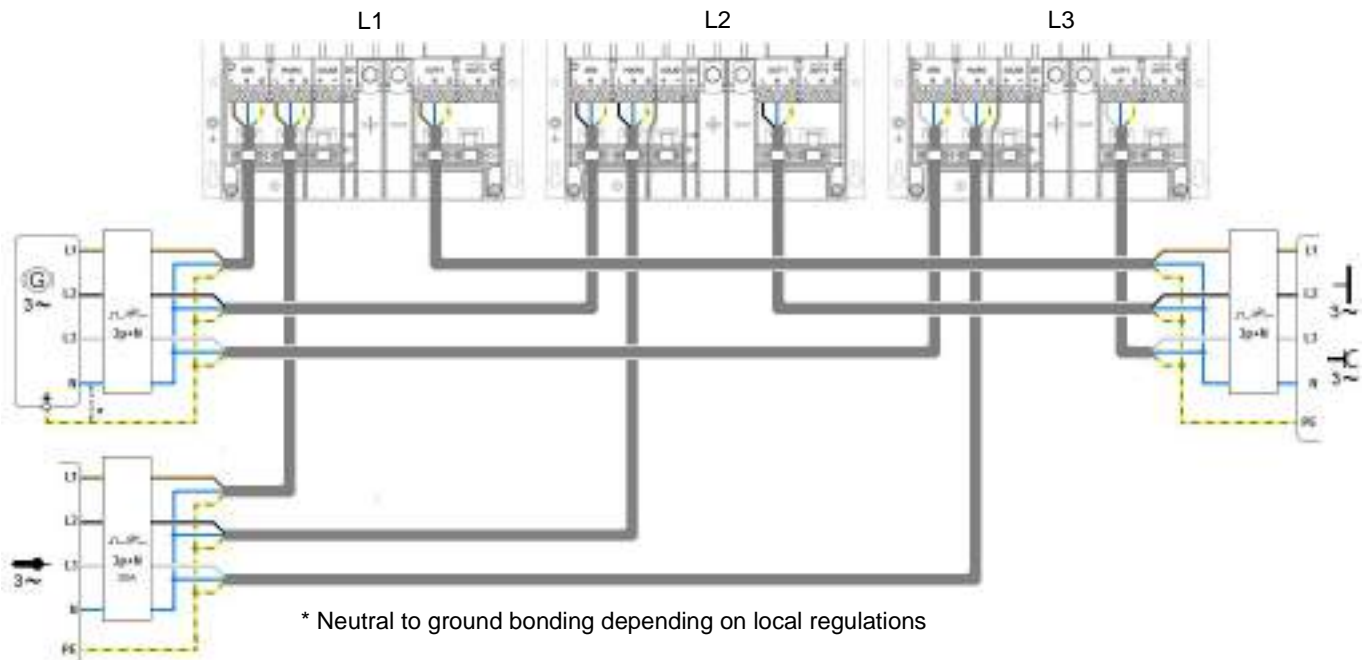
**Note:** Always use the same length positive and negative cables! Be aware that to keep the drawings in this chapter clear and easy to read, the cable lengths have not been drawn in proportion to each other.



Power system	DC cable cross section	Inline fuse	Recommended battery bank
12V	95 mm <sup>2</sup>	350 A	800 Ah
24V	50 mm <sup>2</sup>	175 A	400 Ah
48V	35 mm <sup>2</sup>	80 A	200 Ah

Indicated cable sizes are for cables from unit to busbar and shorter than 3m. Cables from busbar to battery bank should be twice the diameter. When cables are longer than 3m, the size should be increased to compensate for cable losses.

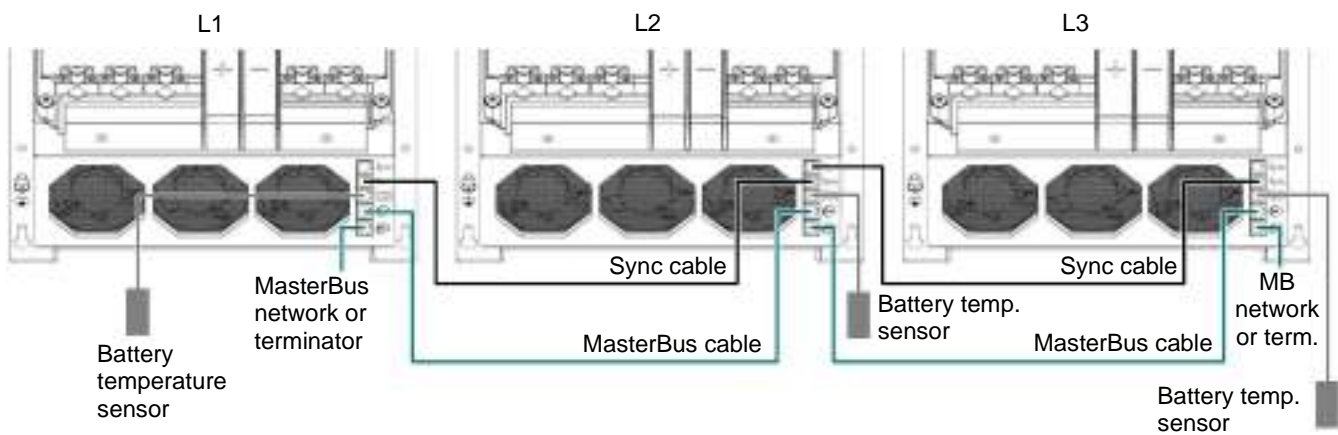
### 5.4 AC wiring of three-phase units



Mains power cable cross section: 2.5 mm<sup>2</sup>

Generator power	AC cable cross section	Breaker size
Max 10 kW	2.5 mm <sup>2</sup>	25 A
11 – 20 kW	4.0 mm <sup>2</sup>	40 A
21 – 30 kW	6.0 mm <sup>2</sup>	50 A
> 30 kW	10.0 mm <sup>2</sup>	63 A

## 5.5 Network wiring of three-phase units



## 5.6 Configuration with MasterAdjust

### Pre-commissioning

1. Make sure that the units are switched off.
2. Make sure that all connections are firmly tightened.
3. Install the DC fuses and close the battery switch.
4. Close the covers of all units.
5. Switch on all units.
6. If not already available, connect a MasterBus USB Interface to the MasterBus network and to a PC, and open MasterAdjust. Installation or configuration errors may come up in MasterAdjust while the configuration is in progress. This is normal.

### Configuration

7. In MasterAdjust, check that the units are running the latest firmware. See the Mastervolt Portal for more information.



8. In the device list, in the left pane of MasterAdjust, right-click the L1 unit and select **Login**.
9. Select **Installer** and enter the installer code.

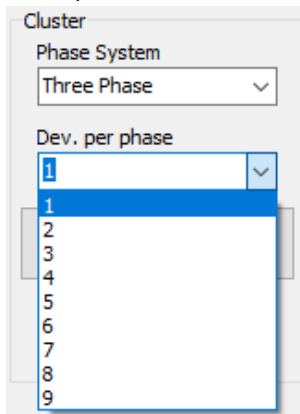


10. Go to the Configuration tab and give the unit a logical name. For example, MCU L1, MCU L2 and MCU L3.
11. Return to the Configuration tab of the L1 unit. All settings are done here. However, if Mastervolt Lithium-Ion batteries are connected, all events, like Stop Discharge for example, must be configured for ALL units separately.
12. In the **Cluster** pane, from the **Phase System** drop-down list, select **Three Phase**. You may need to maximize the MasterAdjust window or scroll all the way to the right to see this.

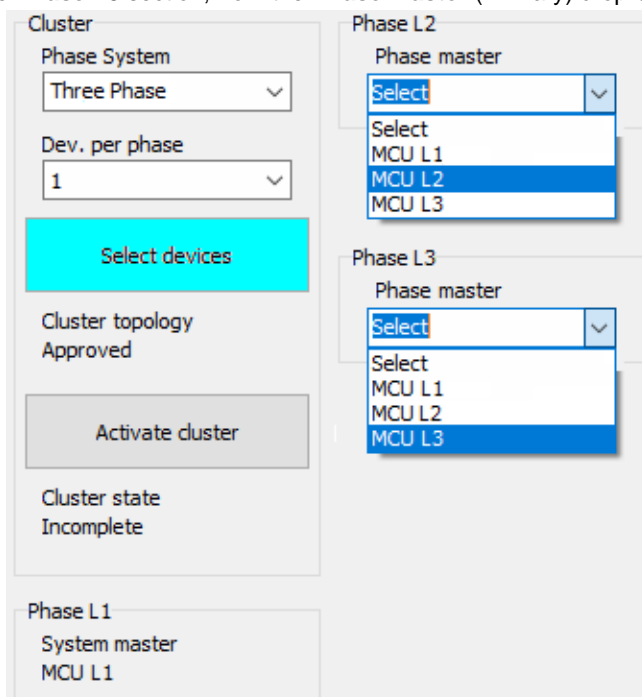




13. From the **Dev. Per phase** drop-down list, select PER PHASE the number of units in parallel (Primary + Replica)!  
 In our example this is 1.



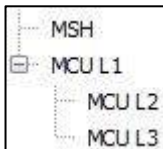
14. Click the **Select devices** button to be able to select the L2 and L3 units.  
 In the **Phase L2** section, from the **Phase master** (Primary) drop-down list, select the L2 unit.  
 In the **Phase L3** section, from the **Phase master** (Primary) drop-down list, select the L3 unit.



15. Notice the **Cluster topology** and **Cluster state**. Topology monitors the size of the cluster (whether the selected number of units is equal to the selected number of devices). State monitors the configuration state of the cluster. Click the **Activate cluster** button to finish the cluster configuration. The Cluster state will change from "Incomplete" to "Active".

The screenshot shows a 'Cluster' configuration window. At the top, 'Phase System' is set to 'Three Phase' and 'Dev. per phase' is set to '1'. Below these are two buttons: 'Select devices' and 'Activate cluster'. The 'Cluster topology' is shown as 'Approved' and the 'Cluster state' is shown as 'Active'.

16. In the device list, in the left pane of MasterAdjust, the L2 and L3 units will now be listed under the L1 unit.



## 5.7 Initial start-up

1. Switch all units off and on again.
2. Check that the units are working as inverter.
3. Close the AC breaker in the Mains Input of each unit.
4. Check that the units are working as charger when 230Vac is applied to the Mains Inputs.
5. If applicable repeat this procedure for the generator.

**Note:** in three-phase configuration the units will only switch over to charger mode if all three phases are present and accepted (gen and/or mains)

## 5.8 General remark on three-phase public power grids

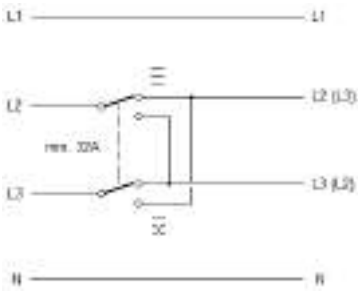
Depending on national guidelines, the rotation of the three-phase public grid can be different. The field-rotation of the configured Combi-system is always L1-L2-L3-L1-L2-L3- ... etc. If the public grid has a – in respect to the Combi-rotation – reverse rotation (L1-L3-L2-L1-L3-L2 etc.), then the grid power will not be accepted by the Combis and result in an error and/or units remaining in inverter-mode. To overcome this situation, the incoming phase lines L2 and L3 on the mains-inputs of the Combis L2 and L3 the must be swapped. There are several ways to achieve this:

- Use of three-phase inlets/sockets with integrated phase swapping. Plugs from Mennekes for example, can invert the phases by simply rotating a swivel with a screwdriver.

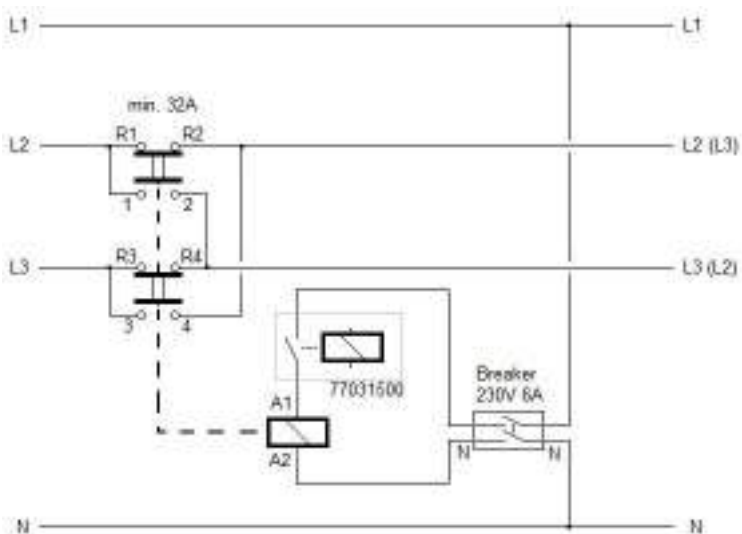
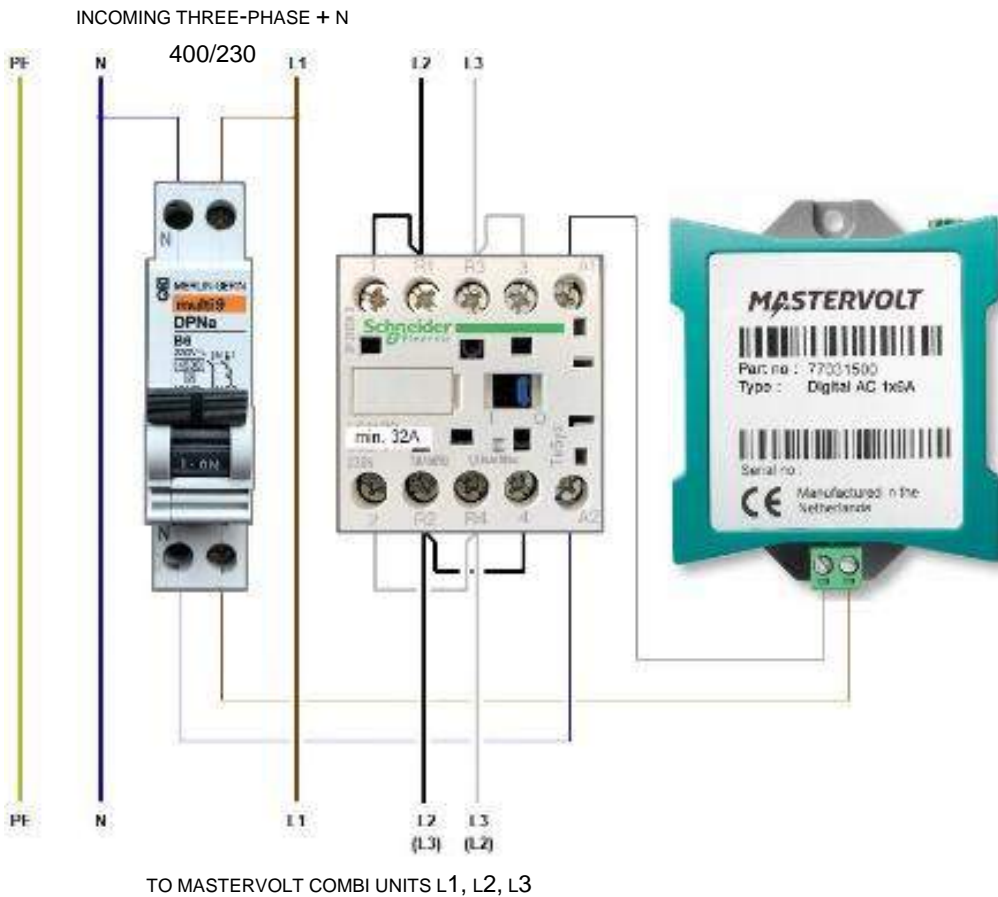


- Phase inverter plug 32A (EAN: 4015394215530)
- Phase inverter plug 16A (EAN: 4015394201182)
- Panel mounted phase inverter inlet 16A (EAN: 4015394180630)
- Wall mounted phase inverter inlet 32A (EAN: 4015394215769)
- Wall mounted phase inverter inlet 16A (EAN: 4015394207450)

- Use of a double pole double throw switch of at least 32A / 400V)



- Use of an AC 1x6 relay controlled by MasterBus (product code: 77031500):



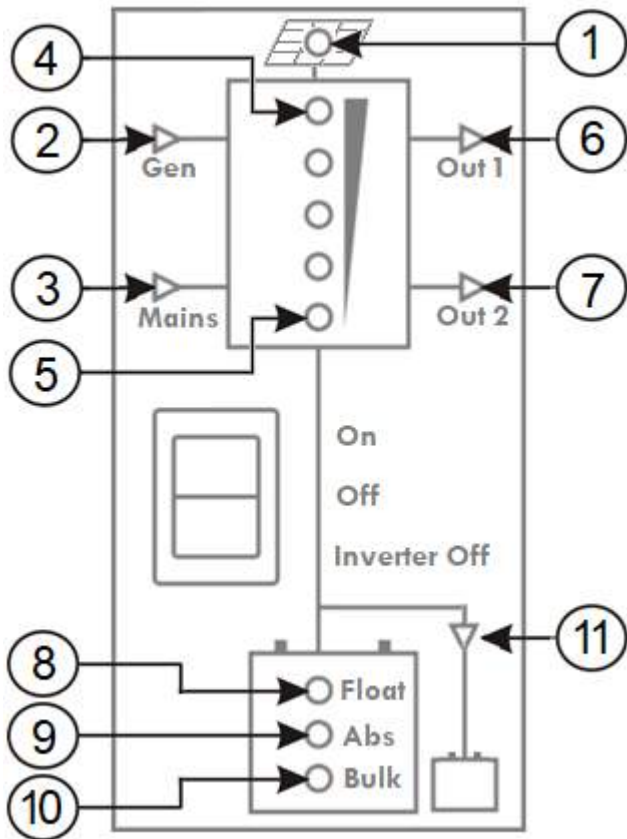
To control the relay, suitable events need to be configured. This can be done from an EasyView 5 for example. See the relevant user manual for more information on events.

## 6 TROUBLESHOOTING

Errors in parallel configuration will be shown by the LED indicators in the display.

**Note:** An error also occurs if the AC OUT-1 of the units are not connected to each other (breakers!).

The "Mains" LED on the Replica unit will keep blinking while the same LED on the Primary unit will be solid on when the MAINS AC input is accepted. This normal behavior. Likewise LED "GEN" on the Replica unit will keep blinking while the same LED on the Primary unit will be solid on when the GEN AC input is accepted. This is also normal behavior.



LED 1 is MCU 12/3000-150 and 24/3500-100 only

illuminating LEDs	MasterBus alarm	Explanation / Possible cause	What to do
<b>Normal operation and warnings</b>			
None		The MCU/MCP is switched off manually.	Switch on the MCU/MCP by means of the main switch.
(1) blinking		Error: solar voltage or current out of range	Check Solar input, refer to input specifications in user manual.
(2) blinking slowly (2x/sec)		Inverter is synchronizing voltage and frequency to generator AC.  <b>On Replica unit:</b> normal operation, Replica unit is detecting AC mains	Wait until the inverter is ready synchronizing. After this, it will activate the generator input.  No action required
(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 8.
(3) blinking slowly (2x/sec)		The inverter is synchronizing its voltage and frequency to mains AC  <b>On Replica unit:</b> normal operation, Replica unit is detecting AC gen	Wait until the inverter is ready synchronizing. After this, it will activate the mains input.  No action required
(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 manual.
(4) red	MB monitoring: Overload	Inverter in overload, inverted power exceeds 3500 W	Check the load connected and disconnect.
(10) red	Battery low	Battery voltage low	Stop inverting, start charging
(11) blinking	Error in sec charger	Internal Hardware error	Contact Mastervolt
(10) blinking red		Charging a low battery	Disconnect all DC loads
<b>Errors (MCU/MCP shuts down)</b>			
(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 Sync cables and connectors
<b>Permanent errors (manual reset required)</b>			
(4) and (10) blinking fast red	Overload	Number of inverter overload restart attempts exceeded.	Reduce the output loads, shut off and on the MCU/MCP.
	System error	Hardware issue	Switch off and on the MCU/MCP.
(6) and (7) blinking fast	Install error	Installation error	Correct installation, shut off and on the MCU/MCP.

### Monitoring a three-phase cluster

In MasterAdjust, on the monitoring tab of the L1 unit, first the data for the unit itself is shown. Next are the Cluster groups(L1, L2 and L3). Per phase, input and output data is shown. If more units are clustered per phase, their values are combined.

The list with AC outputs shows the values for the selected unit.



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