MASTERVOLT

THE POWER TO BE INDEPENDENT

MULTIPLE UNITS

MASS SINE ULTRA

Parallel or three-phase configurations

INSTALLATION MANUAL

TABLE OF CONTENTS:

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 Sine Ultra 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 Sine Ultra (MSU) in a multiple unit configuration. This can be a parallel configuration, a three-phase configuration, or a combined three-phase and parallel configuration.

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 MSU 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 MSU 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 user manual:

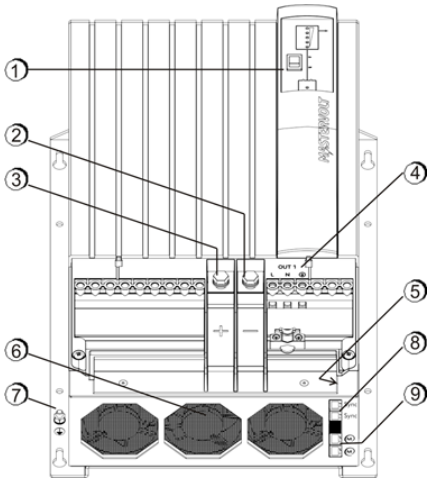
- Maximum number of units in parallel: 10.
- Maximum number of units in a three-phase parallel configuration: 3 x 3.
- Installation and commissioning of multiple units requires configuration of MasterBus settings in MasterAdjust from a Windows PC connected to a unit via a Mastervolt USB Interface. MasterAdjust software is available as free to download software on the Mastervolt website: 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!

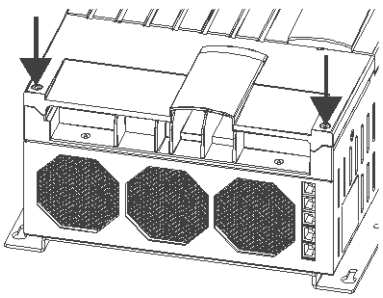
High currents will pass through the wiring! The wire sizes stated in this manual are only guidelines. Fusing is based on the size and length of the cable, which in turn depend on the load connected to the unit. Always comply with all local rules and regulations.

1.5 Overview Mass Sine Ultra

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

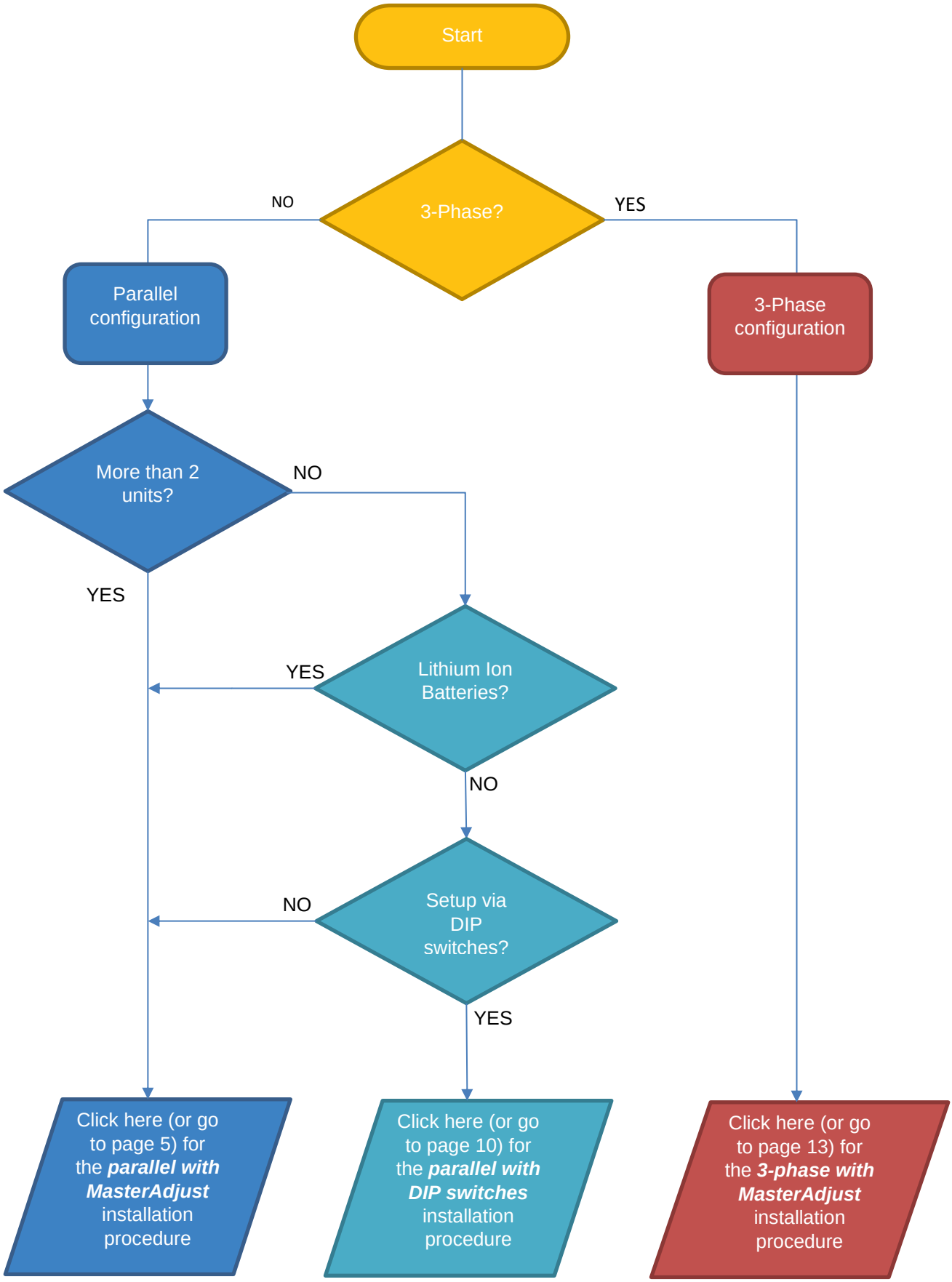


Remove the cover by loosening these two screws:



2 FLOWCHART

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



3 PARALLEL CONFIGURATION WITH MASTERADJUST

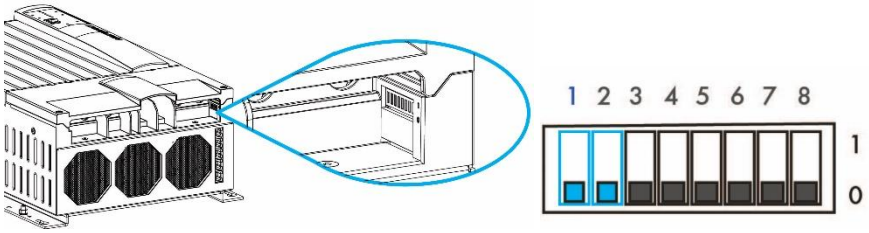
Up to 10 units may be set in parallel with MasterAdjust. Basic knowledge of MasterAdjust is required.

3.1 Materials needed

Description	Quantity
Multiple units (product code: 26024000)	n
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
Mastervolt 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 (MSU)	n
AC cable to connect the external load to OUT	n

3.2 Preparations

- Make sure that all power sources (AC and DC) are switched off.
- Make sure that DIP switches 1 and 2 are off on all units.

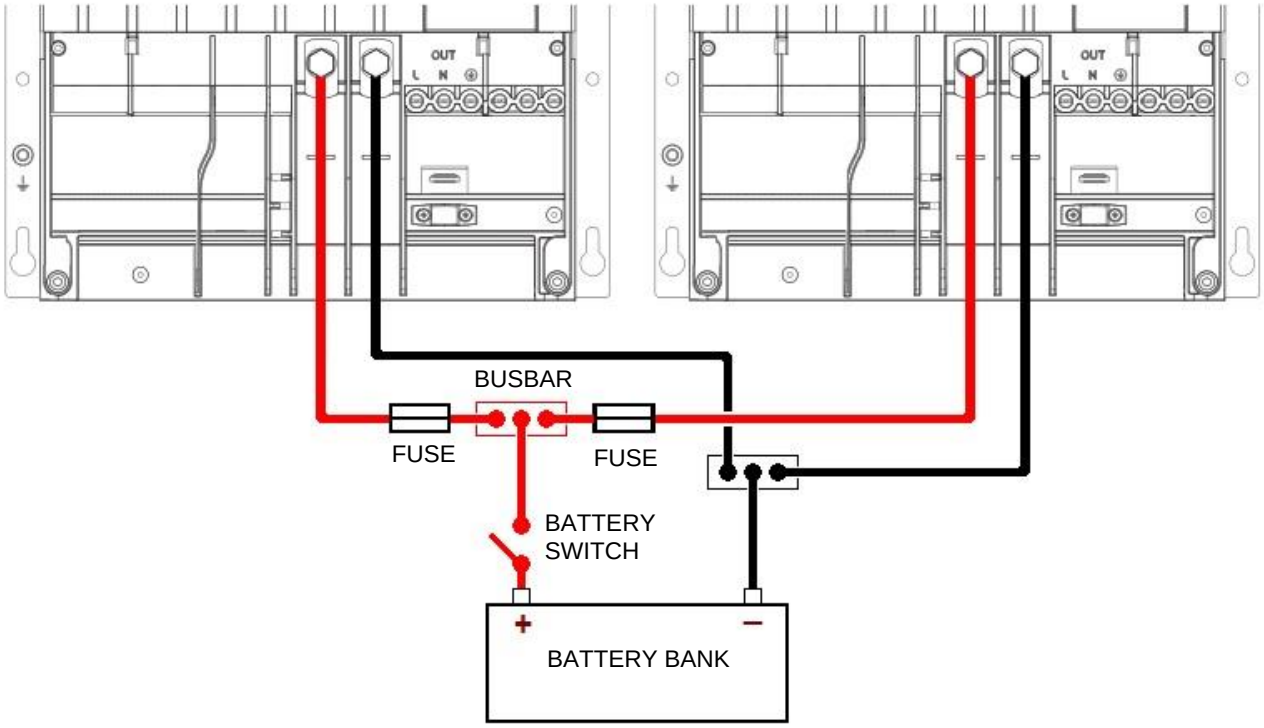


DIP switch location

All other DIP switches (3…8) 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

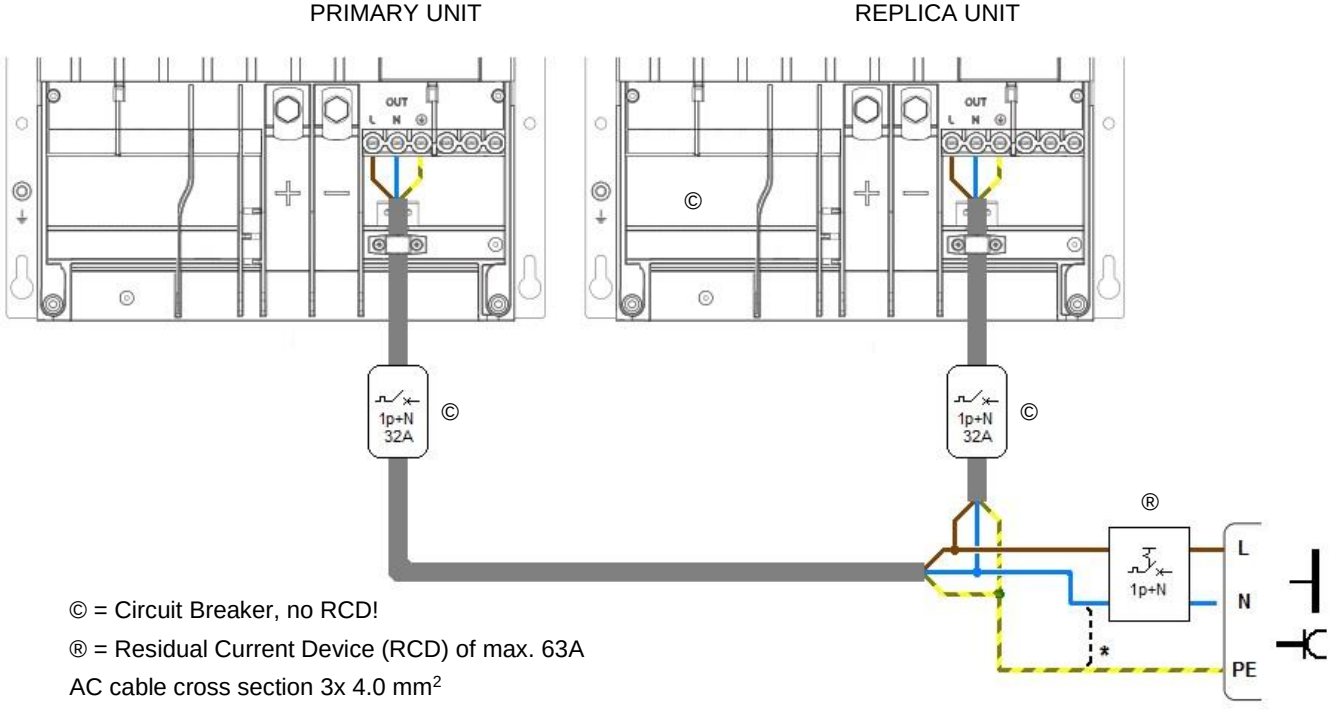
Note: Always use the same length positive and negative cables! Be aware that to keep the drawings in this chapter clear and easy to read, the cable lengths have not been drawn in proportion to each other.



Minimum DC cable cross section	Inline fuse	Recommended battery bank
70 mm²	250 A	400 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



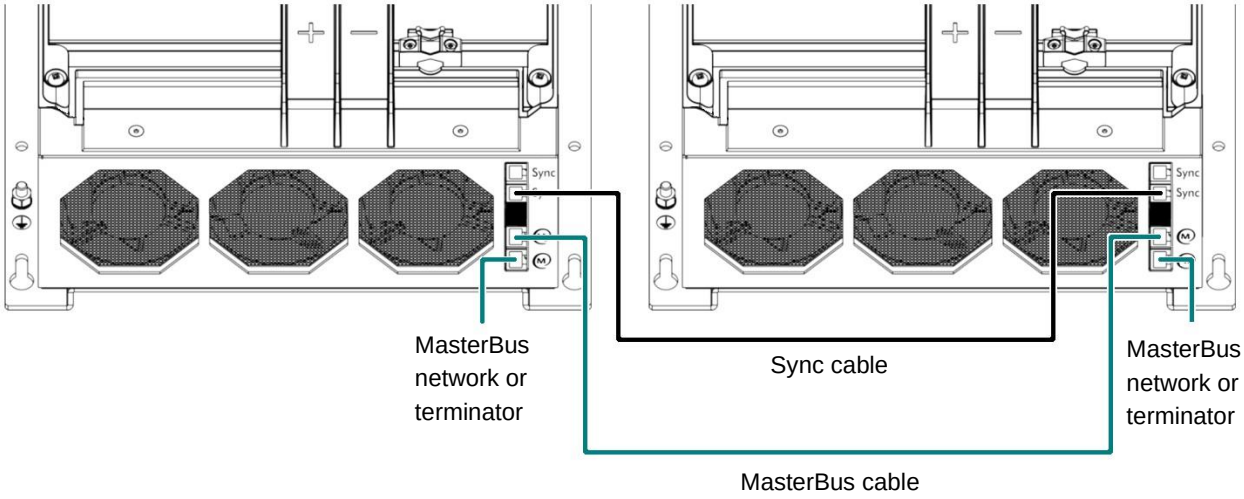
© = Circuit Breaker, no RCD!

® = Residual Current Device (RCD) of max. 63A

AC cable cross section 3x 4.0 mm²

* Neutral to ground bonding depending on local regulations

3.5 Network wiring of parallel units



3.6 Configuration with MasterAdjust

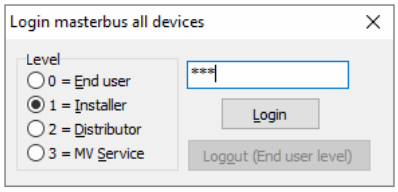
Pre-commissioning

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 Mastervolt 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.

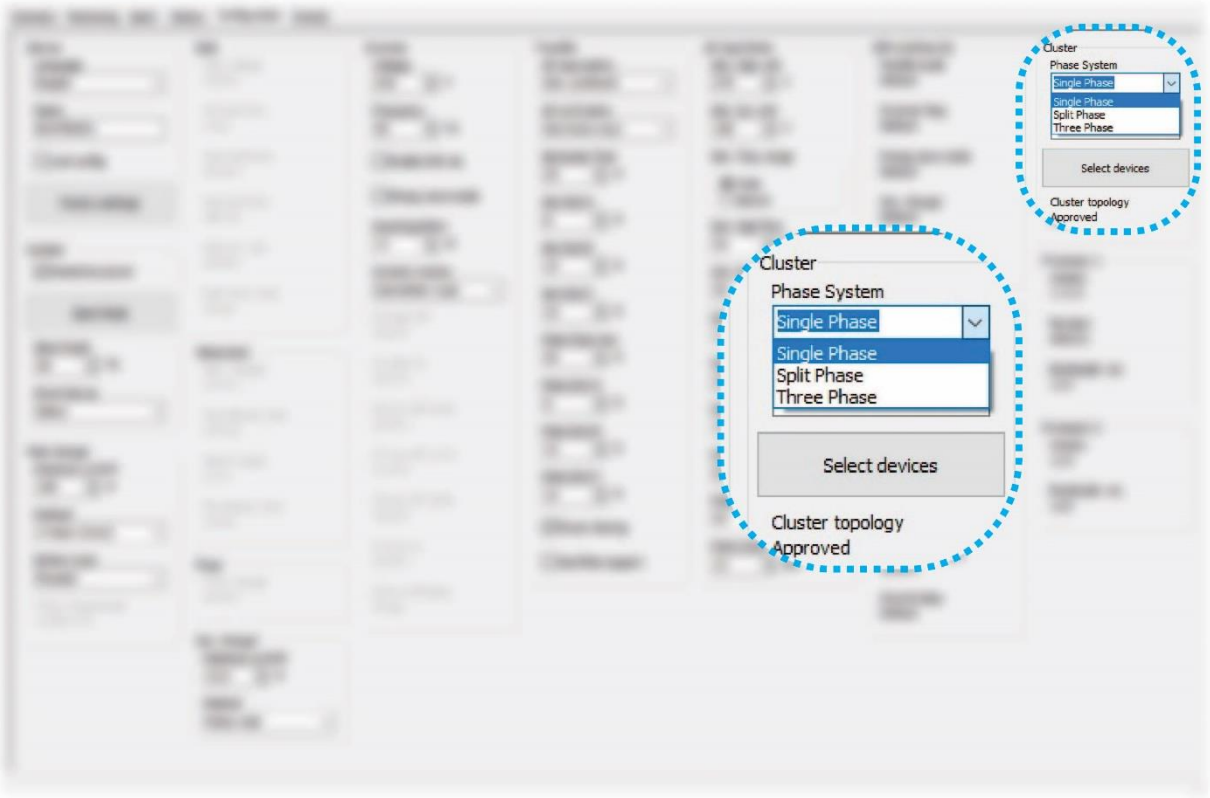
Configuration

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

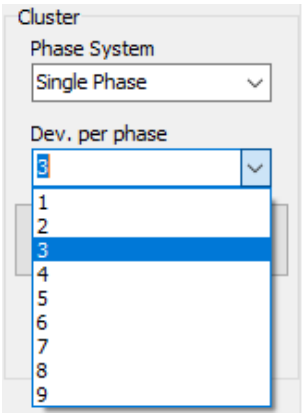
9. In the device list, in the left pane of MasterAdjust, right-click the Primary unit and select **Login**.
   The Primary unit is the device that has the AC OUT-2 connection. The other units are called Replica units. Note that in the older MasterAdjust dialog windows, Primary is called Master and Replica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



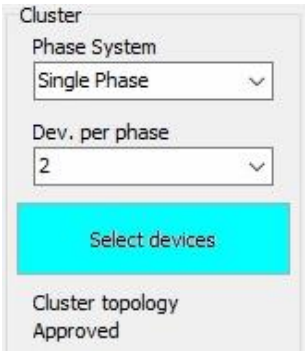
11. Go to the Configuration tab and give the unit a logical name. For example, MSU Primary. Do the same for the Replica units. It's good practice to label them Replica 1, Replica 2 etc.
    Note: battery settings must be configured the same on all units.
12. Return to the Configuration tab of the Primary 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.



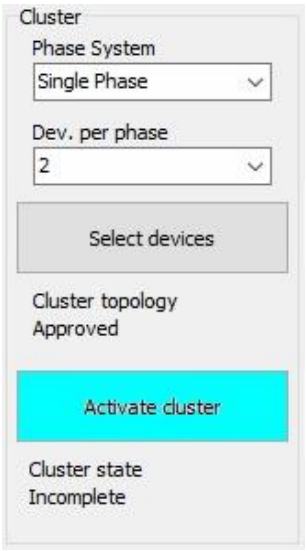
14. From the **Dev. Per phase** drop-down list, select the number of units in parallel (Primary + Replica).



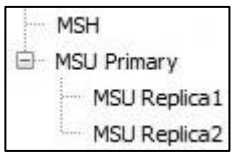
15. Click the **Select devices** button to be able to select the Replica unit(s).



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.



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.

4 PARALLEL CONFIGURATION WITH DIP SWITHES

Two identical MSU units can be set in parallel with DIP-switches.

4.1 Materials needed

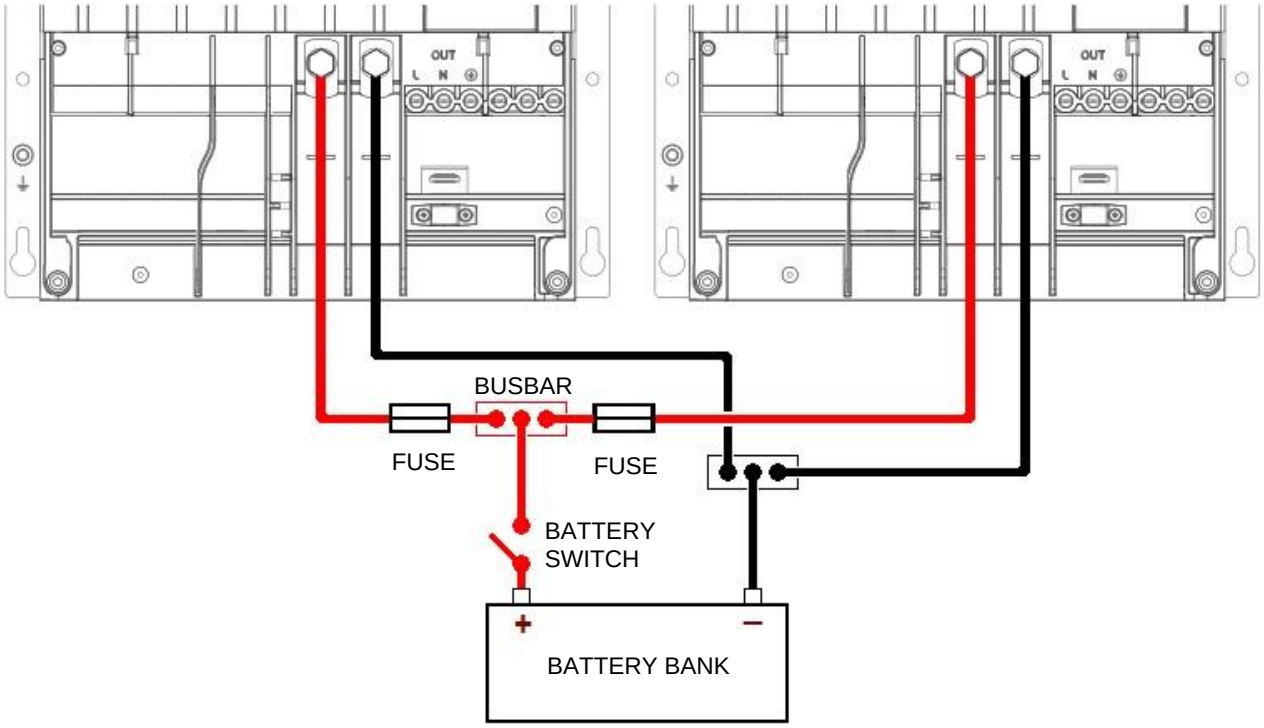
Description	Quantity
Two units (product code: 26024000)	2
MasterBus Terminator (included but not always needed)	
MasterBus cables between units (product code e.g. 3 meter: 77040300)	1
Sync cables to interconnect all units (product code e.g. 3 meter: 6502000030)	1
DC + cable with fuse	2
DC – cable	2
AC cable to connect the AC input of the unit to an external power source (MSU)	2
AC cable to connect the external load to OUT	2

4.2 Preparation

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

4.3 DC wiring of parallel units

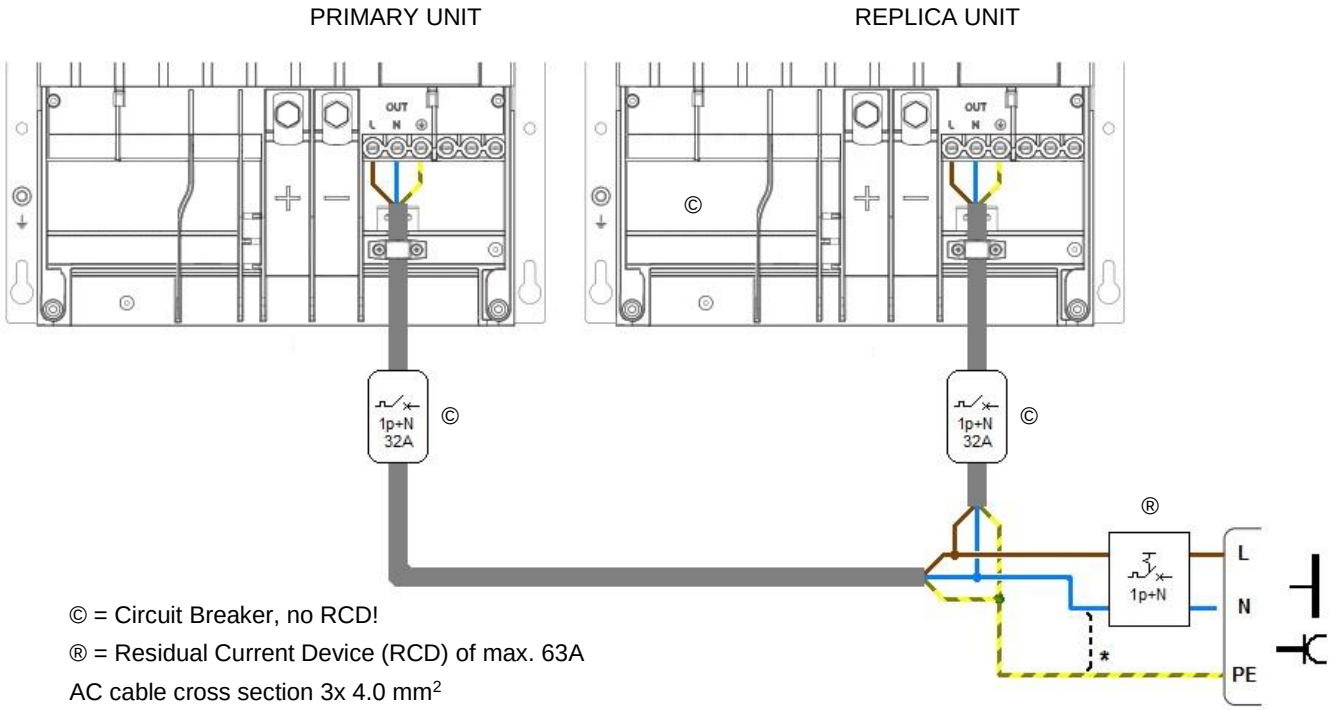
Note: Always use the same length positive and negative cables! Be aware that to keep the drawings in this chapter clear and easy to read, the cable lengths have not been drawn in proportion to each other.



Minimum DC cable cross section	Inline fuse	Recommended battery bank
70 mm^2	250 A	400 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



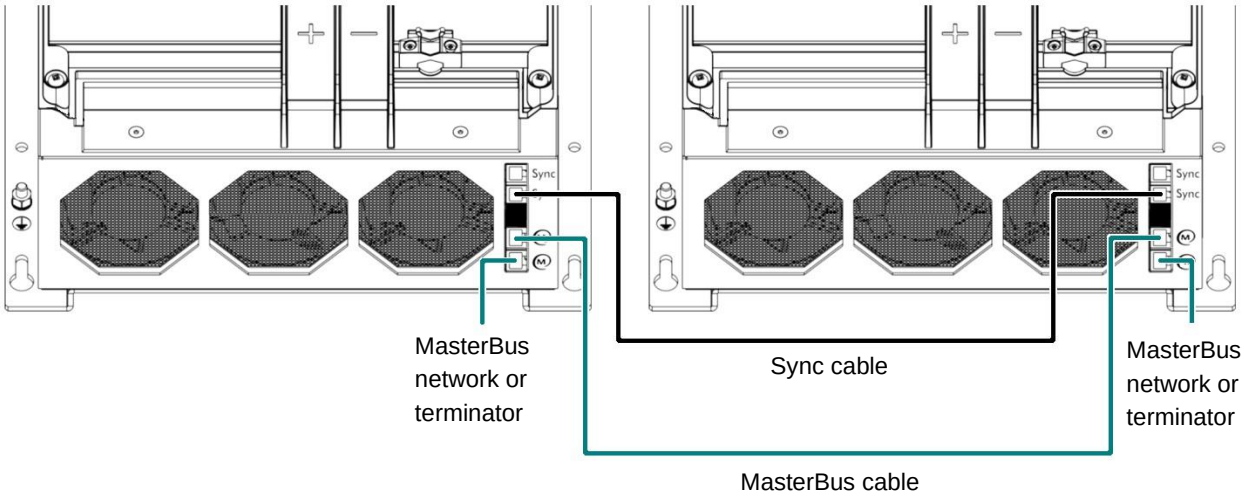
© = Circuit Breaker, no RCD!

® = Residual Current Device (RCD) of max. 63A

AC cable cross section 3x 4.0 mm^2

* Neutral to ground bonding depending on local regulations

4.5 Network wiring of parallel units



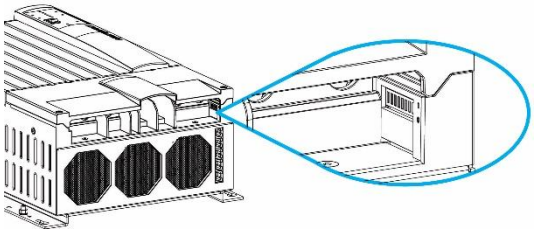
4.6 Configuration with DIP switches

Pre-commissioning

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

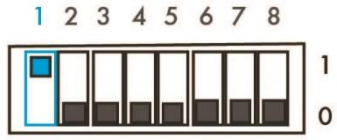
Configuration

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

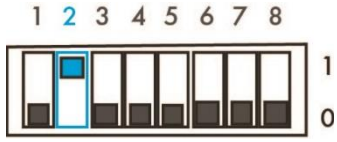


DIP switch location

On the Primary unit set DIP switch 1 on (position 1) and keep 2 off (position 0).



On the Replica unit keep DIP switch 1 off (position 0) and set 2 on (position 1).



All other DIP switches (3…8) 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 properly.

5 THREE-PHASE CONFIGURATION WITH MASTERADJUST

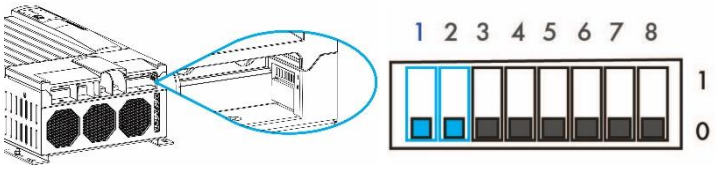
Three MSU units can be set in a 3-phase star-configuration with MasterAdjust. Basic knowledge of MasterAdjust is required.

5.1 Materials needed

Description	Quantity
Three units (product code: 26024000)	3
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
Mastervolt 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 OUT	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.

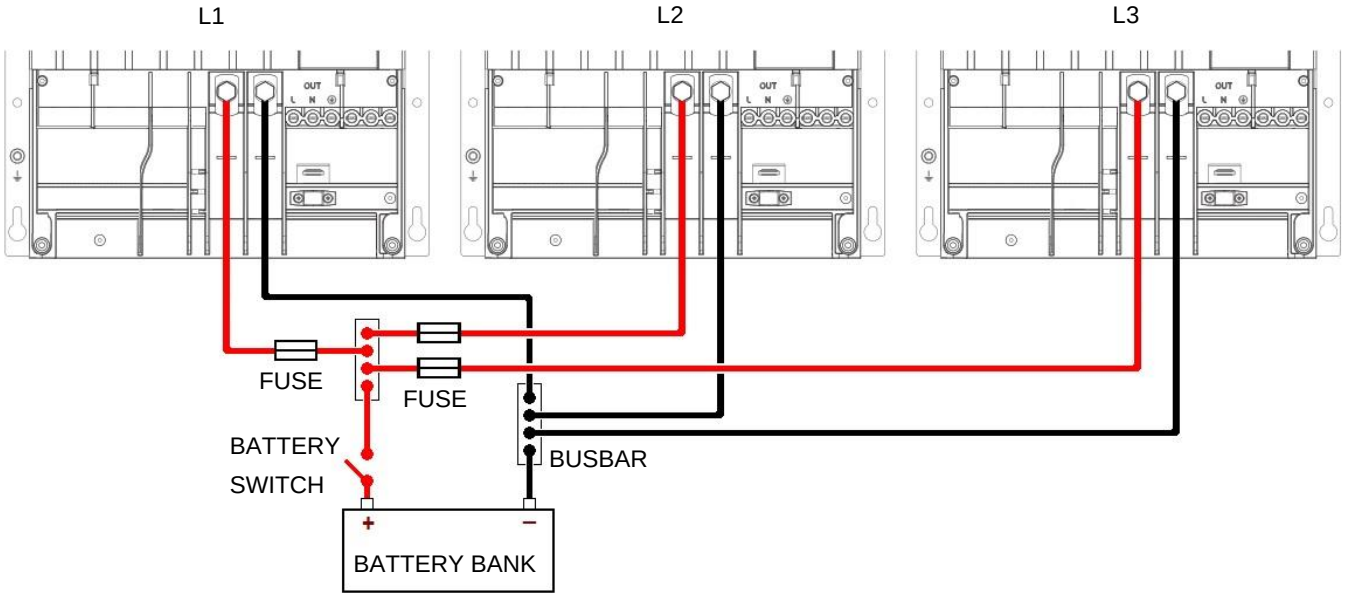


DIP switch location

All other DIP switches (3…8) 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

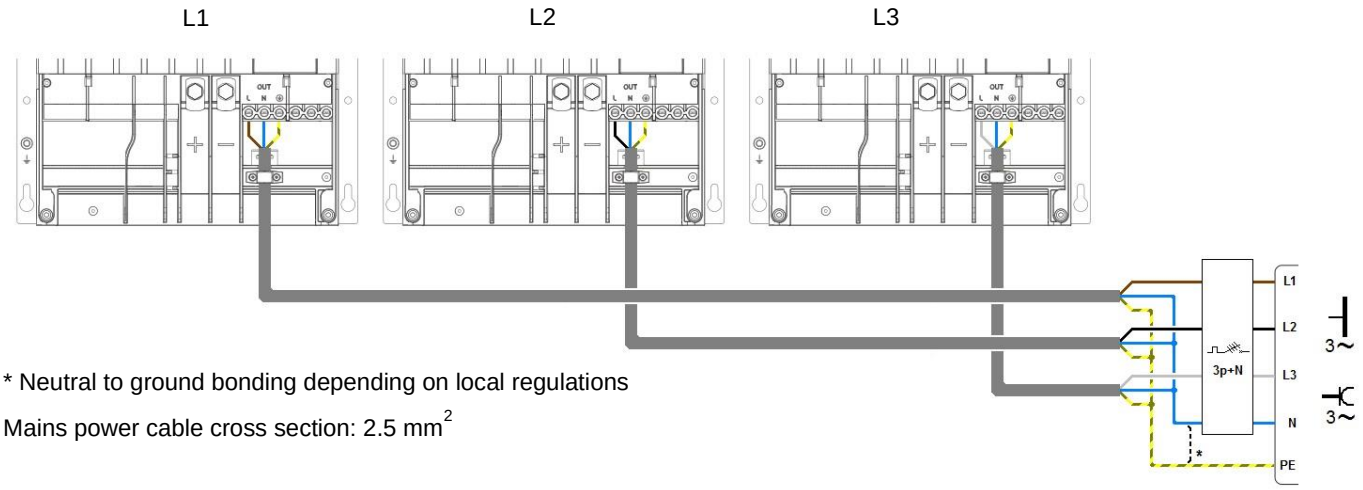
Note: Always use the same length positive and negative cables! Be aware that to keep the drawings in this chapter clear and easy to read, the cable lengths have not been drawn in proportion to each other.



DC cable cross section	Inline fuse	Recommended battery bank
70 mm^2	250 A	400 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.

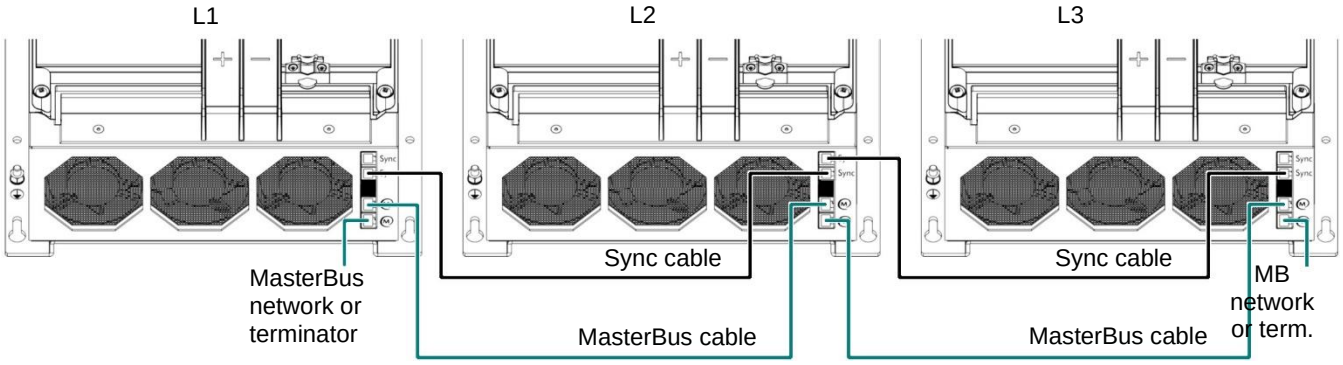
5.4 AC wiring of three-phase units



* Neutral to ground bonding depending on local regulations

Mains power cable cross section: 2.5 mm^2

5.5 Network wiring of three-phase units



5.6 Configuration with MasterAdjust

Pre-commissioning

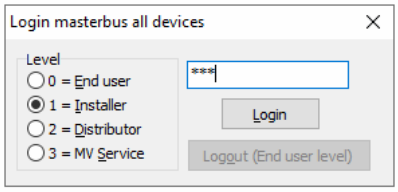
1. Make sure that the units are switched off.
2. Make sure that all connections are firmly tightened.
3. Install the DC fuses and close the battery switch.
4. Close the covers of all units.
5. Switch on all units.
6. If not already available, connect a Mastervolt USB Interface to the MasterBus network 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

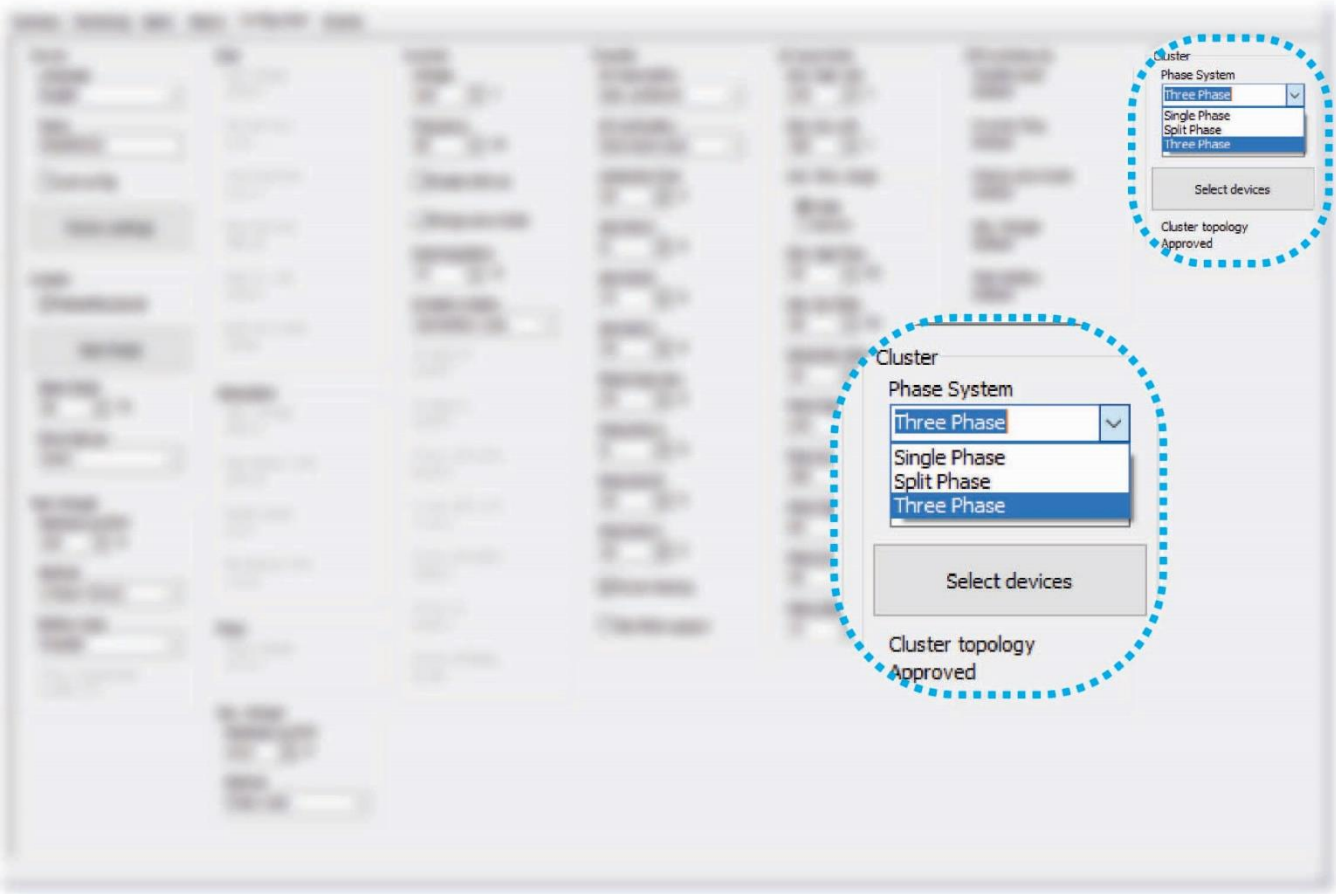
7. In MasterAdjust, check that the units are running the latest firmware. See the Mastervolt Portal for more information.

8. In the device list, in the left pane of MasterAdjust, right-click the L1 unit and select **Login**.

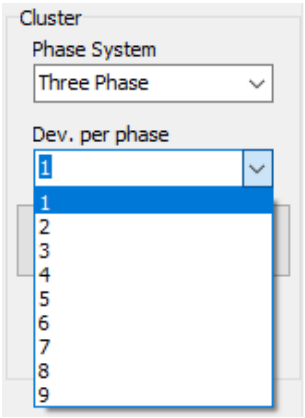
9. Select **Installer** and enter the installer code.



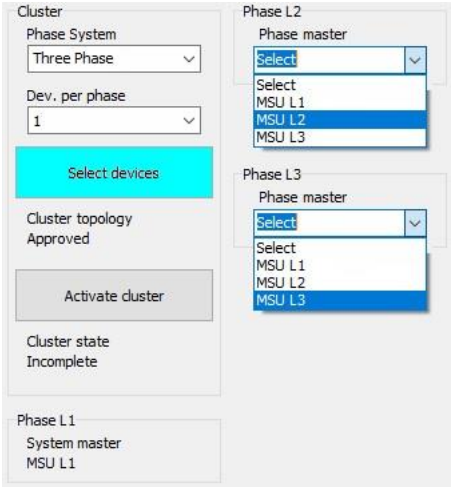
10. Go to the Configuration tab and give the unit a logical name. For example, MSU L1, MSU L2 and MSU L3.
11. Return to the Configuration tab of the L1 unit. All settings are done here. However, if Mastervolt Lithium-Ion batteries are connected, all events, like Stop Discharge for example, must be configured 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.



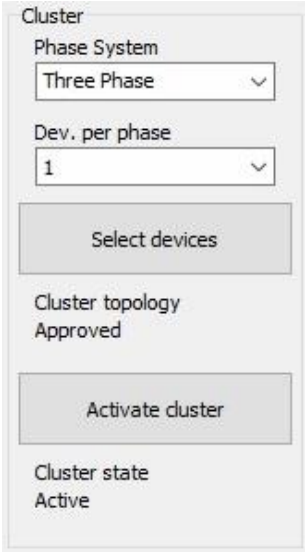
13. From the **Dev. Per phase** drop-down list, select PER PHASE the number of units in parallel (Primary + Replica)! In our example this is 1.



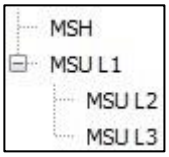
14. Click the **Select devices** button to be able to select the L2 and L3 units.
    In the **Phase L2** section, from the **Phase master** (Primary) drop-down list, select the L2 unit.
    In the **Phase L3** section, from the **Phase master** (Primary) drop-down list, select the L3 unit.



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".



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



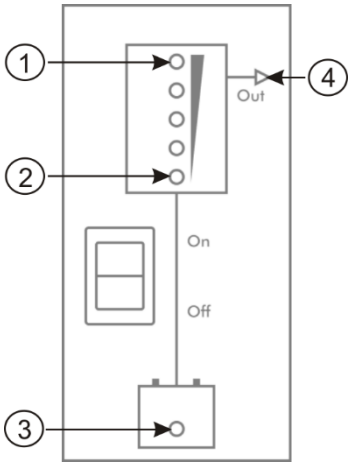
5.7 Initial start-up

1. Switch all units off and on again.
2. Check that the units are working properly.

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 of the units are not connected to each other (breakers!).



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

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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Document version: 10000019321/01 (February 22)