



MLI Ultra

LITHIUM-ION BATTERY
12/2500, 12/5000, 24/5000



USER AND INSTALLATION MANUAL

10000005784/05

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1. Safety instructions

Safety warnings



DANGER!

When transported, make sure that:

- the battery is in its original package or equivalent;
- the battery is in upright position;
- soft slings are used to avoid damage;
- nobody is standing underneath the battery during hoisting;
- the battery is only lifted at the handles;
- the battery is handled with care.



WARNING!

The battery contains hazardous materials that are stored safely during normal use. Do not crush, open or drop the battery housing. Do not touch or ingest any of the released materials or inhale released gasses when accidental leakage of the battery occurs. Should skin contact, eye contact or inhalation nevertheless occur, take the necessary first aid measures immediately. Refer to the Material Safety Data Sheet for Mastervolt Lithium-Ion batteries, which is available on www.mastervolt.com.



WARNING!

Connection of the positive terminal and negative terminal with a metal object will cause short-circuit of the battery. Short-circuit may result in fire, explosion, electric shock or release of toxic gas. Use insulated tools only and keep metal objects away from the battery. Do not wear watches, bracelets, necklaces or other metal objects when working on the battery. In case of fire, take the necessary firefighting measures immediately. Refer to the Material Safety Data Sheet for Mastervolt Lithium-Ion batteries, which is available on www.mastervolt.com.



WARNING!

Short circuits, too deep discharges and too high charge currents will damage the battery and may result in fire, explosion, electric shock or release of toxic gas.

Always install an external safety relay!

Never charge a battery:

- when the safety relay has cut out;
- after it was discharged below the *Discharge cut-off voltage*;
- when the battery is damaged;
- when the battery was overcharged.

If in doubt, contact your supplier or Mastervolt.



WARNING!

Never open the connector hatch on top of the battery as this may cause damage to the printed circuit board.

Note: The voltage range (12.0-14.6V or 24.0-29.2V) is larger than you may expect from other battery types such as lead-acid batteries. Be aware that these voltages would exceed the permitted voltages of the connected load(s).

Safety guidelines

- Read this manual before using the MLI Ultra. Keep the manual in a secure place for future reference.
- Use the MLI Ultra following the instructions and specifications stated in this manual.
- Work on the Li-Ion Battery should be carried out by qualified personnel only.
- Non-compliance with operating instructions, repairs made with other than original parts, or repairs made without authorization render the warranty void.
- Always install a safety relay which disconnects the battery under abnormal circumstances.
- Installation and commissioning of the battery requires programming of events in a MasterBus network. The installer must be familiar with the programming of such events.
- Connections and safety features must be executed according to the locally applicable regulations.
- Use cables with an appropriate size.
- Never use the MLI Ultra in situations where there is danger of gas or dust explosion or potentially flammable products!
- Only use the MLI Ultra in a technical correct condition.
- Only use the MLI Ultra in a well-ventilated room and protect the connector hatch from moisture and dust. Do not obstruct the ventilation openings.
- Switch off all charging systems and disconnect the batteries from the electrical installation during maintenance and/or repair activities.

2. Liability

Mastervolt cannot be held liable for:

- Consequential damage resulting from the use of the MLI Ultra.
- Possible errors in the included manual and the consequences of these.
- Use that is inconsistent with the purpose of the product.

Disclaimer: Our products are subject to continual development and improvement. Therefore, additions or modifications to the products may cause changes to the technical data and functional specifications. No rights can be derived from this document. Please consult our online Terms & Conditions of Sale.

3. Warranty

Mastervolt assures the product warranty of the MLI Ultra during two years after purchase, on the condition that the product is installed and used according to the instructions in this manual. Please consult our online Terms & Conditions of Sale.

4. Correct disposal of this product



This product is designed and manufactured with high quality materials and components, which can be recycled and reused. When this crossed-out wheeled bin symbol is attached to a product, it means the product is covered by the European Directive 2012/19/EU.

Please be informed about the local separate collection system for electrical and electronic products. Please act according to your local rules and do not dispose of your old products with your normal household waste. The correct disposal of your old product will help prevent potential negative consequences to the environment and human health.

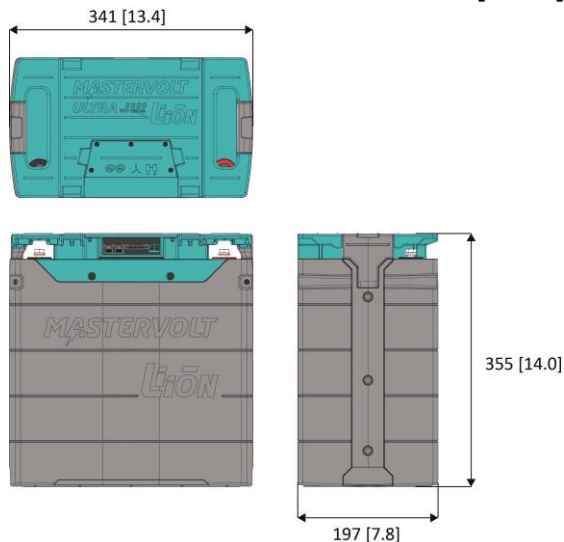
Contact your supplier for recollection and recycling of batteries or contact an authorized waste management company.

5. Product description

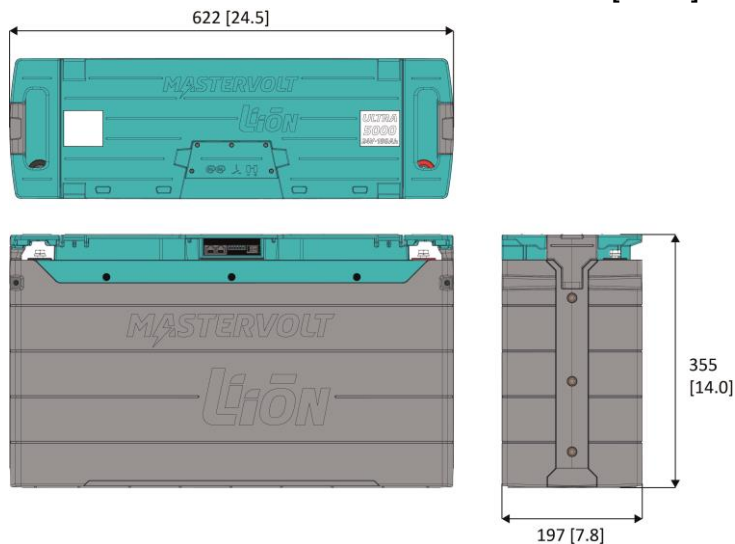
Introduction

The MLI Ultra is a heavy-duty Lithium Ion battery for running heavy loads for extended periods. The MLI Ultra consists of a waterproof electronics cabinet, with Lithium-iron phosphate cells.

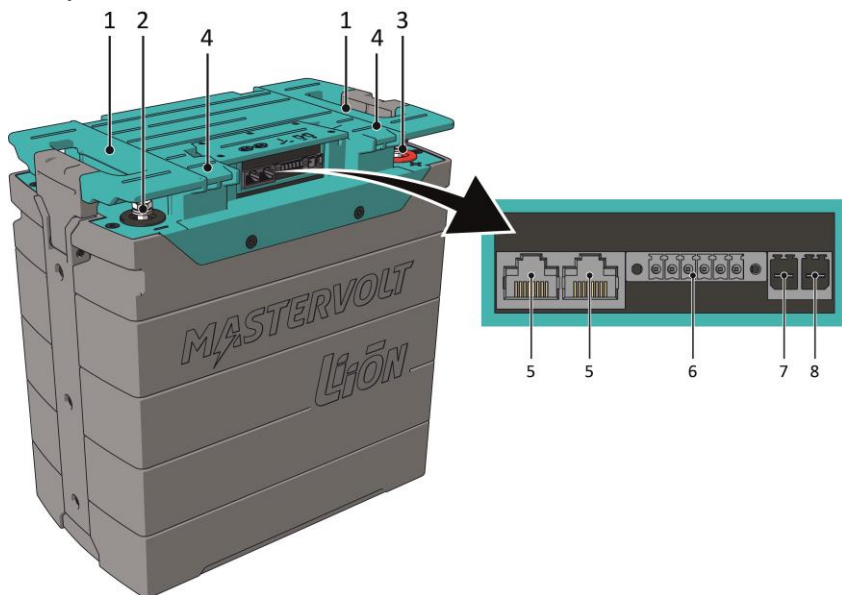
Dimensions of the MLI Ultra 12/2500 in mm [inches]



Dimensions of the MLI Ultra 12/5000 and 24/5000 in mm [inches]



Main parts



Main parts

1	Extractable side handle for lifting
2	Negative battery terminal (M8)
3	Positive battery terminal (M8)
4	Mounting strap position
5	MasterBus connection
6	Safety relay terminals
7	Series balancing terminal (-)
78	Series balancing terminal (+)

MasterBus

The MLI Ultra can be monitored and configured through the MasterBus network by means of a MasterBus remote control panel or a MasterBus USB interface connected to a PC with MasterAdjust software. See chapters 13 and 14 for more information.

You can setup clusters of batteries for easier display of multiple battery systems, see chapter 15.

Protection

The MLI Ultra is equipped with a Battery Management System (BMS). The BMS:

- balances the voltages between the cells;
- protects each cell from undercharging and overcharging;
- prevents too deep battery discharges;
- monitors the temperature of each cell;
- can communicate with Mastervolt charge devices over MasterBus;
- sends out warnings and alarms.

These protection and alarm features can be programmed as MasterBus events that display warnings or intervene on the electrical system. The event *Stop Charge* is mandatory to be programmed for the battery, see step 11 on page 11. The event *Battery Low* is highly recommended to be programmed for the battery, see chapter 14 on page 15.

Identification label



The identification label is located at the right-hand side of the MLI Ultra. Technical information required for service and maintenance (part number, serial number and revision code) can be derived from the identification label.



CAUTION!

Never remove the identification label.

6. Installation

Refer to chapter 15 for information on creating systems with multiple units in parallel or series.

Unpacking

The delivery consists of the following parts:

- MLI Ultra battery
- Safety relay connector
- Series balancing connector
- 2x M8 bolt + washer + spring washer
- MasterBus cable (3 m)
- MasterBus terminator
- Mounting straps
- The user and installation manual

Check the battery

Check the battery for possible damage and the open clamp voltage with a suitable voltage meter.

Allowed open clamp voltage		
Model	Minimum	Maximum
12V	12.0V	14.6V
24V	24.0V	29.2V

Never use a damaged battery or a battery with an open clamp voltage that is out of range. If in doubt, contact your Mastervolt supplier. Optionally save the original packaging for future transport of the battery.

Choosing a location to install

- Install the MLI Ultra in a well-ventilated room protected against rain, snow, spray, vapour, bilge, moisture and dust.
- Keep the Li-Ion battery away from heat sources. See specifications for allowed operating temperatures.
- The Li-Ion battery must be installed in upright position or on the long side, although upright mounting is recommended.
- Keep at least 1 cm between two Li-Ion batteries for air flow.
- The Li-Ion battery must be secured to its foundation with the two included straps.

Required tools

- Hexagon socket wrench 13mm (M8 bolt)
- 2mm flat blade screwdriver to fasten the relay wiring
- 4mm flat blade screwdriver to fasten the balance line wiring
- MasterBus control panel or laptop with configuration software and MasterBus USB interface

Required materials

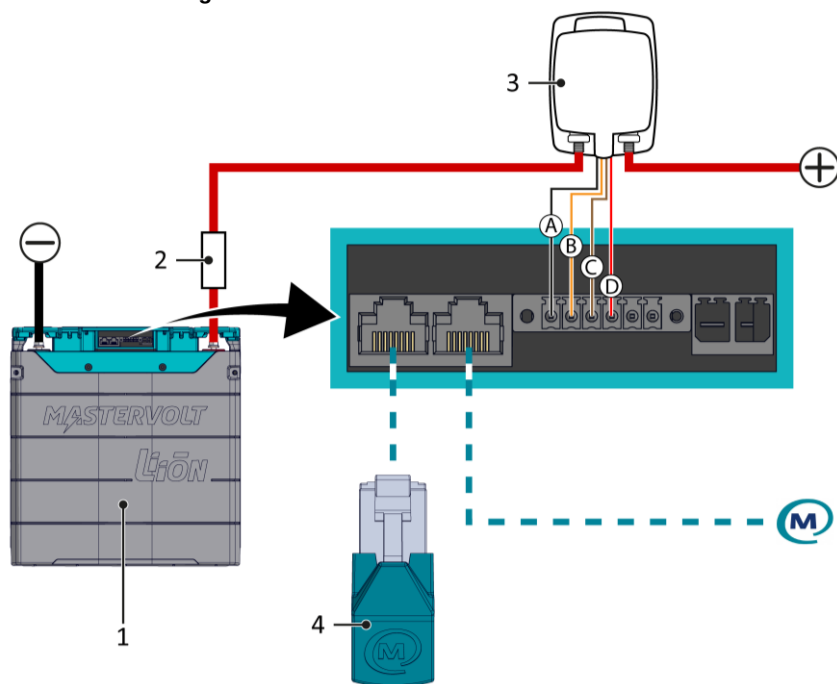
- DC main wiring (cross section depending on the maximum system current)
- Safety relay(s) suitable for nominal voltage
- Wiring for control circuit of the safety relay(s) (minimum cross section: 0.5mm²)
- T-Fuse holder + T-Fuse of max. 500A and min. DC breaking capacity (IR): 15kA.
- Mastervolt battery charger
- MasterBus cabling

Charger settings

A single battery can be charged with any Mastervolt battery charger. Adjust charge characteristic of the IUoUo characteristic as follows:

Li-Ion battery model	Bulk / absorption voltage setting	Float voltage setting
MLI Ultra 12/2500	14.25V	13.5V
MLI Ultra 12/5000	14.25V	13.5V
MLI Ultra 24/5000	28.5V	27.0V

Installation drawing



Installation drawing

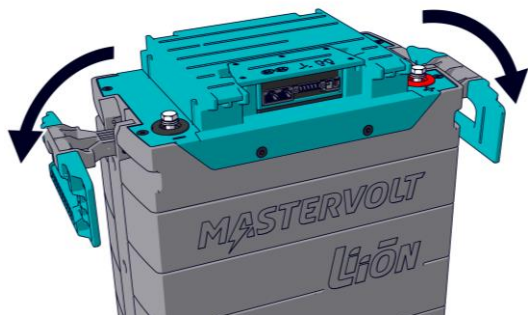
1	MLI Ultra battery	A	Relay Control (-)	Black wire
2	Battery fuse in positive battery line	B	Open relay pulse (12/24V)	Orange wire
3	Safety relay	C	Close relay pulse (12/24V)	Brown wire
4	MasterBus terminator	D	Relay Control (+)	Red wire

Safety relay

Function	Description	Action	End position
REMOTE ON	To connect the Li-Ion Battery to load and charging devices	1. Rotate the knob to the left 2. Push the button down until latched.	
REMOTE OFF	To disconnect the Li-Ion Battery from load and charging devices	1. Rotate the knob to the right to unlatch the button. 2. Rotate the knob to the left.	
LOCK OFF	To prevent remote operation	Rotate the knob to the right.	

Installation procedure

1. Switch off all loads and chargers.
2. Extract the side handles to uncover the battery terminals.



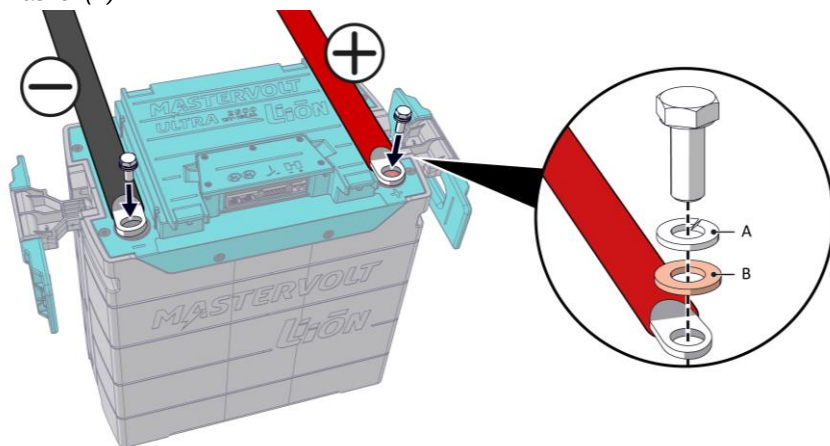
3. Connect the DC main wiring.



WARNING!

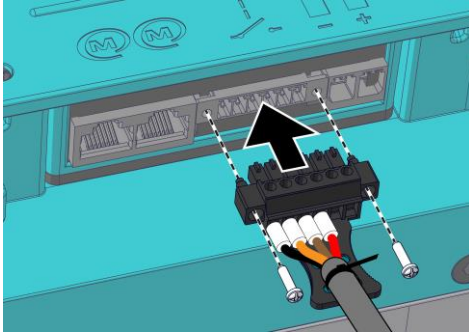
In installations with a negative earth: Connect the negative cable last of all to prevent short circuiting.

Note: Use properly sized and reliable, cables, cable lugs and battery terminals. Tighten all connections. For the main DC connections use 14.7 to 19.6 Nm / 130 to 170 InLbs torque. See the illustration detail for the right order of placing the spring washer (A) and the flat washer (B).



4. Close the side handles to cover the battery terminals again.
5. Integrate a fuse holder in the positive battery wire, but do not place the fuse yet.
6. Set the safety relay knob to "LOCK OFF", see page 9.
7. Integrate the safety relay in the positive battery wire.
8. Use the supplied connector and a tie-wrap to connect the control wiring of the safety relay to the battery. Fix the connector to the battery with the screws.

Note: The yellow wire is not connected.



WARNING!

Do not use a sensor for temperature compensated charging. Temperatures of the battery and its cells are monitored by the built-in BMS.

9. Connect the MasterBus cabling.

Refer to *How to set up a MasterBus network* on page 14.

10. Add a MasterBus control panel to the MasterBus network. In our example, we used a MasterBus USB Interface and a Windows PC with MasterAdjust software.
11. Configure the Stop Charge event of each battery. The Command and Data settings depend on the used charger and battery configuration (parallel or series).
 - Parallel (or single) connection: Copy to Float.
 - Series connection: switch the charging state to off.
 - Because different chargers have different state options, check the manual of the used charger for the correct command to switch the charging state.

Stop Charge event examples for parallel (or single) connection

Event 1 source	Event 1 target	Event 1 command	Event 1 data
Stop charge ▼	APR Alpha Pro MB ▼	Suspend charging ▼	Copy ▼
Event 1 source	Event 1 target	Event 1 command	Event 1 data
Battery safety ▼	APR Alpha Pro MB ▼	Suspend charging ▼	On ▼
Event 1 source	Event 1 target	Event 1 command	Event 1 data
Stop charge ▼	CHG CM24/30 ▼	Float ▼	Copy ▼

Stop Charge event examples for series connection

Event 1 source	Event 1 target	Event 1 command	Event 1 data
Stop charge ▼	INT COMBI ▼	Charger ▼	Copy invert ▼
Event 1 source	Event 1 target	Event 1 command	Event 1 data
Stop charge ▼	CHG Mass Charger ▼	On/Stand-by ▼	Copy invert ▼

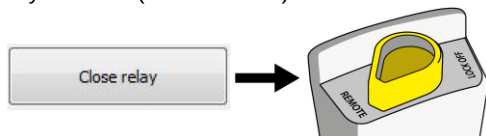


WARNING!

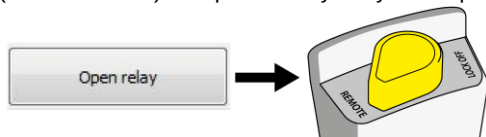
If more charging devices are used to charge the battery (for instance by both an AC powered charger and an alternator) then the Stop charge events must be configured for each charging device.

7. Commissioning

1. Check all wiring and connections.
2. Set the safety relay to REMOTE OFF, see page 9. Do not place the fuses yet!
3. On the MasterBus control panel, go to the monitoring page of the (first) battery. See chapters 13 and 14.
4. Push the battery's **Close relay** button. Check if the button on the safety relay goes down and stays latched (REMOTE ON).



5. Push the (last) battery's **Open Relay** button. Check if the button on the safety relay unlatches (REMOTE OFF). Keep the safety relay in this position.



6. Install all fuses.
7. Switch on some loads.
8. Verify that the current of the battery is 0A on the control panel's monitoring page.
9. Close the safety relay by setting the knob to REMOTE ON, see page 9 (or with MasterAdjust).
10. Verify that a current is flowing out of the battery (negative value).
11. Switch off the load, switch on the charger and verify that a current is flowing into the battery (positive value).
12. If necessary, check if MasterBus Power mode is active, see Configuration tab in MasterBus. Note that this will slowly drain the battery.
13. Depending on the installation in which the battery is used, programming of additional MasterBus events may be required, see chapter 15 for all event sources.
14. Charge the battery fully until the charger switches to the float stage (maintenance charge) of the charging algorithm.

Now the battery or multiple battery system is ready for operation.

8. Operation



WARNING!

If a non-resettable *Battery Safety* event occurs: set the safety relay(s) to "LOCK OFF" and contact a Mastervolt representative for assistance.

If the safety relay has been triggered

1. On the MasterBus control panel, check that the voltage is within limits; >10V (20V) and <15,5V (31V).
2. If within limits click the "Close relay" button on the MasterBus control panel. Start charging if voltage is low (10V/20V) or discharging when high (15,5V/31V).
3. If relay trips again. Isolate battery and contact Mastervolt representative.

9. Maintenance

No specific maintenance is required. If necessary, use a soft clean cloth to clean the MLI Ultra. Never use any liquids or acids.

For reliable and optimum function examine your electrical installation on a regular base, at least once a year. Defects such as loose connections, burnt wiring etc. must be corrected immediately.

10. Decommissioning

If it is necessary to take the Li-Ion battery out of operation, follow the instructions in order of succession as described below:

1. Disconnect all loads and charging devices.
2. Move the safety relay(s) in the LOCK OFF position, see page 9.
3. Disconnect all wiring.

11. Replacements

If Li-Ion batteries need to be replaced individually, make sure that the open circuit voltage of these batteries equals the voltage of the replaced or paralleled batteries. After re-installation MasterBus events need to be reprogrammed for each replaced battery.

When exchanging charging devices that are used to charge the battery, the event configuration (such as the mandatory Stop Charge event), as well as other settings (such as charge voltage settings) needs to be redone for every new device.

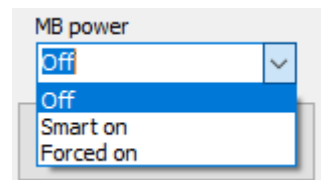
12. Storage

The battery should be stored in a dry and well ventilated environment. The rate of self-discharge is less than 4% per month. Elevated environmental temperatures increase the self-discharge rate of the batteries and natural aging. If the battery will not be used for a period exceeding 3 months, we advise the following:

- If external AC power is available switch off all loads and switch on the charger. Apply a float voltage as specified in the following table.

Li-Ion battery model	Float voltage setting
MLI Ultra 12/2500	13.5V
MLI Ultra 12/5000	13.5V
MLI Ultra 24/5000	27.0V

- If no external AC power is available:
 - Set the safety relay knob to "LOCK OFF", see page 9.
 - Set MasterBus powering to off.
 - Uncheck the MasterBus Power setting (see Configuration tab in the MasterBus settings)
 - Disconnect the MasterBus cables from the Li-Ion battery.



In this setup the batteries can be kept at least 6 months without maintenance.

13. MasterBus

About MasterBus



All devices that are compatible with MasterBus are marked with the MasterBus symbol.

MasterBus is a CAN based, fully decentralized data network for communication between Mastervolt devices. MasterBus is used as power management system for all connected equipment, such as the inverter, battery charger, generator and many more.

Every device that is compatible with MasterBus is equipped with two data ports. The devices are simply daisy chained together, forming a local data network. Monitoring panels such as the EasyView 5, or a MasterBus USB interface connected to a PC with MasterAdjust software, can be used for monitoring and control 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.

Event based commands

With MasterBus a device can be programmed to initiate an action at another connected device. This is done by means of *event based commands*.

How to set up a MasterBus network

- Connections between the devices are made by standard straight MasterBus cables. Mastervolt can supply these cables.
- Up to 63 MasterBus devices can be connected together.
- MasterBus needs a terminating device on both ends of the network.
- The electric power for the network comes from the connected devices according to the rule: 1 powering / 3 non-powering. Spread the powering devices over the network
- Do not make ring networks.
- Do not make T-connections in the network.

For more details on MasterBus, please contact your Mastervolt supplier.

14. MasterBus on the MLI Ultra

The following screenshots are for illustration only and do not give a full overview.

Monitoring

General

State of charge
100 %

Time remaining
--:--:--

Cap. consumed
0,2 Ah

Battery
13,48 V

Battery
0,00 A

Battery
23 °C

Time
12:05:16

Date
02-11-2018

Close relay

Open relay

☐ Stop charge

History

Days running
0 days

Days since low
0 days

Last time 100%
0 days

Battery usage
0 cycles

Avg. discharge
0,0 Ah

Total consumed
0,0 kWh

Max Ah used
0,0 Ah

V at max Ah used
13,59 V

Highest voltage
13,59 V

Alarms

General

☐ Battery safety

☐ Overtemperature

☐ Overcurrent

Configuration – Event levels

Event levels

Battery low
20 %SOC

Battery pre low
30 %SOC

☐ Pre/low alarm

Battery full
95 %SOC

Overvoltage
16,0 V

Delay
10 s

Last time 100%
5 Day

◀ The Stop charge check box is ready only.

Events

Events

Event 1 source	Event 1 target	Event 1 command	Event 1 data
Stop charge	INT Mass Combi	Charger	Copy invert
Event 2 source	Event 2 target	Event 2 command	Event 2 data
Battery low	BAT MyMLI Ultra	Open relay	Copy

Stop Charge event

When the battery gets too close to the allowed operating specifications, the Stop Charge event forces the Mastervolt charger to switch to the float stage, in which a lower charge voltage is used (or switch off in case of parallel connection). The event will be active for 10 minutes.

Battery safety event

A battery safety event triggers the safety relay to automatically disconnect the battery from the loads and charging devices. There are two kinds of battery safety events: a resettable and a non-resettable.

A resettable safety event occurs if one of the following conditions is met for 10 seconds:

- The battery voltage is less than 10.0V (12V battery) or 20.0V (24V battery);
- The battery voltage is more than 15.5V (12V battery) or 31.0V (24V battery);
- The voltage of one of the individual cells inside the Li-Ion battery is too high or too low (2.5V / 4V for 10 sec or 2V / 4.2V for 1 sec);
- The internal temperature of one of the individual cells is too high (>85°C).

This event is repeated every 60 seconds. It will only stop repeating if:

- the battery voltage returns and remains within specifications, i.e. 10.0-15.5V (12V battery) or 20.0-31.0V (24V battery);

A non-resettable safety event occurs if one of the following conditions is met for 10 seconds:

- The battery voltage is less than 9.0V (12V battery) or 18.0V (24V battery);
- The battery voltage is more than 16.0V (12V battery) or 32.0V (24V battery);
- The voltage of one of the individual cells inside the Li-Ion battery is too high or too low (5V / 1.5V for 1 sec);
- The internal temperature of one of the individual cells is too high (>90°C).

Events sources

Event source	Condition	Comments
Disabled	(no event programmed)	
Battery Safety	Battery Safety event occurred. At the same time the safety relay is triggered to disconnect the battery from the loads and charging devices.	See chapter 9 for what to do if the safety relay has been triggered.
Reduce charge	Battery voltage > 14.5V (12V battery) / > 29.0V (24V battery) or voltage of one of the individual cells is too high or cell temperature is too high.	Reduction of the charge current is recommended.
Reduce discharge	Battery voltage < 11.0V (12V battery) / < 22.0V (24V battery) or voltage of one of the individual cells is too low.	Reduction of the discharge current is recommended, for instance by disconnecting non-peripheral loads or switching on additional charging devices.

Event source	Condition	Comments
Stop charge	Battery voltage > 15.0V (12V battery) / > 30.0V (24V battery) or voltage of one of the individual cells is too high or cell temperature is too high.	Programming of this event is mandatory. See the related step of the installation procedure.
Stop discharge	Battery voltage < 10.5V (12V battery) / < 21.0V (24V battery) or voltage of one of the individual cells is too low	Discharging must be stopped or additional charging devices must be switched on immediately
Overcurrent	Battery current >600A	Battery current must be reduced immediately
Charging	Battery charging current > 1A	Indicates that the battery is being charged
Battery pre low	State of Charge < <i>Battery pre low</i>	See Configuration - Event levels for adjustment of the Battery pre low threshold level
Battery low	State of Charge < <i>Battery low</i>	This is a highly recommended event. See Configuration- Event levels for adjustment of the Battery low threshold level
Battery full	State of Charge > <i>Battery full</i> .	See Configuration - Event levels for adjustment of the Battery full threshold level
Overvoltage	Battery voltage > <i>Overvoltage</i> for <i>Delay</i> seconds	See Configuration - Event levels for adjustment of the Overvoltage and Delay threshold levels
Battery > 20%	State of Charge > 19.5 %	
Battery > 40%	State of Charge > 39.5 %	
Battery > 60%	State of Charge > 59.5 %	
Battery > 80%	State of Charge > 79.5 %	
Battery = 100%	State of Charge > 99.5 %	
Timer 1	Actual time > <i>Timer 1 On</i> and Actual time < <i>Timer 1 Off</i> and <i>Stop on full</i> is not triggered	See Configuration - Timer for adjustment of the timer settings
Timer 2	Actual time > <i>Timer 2 On</i> and Actual time < <i>Timer 2 Off</i> and <i>Stop on full</i> is not triggered	See Configuration - Timer for adjustment of the timer settings

15. Multiple battery systems



CAUTION!

Only create multiple battery systems with batteries of the same type and capacity. Make sure that all batteries have approximately equal states of charge.

In case of replacing, make sure that the batteries have been charged and have the same part numbers.

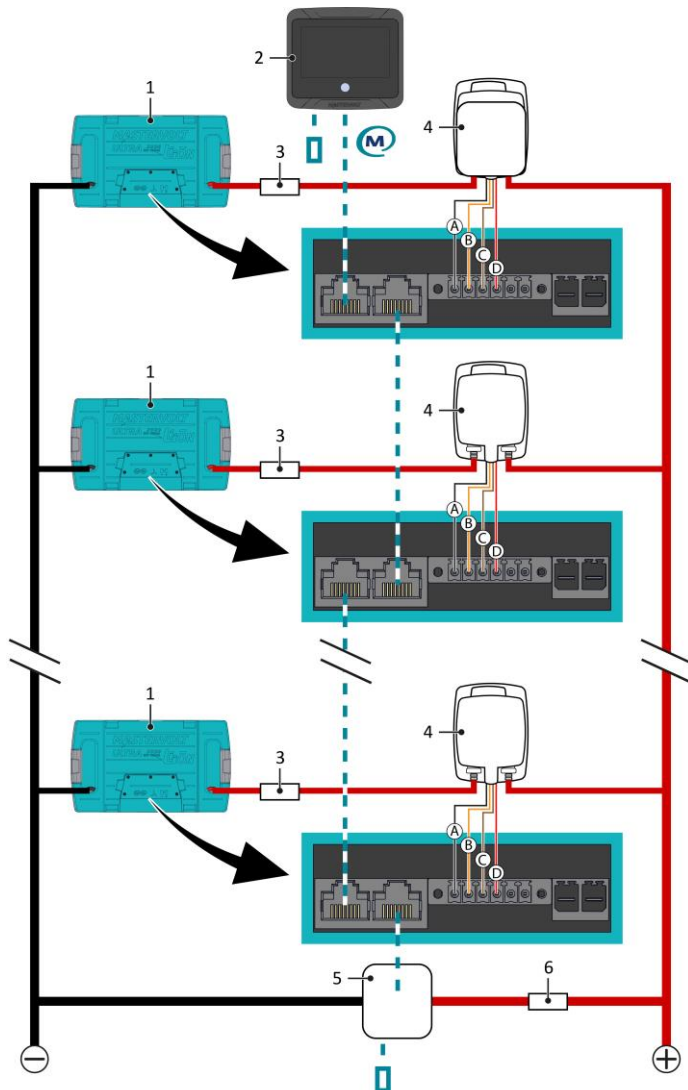
If connected in series, then all units can be protected by one safety relay.

If connected in parallel, then each unit requires its own safety relay!

Notes when combining the MLI 12/320 or 24/160 with the MLI Ultra batteries:

- Do NOT combine older type MLI batteries with the MLI Ultra.
- The batteries do not work to their full capacity as the MLI Ultra batteries have a larger capacity.
- You can use the cluster and/or balance line functionality between the MLI Ultra batteries only.
- The MLI Ultra is 1 cm higher than its predecessor.
- For a series connection with up to 10 batteries, please contact Mastervolt for support.

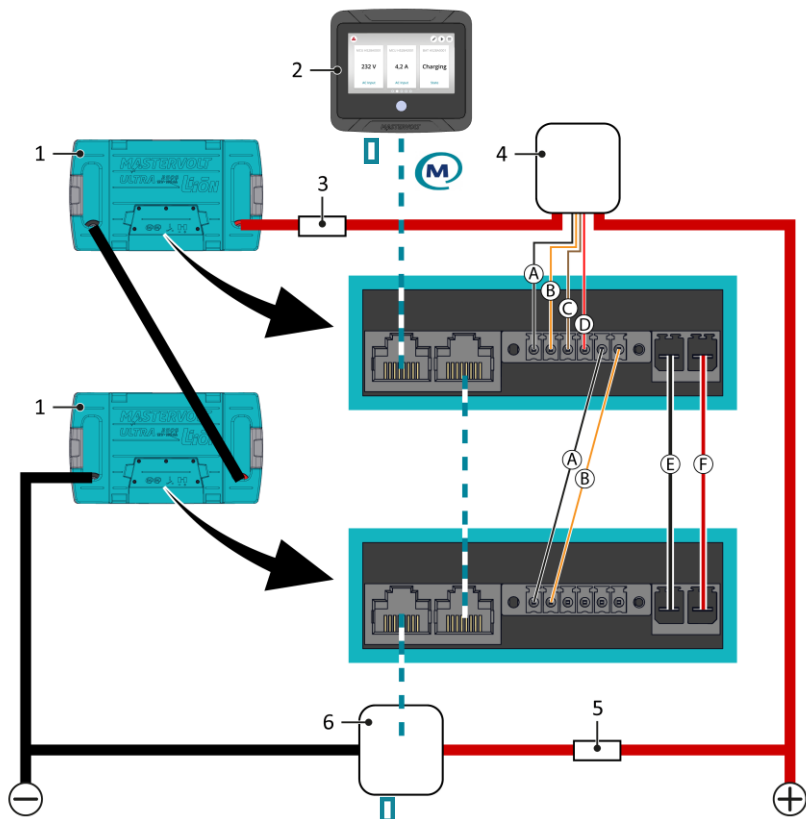
Parallel connection



Parallel connection

1	MLI Ultra battery	A	Relay Control (-)	Black wire
2	MasterBus control panel	B	Open relay pulse (12/24V)	Orange wire
3	Battery fuse in positive battery line	C	Close relay pulse (12/24V)	Brown wire
4	Safety relay	D	Relay Control (+)	Red wire
5	MasterBus compatible charger	□		MasterBus Terminator
6	Fuse to protect the charger			

Series connection with one 48V charger for two 24V batteries



Series connection with one 48V charger for two batteries

1	MLI Ultra battery 24/5000	A	Relay Control (-)	Black wire
2	MasterBus control panel	B	Open relay pulse (12/24V)	Orange wire
3	Main fuse in positive bus bar	C	Close relay pulse (12/24V)	Brown wire
4	48V Safety relay	D	Relay Control (+)	Red wire
5	Fuse to protect the charger	E	Series balancing line (-)	
6	48V MasterBus compatible charger	F	Series balancing line (+)	
	harger		MasterBus Terminator	

Use of the balance line in this setup enables you to activate voltage balancing of all cells and use only one charger for the two batteries.



CAUTION!

Never create a balance line between the first and the last battery. Only create balance lines between subsequent batteries.

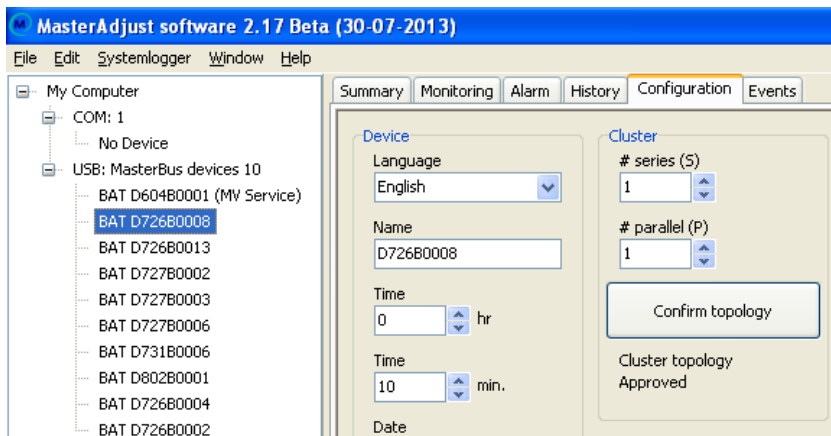
Notes:

- Maximum wire size for the balance line is 4mm². For optimal connection a ferrule is recommended.
- The series balancing terminals on the batteries are equipped with internal fuses for wire protection.

Set up clusters in MasterBus

In MasterBus Configuration, you can create a Cluster to show the group of batteries as one for monitoring the state of charge for example. The number of batteries in series and parallel can be set. Topology is the name for the total of batteries in series and parallel respectively. The topology must be confirmed.

Depending on the number of batteries in parallel and in series, the IDs (or names if you set them) of the batteries connected will show in the next window. You still need to activate the cluster. The cluster state is displayed.



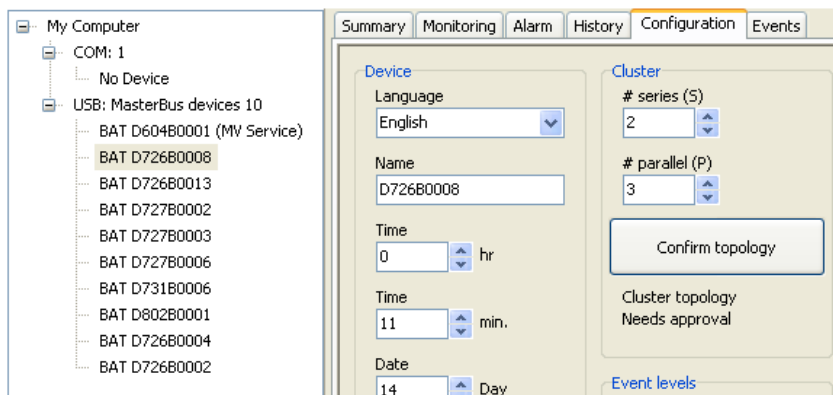
Enter the number of batteries in series (S) and the number of series strings in parallel (P).

Note: 2 batteries in parallel are considered to be 2 strings of batteries, each string consisting of 1 battery.

Example: Creating a cluster of 2 batteries in series and 3 strings in parallel

A series string can be up to 10 devices. A cluster can be up to 24 devices in total.

Press the **Confirm topology** button when you are satisfied with the chosen topology.



Note: The status of the Cluster topology can be “Approved”, “Needs approval” or “Too many devices”. “Needs approval” means the topology was not confirmed. “Too many devices” means the proposed topology is not possible.

After approval of the topology, it is shown as subsequent Series strings. The example shows three Series strings of two batteries in series each. Series string 1 is the first string in the configuration page. It shows:

- S: 1, P:1 (-) = the battery in Series string 1, located at the Minus side of the string.
- S: 2, P: 1 (+)= the battery in Series string 1, located at the Plus side of the string.

The first battery has been selected already, this is the battery you are configuring. **This battery will be the Cluster Master and will show the Cluster state.**

The other batteries have yet to be selected. Selectable batteries must have:

- an equal part number AND
- an equal software version.

“Cluster state Incomplete” means not enough batteries have been selected for the cluster configured OR one battery was selected twice.

Cluster

series (S)
2

parallel (P)
3

Confirm topology

Cluster topology
Approved

Cluster

Activate cluster

Cluster state
Incomplete

Event levels

Battery low
20 %SOC

Battery pre low
30 %SOC

Battery full
95 %SOC

Overvoltage
16,0 V

Delay
10 s

Series string 1

S: 1, P: 1 (-)
BAT D726B0008

S: 2, P: 1 (+)
Select

Series string 2

S: 1, P: 2 (-)
Select

S: 2, P: 2 (+)
Select

Series string 3

S: 1, P: 3 (-)
Select

S: 2, P: 3 (+)
Select

BAT D726B0008

BAT D727B0002

BAT D726B0013

BAT D727B0003

BAT D726B0004

BAT D726B0002

BAT D727B0006

BAT D731B0006

BAT D802B0001

“Activate cluster” will make this battery the master and the selected batteries the slaves. Cluster creation will fail if:

- the battery you activate the cluster on, is already ‘slave’ in another cluster or;
- a selected unit has a topology other than 1*1 confirmed, i.e. it consists of more than one battery.

Note: On monitoring panels such as the EasyView 5, only the master battery is shown on the main screen. In MasterAdjust, unfold the cluster (i.e. click the plus sign) to access the individual battery.

16. Troubleshooting

Failure	Possible cause	What to do
No DC power available	A fuse has blown	Check all fuses and replace if necessary
	A cable or cable connection is defective	Check all cables and their connections. Replace if necessary.
	A relay has accidentally switched position.	Check all relays.
	The Battery Safety Event has triggered the safety relay.	Refer to chapter 9.
MasterBus display shows no Li-Ion battery	The MasterView Easy has been configured to display selected devices only.	Check the option All devices or select the Li-Ion battery to be displayed.
	Error in the wiring.	Check the MasterBus cables.
	No terminating device placed at the ends of the network.	MasterBus needs a terminating device on both ends of the network. Check if available.
	MasterBus network is configured as a ring network.	Ring networks are not allowed. Check the connections of the network.
	Batteries are completely empty.	Contact your Mastervolt supplier.
Overcurrent alarm	Too heavy load on the battery.	Battery current is >600A for more than 30 seconds. Reduce load immediately.

17. Technical data

	MLi Ultra 12/2500	MLi Ultra 12/5000	MLi Ultra 24/5000
Part number	66012500	66015000	66025000
Nominal voltage	12V	12V	24V
No load voltage, fully charged	13.2V	13.2V	26.4V
Nominal capacity (Cn)	180Ah	360Ah	180Ah
Nominal energy	2.5kWh	5kWh	5kWh
Approximate weight	30 kg (128 lbs)	58 kg (128 lbs)	58 kg (128 lbs)
Number of cells	4	8	8
Terminal type	Bolts M8	Bolts M8	Bolts M8
Chemistry	Lithium iron phosphate		
Charge/discharge parameters			
Charge voltage, Bulk/absorption phase****	Minimum 13.75V Recommended 14.25V Maximum 14.6V	Minimum 13.75V Recommended 14.25V Maximum 14.6V	Minimum: 27.5V, Recommended 28.5V Maximum: 29.2V
Charge voltage, Float phase	13.5V	13.5V	27V
Discharge cut off voltage***	10V	10V	20V
Recommended charge/ discharge current	60A	120A	60A
Maximum charge/ discharge current	500A	500A	500A
Required fuse:	Max. 500A. Minimum DC breaking capacity (IR): 15kA		
Pulse current (10 sec)	< 1800A	< 1800A	< 1800A
Rated capacity and cycle life			
Rated capacity	180Ah (2.5kWh)	360Ah (5kWh)	180Ah (5kWh)
Cycle life	~ 3500 @ 80% DOD	~ 3500 @ 80% DOD	~ 3500 @ 80% DOD
Dimensions			
Length (L)	341±2mm / 22.3±0.1"	622±2mm / 24.5±0.1"	622±2mm / 24.5±0.1"
Width (W)	197±2mm / 3.9±0.1"	197±2mm / 7.8±0.1"	197±2mm / 7.8±0.1"
Height (H)	355±2mm / 7.0±0.1"	355±2mm / 14.0±0.1"	355±2mm / 14.0±0.1"
Installation angle	Upright (recommended) or on the long side		

	MLi Ultra 12/2500	MLi Ultra 12/5000	MLi Ultra 24/5000
General			
Parallel configuration*	Yes, unlimited		
Series configuration*	Yes, up to 10		
Operating temperature**	–25 to 50 °C / –13 to 122 °F		
Nominal operating temperature	25 °C / 77 °F		
Storage temperature	–25 to 50 °C / –13 to 122 °F		
Self-discharge	< 4% per month @ 20 °C		
Warranty	2 years		
Protection degree	IP65 (electronics cabinet)		

* For systems with more than one single battery, please refer to www.mastervolt.com/batteries.

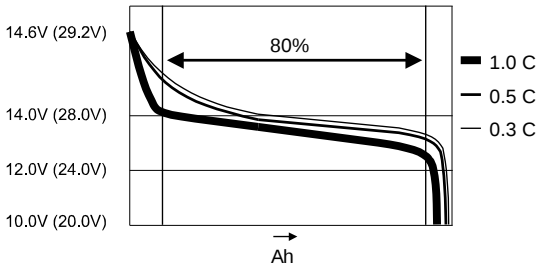
** Temperatures below 5 °C/ 41°F and above 25 °C/ 77 °F may affect life time and cycle life.

*** Trigger point for battery safety event

**** Bulk/absorption phase should be terminated before current accepted by the battery < 0,015xCn

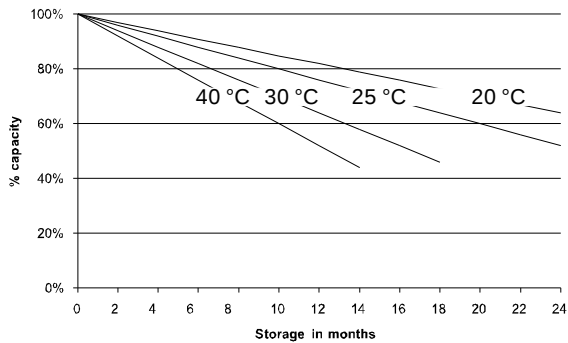
Interfacing	
MasterBus connectivity	Yes
Powering capabilities for MasterBus	Yes
External disconnect switch	Obligatory, direct connection
Interconnect balancing multiple batteries	Yes, up to 2 equal Li-Ion batteries in series*
Important available monitoring/events through MasterBus	
Battery Safety event	Preventing unsafe overcharge, overdischarge and overtemperature
Stop Charge event	Communication to charging devices preventing overcharging

Charge and discharge characteristic



The characteristic shows that the voltage curve more or less remains at the same level for about 80% of the discharging. At the borders of the characteristic the voltage rises and drops very fast.

Self-discharge in reflection to the storage temperature



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