

# **MASTERVOLT**

USERS MANUAL

# Lithium-ion Battery

MLI-E 12/1200



CE

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**DELIVERY CONTENTS**

The MLI-E 12/1200 is part of the Mastervolt MLI series of Lithium Ion batteries. These batteries are equipped with an integrated cell management system which features:

- Cell balancing
- Battery voltage monitoring
- Battery current monitoring
- Pre warning when battery is almost empty
- Battery temperature monitoring (integrated temperature sensor)
- Communication with other devices like chargers and alternators

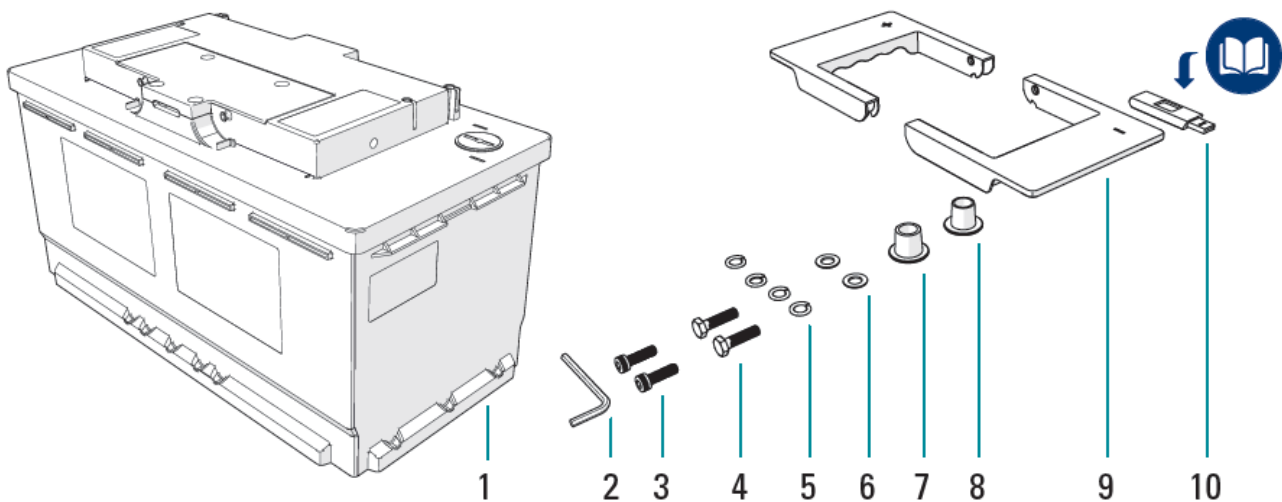


Figure 1: Delivery contents

1. (1x) MLI-E 12/1200 Battery
2. (1x) Tool (combined 2.5mm/6mm Allen hex key)
3. (2x) Hex bolt M8 x 16mm
4. (2x) Bolt M8 x 20mm
5. (4x) Spring washer M8
6. (2x) Plain washer M8
7. (1x) removable automotive battery pole positive
8. (1x) removable automotive batty pole negative
9. (2x) removable handles
10. (1x) USB drive with manual

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# 1 SAFETY GUIDELINES AND MEASURES

## 1.1 General rules



Observe these instructions and keep them located near the Li-ion Battery for future reference.

Work on the Li-ion Battery should be carried out by qualified personnel only.



While working on the Li-ion Battery wear protective eye-glasses and clothing.



Any uncovered battery material such as electrolyte or powder on the skin or in the eyes must be flushed with plenty of clean water immediately. Then seek medical assistance. Spillages on clothing should be rinsed out with water.



Explosion and fire hazard. Terminals of the Li-ion Battery are always alive; therefore do not place items or tools on the Li-ion Battery. Avoid short circuits, too deep discharges and too high charge currents. Use insulated tools. Do not wear any metallic items such as watches, bracelets, et cetera. In case of fire, you must use a type D, foam or CO<sub>2</sub> fire extinguisher.



Never try to open or dismantle the Li-ion Battery. Electrolyte is very corrosive. In normal working conditions contact with the electrolyte is impossible. If the battery casing is damaged do not touch the exposed electrolyte or powder because it is corrosive.



Li-ion Batteries are heavy. If involved in an accident they can become a projectile! Ensure adequate and secure mounting and always use suitable handling equipment for transportation. Handle with care because Li-ion Batteries are sensitive to mechanical shock.



Li-ion batteries can be charged with a voltage up to 14.6 V. On the other hand, Li-ion batteries can be discharged down to 11.0 V. Note that this voltage range (11.0-14.6V) is larger than you may expect from other battery types such as lead-acid batteries. Be aware that these voltages may exceed the permitted voltages of the connected load(s). Therefore appropriate

measures must be taken to avoid damage to the connected load(s).



If charged after the Li-ion battery was discharged below the Discharge cut-off voltage, or when the Li-ion battery is damaged or overcharged, the Li-ion battery can release a harmful mixture of gasses such as phosphate.

**Non-compliance with operating instructions, repairs made with other than original parts, or repairs made without authorization render the warranty void.**

## 1.2 Transportation warnings



The Li-ion battery must be transported in its original or equivalent package and in an upright position. If the battery is in its package, use soft slings to avoid damage. Do not stand below a Li-ion battery when it is hoisted. Never lift the battery at the terminals, only lift the battery at the handles.

Batteries are tested according to UN Handbook of Tests and Criteria, part III, sub section 38.3 (ST/SG/AC.10/11/Rev.5).

For transport the batteries belong to the category UN3480, Class 9, Packaging Group II and have to be transported according to this regulation. This means that for land and sea transport (ADR, RID & IMDG) they have to be packed according to packaging instruction P903 and for air transport (IATA) according to packaging instruction P965. The original packaging satisfies these instructions.

## 1.3 Disposal of li-ion batteries

Batteries marked with the recycling symbol must be processed via a recognized recycling agency. By agreement, they may be returned to the manufacturer. Batteries must not be mixed with domestic or industrial waste.

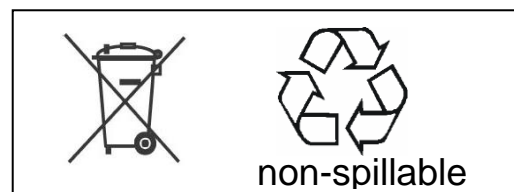


Figure 2: Disposal and recycling symbols

## 2 GENERAL INFORMATION

### 2.1 Use of this manual

Copyright © 2017 Mastervolt. All rights reserved.  
 Reproduction, transfer, distribution or storage of part or all of the contents in this document in any form without the prior written permission of Mastervolt is prohibited.  
 This manual serves as a guideline for the safe and effective installation, operation and maintenance of the Mastervolt MLI-E series of lithium ion batteries further mentioned as “Li-ion Battery” or “Li-ion Batteries”. It is therefore obligatory that every person who works on or with the Li-ion Battery is completely familiar with the contents of this manual, and that he/she carefully follows the instructions contained herein.

Installation of, and work on the Li-ion Battery, may only be carried out by qualified, authorized and trained personnel, consistent with the locally applicable standards and taking into consideration the safety guidelines and measures (chapter 1 of this manual). Keep this manual at a secure place!

### 2.2 Use of pictograms

Safety instructions and warnings are marked in this manual by the following pictograms:



**WARNING**

A WARNING refers to possible injury to the user or significant material damage to the battery if the user does not (carefully) follow the procedures.



**CAUTION!**

Special data, restrictions and rules with regard to preventing damage.

### 2.3 Validity of this manual

All of the specifications, provisions and instructions contained in this manual apply solely to the following products:

Part number	Description
66011200	Li-ion Battery MLI-E 12/1200

### 2.4 Warranty specifications

Mastervolt guarantees that the Li-ion Battery has been built according to the legally applicable standards and specifications. Acting not conform instructions and specifications contained in this manual, may damage the battery or it may not fulfill its specifications. All of these matters mean that the warranty becomes invalid.  
 The warranty is limited to the costs of repair and/or replacement of the product. Costs for installation labor or shipping of the defective parts are not covered by this warranty. Battery damage as a result of over and undercharging is not compensated. You must take measures to disconnect the Li-ion battery based on (MasterBus) generated alarms by this battery, otherwise warranty becomes invalid. Use of a battery controlled external safety relay is obligatory. (refer to chapter 4). The correct functioning of this product is subject to warranty. The period and conditions of this warranty are laid down in Mastervolt Warranty Terms and Conditions which can be downloaded from [www.mastervolt.com/support](http://www.mastervolt.com/support).

### 2.5 Liability

Mastervolt accepts no liability for:

- consequential damage due to use of the Li-ion Battery;
- possible errors in the manuals and their results.

### 2.6 Identification label

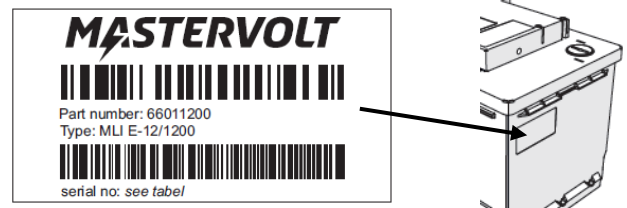


Figure 3: Identification label

The identification label is located at the top side of the Li-ion Battery, next to the grip handle (see Figure 3). Important technical information required for service, maintenance & secondary delivery of parts can be derived from the identification label.



**CAUTION!**

Never remove the identification label.

## 2.7 Use for intended purpose

The Li-ion Battery is constructed as per the applicable safety-technical guidelines.

Use the Li-ion Battery only:

- in a technical correct condition;
- in a closed, well-ventilated area, protected against rain, moist, dust and condensation;
- observing the instructions and specifications in this manual.



### WARNING

Never use the Li-ion Battery at locations where there is danger of gas or dust explosion or potentially flammable products!

Use of the Li-ion Battery other than mentioned in point 2 is not considered to be consistent with the intended purpose. Mastervolt is not liable for any damage resulting from the above.

## 2.8 Organizational measures

The user must always:

- have access to the user's manual;
- be familiar with the contents of this manual. This applies in particular to chapter Safety Guidelines and Measures.

## 2.9 Maintenance and repair

If the electrical installation is switched off during maintenance and/or repair activities, it should be secured against unexpected and unintentional switching on:

- switch off all charging systems;
- switch off the connection with the batteries;
- be sure that third parties cannot reverse the measures taken.

If maintenance and repairs are required, only use original spare parts.

## 2.10 General safety and installation precautions

- Do not expose the Li-ion Battery to rain, snow, spray, moisture, excessive pollution and condensing circumstances. Do not install the Li-ion Battery in a non-ventilated area, overheating may result.
- Short circuiting or reversing polarity will lead to serious damage to the Li-ion Battery, equipment connected to the Li-ion Battery and the wiring. Fuses between batteries and equipment cannot prevent damage caused by reversed polarity and the warranty will be void.
- Protect the wiring with fuses, according to the local standards.
- Connection and protection must be done in accordance with local standards.
- Do not work on the Li-ion Battery or system if it is still connected to a power source. Only allow changes in your electrical system to be carried out by qualified electricians.
- Check the wiring at least once a year. Defects such as loose connections, burned cables etc. must be corrected immediately.

## 2.11 Warning regarding life support applications

The Li-ion Battery is not sold for applications in any medical equipment intended for use as a component of any life support system unless a specific written agreement pertaining to such intended use is executed between the manufacturer and Mastervolt. Such agreement will require the equipment manufacturer either to contract additional reliability testing of the Li-ion Battery parts and/or to commit to undertake such testing as a part of the manufacturing process. In addition the manufacturer must agree to indemnify and not hold Mastervolt responsible for any claims arising from the use of the Li-ion Battery in the life support equipment.

## 3 OPERATION

### 3.1 Charging and discharging

Use the Li-ion Battery within the specifications as stated in chapter 10.

### 3.2 Cell management system

The Mastervolt Li-ion battery consists of a pack of battery cells. As with all kind of batteries, there is always some kind of unbalance present between the individual cells. During charging of an unbalanced battery pack, one or more cells will reach the maximum state of charge before the other cells. During discharge the cells that are not fully charged will be depleted prior to the other cells, causing early undervoltage shutdown of the pack. Normally spoken, these early charge and discharge limits reduce the usable capacity of the battery and will shorten the expected lifetime of the pack. To avoid this kind of premature failure, the Mastervolt Li-ion battery is provided with a Cell Management System (BMS). With this system, each cell is conditioned individually.

Features of the Cell Management System:

- Balancing between the different cells. Normally, cells in a series string receive identical currents. With the Cell Management System current from stronger cells will be transferred to the weaker cells during the charging/ discharging process and idle mode;
- Protection of each separate cell from under- and over-charging by voltage monitoring of each individual cell;
- Prevention of too deep battery discharges;
- Monitoring of temperature. Each separate cell as well as the external temperature of the battery pack is being monitored;
- Communication with Mastervolt charge devices to maximize safety and performance;
- Pre warnings when the state of charge is becoming low.



#### WARNING

Before using the Li-ion battery, it must be installed and commissioned in accordance with the instructions stated in chapters 4 and 5 of this manual!

### 3.3 Safety features

Under- and over-charging and excessive temperatures may lead to permanent damage to the Li-ion battery and even to dangerous situations. Therefore the Li-ion battery is provided with several advanced safety features.



#### WARNING

Alarms and warnings generated by the Li-ion battery should not be neglected. It is the user's responsibility to take adequate measures.

There are two levels of protection:

- *Warning*: The orange LED of the MLI-E will be lit.
- *Alarm*: The red LED of the MLI-E will be lit. This is an "emergency stop" of the battery. The battery will disconnect itself from the system.

### 3.4 MasterBus functionality

Refer to chapter 6 for advanced MasterBus functionality.

The Li-ion battery is **not** able to power the MasterBus network. A proper amount of powering devices should be placed in the MasterBus network.



#### CAUTION!

Make sure to place the MLI-E batteries on the end of a MasterBus network.

**3.5 LED indicators**

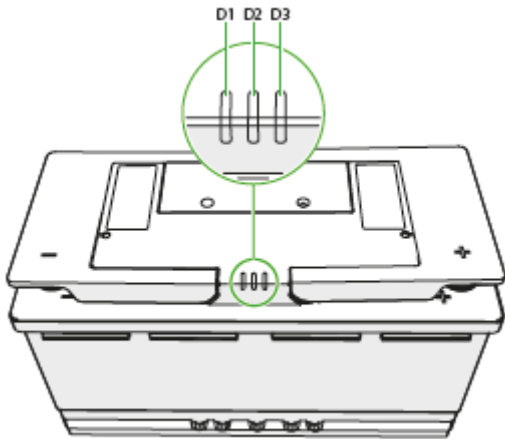


Figure 4: LED positions

D1 (Green)	D2 (Yellow)	D3 (Red)	Operating mode	Protective disconnect device	Communication	BMS
Off	Off	Off	De-energized mode	Open	No	Inactive
			Shutdown mode	Open / Closed	No	Sleep
Off	Off	On	Degrade mode (reduced functionality)	Open	Yes	Active
On	Off	Off	Normal operation mode	Closed	Yes	Active
On	On	Off	Warning	Closed	Yes	Active
On	On	On	Configuration mode	Open	Yes	Active
Blink	Blink	Blink	Maintenance/ Test mode	Closed	Yes	Active

**3.6 Operation modes**

*De-energized mode*

When the battery is in idle mode for a specified time the BMS shuts down all non-essential electronics to minimize the quiescent current.

*Shutdown mode*

All BMS services are stopped.

*Degraded mode*

The BMS device detects either an internal or external failure. If a critical error occurs during Normal Operation mode, the mode management function goes to degraded mode.

*Normal Operation mode*

The device is fully operational. It means that no error is detected and that the device can execute its Control and Monitoring tasks.

*Configuration mode*

The BMS device can receive, check and take into account additional configuration data sent by its main BMS device (Used to program the BMS).

*Maintenance/Test mode*

In this mode maintenance and test operations can be executed.

**3.7 Connections and battery controls**

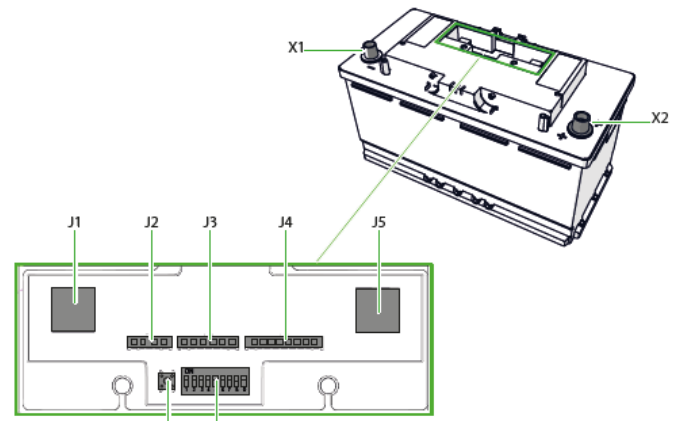


Figure 5: Connections and battery controls

Port/connection	Description
J1	RJ45 (CAN1)
J2	Inputs 4-pins
J3	Monitor 6-pins
J4	Outputs 8-pins
J5	RJ45 (CAN2)
S1	Push button
S2	Configuration switch
X1	Battery terminal 1x 95 mm <sup>2</sup> wire connection or automotive terminal
X2	Battery terminal 1x 95 mm <sup>2</sup> wire connection or automotive terminal



## 4 INSTALLATION



During installation and commissioning of the Li-ion battery, the Safety Guidelines & Measures are applicable at all times. See chapter 1 of this manual.

### 4.1 Unpacking

After unpacking, check the contents for possible damage. Check the open clamp voltage with a suitable voltage meter. It should be within the following range:

Model	Allowed open clamp voltage
12V models	11.0 – 14.5 Volt

Do not use the product if it is damaged or if the open clamp voltage is out of range. If in doubt, contact your supplier.

### 4.2 Required tools:

- Hexagon socket wrench 13mm (M8 bolt) to connect the battery cables to the Li-ion battery (torque: see section 4.4)
- Tools to install the wiring.

### 4.3 Location to install

- Place the battery in a sufficiently ventilated room
- Keep the Li-ion battery away from heat sources. See specifications for allowed operating temperatures.
- Keep the Li-ion battery away from moist.
- Keep at least 1 cm between two Li-ion batteries for air flow.
- The Li-ion battery must be secured to its foundation, use appropriate LN5 fastening brackets.

### 4.4 General installation guidelines

- Switch off all loads and chargers before starting installation.
- Use properly sized and reliable, cables, cable lugs and battery terminals. Tighten all connections. For the main DC connections use 13 Nm torque. Do not over torque as this will damage the Li-ion Battery beyond repair.
- Unused wiring should be insulated properly to avoid accidental contact.
- Connect the battery with the correct polarity to the charger and load(s) (positive pole to positive terminal). Note that the position of the battery poles may differ from previously installed batteries! In installations with a negative earth, connect the negative cable last of all to prevent short circuiting.
- After connecting the battery cable, close the protection lids (grip handles of the Li-ion battery) to prevent incidental touching of the terminals.



### WARNING

To prevent hazardous situations YOU MUST use properly sized fuses and wiring.

### 4.5 Connecting power cables with automotive type terminals

1. Connect the load or charger to the X2 (+) terminal of the battery, see Figure 6.



Do not connect the X1 (-) terminal first as this may lead to short circuits.

2. Connect the load or charger to the X1 (-) terminal of the battery, see Figure 6.

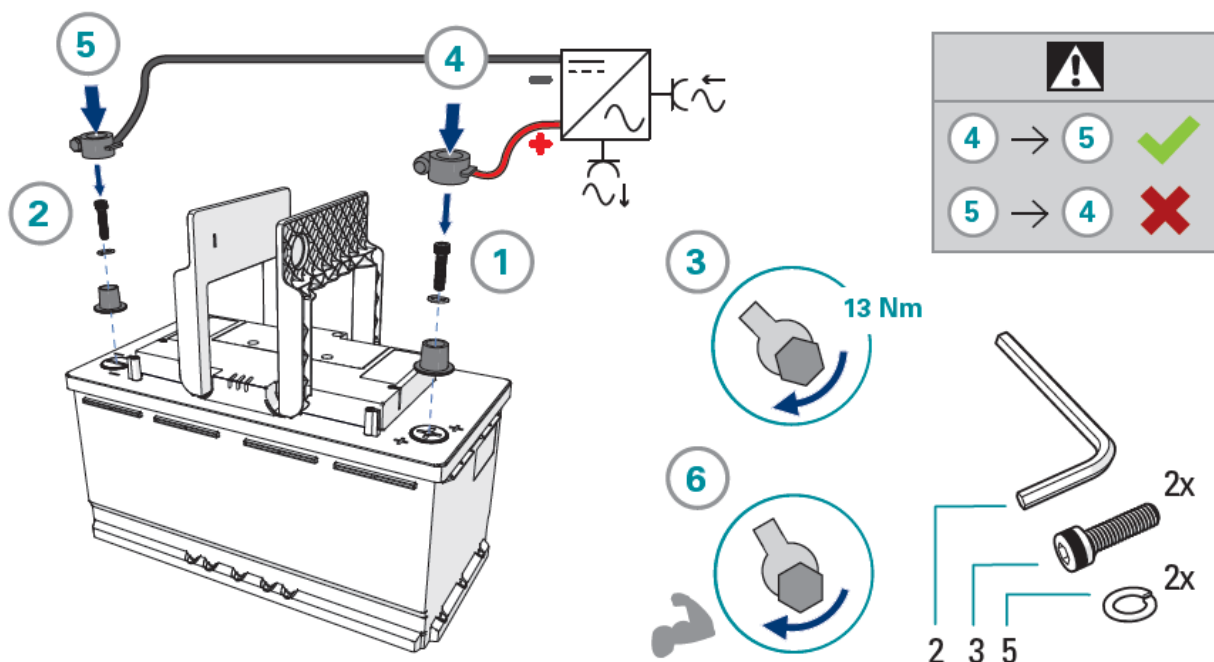


Figure 6: Connect the X1 (-) and X2 (+) terminal of the battery (automotive terminals)

3. Ensure both contacts are firmly tightened.
4. Place the handle covers over the terminals.

**4.6 Connecting shrink fit type of power cables**

1. Remove the automotive power terminals, see Figure 7.
2. Connect the load or charger to the X2 (+) terminal of the battery, see Figure 8. Use the included M8 bolt, spring washer and plain washer to connect the battery cable.



Do not connect the X1 (-) terminal first as this may lead to short circuits.

3. Connect the X1 (-) terminal of the battery, see **Error! Reference source not found.** Use the included M8 bolt, spring washer and plain washer to connect the battery cable.
4. Ensure both contacts are tightened to 13Nm.
5. Place the handle covers over the terminals.

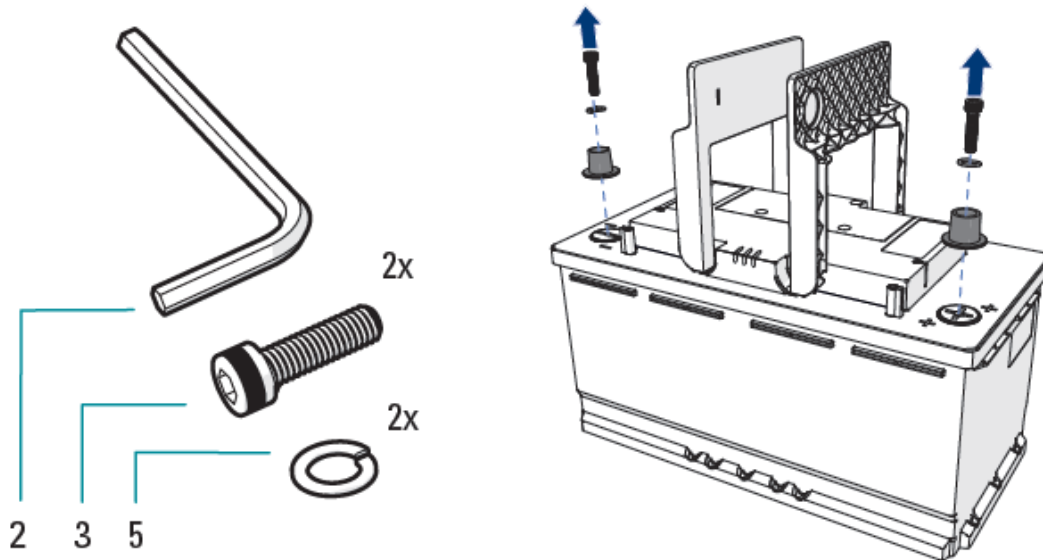


Figure 7: Remove automotive power terminals

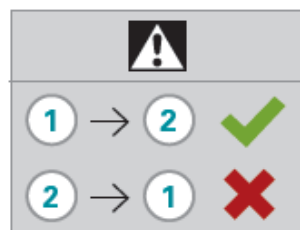
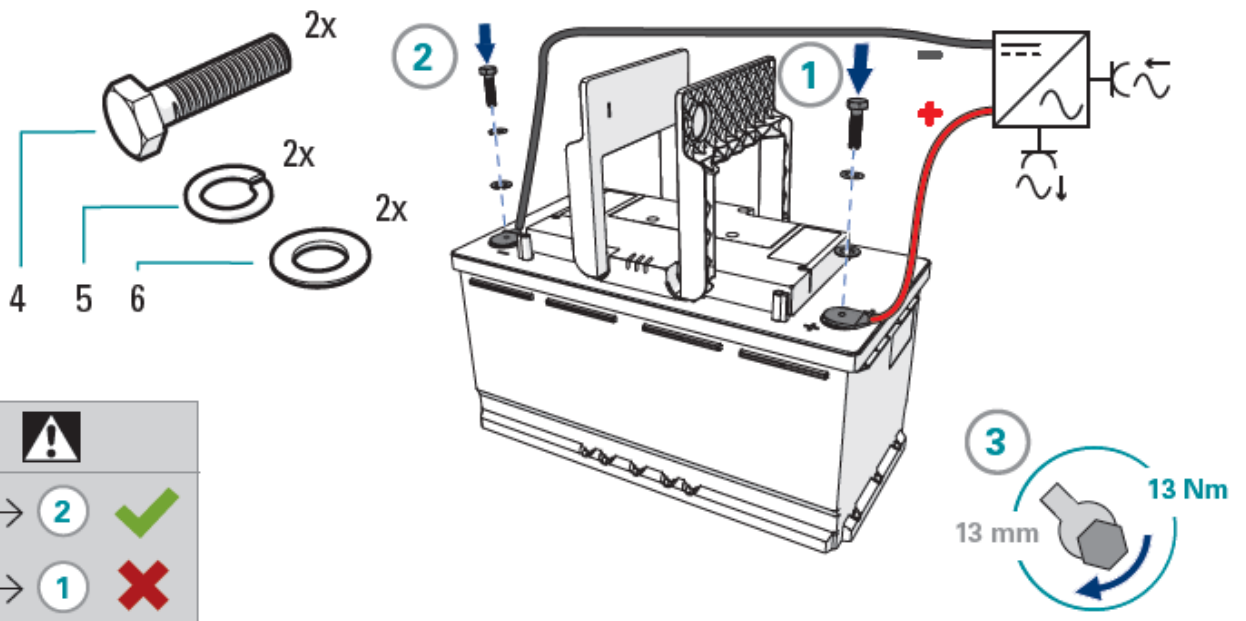


Figure 8: Connect the X1 (-) and X2 (+) terminal of the battery (shrink fit)

## 4.7 Connecting power cables with automotive type terminals and placing protective caps

1. Remove the handle covers, see Figure 9.
  - a. Lift the handles 30°.
  - b. Remove the handles by pulling them outwards.
2. Connect the load or charger to the X2 (+) terminal of the battery, see Figure 10.

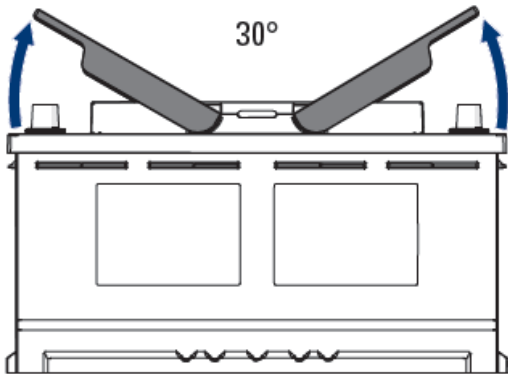


Figure 10: Remove the handle covers



Do not connect the X1 (-) terminal first as this may lead to short circuits.

3. Connect the load or charger to the X1 (-) terminal of the battery, see Figure 10.
4. Ensure both contacts are firmly tightened.
5. Place the accessory caps over the terminals, see Figure 11.

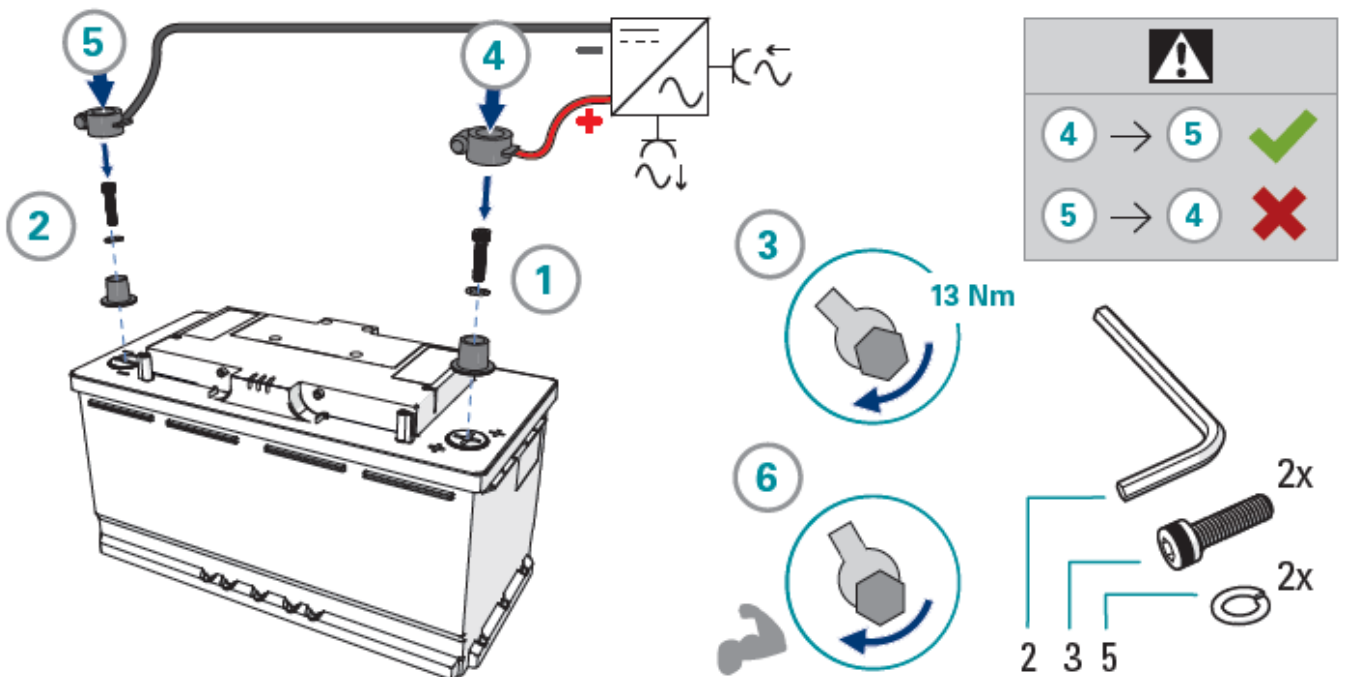
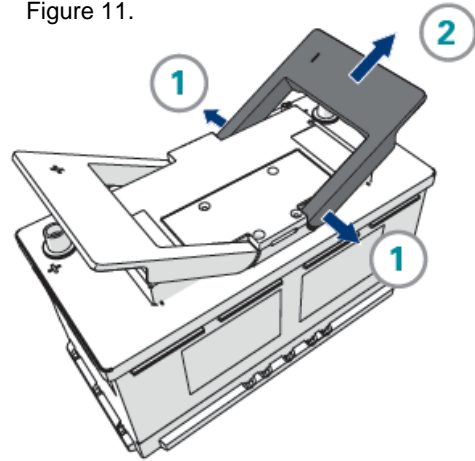


Figure 9: Connect the X1 (-) and X2 (+) terminal of the battery (automotive terminals and caps)

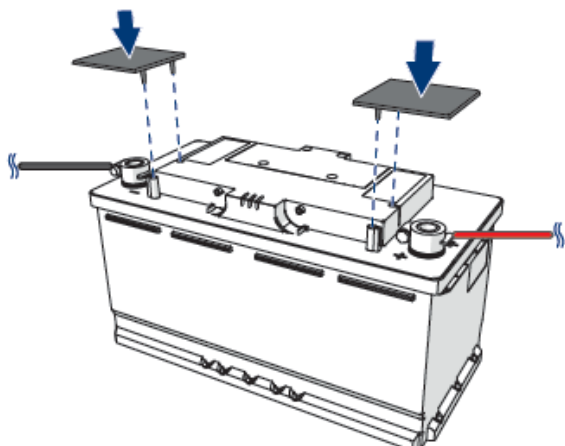


Figure 11: Place the accessory caps over the terminals

**4.8 Set battery in normal operation mode**

The Li-Ion battery is pre-programmed in storage mode. Before it is used, the Li-Ion battery must be set up in normal operation mode.

The Li-Ion battery can be set to normal operation mode by one of the following procedures:

- Press the S1 Push button for 2 seconds.
- Connect the battery to the charger.
- Charge before use

**4.9 Charger settings**

A single Mastervolt Li-ion battery can be charged with any standard Mastervolt battery charger. These chargers feature the MLI charging option. Without this option, IUoUo charge settings must be as follows:

Li-ion battery model	Bulk / absorption voltage setting	Float voltage setting
MLI-E 12/1200	14.25 V	13.5 V

Refer to the user's manual of the battery charger for adjustment.

The temperature of each cell pack as well as the temperature of the entire Li-ion battery is monitored by the

cell management system. Therefore, do not use a sensor for temperature compensated charging.



Do not use a temperature sensor for temperature compensated charging!

**4.10 Fuse to cable size**

For fuses that comply with your cabling cross sections, we refer to ISO 10133.

**4.11 Battery balancing**

During the batteries lifespan, the cells within the battery may become unbalanced due to high discharge currents and short float charge periods. This may result in a loss of capacity and overcharged cells.

The MLI-E 12/1200 automatically balances the cells if necessary. Balancing can take place during charging and idle mode.

**4.12 Battery History Recording**

The complete battery history is stored inside the battery and can be accessed by Mastervolt.

## 5 COMMISSIONING

Follow the steps described below for commissioning of the Li-ion battery:

1. Check all wiring and connections; see also the figures in chapter 4 for wiring details.
2. Install all fuses.
3. Switch on some loads.
4. Verify that a current is flowing out of the battery (negative current).
5. Switch off the load, switch on the charger and verify that a current is flowing into the battery (positive value).
6. Depending on the installation in which the Li-ion battery is used, programming of additional MasterBus events may be required. See chapter 6.
7. Charge the Li-ion battery fully until the charger switches to the float stage (maintenance charge) of the charging algorithm.

Now the Li-ion battery is ready for operation.

## 6 COMMUNICATION

The MLI-E can be used in systems with Masterbus Communication or in systems with NMEA2000.

For both networks select communication type NMEA2000 by setting the Configuration switches (S2).

Using the MLI-E in a MasterBus network always requires the use of the Mastervolt EasyView 5 remote control panel.

Switch 1	Switch 2	Switch 3	Protocol
Off	Off	Off	No CANOpen
On	Off	Off	J1939
Off	On	Off	CANOpen
On	On	Off	NMEA2000

### 6.1 Basic NMEA Components and how to use them

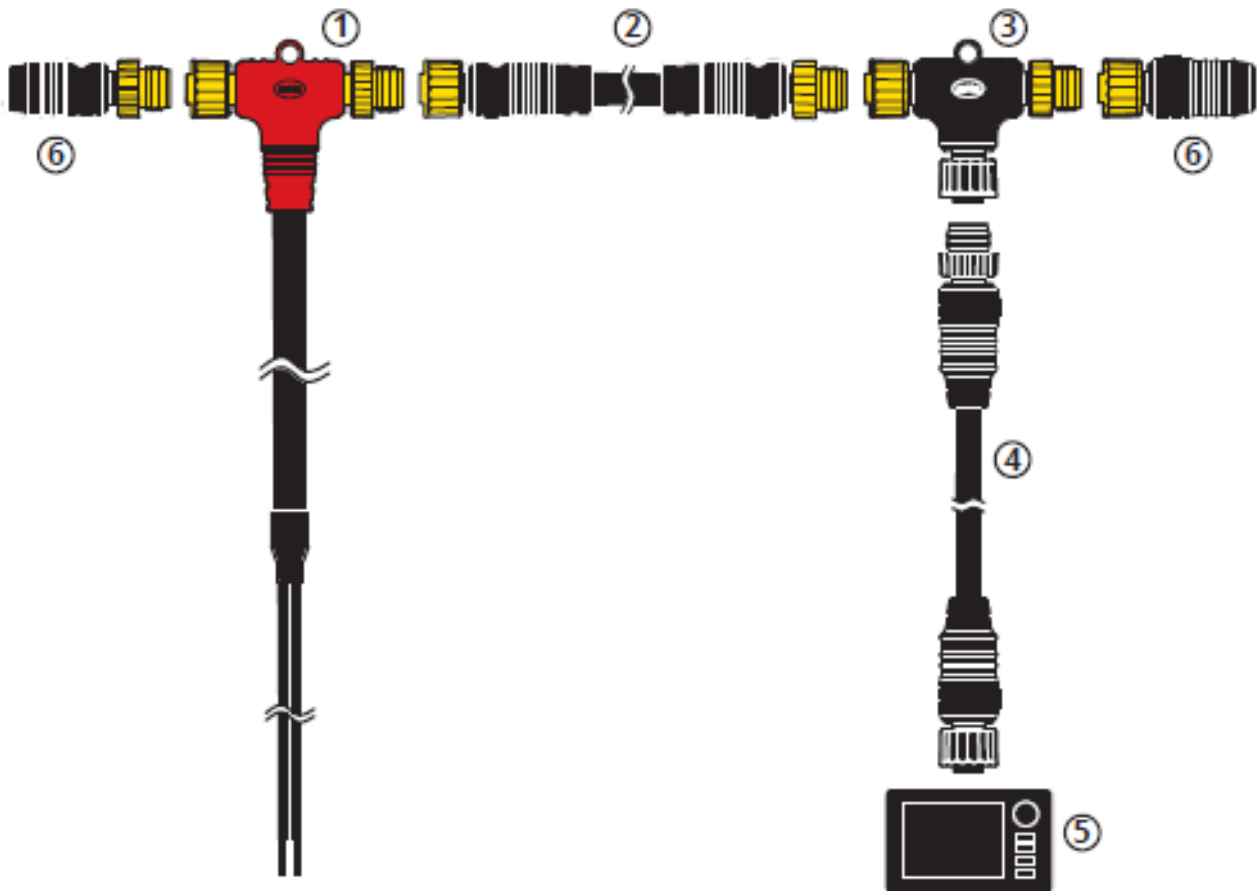


Figure 12: Simple NMEA Network Example

#### 1 Power Tee - Connects to Power Source

The power tee connects the network to a power source. When connecting to a power source, remember to connect the positive wire to either an ignition switch or a standalone switch. This will ensure that your NMEA 2000 network is not draining power when not in use. The power tee is easily identified by the red tee with yellow couplers on both sides.

#### 2 Backbone Cable - Connects the Tees

Backbone cables connect tee connectors to one another or to a power tee. Backbone cables are used when the power tee and device are at different locations or when multiple devices are at different locations along the network backbone. Ancor backbone cables have yellow couplers and are made from a heavier gauge wire than Ancor drop cables to help reduce voltage drop along the network backbone. Ancor offers backbone cables in 0.5m (1.6ft), 2m (6.5ft), 5m (16ft) and 10m (32ft) lengths.

**3 Tee Connector** - A point for breakoff connecting

Tee connectors create a point within the network backbone to add a drop cable and device. The network backbone will always be linear and may consist of any combination of backbone cables, tee connectors and a power tee. The yellow coupler on the tee connects to the yellow coupler on either side of the power tee or backbone cable. The black coupler on the tee connects to the drop cable. Ancor offers single, two way and four way tee connectors.

**4 Drop Cable** - Connects to the Tees of the Backbone

Drop cables connect the network backbone to NMEA 2000 devices. The drop cable connects the tee connectors' black coupler to the NMEA 2000 device. Ancor drop cables have black couplers and are made from a lighter gauge wire than Ancor backbone cables to allow easier wire routing from the network backbone to the NMEA 2000 device. Ancor offers drop cables in 0.5m (1.6ft), 1m (3.3ft), 2m (6.5ft) and 5m (16ft) lengths.

**5 NMEA 2000 device**

Any electronic device with a NMEA 2000 connection and a NMEA 2000 communication protocol. NMEA 2000 Certified devices and Approved components are strongly recommended as they ensure compatibility and proper data exchange. Common NMEA 2000 devices include chartplotters, engine instruments, GPS units and more.

**6 Terminating Resistors** - Terminating the connection

Terminators are required on each end of the network backbone to ensure signal integrity. The yellow coupler on the terminator will connect to the yellow coupler on a tee connector. Ancor terminators are offered with either a male or female coupler to attach to either side of a tee connector at the end of a backbone.

**6.1.1 Adding additional devices**

1. To add another NMEA 2000 device to the network created in the instructions above, start by determining where you will need to place a drop cable for the device.
2. Once you have determined this location, disconnect the backbone at the closest backbone connection and add in a tee connector. When connecting several drop cables in a similar location use an Ancor 2-way or 4-way tee connector.
3. Reconnect the backbone connection(s) with the new tee connector in place.
4. Connect the drop cable to the black coupler on the tee and then connect to the new NMEA 2000 device.

**6.1.2 Network limits**

- Total length of the NMEA 2000 network cannot exceed 100 meters (328 feet)
- Each drop cable cannot exceed 6 meters (19.7 feet)
- Total length of all drop cables within the network cannot exceed 78 meters (256 feet)
- Maximum number of connected devices cannot exceed 30.

**CAUTION!**

Always make sure the NMEA 2000 network has **ONLY** two total terminating resistors (one at each end of the backbone) and is connected to a power source with a power tee in **ONLY** one location.

**6.2 What is MasterBus?**



All devices that are suitable for MasterBus are marked by the MasterBus symbol.

MasterBus is a fully decentralized data network for communication between the different Mastervolt system devices. It is a CAN-bus based communication network which has proven itself as a reliable bus-system in automotive applications. MasterBus is used as power management system for all connected devices, such as the inverter, battery charger, generator and many more. This facilitates communication between the connected devices, for instance to start the generator when the batteries are low.

MasterBus reduces complexity of electrical systems by using less cables. All system components are simply chained together. For this purpose every MasterBus device has been equipped with two MasterBus data ports. When two or more devices are connected through these data ports, they become a local data network, called the MasterBus. The results are a reduction of installation costs as only a few electrical cables and less installation time are needed.

For central monitoring and control of the connected devices, Mastervolt offers the EasyView 5 remote control panel which show full status information of your electrical system at a glance and a push of a button.

New devices can be added to the existing network in a very easy way by just extending the network. This makes the MasterBus a highly flexible network for extended system configuration, today and in the future.

Mastervolt also offers several interface units, making even non-MasterBus devices suitable to operate in the MasterBus network. For direct communication between the MasterBus network and a product which is not from Mastervolt, several interfaces are available. Example is the MasterBus Modbus interface.



**CAUTION!**  
Never connect a non-MasterBus device to the MasterBus network directly! This will void warranty of all MasterBus devices connected.

**6.3 How to set up a MasterBus network**

Every device that is suitable for the MasterBus network is equipped with two data ports. When two or more devices are connected to each other through these ports, they form a local data network, called the MasterBus.

Keep the following rules in mind:

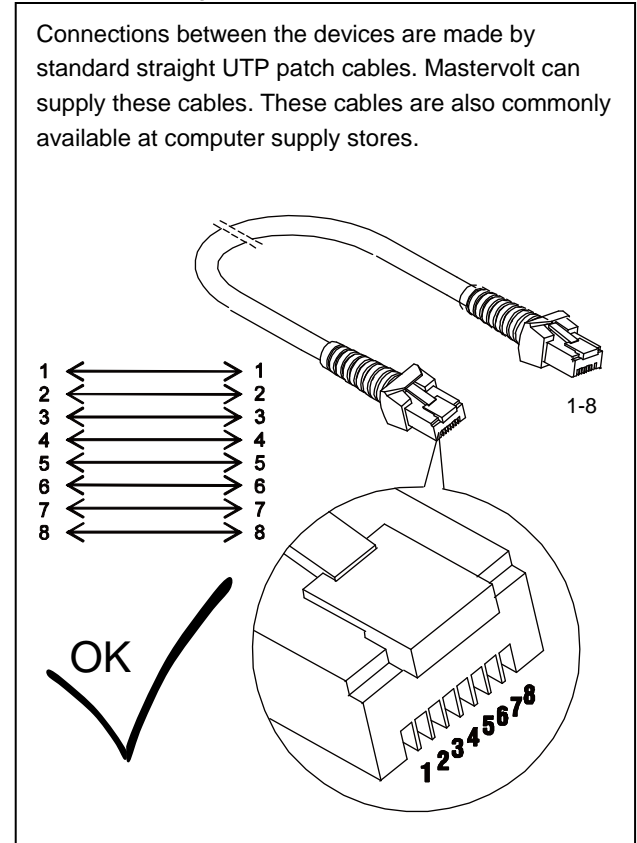


Figure 13: UTP patch cable

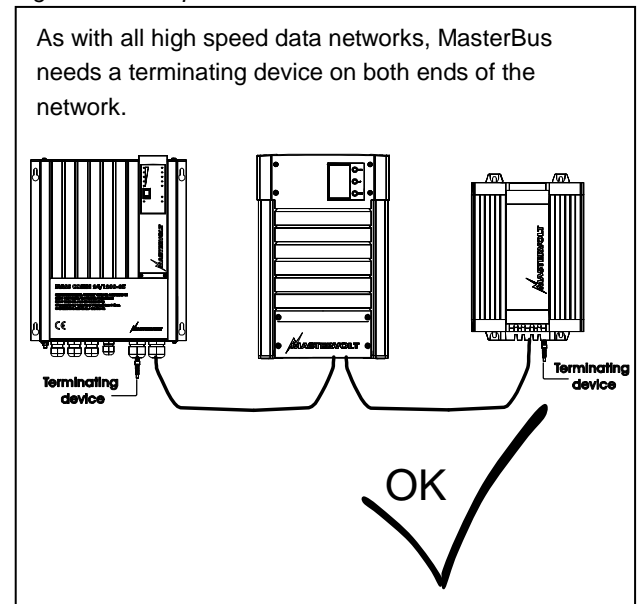


Figure 14: Two Terminators



The electric power for the network comes from the connected devices.

At least one device in the network should have powering capabilities (see specifications).

One powering device can power up to three non-powering devices.

As all powering devices are galvanically isolated, multiple powering devices are allowed.

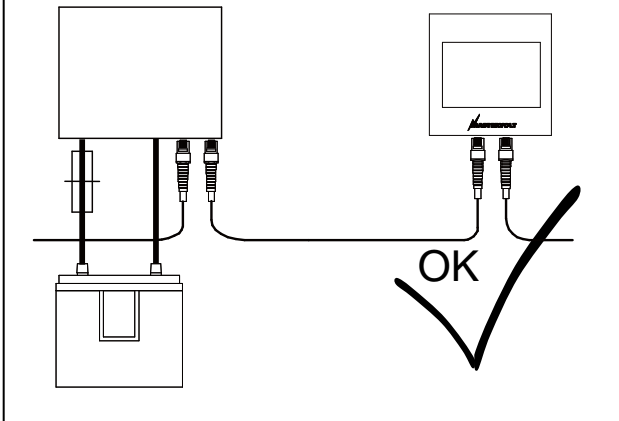


Figure 15: Power supply

Do not make ring networks.

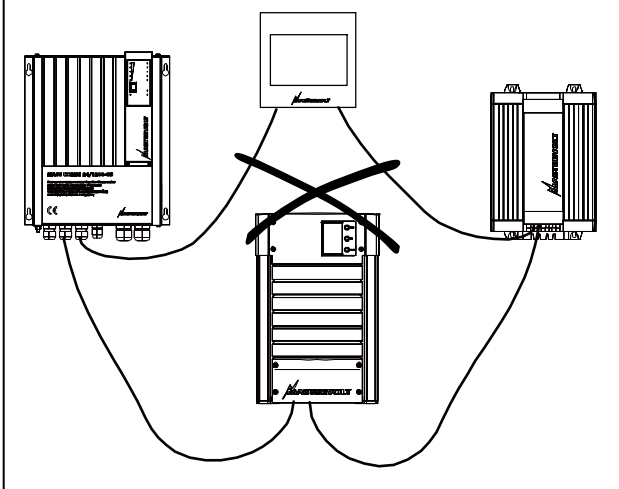


Figure 16: No ring networks

Do not make T-connections in the network.

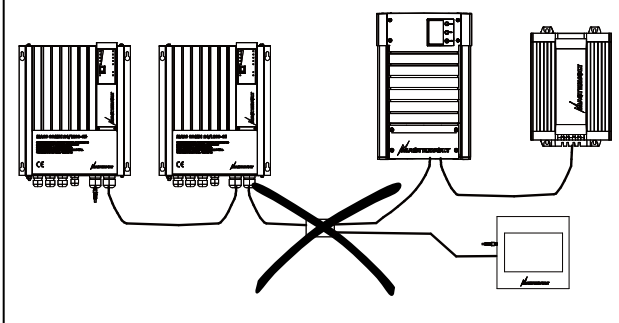


Figure 17: No T-connections

## 6.4 Monitoring and Configuration of the Li-ion battery

To monitor the MLI-E values on a MasterBus network an Easyview 5 remote control panel needs to be installed. To configure the MLI-E in a MasterBus network a MasterBus-USB interface connected to a PC with MasterAdjust software is also needed. The available menu pages are Monitoring, Alarms and Events.

The Li-ion battery can also be monitored by means of an NMEA display.

### 6.4.1 Monitoring

Menu	Description	Adjustable range
<b>General</b>		
State of charge	Battery state of charge in %	(read only)
Battery (V)	Battery voltage measured by the cell management system	(read only)
Battery (A)	Current measured by the cell management system Positive value: charging, Negative value: discharging	(read only)
Battery (°C)	Internal temperature of the battery in °C	(read only)

### 6.4.2 Alarms

Menu	Description	Range
<b>General</b>		
Stop Charge	Toggles on when cell voltage becomes high (3.75V)	On/off (read only)
Stop Discharge	Toggles on when cell voltage becomes low (2.5V)	On/off (read only)
Safety high V	Toggles on when the voltage is to high (>3.85V)	On/off (read only)
Safety low V	Toggles on when the cell voltage is to low (<2V)	On/off (read only)

## 7 TROUBLE SHOOTING

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.
The battery cannot be discharged.	Battery is in normal mode Green LED is blinking/lit. (Chapter 3.5)	Check the installation of the battery.
	Battery is in shutdown mode. No LED is lit (Chapter 3.5)	Charge the battery or Press the S1 Push button for 2 seconds.
	Battery is in degrade mode Red LED is blinking/lit. (Chapter 3.5)	Charge the battery.
The battery cannot be charged.	Battery is in normal mode Green LED is Blinking/lit.(Chapter 3.5)	Check the installation of the battery.
	Battery is in degrade mode Red LED is lit. (Chapter 3.5)	Discharge the battery.
Green and Yellow LED is blinking or lit	Battery in Warning mode (Chapter 3.5)	State of charge is low, fully charge the battery
All LEDs are blinking	Battery in Maintenance/Test mode (Chapter 3.5)	Consult your reseller or Mastervolt for support
Alarm on the MasterBus display	An alarm is activated.	The EasyView 5 will display an alarm. Correct the source of the alarm.
MasterBus display shows no Li-ion battery	The firmware of the Easyview 5 is too old.	Check if the firmware version is at least V2.10
	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 (see section 6.3). Check if available.
	MasterBus network is configured as a ring network.	Ring networks are not allowed. Check the connections of the network (section 6.3).
	Battery is in storage mode	Charge the battery or press S1 Push button

## 8 MAINTENANCE, DECOMMISSIONING AND STORAGE

### 8.1 Maintenance

No specific maintenance of the Li-ion battery is required. 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.

Keep the battery clean and dry to avoid leakage currents. If necessary, use a soft clean cloth to clean casing of the Li-ion battery. Never use any liquids, acids and/ or scourers.

Place the enclosed protective caps over the terminals before cleaning and other maintenance activities to avoid the risk of contacting the terminals.

### 8.2 Taking out of operation

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 optional maintenance switch in the off position.
3. Disconnect all wiring
4. Place the enclosed protective caps over the terminals to avoid the risk of contacting the terminals.

Now the Li-ion battery can be demounted in a safe way.

### 8.3 Battery replacement



#### CAUTION

If Li-ion batteries need to be replaced individually, make sure that:

Before reconnection: the open circuit voltage of these batteries equals the voltage of the replaced or paralleled batteries.

### 8.4 Storage

The Li-ion battery should be stored in a dry and well ventilated environment. Follow the storage instructions in this manual to optimize the lifespan of the battery during storage. If these instructions are not followed and the Li-ion battery has no charge remaining when it is checked, consider it to be damaged. Do not attempt to recharge or use it. Replace it with a new battery.

1. Disconnect the Li-Ion battery from all loads and, if present, the charging device.
2. To put the MLI-E back in storage mode, 12V should be applied to pins 3/4 of connector J2. Where Pin3 is +12V and pin 4 is GND, as shown in figure 16.
3. Place the terminal covers over the battery's terminals during storage.
4. Store the battery in a cool and well ventilated space.
5. Avoid exposure of the battery to sunlight and/or UV radiation.
6. Charge the battery to > 80% of its capacity before storage.
7. Charge the battery to > 80% of its capacity every 100 days.

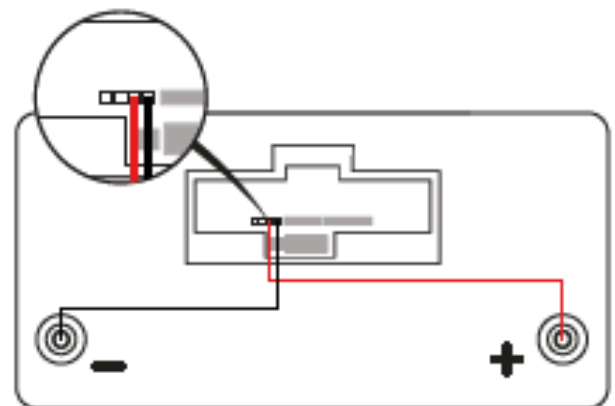


Figure 18: Storage

## 9 ORDERING INFORMATION

Part number	Description
66011200	Li-ion Battery MLI-E 12/1200
77010310	EasyView 5, required to connect the Li-ion Battery to a MasterBus network
77030100	MasterBus USB interface, required as interface between your PC and the MasterBus network
77040000	MasterBus terminator for the MasterBus network
77040100	MasterBus connection cable 1,0m / 3.3ft
77040300	MasterBus connection cable 3,0m / 10ft
77040600	MasterBus connection cable 6,0m / 20ft
77041000	MasterBus connection cable 10m / 33ft
77042500	MasterBus connection cable 25m / 82ft
77050100	100m / 330ft MasterBus cable
77050200	50 pcs. MasterBus connectors
77050000	Complete set to assemble MasterBus cables. Delivery includes: 100m / 330ft MasterBus cable, 50 pcs. modular jacks and crimping tool
80-911-0030-00	NMEA terminator female
80-911-0031-00	NMEA terminator male
77046000	CZone/Masterbus dropcable (1m)
80-911-0048-00	4-way T-piece
80-911-0047-00	2-way T-piece
80-911-0116-00	NMEA Dropcable 0,5m
80-911-0117-00	NMEA Dropcable 1,0m
80-911-0118-00	NMEA Dropcable 2.0m
80-911-0115-00	NMEA Dropcable 5.0m
80-911-0026-00	NMEA Backbone cable (0.5m)
80-911-0027-00	NMEA Backbone cable (2m)
80-911-0024-00	NMEA Backbone cable (5m)
80-911-0025-00	NMEA Backbone cable (10m)
80-911-0028-00	NMEA Power cable (1m)
80-911-0124-00	CZone Touch 5
80-911-0100-00	CZone Touch 10
80-911-0044-00	USB CAN Adaptor

## 10 TECHNICAL INFORMATION

### 10.1 Specifications

Model	MLI-E 12/1200
Article number	66011200
Nominal voltage	12 V
No load voltage, fully charged	13.2 V
Nominal capacity (C <sub>n</sub> )	90 Ah
Nominal energy	1.2 kWh
Approximate weight	12.5 kg (27.6 lbs)
Terminal type	Bolts M8 or Automotive
Chemistry	Lithium iron phosphate
<b>Charge/discharge parameters</b>	
Charge voltage, Bulk/absorption phase****	Minimum 13.75 V Recommended 14.25 V Maximum 14.6 V
Charge voltage, Float phase	13.5V
Undervoltage cut off voltage***	10V
Overvoltage cut off voltage***	15V
Recommended charge/ discharge current	30 A / 45A
Maximum charge/ discharge current	90 A / 200A
Discharge pulse current (30 sec)	350 A
Discharge current pulse (1 sec)	600 A
Short circuit protection	700 A
<b>Rated capacity and cycle life</b>	
Rated capacity	90 Ah (1.2 kWh)
Cycle life	~ 5000 @ 80% DOD and 23 °C
<b>General</b>	
Parallel configuration*	Yes, unlimited
Series configuration*	No
Operating temperature**	-40 to 65 °C / -40 to 149 °F
Nominal operating temperature:	25 °C / 77 °F
Storage temperature**	-40 to 65 °C / -40 to 149 °F
Self-discharge	< 4% per month @ 23 °C
Warranty	2 years
Protection degree	IP65
<b>Dimensions</b>	
Length (L)	353±2mm
Width (W)	175±2mm
Height (H)	190±2mm
Installation angle	Mountable in multiple orientations, suitable for LN5 fastening brackets
<b>Interfacing</b>	
MasterBus connectivity	Yes (see chapter 6)
Powering capabilities for MasterBus	No, cuts power to the bus (see section 3.4)
Internal disconnect switch	Yes
NMEA2000 connectivity	Yes

\* For systems with more than one single battery, please refer to [www.mastervolt.com/batteries](http://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 safety switch

\*\*\*\* Bulk/absorption phase should be terminated before current accepted by the battery < 0,015xC<sub>n</sub>

10.2 Dimensions

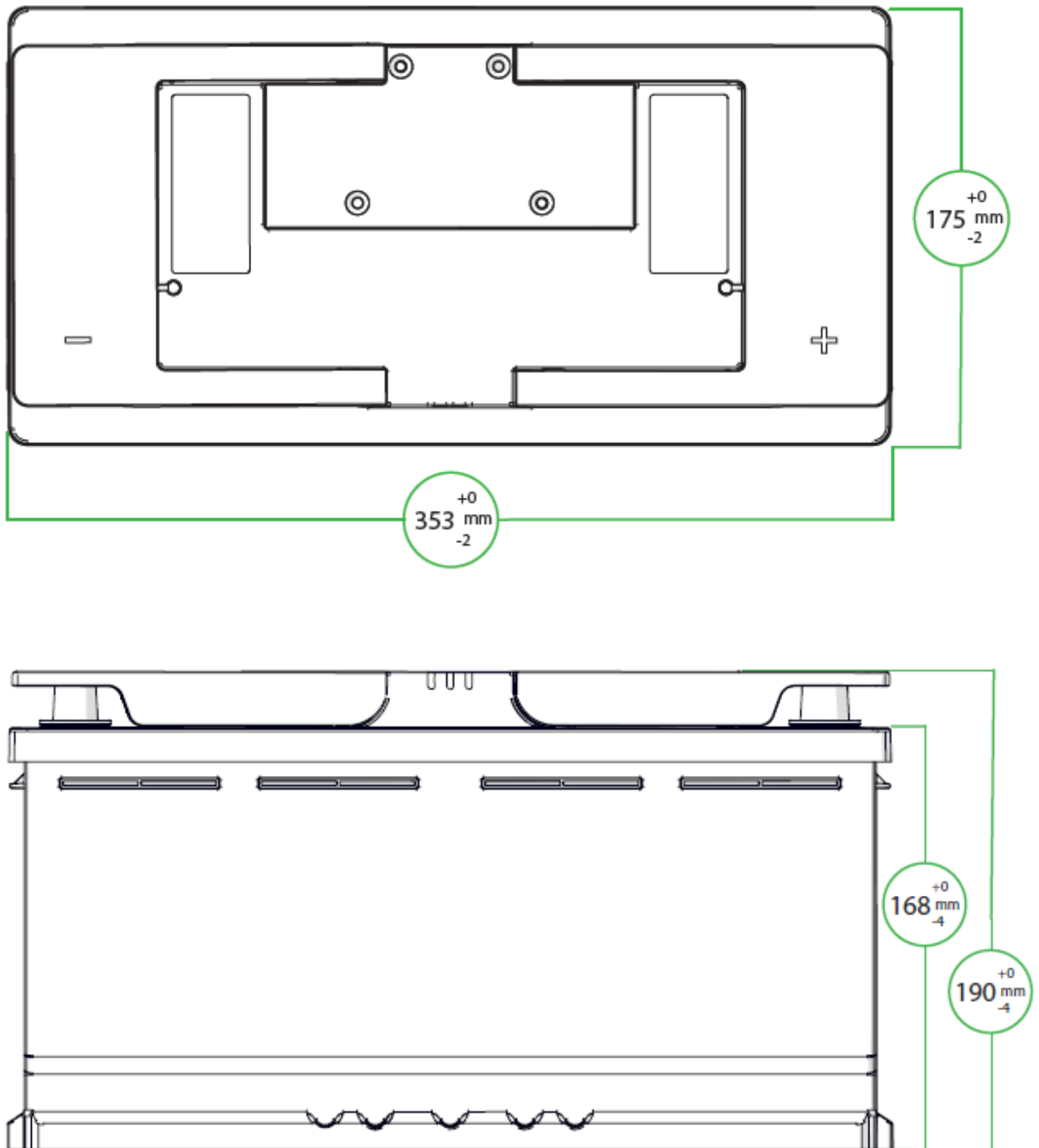


Figure 19: Li-ion battery MLI-E 12/1200 dimensions in mm

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