victron energy
BLUE POWER

# Manual

EN

Appendix

## VE.Bus BMS

# 1. General Description

**Protects each individual cell of a Victron lithium iron phosphate ($LiFePO_4$) battery**
Each individual cell of a $LiFePO_4$ battery must be protected against over voltage, under voltage and over temperature. Victron $LiFePO_4$ batteries have integrated Balancing, Temperature and Voltage control (acronym: BTV) and connect to the VE.Bus BMS with two M8 circular connector cord sets.
The BTV's of several batteries can be daisy chained. Please see our LiFePO4 battery documentation for details
The BMS will:

- shut down or disconnect loads in case of imminent cell under voltage,
- reduce charge current in case of imminent cell overvoltage or over temperature (VE.Bus products, see below), and
- shut down or disconnect battery chargers in case of imminent cell overvoltage or over temperature.

**Protects 12 V, 24 V and 48 V systems**
Operating voltage range of the BMS: 9 to 70 V DC.

**Communicates with all VE.Bus products**
The VE.Bus BMS connects to a MultiPlus, Quattro or Phoenix inverter with a standard RJ45 UTP cable.

Products without VE.Bus can be controlled as shown below:

**Load Disconnect**
The Load Disconnect output is normally high and becomes free floating in case of imminent cell under voltage. Maximum current: 2 A.
The Load Disconnect output can be used to control

- the remote on/off of a load, and/or
- the remote on/off of an electronic load switch (BatteryProtect) and/or
- a Cyrix-Li-load relay.

**Charge Disconnect**
The Charge Disconnect output is normally high and becomes free floating in case of imminent cell over voltage or over temperature. Maximum current: 10 mA.
The Charge Disconnect output can be used to control

- the remote on/off of a charger and/or
- a Cyrix-Li-Charge relay and/or
- a Cyrix-Li-ct Battery Combiner.

**LED indicators**

- Enabled (blue): VE.Bus products are enabled.
- Cell>4V or temperature (red): charge disconnect output low because of imminent cell over voltage or over temperature.
- Cell>2,8V (blue): load disconnect output high.
  Load disconnect output low when off, due to imminent cell under voltage (Vcell≤2,8V).

# 2. Safety instructions

Installation must strictly follow the national safety regulations in compliance with the enclosure, installation, creepage, clearance, casualty, markings, and segregation requirements of the end-use application. Installation must be performed by qualified and trained installers only. Switch off the system and check for hazardous voltages before altering any connection.

• Do not open the Lithium Ion Battery.
• Do not discharge a new Lithium Ion Battery before it has been fully charged first.
• Charge only within the specified limits.
• Do not mount the Lithium Ion Battery upside down or on the side.
• Check if the Li-Ion battery has been damaged during transport.

# 3. Things to consider

**3.1 AC Detector for MultiPlus and Quattro**
The AC Detector is a small add-on that has to be built in a MultiPlus or Quattro when used together with a $LiFePO_4$ battery and a VE.Bus BMS.
The purpose of the AC Detector is to restart the MultiPlus or Quattro when AC supply becomes available, in case it has been switched off by the BMS due to low cell voltage (so that it can recharge the battery).
Without the AC Detector the MultiPlus or Quattro would remain off and therefore would not start recharging the battery after shut down due to low battery voltage.

Inverters (DC to AC only) with VE.Bus can be connected directly to the MultiPlus/Quattro input of the BMS, no AC Detector needed.

**3.2 DC loads with remote on/off terminals**
DC loads must be switched off or disconnected in case of imminent cell under voltage.
The Load Disconnect output of the VE.Bus BMS can be used for this purpose.

The Load Disconnect is normally high (equal to battery voltage) and becomes free floating (= open circuit) in case of imminent cell under voltage (no internal pull down in order to limit residual current consumption in case of low cell voltage).

DC loads with a remote on-off terminal that switches the load on when the terminal is pulled high (to battery plus) and switches it off when the terminal is left free floating can be controlled directly with the Load Disconnect output.
See appendix for a list of Victron products with this behavior.

For DC loads with a remote terminal that switches the load on when the terminal is pulled low (to battery minus) and switches it off when the terminal is left free floating, the **Inverting remote on-off cable** (also known as the MPPT 70/15 to inverter remote on-off cable) can be used. See appendix.

**Note: please check the residual current of the load when in off state. After low cell voltage shutdown a capacity reserve of approximately 1 Ah per 100 Ah battery capacity is left in the battery. A residual current of 10 mA for example may damage a 200 Ah battery if the system is left in discharged state during more than 8 days.**

### 3.3 DC load: disconnecting the load with a BatteryProtect (available in 12 V and 24 V only)

A Battery Protect will disconnect the load when:

- input voltage (= battery voltage) has decreased below a preset value, or when
- the remote on/off terminal is pulled low. The VE.Bus BMS can be used to control the remote on/off terminal (**Non inverting remote on-off cable** needed).
  Contrary to a Cyrix or contactor, a BatteryProtect can start a load with a large input capacitor such as an inverter or a DC-DC converter.

### 3.4 DC load: disconnecting the load with a Cyrix-Li-load

The Cyrix-Li-load has been designed to operate together with the VE.Bus BMS. Its microprocessor will prevent frequent switching when a low cell voltage is followed by a higher voltage after loads have been switched off.
Note: A load with a large input capacitor such as an inverter or a DC-DC converter may damage the contacts of the Cyrix. Use a BatteryProtect instead.

### 3.5 Charging the $LiFePO_4$ battery with a battery charger

Battery charging must be reduced or stop in case of imminent cell overvoltage or over temperature.

The Charge Disconnect output of the VE.Bus BMS can be used for this purpose.
The Charge Disconnect is normally high (equal to battery voltage) and switches to open circuit state in case of imminent cell under voltage.

Battery chargers with a remote on-off terminal that activates the charger when the terminal is pulled high (to battery plus) and deactivates when the terminal is left free floating can be controlled directly with the Load Disconnect output.
See appendix for a list of Victron products with this behavior.

Battery chargers with a remote terminal that activates the charger when the terminal is pulled low (to battery minus) and deactivates when the terminal is left free floating, the **Inverting remote on-off cable** (also known as the MPPT 70/15 to inverter remote on-off cable) can be used. See appendix.

Alternatively, a **Cyrix-Li-Charge** can be used:
The Cyrix-Li-Charge is a unidirectional combiner that inserts in between a battery charger and the $LiFePO_4$ battery. It will engage only when charge voltage from a battery charger is present on its charge-side terminal. A control terminal connects to the Charge Disconnect of the BMS.

### 3.6 Charging the $LiFePO_4$ battery with an alternator

See figure 6.
The **Cyrix-Li-ct** is recommended for this application.

# 4. Installation

### 4.1 AC Detector for MultiPlus and Quattro

The purpose of the AC Detector is to restart the MultiPlus or Quattro when AC supply becomes available, in case it has been switched off by the BMS due to low cell voltage (so that it can recharge the battery).

Note 1: The AC Detector is not needed in case of an inverter.
Note 2: In systems consisting of several units configured for parallel, three phase or split phase operation, The AC Detector should be wired in the master or leader unit only.

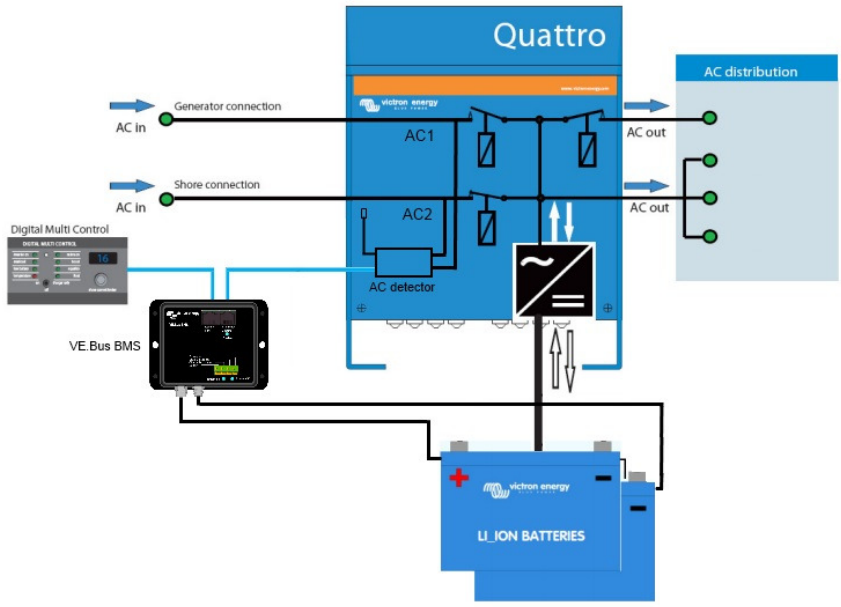



Figure 1: Block diagram with AC Detector in a Quattro

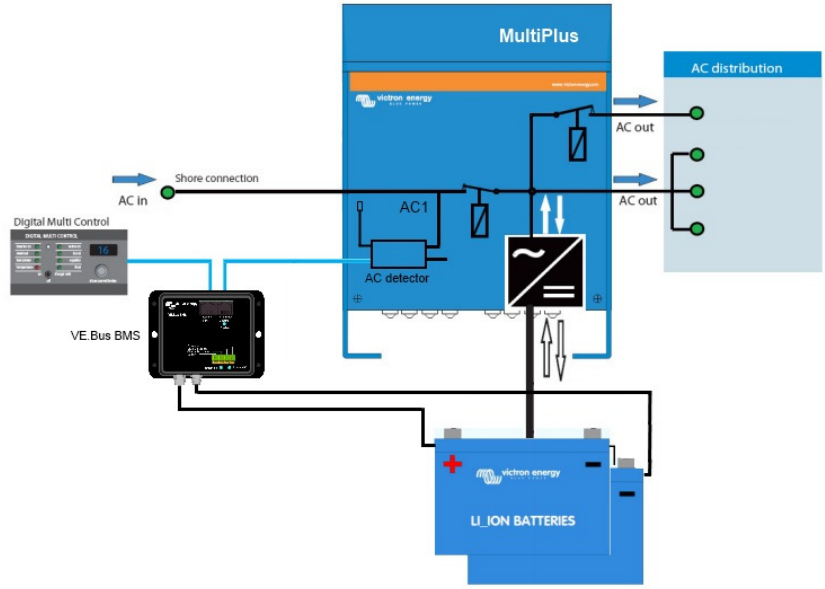



Figure 2: Block diagram with AC Detector in a MultiPlus

**Installation procedure (see figure 3)**

1. Connect the red AC1 wires to the neutral and phase of the AC-in-1 input.
2. Quattro: connect the black AC2 wires to the neutral and phase of the AC-in-2 input.
   MultiPlus: no AC-in-2 input available. Please cut the AC2 wires close to the AC Detector

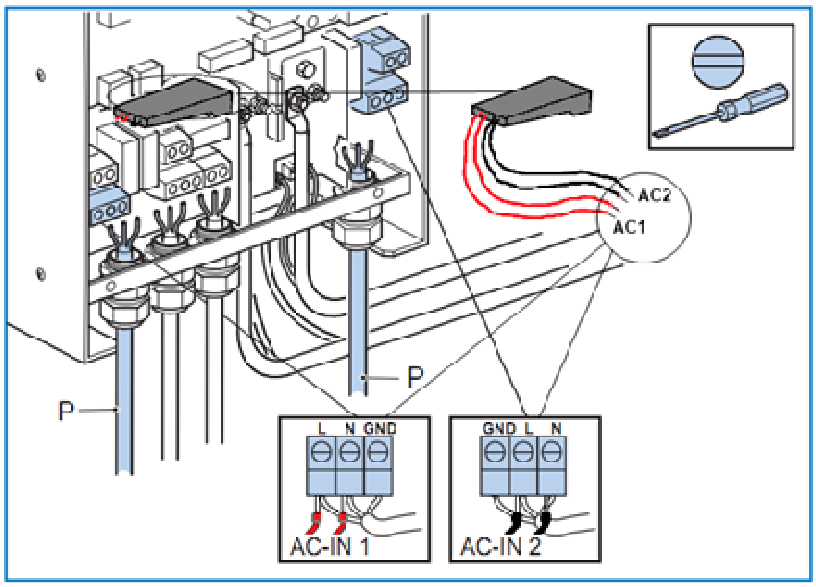



Figure 3: Connecting the AC Detector

3. Use the short RJ45 UTP cable to connect the AC Detector to one of the two the VE.Bus sockets in the MultiPlus or Quattro (see figure 4).
4. Connect the VE.Bus BMS to the AC Detector with a UTP cable (not included).
5. If a VE.Bus control panel is used: connect to the Remote Panel socket of the VE.Bus BMS.

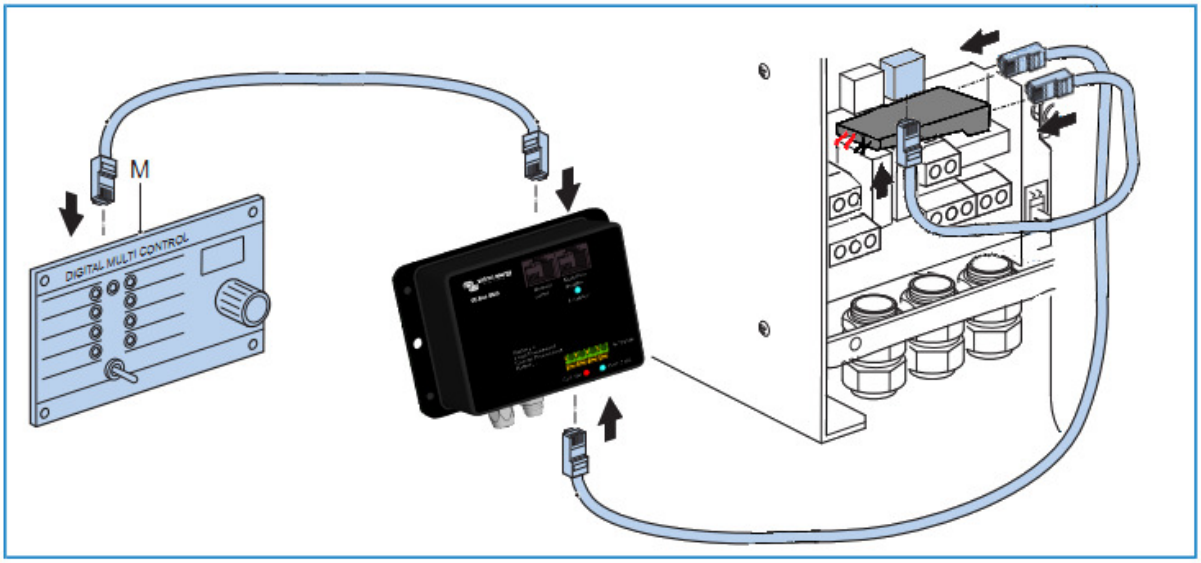



Figure 4: VE.Bus connections

**4.2 Wire the system**
**Do not connect to the battery plus at this stage** (alternatively: do not insert the battery fuse(s)).

Important: the UTP cable to the inverter or inverter/charger also connects the battery minus to the BMS.
In this case, in order to prevent ground loops, do not wire the battery minus connector of the BMS.

**4.2. Battery**
In case of several batteries in parallel and or series configuration, the two M8 circular connector cord sets of each battery should be connected in series (daisy chained).
Connect the two remaining cord sets to the BMS.

**4.3. Powering up**
In case of a DC only system: connect the battery plus. The system is now ready for use.

In case of a system with Multis, Quattros or inverters with VE.Bus:
4.3.1. After completion of the installation, disconnect the BMS from the VE.Bus and replace by a Victron Interface MK2 and a computer.
4.3.2. Connect the battery plus.
4.3.2. Configure inverter/charger(s) or inverter(s) for parallel or three phase configuration if applicable.
Inverter/chargers: the AC Detector should be installed only in the master or leader of a parallel or three phase system.
Inverters: AC detector not needed.
4.3.3. Load the BMS VE.Bus assistant in all units (must be done for each unit separately)
4.3.4. Remove the MK2 and reconnect to the BMS.
4.3.5. The system is now ready for use

# 5. System examples

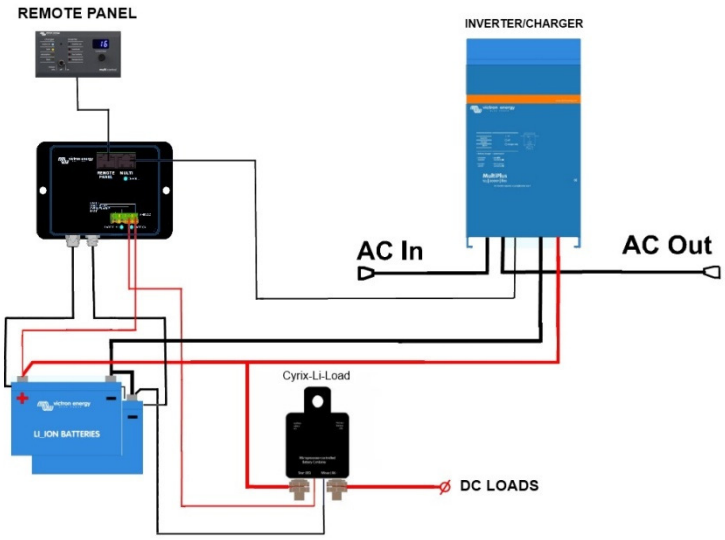



Figure 5: System with MultiPlus and DC loads (DC fuses not shown)
Note: the BMS is connected to the battery minus by the UTP cable between the BMS and the inverter/charger. Therefore, in order to prevent ground loops, do not wire the BMS minus connector.

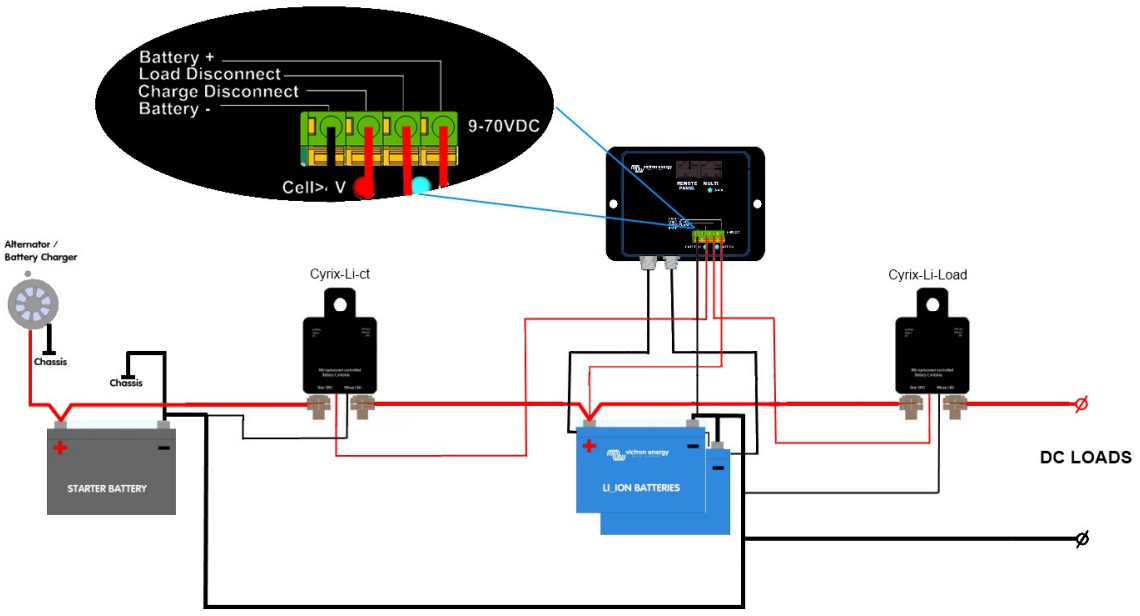



Figure 6: DC only system for a boat or vehicle with parallel connection of the starter- and Li-ion battery (DC fuses not shown)
Note: in this case the battery minus of the BMS must be wired.

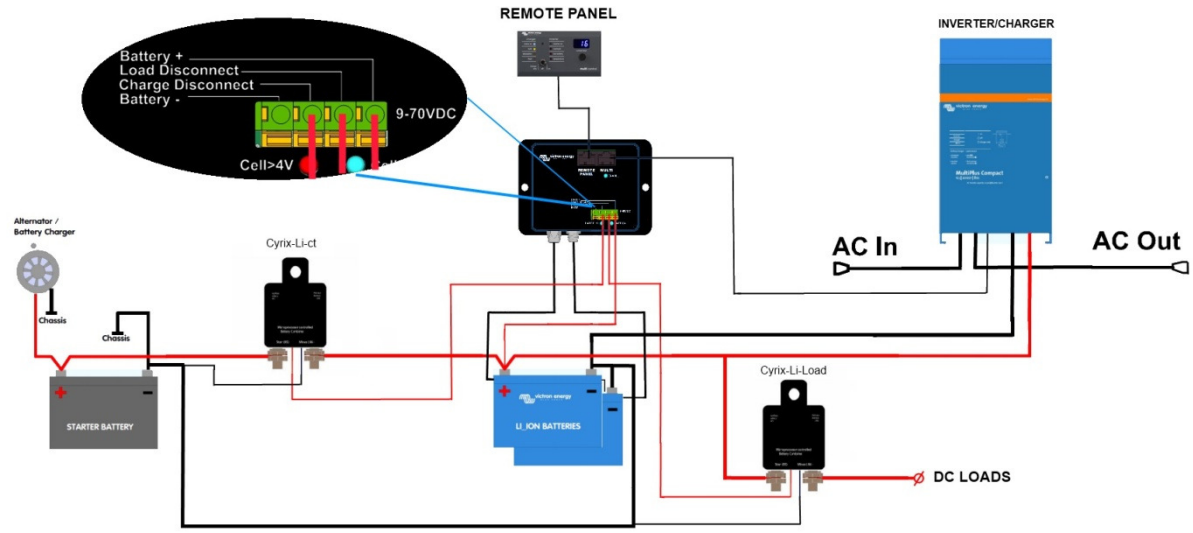



Figure 7: System for a boat or vehicle with inverter/charger (DC fuses not shown)
Note: the BMS is connected to the battery minus by the UTP cable between the BMS and the inverter/charger.
Therefore, in order to prevent ground loops, do not wire the BMS minus connector.

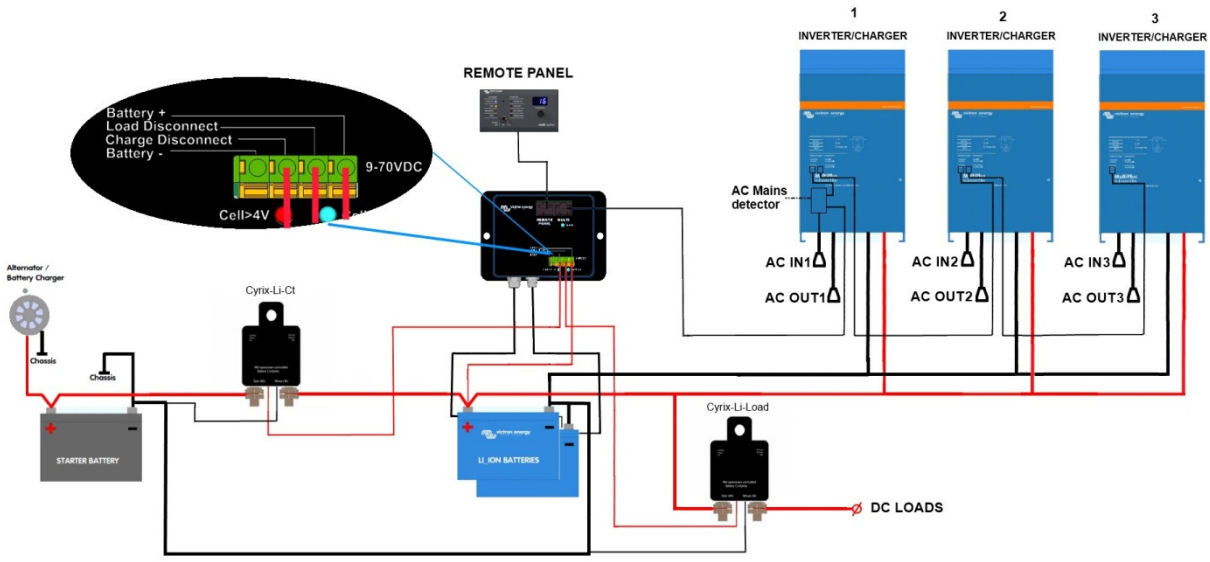
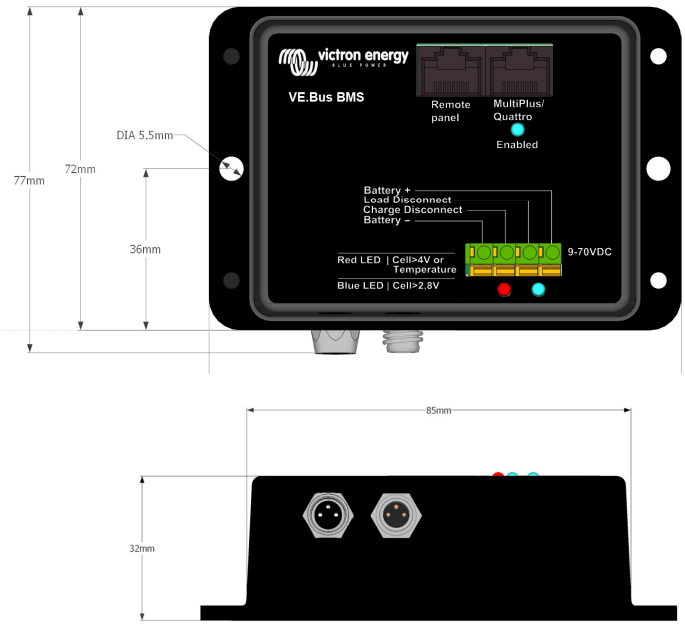



Figure 8: System for a boat or vehicle with a three phase inverter/charger configuration (DC fuses not shown)
Note 1: the AC Detector is installed only in the leader.
Note 2: the BMS is connected to the battery minus by the UTP cable between the BMS and the inverter/charger.
Therefore, in order to prevent ground loops, do not wire the BMS minus connector.

## 6. Dimensions




## 7. Specification

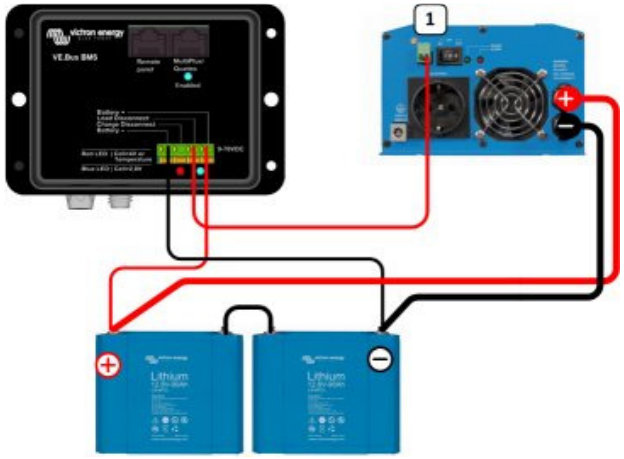
| VE.Bus BMS | |
|---|---|
| Input voltage range | 9 – 70 VDC |
| Current draw, normal operation | 10 mA (excluding Load Disconnect current) |
| Current draw, low cell voltage | 2 mA |
| Load Disconnect output | Normally high (supply voltage – 1 V)<br>Source current limit: 2 A<br>Sink current: 0 A (pull down resistor needed) |
| Charge Disconnect output | Normally high, (supply voltage – 1 V when high)<br>Source current limit: 10 mA<br>Sink current: 0 A (pull down resistor needed) |
| GENERAL | |
| VE.Bus communication port | Two RJ45 sockets to connect to all VE.Bus products |
| Operating temperature | -20 to +50°C 0 - 120°F |
| Humidity | Max. 95% (non condensing) |
| Protection grade | IP20 |
| ENCLOSURE | |
| Material and color | ABS, matt black |
| Weight | 0,1 kg |
| Dimensions (hxwxd) | 105 x 78 x 32 mm |
| STANDARDS | |
| Standards: Safety<br>Emission<br>Immunity<br>Automotive Directive | EN 60950<br>EN 61000-6-3, EN 55014-1<br>EN 61000-6-2, EN61000-6-1, EN 55014-2<br>EN 50498 |

## Appendix:

**Loads which can be controlled directly by the Load Disconnect output of the BMS**

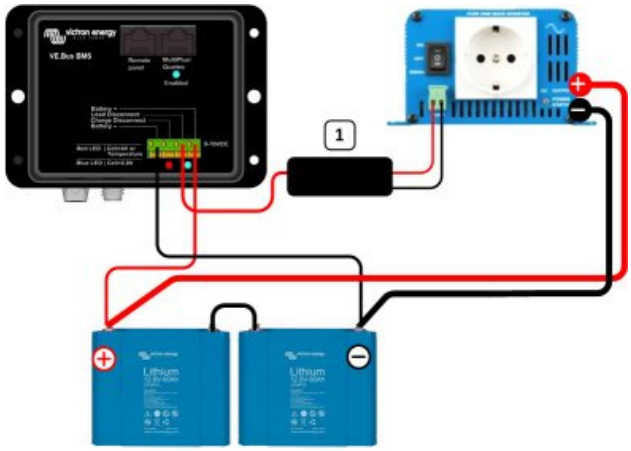
**Inverters:**
Phoenix 12/800
Phoenix 24/800
Phoenix 12/1200
Phoenix 24/1200
Phoenix 48/800
Phoenix 48/1200

**DC-DC converters:**
Orion 12/24-20
Orion 24/12-25
Orion 24/12-40
Orion 24/12-70



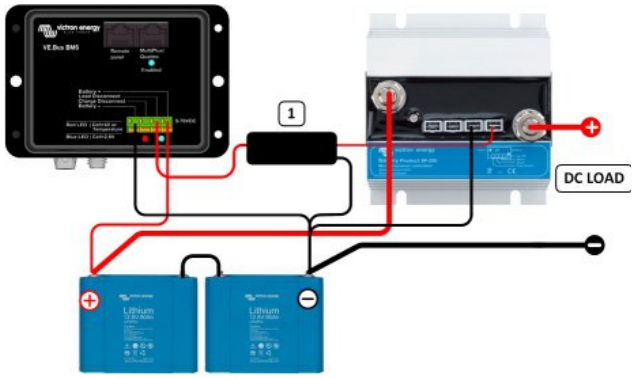

**Loads for which a Inverting remote on-off cable is needed**
(also known as the MPPT 70/15 to inverter remote on-off cable, article number ASS030550100)

**Inverters:**
Phoenix 12/180
Phoenix 24/180
Phoenix 12/350
Phoenix 24/350



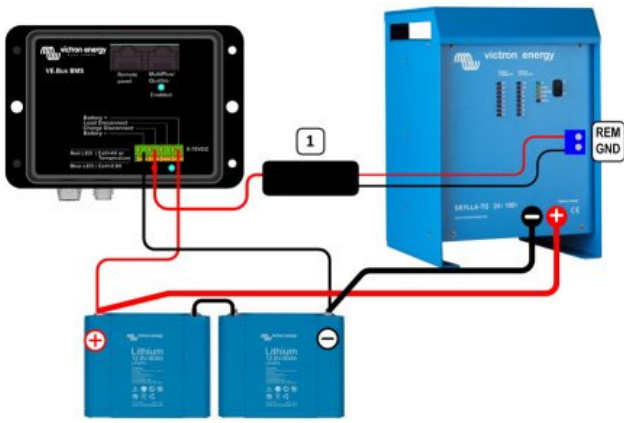

**Load disconnect switch for which a Non inverting remote on-off cable is needed**
(article number ASS030550200)

BatteryProtect BP-40i
BatteryProtect BP-60i
BatteryProtect BP-200i




**For Skylla battery chargers a Non inverting remote on-off cable Is needed**
(article number ASS030550200)

Note: not applicable to the Skylla-i



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