Victron & Pylontech US2000, US3000 and Phantom-S

The combination of Victron products with Pylontech lithium batteries has been tested and certified by the Victron and Pylontech R&D departments.

General information about the battery is found in Pylontech's documentation.

This manual is intended to be used in conjunction with the product manual supplied by Pylontech. It provides additional and specific information regarding integration with Victron systems.

The Pylontech includes a Battery Management System (BMS) with each battery module. This interfaces with the Victron GX device and can support multiple battery modules connected in parallel.

1. Product & system compatibility



Battery	US2000 (Plus)	US3000	Force-L1
Module capacity	2.4 kWh	3.5 kWh	3.55 kWh

1.1 Offgrid, Backup and Energy Storage Systems are possible

Victron + Pylontech can be used for the following system types:

- Off-grid (DVCC)
- Grid Backup (DVCC or ESS)
- Energy Storage Systems (ESS) - Self Consumption (ESS - Start page)

1.2 A GX-device is required, eg Color Control GX (CCGX) or Venus GX (VGX)

It is essential to use the CAN-bus connection of the GX device (eg CCGX or VGX) with the batteries for the keep-alive signal, communication of charge and discharge limits, error codes and state of charge.

The minimum required firmware version for the Color Control GX is v2.15. It is highly recommended to

use the latest firmware version on all connected devices, including CCGX/VGX, Inverter/Charger and MPPTs. There are regular updates to improve performance and reliability.

1.3 All 48V Multi, MultiPlus, MultiGrid and Quattro are compatible

The minimum firmware version is 422. Though updating to the latest firmware is recommended where possible, and a necessary first step when troubleshooting issues.

These inverter/charger units must be connected to the GX device via the VE.Bus connection port.

1.4 All 48V VE.direct BlueSolar and SmartSolar MPPT Chargers are compatible

For proper operation, the Pylontech battery needs to be able to control the charge current. Therefor it is recommended to use Victron 48V compatible MPPTs models with VE.Direct port for charging.

MPPTs with a VE.Direct port

MPPTs are controlled via the GX device. Make sure the GX device runs v2.15 or later, and the MPPTs to 1.37 or the latest available version.

The MPPT requires connection to the GX device to regulate charge currents as the batteries require (due to temperature, etc) To test operation, try disconnecting the GX device from the MPPT. After a time-out, the MPPT will stop charging and flash an error code on its LEDs. The error code is error #67: no BMS.

MPPTs with a VE.Can port

Use of VE.Can MPPT's with Pylontech batteries is not supported or documented.

2. Minimum Battery Sizing Recommendations

Each US2000B Plus battery module is approximately 50Ah at 48V, can provide 25A continuous charge and discharge and 100A peak for 1 minute.

The charge and discharge rates are managed automatically by the Pylontech battery and GX device.

Using very large solar arrays with battery banks that are too small can exceed the limits of the batteries ability to charge and possibly lead to the BMS triggering over-current alarms.

You must have the minimum number of battery modules to supply the inverters startup inrush surge currents that charge the capacitors when the inverter is first connected, this occurs prior to any loads being connected. There is also the subsequent potential current demands of the loads connected to the inverter. It is much more desirable to have the inverter/charger overload than the battery, as the inverter will automatically recover, whereas the battery may require intervention once in a fault state.

Some suggested battery sizings for common Victron inverter/chargers are listed below. These are

suggestions for reliable operation for single phase off grid and are not specified by Pylontech.

Inverter / Charger Model	Inv continuous watts @ 25 degrees	Inverter peak watts surge rating	Number of Pylontech modules	Battery continuous discharge watt rating	Battery peak discharge watt rating
Multiplus 48/500/6	430	900	1	1200	4800
Multiplus 48/800/9	700	1600	1	1200	4800
Multiplus 48/1200/13	1000	2400	1	1200	4800
Multiplus 48/3000/35	2400	6000	2	2400	9600
Multiplus 48/5000/70	4000	10000	4	4800	19200
Quattro 48/8000/110-100/100	6500	16000	6	7200	28800
Quattro 48/10000/140-100/100	8000	20000	7	8400	33600
Quattro 48/15000/200-100/100	12000	25000	10	12000	48000

3. CAN-bus Wiring



You can connect multiple battery modules together to form a single large battery by connecting the RJ-45 cable supplied by Pylontech using the link ports on the battery. This is shown in more detail in the example wiring diagram and Pylontech manual.

The batteries will automatically detect and link to each other, no adjustment of dip switches or software changes are necessary on the batteries.

The battery with the empty link port 0 is the master battery. You must use the *VE.Can to CAN-bus BMS type B Cable*, part number ASS030720018, you cannot use the cable supplied by Pylontech.

Plug the type B cable with the side which is labeled Battery BMS into the Pylontech CAN port of the master battery. Plug the side labeled Victron VE.Can into the GX device.

Then, plug a VE.Can terminator in the other VE.Can socket on the GX device. Two VE.Can terminators are included with the package of the GX device as an accessory, only one is used. Keep the other one as a spare.

More information about the cable can be found in its manual.

Without properly connecting this cable, the battery will not show up on the display of the GX device. The battery will also turn itself off.

It is important to ensure this connection and display of the battery on the GX device display before attempting firmware updates or settings changes on other devices if they depend on the power supply from the battery. Without this connection, the battery may turn off unexpectedly.

4. VEConfigure Settings

You will need the latest firmware on all connected devices.

This section presumes familiarity with VEConfigure software.

4.1 General tab

- Check the “Enable battery monitor” function
- Set the battery capacity to the total capacity of the battery: eg 50Ah times the number of battery modules for the 2000B Plus model.
- The other parameters (“State of charge when bulk finished” and “Charge efficiency”) can be left to their default setting: They are ignored for a Pylontech installation.

4.2 Charge Settings

Charger tab

Parameter	Setting
Battery type	Lithium
Charge curve	Fixed
Absorption voltage	52.0 V
Float voltage	51.0 V
Absorption time	1 Hr

Note: make sure to double check the float voltage after completing Assistants, and if necessary set it back to 51.0 V.

Note For off-grid use: ignore the 'bms assistant required' warning.

4.3 Inverter Settings

In the Inverter tab of VEConfigure

VEConfigure Inverter Parameter	Setting
DC input low shut-down	44V
DC input low restart	48V
DC input low pre-alarm*	48V

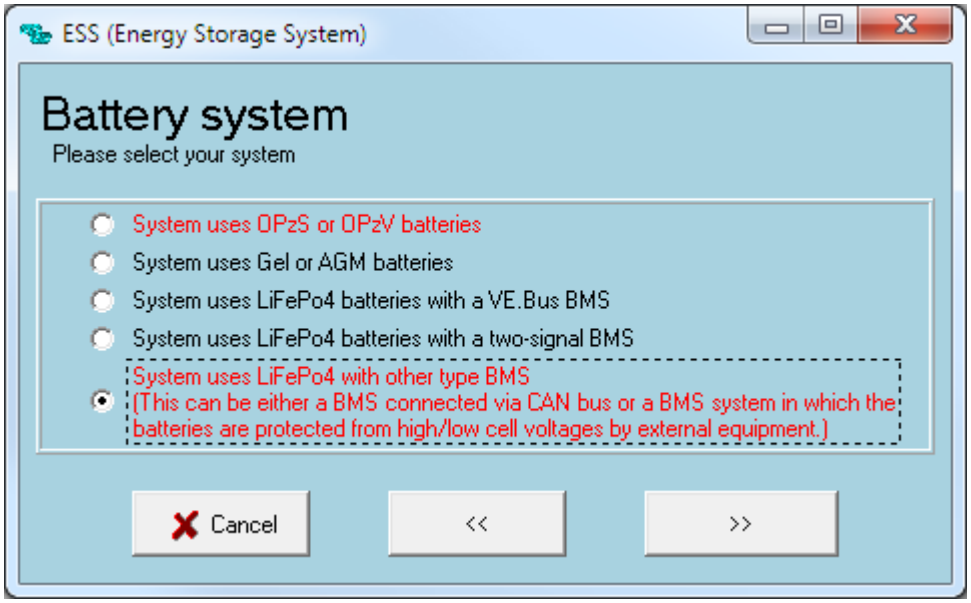
* The pre-alarm setting is dependant on your preference and on site specific requirements. You may wish for this to be activated earlier in an off grid situation to allow time to start a backup generator.

ESS System Settings

If you are using the battery as part of a grid connected ESS system, please review the ESS Quickstart guide and Design and Installation Manual.

The settings that are specific to the Pylontech battery in the VEConfigure ESS Assistant are below:

Select the externally managed Lithium battery option



ESS Parameter	Settings
Sustain voltage.	48V
Dynamic cut-off values	set all values to 46V.
Restart offset:	1.2V (Default)

Due to the reliability of the grid supply and the behaviour of the sustain voltage threshold in ESS; you may wish to suppress the low voltage pre-alarm warning so that it does not trigger every day on its regular deep cycle. See ESS FAQ Q5 - about suppressing the low-voltage alarm.

Hardware Protection Points

In normal operation, the charge parameter limits are set by the Pylontech battery and communicated through the system by the GX device to the inverter/charger and MPPT.

- Low Voltage: When the battery discharges to 44.5V or less, battery protection will turn on.
- High Voltage: If charging voltage above 54V, battery protection will turn on.
- Working discharge temperature range is from -10 to 50 degrees celsius.
- Charging temperature range is from 0 to 50 degrees celsius.
- Discharge Current Limit set to 0A at 47V, inverter will turn off.
- Over-charge and Over-discharge Current Limit 102A for 15 seconds, 200A for 0.1 seconds and 400A short circuit current.

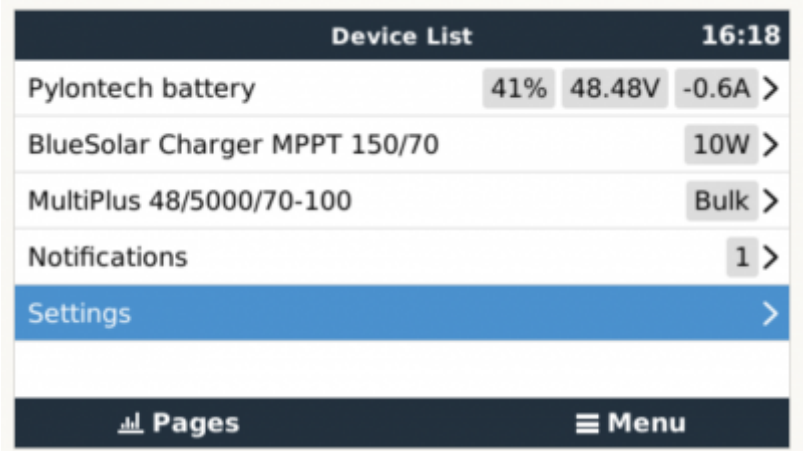
If operation is attempted outside the operating range, the battery will disconnect to protect itself.

5. GX Device Settings

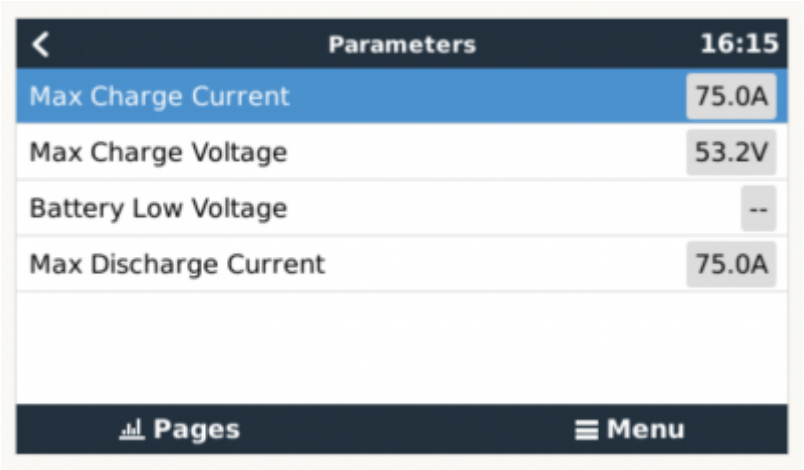
On the GX device, go to Settings, System setup:

Venus Settings → System Setup Parameter	Value
DVCC	ON
Shared Voltage Sense	OFF

- Select the *CAN-bus BMS (500 kbit/s)* CAN-profile in the CCGX. Menu path: *Settings* → *Services* → *CAN-profile*.
- After properly wiring and setting up, the Pylontech will be visible as a battery in the device list. If you have multiple batteries a single entry will show up, which represents all batteries:



- The parameters option within the battery page shows the actual battery charge and discharge limits



This parameters page is also a good place to check that all batteries are connected and working properly. In normal working conditions, the current limit is 25A per cell. For example, 75A charge current limit (75 / 25 = 3) means there are 3 Pylontech battery modules connected.

6. VE-Direct MPPT Settings

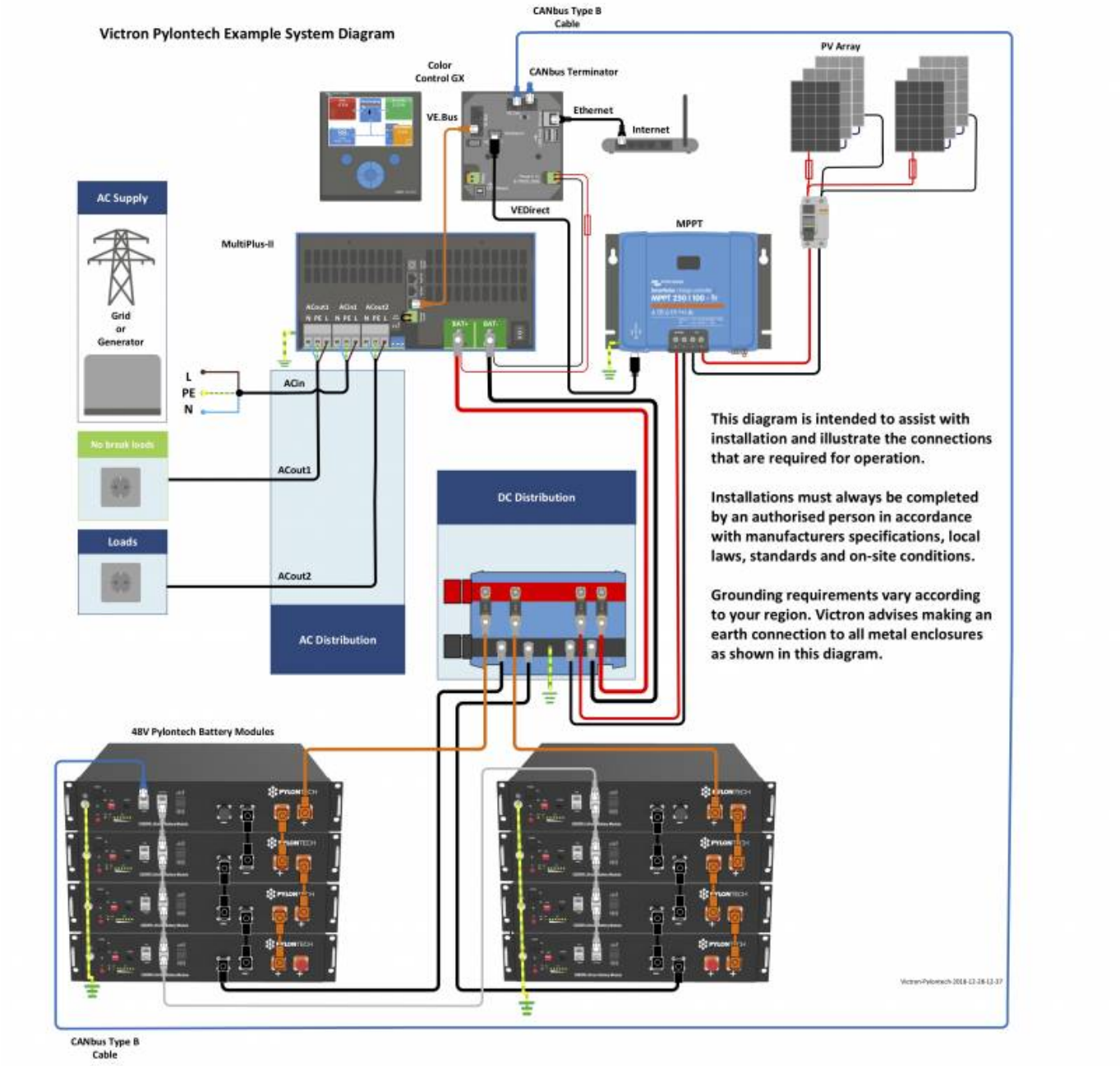
In normal operation the MPPT charge characteristics are governed by the GX device via DVCC, with instructions from the connected Pylontech battery.

This section presumes familiarity with VictronConnect

The settings below are a precautionary measure.

MPPT Parameter	Setting
Battery voltage.	48V
Absorption voltage	53V

7. Example Wiring Diagram



8. Troubleshooting

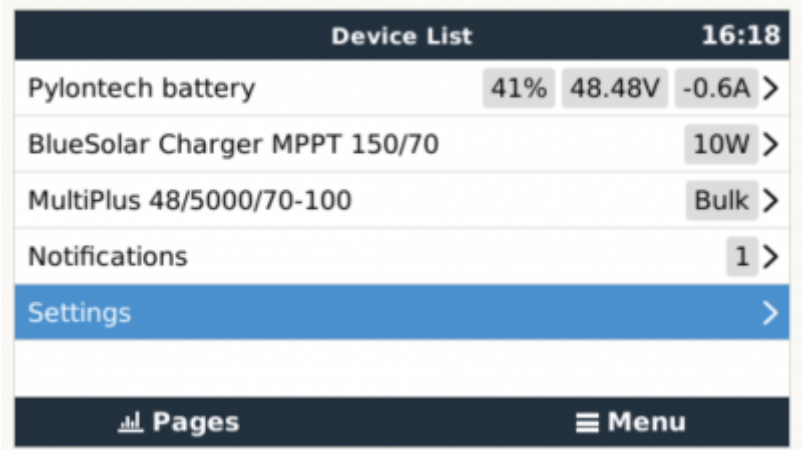
If the system is not operating correctly, go through these steps.

Step 0. If the Inverter/Charger or GX device does not switch on

As a safety precaution, the inverter/charger will not switch on if the GX device is not on. If you are unable to start the system due to a total system blackout / battery shutdown due to low voltage, you may need to disconnect the VE.BUS connection cable between the inverter/charger and GX device.

You can then start the inverter/charger from an external charge source such as a generator or grid connection. Once the inverter/charger has started, it should supply power to the DC terminals and this should start the GX device and Pylontech battery again. You will need to then reconnect the VE.Bus Communications cable back to the inverter/charger and GX device.

Step 1. Check that the Pylontech battery is visible on the GX device list



If its not visible, check:

- GX device firmware version (update to latest version, v2.15 or later)
- CAN-bus communication cabling between Pylontech and Victron system. Make sure that it is in the right way around.
- Pylontech system is up and running (LEDs are on)

Step 2. Check that the Pylontech battery is ready for use

Check the Max Charge Voltage parameter. This voltage parameter is sent, together with the other three parameters, by the Pylontech system via the CAN-bus cable. They are visible on the GX device: Device List → Pylontech battery → Parameters menu.

Step 3. Check the Pylontech manual

The Pylontech manual contains additional diagnostic and troubleshooting information, specifically around decoding any indicator LEDs.

9. FAQ and Known Issues

The maximum charge and discharge current is limited to 25A, but the data sheet tells me the maximum is 100A.

The maximum current is limited to keep the battery healthy and reach the 10 year guarantee. In off-

grid, the inverter can draw more than the 25A limit to run the loads, make sure you have sufficient batteries installed to keep the load per battery around this limit.

After charging the battery the charge current often changes between 0A and 25A.

This is caused by cell balancing inside the battery. This happens with new batteries and after a deep discharge.

My system isn't charging at the rated capacity, or my PV is shutting down

Pylontech's BMS will restrict the Charge Current Limit of the battery in cold weather. The precise temperatures and limits are not published by Pylontech, but anecdotally from reports on Victron Community it would appear that batteries begin to be limited below 18 degree C, severely limited below 10 degrees C, and completely restricted from charging below 2 degrees C.

You can confirm if this is affecting your installation be entering the Pylontech Battery menu on your GX device, and then the Parameters Menu. This will report the Charge Current Limit (CCL) and Discharge Current Limit (DCL).

My system only charges the battery to 52V

When DVCC is enabled, the battery (via the CAN-bms) is responsible for the charge voltage. The Pylontech battery requests a charge voltage of 53.2V. We have however found that in practice this is too high.

The Pylontech battery has 15 cells in series, so 53.2V equates to 3.55V per cell. This is very highly charged and makes the system prone to go overvoltage.

It should also be noted that a LiFePO4 cell stores very little additional energy above 3.45V.

For this reason we opted to override the BMS and cap the voltage at 52V. This sacrifices almost none of the capacity and greatly improves the stability of the system.

The battery won't charge to 100%

Also see the question above. The state of charge of the battery is estimated based on the overall voltage and on how well balanced the internal cells are. Because we cap the battery voltage at 52V, the state of charge will sometimes rise very slowly once it reaches the mid-90s. This is normal and usually resolves over time.

10. Further Information

For information about where to buy or find suitably qualified installers, visit the Where to Buy Page.

Further community discussion about installing and using Pylontech and Victron can found at Victron Community, use the topic label 'Pylontech'.

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