Victron & BYD

Battery	Pro 2.5-10.0	Pro 12.8 & 13.8	L 3.5-14.0	Premium LVL 15.4	Premium LVS 4.0	LV Flex 5	LV5.0+
Appearance							
ESS	yes	yes	yes	yes	yes	yes	yes
Grid Backup	yes	yes	yes	yes	yes	yes	yes
Off-Grid	yes	yes	no	yes	yes	yes	yes
Module capacity	2.5 kWh	13.8 kWh	3.5 kWh	15.36 kWh	4.0 kWh	5.0 kWh	5.12 kWh
Module limit	32	32	12	64	64	64	32
Max capacity	80 kWh	441.6 kWh	42 kWh	983 kWh	256 kWh	320 kWh	163.84 kWh

1. Product & System compatibility

1.1 Offgrid, Backup and Energy Storage Systems (ESS)

Victron + BYD B-Box can be used for the following system types:

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

Special note for Off-Grid systems

For Off-grid systems, its strongly recommend to make sure there is a minimum of DC-Coupled PV (= MPPT Solar Charger) in the system. Ie. not only AC-Coupled PV. Also, minimum battery configuration, and factor 1.0 are always important to adhere to, and even more so in case of Off-grid systems. Both BYD and Victron will be reluctant or even refusing to give support to systems that are not sized according to the minimum battery configuration table.

1.2 A GX device is required, eg Cerbo GX, etc

It is essential to use the BMS-Can (or CAN-bus) connection of a GX device with the BYD batteries for the keep-alive signal, communication of charge and discharge limits, error codes and state of charge. This is set to 500 kbit/s.

When used with B-Box Pro series batteries, the minimum supported firmware version for the GX device is v2.42. When used with B-Box Premium LV series, the minimum supported GX device firmware version is v2.52. It is recommended to use the latest firmware version on new installations and when trouble shooting issues.

1.3 All 48V Multis, MultiPlusses, MultiGrids, Quattros and RS models are compatible

The minimum supported firmware version is 469. Updating to the latest firmware is recommended for new installations, and troubleshooting issues.

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

In grid connected systems, advanced control functions are configurable in the ESS settings on the GX device.

In off-grid systems, the control functions of the BYD Battery Management System (BMS) are built into the latest version of the GX device.

1.4 Solar Charger compatibility

All 48V BlueSolar and SmartSolar VE.Direct MPPT Chargers are compatible (*).

Some of our Solar Chargers feature a VE.Direct communication port, some feature a VE.Can communication port, and some feature both. Both of these types of communication ports can be used to connect the Solar charger to the GX Device. Such connection is mandatory, because it is used to regulate charge currents and voltages.

When planning to use the VE.Can communications port to connect the Solar Charger(s), make sure to select a GX Device that has sufficient CAN-Bus ports. The Color Control GX has only one such port, its VE.Can port, and is therefor not suitable. All other GX Devices can be used, since they have two ports. One can then be used to connect the BYD battery, and the other to connect the Solar Charger.

(*) with exception of the models “BlueSolar MPPT 150/70 CAN-bus” and “BlueSolar MPPT 150/85 CAN-bus” which are end-of-life since 2019. Legacy systems, historically installed with this configuration using the allow to charge contacts are not required to make any changes, see the legacy chapter below for details.

1.5 Battery compatibility

The following batteries are supported:

B-BOX LV series type
B-BOX Pro 2.5-10.0
B-BOX Pro 12.8
B-BOX Pro 13.8
B-BOX Res 2.5-10.0
B-BOX Compact
B-BOX L 3.5-14.0
B-BOX Premium LVL 15.4
B-BOX Premium LVS 4.0
B-BOX LV Flex 5.0

BYD also releases firmware update for their BMU and BMS.

B-Box Pro BMU Firmware versions earlier than V4-13 are not compatible with Victron equipment and can cause the battery to not be detected.

Minimum BYD firmware version for B-Box Pro: BMU_V2_V4-13_15-Mar-2017. On-screen, or via Remote Console on the GX device, this version is named v4.13. Batteries with older firmware versions can be updated. Please contact BYD for more information.

BYD B-Box Premium batteries firmware should be no less than V1.4, and the BMS firmware should be no less than V1.3. If necessary, this can be updated automatically via the ethernet port on the BMU when connected to the internet.

Victron is not compatible with the BYD HVS/HVM range of high-voltage batteries.

2. Minimum Battery Sizing

The following information is provided by BYD, it is reproduced here for your convenience and should always be confirmed with the latest BYD manuals and specifications.

Each B-Box Pro 2.5 battery module is approximately 50Ah at 48V (51.2V nominal).

The following charge rates are managed automatically by the BYD BMU and GX device. Temperature effects on charge rates should be considered in the design stage in hot and cold climates.

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 BMU triggering over-current alarms.

The table below shows the minimum number of battery modules required for the specified inverter/charger configuration:

Battery Modules Required - Pro 2.5

Phases	Single Phase	Three Phase	Single Phase	Three Phase
Inverter/Charger	Self-consumption	Self-consumption	Off-grid	Off-grid
MultiPlus & MultiPlus II & MP-II GX 48/3000/35	1	3	2	6
MultiPlus, MultiPlus II, MP-II GX, & Quattro-II 48/5000/70	1	3	3	9
Inverter RS & Multi RS 48/6000	1	-	4	-
Quattro 48/5000/70-100/100	1	3	3	9
Quattro 48/8000/110-100/100	1	4	5	15
Quattro & MultiPlus-II 48/10000/140-100/100	1	5	6	18
Quattro & MultiPlus-II 48/15000/200-100/100	1	6	9	27
EasySolar & EasySolar-II 48/3000/35-50 MPPT	1	3	2	6
EasySolar 48/5000/70-100 MPPT	1	3	3	9

Battery Modules Required - Pro 12.8 & 13.8

Phases	Single Phase	Three Phase	Single Phase	Three Phase
Inverter/Charger	Self-consumption	Self-consumption	Off-grid	Off-grid
MultiPlus & MultiPlus II & MP-II GX 48/3000/35	1	1	1	2
MultiPlus, MultiPlus II, MP-II GX, & Quattro-II 48/5000/70	1	1	1	3
Inverter RS & Multi RS 48/6000	1	-	1	-
Quattro 48/5000/70-100/100	1	1	1	3
Quattro 48/8000/110-100/100	1	2	2	5
Quattro & MultiPlus-II 48/10000/140-100/100	1	2	2	6
Quattro & MultiPlus-II 48/15000/200-100/100	1	3	3	7
EasySolar & EasySolar-II 48/3000/35-50 MPPT150/70	1	1	1	2
EasySolar 48/5000/70-100 MPPT150/100	1	1	1	3

Battery Modules Required - L 3.5

Phases	Single Phase	Three Phase	Single Phase	Three Phase
Inverter/Charger	Self-consumption	Self-consumption	Grid-backup	Grid-backup
MultiPlus & MultiPlus II & MP-II GX 48/3000/35	1	2	2	6
MultiPlus, MultiPlus II, MP-II GX, & Quattro-II 48/5000/70	1	2	4	10
Inverter RS & Multi RS 48/6000	1	-	4	-
Quattro 48/5000/70-100/100	1	2	4	10
Quattro 48/8000/110-100/100	1	3	5	x
Quattro & MultiPlus-II 48/10000/140-100/100	1	4	7	x
Quattro & MultiPlus-II 48/15000/200-100/100	1	5	10	x
EasySolar & EasySolar-II 48/3000/35-50 MPPT150/70	1	2	2	6
EasySolar 48/5000/70-100 MPPT150/100	1	2	4	10

Minimum discharge SOC for 1 single Battery Box L 3.5 is 12%; for 2 or more (7kWh+) it can be 10%.

Up to 4 L modules can be installed per L series BCU; 5 or more will require additional BCU.

Battery Modules Required - Premium LVL 15.4

Phases	Single Phase	Three Phase	Single Phase	Three Phase
Inverter/Charger	On-Grid \ with Full Backup	On-Grid \ with inrush	Off-grid	Off-grid \ with inrush

MultiPlus & MultiPlus II & MP-II GX 48/3000/35	1	1 \ 2	1	1 \ 2
MultiPlus, MultiPlus II, MP-II GX, & Quattro-II 48/5000/70	1	2 \ 2	1	2
Inverter RS & Multi RS 48/6000	1	-	1	-
Quattro 48/5000/70-100/100	1	2 \ 2	1	2
Quattro 48/8000/110-100/100	1	2 \ 3	1	2
Quattro & MultiPlus-II 48/10000/140-100/100	1	3 \ 4	1	3 \ 4
Quattro & MultiPlus-II 48/15000/200-100/100	1 \ 2	4 \ 6	2	4 \ 6
EasySolar & EasySolar-II 48/3000/35-50 MPPT150/70	1	1	1	1
EasySolar 48/5000/70-100 MPPT150/100	1	2 \ 2	1	2

Battery Modules Required - Premium LVS 4.0

Phases	Single Phase	Three Phase	Single Phase	Three Phase
Inverter/Charger	On-Grid	On-Grid	Off-grid	Off-grid \ with inrush
MultiPlus & MultiPlus II & MP-II GX 48/3000/35	1	2	1	4 \ 6
MultiPlus, MultiPlus II, MP-II GX, & Quattro-II 48/5000/70	1	2	2	6 \ 8
Inverter RS & Multi RS 48/6000	1	-	3	-
Quattro 48/5000/70-100/100	1	2	2	6 \ 8
Quattro 48/8000/110-100/100	1	2	4	8 \ 12
Quattro & MultiPlus-II 48/10000/140-100/100	1	4	5	12 \ 16
Quattro & MultiPlus-II 48/15000/200-100/100	1	4	7*	16 \ 24
EasySolar & EasySolar-II 48/3000/35-50 MPPT150/70	1	2	1	4 \ 4
EasySolar 48/5000/70-100 MPPT150/100	1	2	2	8 \ 8

* Note for 7 units two stacks are required. One stack is 4 battery modules, the other is 3.

Battery Modules Required - Premium LV Flex 5.0

Phases	Single Phase	Three Phase	Single Phase	Three Phase
Inverter/Charger	On-Grid	On-Grid	Off-grid	Off-grid
MultiPlus 48/500 & 48/800	1	1	1	1
MultiPlus 48/1200 & 48/1600	1	2	1	2
MultiPlus 48/2000	1	2	1	3
MultiPlus & MultiPlus II & MP-II GX 48/3000/35	1	3	2	4
MultiPlus, MultiPlus II, MP-II GX, & Quattro-II 48/5000/70	2	5	3	6
Inverter RS & Multi RS 48/6000	2	-	3	-
Quattro 48/5000/70-100/100	2	5	3	6
Quattro 48/8000/110-100/100	3	8	4	10
Quattro & MultiPlus-II 48/10000/140-100/100	4	10	5	13
Quattro & MultiPlus-II 48/15000/200-100/100	5	14	6	16
EasySolar & EasySolar-II 48/3000/35-50 MPPT150/70	1	3	2	4
EasySolar 48/5000/70-100 MPPT150/100	2	5	2	6

“With inrush” - this is the advice for systems that have load profiles that use the full surge capacity of the inverter, eg MultiPlus 48/5000/70 providing 10 kW for 5 seconds to start an electric motor.

The specification for these minimum battery sizes was obtained from BYD’s 2018 minimum specification guide. There is an additional guide here for the 12.8 and 13.8 models, and here for the Premium LVL 15.4 model.

3. CAN-Bus wiring between the battery and GX Device

Use the *VE.Can to CAN-bus BMS type A Cable*, part number ASS030710018. Plug the side which is labeled Battery BMS into the BYD BMS. 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 after several minutes.

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. It is possible to bypass this automatic shutdown, and other protections temporarily by disconnecting the individual BYD battery cells inside their cabinet from the internal Battery Management Unit (BMU). It is the BMU that signals the battery cells to shut down if the signal from the GX device has not been received. This is a temporary measure for use only when troubleshooting to resume normal operation, DO NOT attempt to operate the battery cells normally without connection to the BMU.

4. VEConfigure settings

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 2.5 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 BYD installation.

4.2 Charge parameters

In normal operation, the charge parameters are controlled by the BYD BMU and communicated

through the system by the GX device to the inverter/charger and MPPT. However as a precaution it is advised to set these as suggested below.

Charger tab

VEConfigure Charge Parameter	Setting
Battery type	Lithium
Charge curve	Fixed
Absorption voltage	55.2 V
Absorption voltage off-grid systems (2)	56.5 V
Float voltage (1)	55 V
Absorption time	1 Hr

Notes:

1. make sure to double check the float voltage after completing Assistants, and if necessary set it back to 55 V.
2. Setting the Absorption voltage for off-grid systems to 56.5V is to ensure the PV Inverter Assistant works properly. Setting this voltage to 56.5V, ie a bit higher than the default 55.2V, prevents the Frequency shift algorithm to lock at 52.7 or 53 Hz, and thereby disabling AC-Coupled PV Inverters. The setting has no effect on the actual charge voltage as used by the inverter and other components in the system, since these are directed directly by the battery via DVCC.

4.3 Inverter Settings

In the Inverter tab of VEConfigure

VEConfigure Inverter Parameter	Setting
DC input low shut-down	47V
DC input low restart	51V
DC input low pre-alarm*	51V

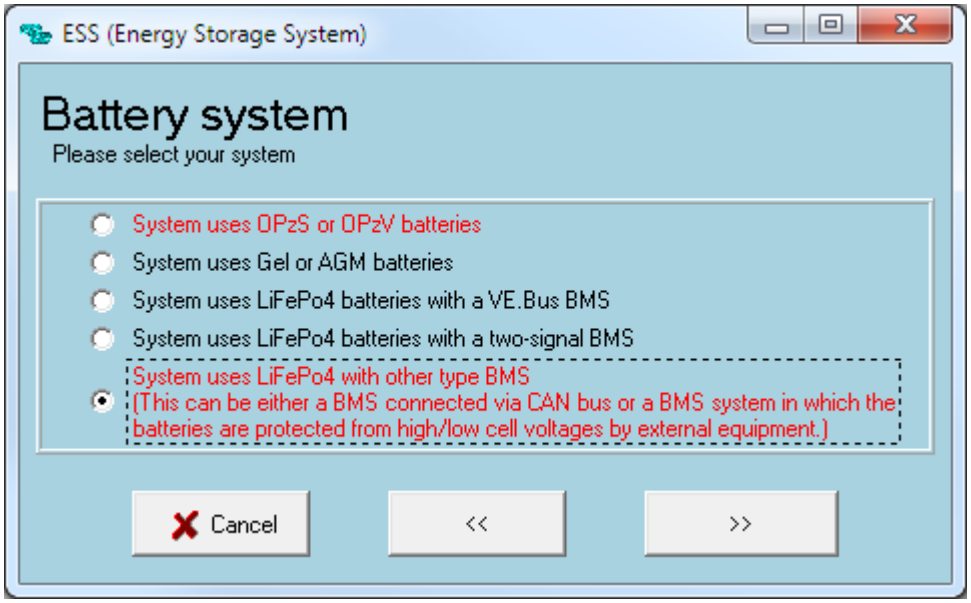
* The pre-alarm setting is dependant on your preference and on site specific requirements. You may wish for this to be activated earlier (eg 53V) in an off grid situation to allow time to start a backup generator. If the system is configured in ESS mode, you may not wish to have this alarm trigger until below the Sustain threshold voltage (eg 49V), as this system is in no danger normally and will 'sustain' at 50V without needing to trigger an alarm.

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 BYD battery in the VEConfigure ESS Assistant are below:

Select the externally managed Lithium battery option



ESS Parameter	Settings
Sustain voltage.	50V
Dynamic cut-off values	set all values to 47V.
Restart offset:	1.2 V (Default)

5. GX device configuration

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

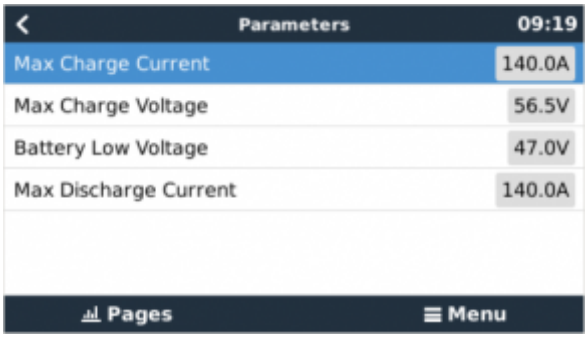
Venus Settings → System Setup Parameter	Value
DVCC	ON
Shared Voltage Sense	OFF

* Select the *CAN-bus BMS (500 kbit/s)* CAN-profile in the GX device. Menu path: *Settings → Services → CAN-profile*.

- After properly wiring and setting up, the B-Box 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, for the 2.5 model, the charge current limit is ~35-50 A per cell. For example, 140A charge current limit (140 / 35 = 4) means there are 4 BYD battery cells connected.

Note these limits have been adjusted higher by BYD during firmware updates, so the charge and discharge current limit figure may appear slightly higher.

GX Device with multiple CAN-bus port configuration

With GX devices that have two CAN-bus interfaces available (eg Cerbo GX and Venus GX), the VE.Can MPPT will remain connected to the VE.Can port, while the BYD CAN-bus cable should use the specific CAN-bus connections (H, L, GND), or BMS-Can ports.

This allows data from the MPPT and BYD battery simultaneously.

The CAN-bus connections are galvanically isolated at the BYD BMU. There is no issues using the non-isolated connection of the VGX.

Color Control GX Configuration - Not Recommended

The CCGX only has one available VE.Can interface. It is not possible to connect both CAN products such as VE.Can MPPT (250 kbit/s) and an B-Box battery BMS-Can CAN-bus (500 kbit/s) together on the CCGX. As the BYD Battery MUST be connected, you will need to use the port for that. This will mean no data is collected from the VE.Can MPPT, nor can the CCGX control it. This means you are required to use the “Allow to Charge” wire configuration for the MPPT.

For this reason it is recommended to use the Cerbo GX instead.

6. Solar Charging

6.1 Victron MPPT charger settings

Victron MPPT charge characteristics are automatically configured & governed by the GX device. The settings below are a precautionary measure only:

MPPT Parameter	Setting
Battery voltage	48V
Absorption voltage	56.5V

Use VictronConnect for Solar Charger configuration.

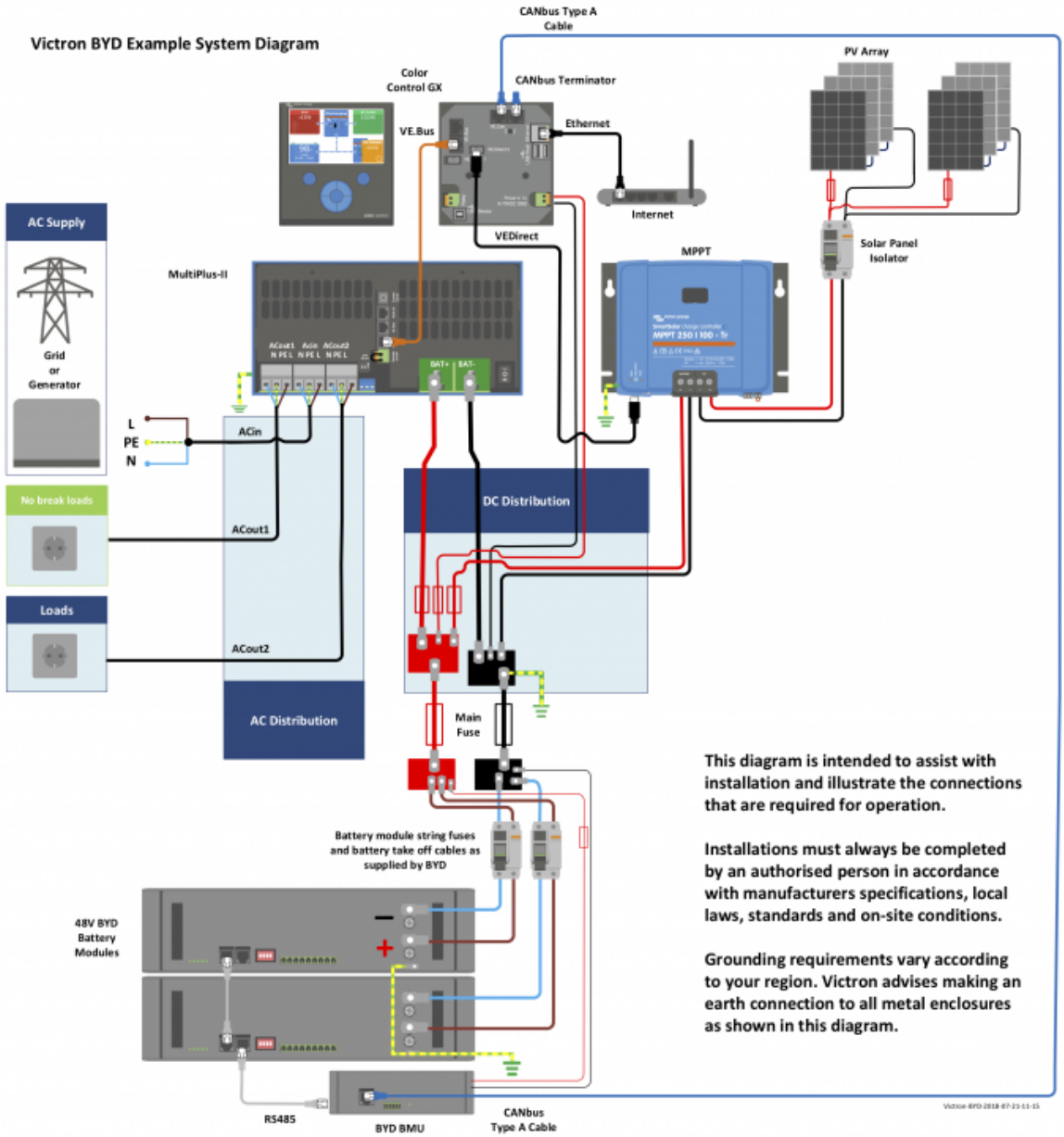
6.2 Self-Startup from Low voltage shutdown modes

In a correctly configured system, the inverter will shut itself down before the batteries enter a self protective shut down state.

Therefore it is essential that there is also either a generator or DC MPPT charge controller for overall system stability. If your system is charged only with an AC-coupled PV inverter, this may prevent the AC-coupled PV inverter from starting up to recharge the batteries.

Even a single 100/20 48V MPPT charger unit with 2 x 60 cell solar panels would be sufficient to add this self correcting mechanism able to maintain the DC bus voltage and improve longterm system reliability considerably from accidental deep discharge and subsequent shut down.

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

When the grid is connected there are two software controls to sustain voltage. The Minimum SOC (while grid is connected) set in the GX device, and the sustain voltage (set in the ESS assistant).

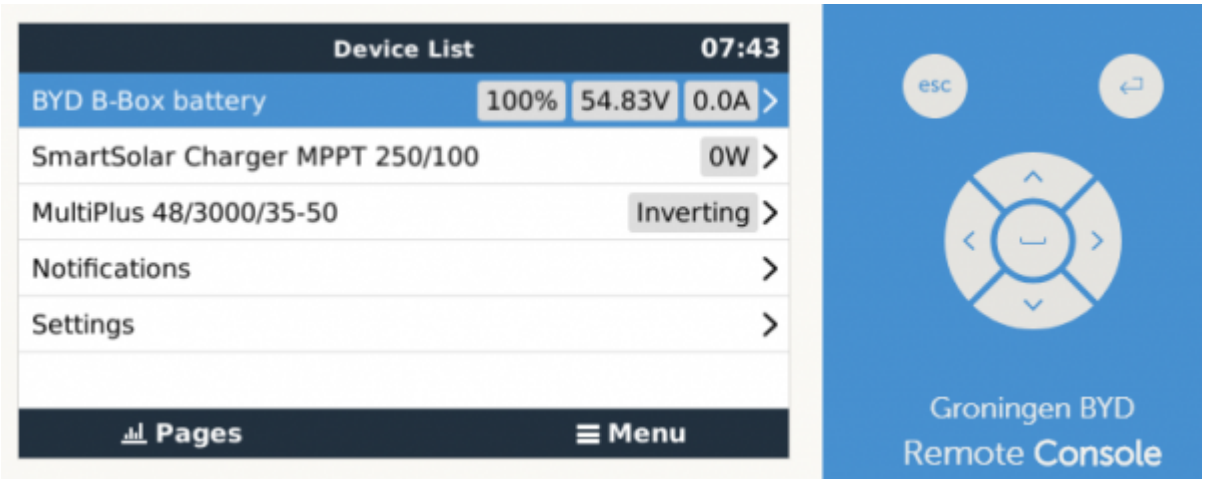
If the grid fails and no AC supply is available, in this deeply discharged state, and the battery has set the Discharge Current Limit (DCL) to 0A, then the inverter will turn off in a software off state.

The GX device will remain on, as there is still DC voltage provided by the batteries for a while. Note in this state an AC PV inverter will not produce any power, and will not start up, as it requires the inverter to create the sine wave to synchronise.

If the AC grid or generator, or DC MPPT is connected, then the battery will begin to charge and then the inverter will start itself again automatically, also resuming charge from an AC PV inverter. If instead the battery becomes completely discharged the battery will further protect itself by not just sending the 0A discharge limit, but also disconnecting DC voltage from the battery terminals (via internal MOSFETS). As there is no DC voltage available on the terminals any more the GX device will also shut down, and the inverter will also then be hard off (not just software off).

If you then reconnect a DC charge source, or AC input supply (grid or generator), after approximately 2 minutes the inverter will start up again, power the DC bus, powering up the GX device, and then powering up the battery, and the system will recover.

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



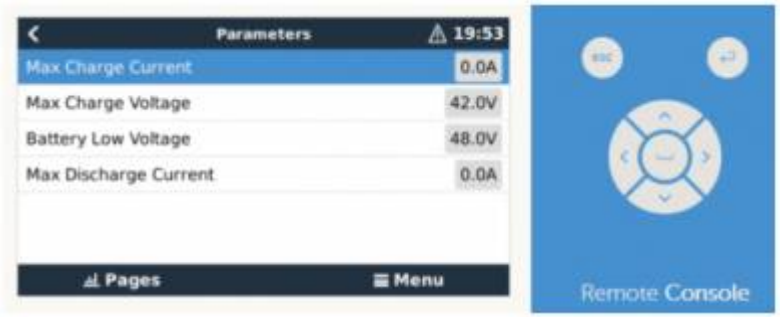
If its not visible, check:

- GX device firmware version (update to latest version, v2.15 or later)
- BYD firmware version (see requirement above)
- CAN-bus communication cabling between BYD and Victron system. Make sure that it is in the right way around. If the special cable is plugged in reversed it won't work.
- BYD system is up and running (RUN led on BYD BMU is on)

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

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

When ready for use, the Max Charge Voltage will read 56.5 V. In case there is an error in the BYD system (wiring, addressing, or other), it will be 42 V:



Also check that your are seeing the expected 35-40 A of discharge current per installed module.

Locally on-site, you can check the Run LED on the BYD BMU, it needs to be lit up continuously:

A blinking RUN led indicates an error. On the Victron system this is visible as a Max Charge Voltage of 42 V instead of 56.5 V.

- BMU led blinking once every time, focus on the communication with the inverter
- BMU led blinking more than once (2, 3 or 4 times) focus on the ADDR and communication (cables) between batteries and BMU.
- Battery module SOC LED scrolling side to side: review the ADDR and check/replace the communication cables leading to that battery

Addressing of the battery modules must start at 1, must be continuous and there may not be two modules with the same address. See BYD documentation for details.

In case above doesn't help, and the battery indicates 42V and/or the RUN led is not blinking continuous, please contact BYD support or refer to BYD documentation.

Restarting the BYD system

Restarting the BYD system is always necessary after adding, or removing, battery modules from the system. It may also be necessary to clear some severe error conditions.

To power down a battery module: one by one, push the reset button on the Battery Module for 5 seconds, until the yellow ARM LED flashes. Once releasing the button, the ARM LED will keep blinking for a few more seconds and then all LEDs switch off on the battery module.

Once all battery modules are powered down, the BMU will shut down also: RUN LED is off.

To power up: one by one shortly press the reset button on the battery modules.

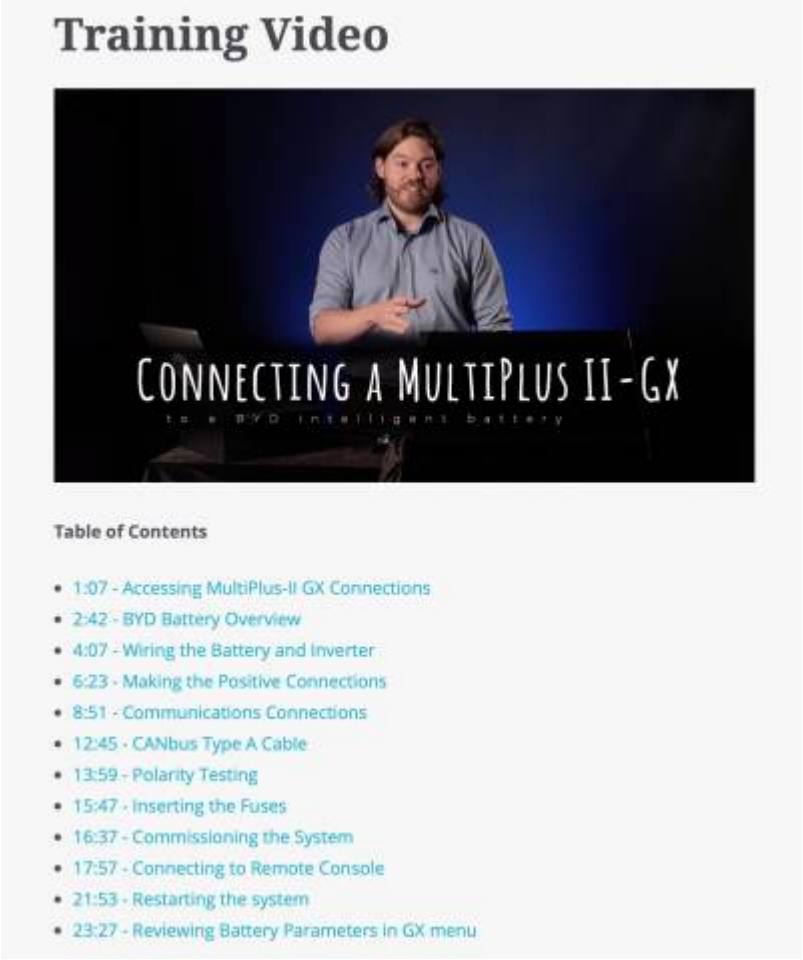
It might be that after power up one or modules will light the ARM (Alarm) LED continuously for a short while. Wait for this to auto-correct itself.

In general the ARM LED on the battery module has these meanings:

- Could be a temporary issue, that corrects self automatically after a short while (matter of minutes).
- Could be an external issue, unacceptable voltage or current.

9. Step by Step Installation Guide

There is a step by step installation video that demonstrates the essential connections and programming that is required for installation of a BYD battery in a Victron system. It is accessible via the E-Learning section in Victron Professional, and a free Victron Professional Installer Account is required.



This written manual should be assumed to be the more accurate and up-to-date, if there are any discrepancies between the video and the written manual,

Introduction to the new BYD Premium range LVL and LVS

Introduction to the new BYD Flex 5.0

BYD recorded a webinar introducing their Flex 5.0 battery - it is available to watch here - https://www.youtube.com/watch?v=wRVdlmGh3Fc

Victron presented more information that was specific to our integration as part of that webinar - available here - https://youtu.be/wRVdlmGh3Fc?t=1065

User contributed installation guide

A user contributed step by step installation guide is available here. Please be aware that this guide is no longer current. It recommends legacy practices and should not be considered current best practice, but provides further detail and insights from an actual installation.

10. Known Issues with B-Box Pro models

The following information only applies to the B-Box Pro models, and not to the B-Box Premium models.

10.1 Inaccurate State of Charge (SoC) Readings with B-Box Pro models

Each BYD battery module has it's own BMS. This BMS reports it's battery information to the BMU which is connected to the GX device and reported to the user and the system.

Each BYD module BMS has a threshold current of 1A (~50W) before it begins to report. For multiple modules, this is additive. So 4 modules could supply a 180W load and report it as 0 W.

This leads to the state of charge reported by the BMU to not accurately match the actual state of charge of the battery.

This limitation also applies to charge currents as well as loads. However it is more common to have low powered loads for long periods of time than low charge currents.

The reported State of Charge will self correct when it reaches the calibration voltage point (55.2v ~ 100% full) or near 10% empty, and this can appear as sudden jumps in the VRM from very little load or charge.

This has no impact on actual usable capacity of battery, only on the how it is reported to the user and other systems (such as alarms or triggers).

Work-arounds

If precise state of charge is important, it is possible to install a Victron BMV shunt, and program the GX device to use it for the displayed State of Charge. The limitations of this method are if cells are added, removed or shut down, the BMV will continue to report SoC based on the total Ah of storage set.

You should have alarms and auto-start generators programmed to operate on system voltage as well as state of charge.

System voltage is always reported accurately, and action should be taken once batteries are below 50V for any length of time,

Example

This example below clearly shows the comparison between a BYD BMU (512) and the shunt reading that is reported by the BMV-700 (258).

You can observe a 'flat' reading from the BYD during the night, while the BMV continues to read the discharge and report a slowly decreasing state of charge.

10.2 125A cabinet limit

The IP55 BYD cabinets are designed to take 4 battery modules and are supplied with 125A circuit breakers. Each battery module is able to supply and receive a continuous 35A, all together a combined 140A. This means it is possible to overload the circuit breaker.

If you have multiple large charge sources, set the DVCC distributed charge current limit to 120A per cabinet to stay under the circuit breaker limit.

If you have a system with multiple cabinets, try to balance the modules evenly between the cabinets to make it less likely to overload the breakers.

Multiple cabinets will also require other circuit protection at the DC bus level.

10.3 Cold Weather Performance

The BYD cells will limit the charge current allowed at lower temperatures.

Temperature (Celsius)	Charge Current Limit Per Cell	C rating
50 to 13 degrees	35 A	0.7C
12 to 3 degrees	6 A	0.12C

Temperature (Celsius)	Charge Current Limit Per Cell	C rating
2 to -7 degrees	3 A	0.06C

Keep your batteries in a climate controlled environment as close to 20 degrees celsius as possible for best performance. Depending on your climate, consider insulation and reverse cycle air-conditioning to prevent issues in hot and cold weather.

Cells will also heat themselves up when charged and discharged.

There has been a firmware revision for the BYD battery modules and BMU that improves cold weather performance slightly. This manual will be updated with the new (slightly improved) specifications when stock supplied with the new firmware has had sufficient time to enter the market. Contact your BYD distributor for further information about this.

11. Legacy systems using allow-to-charge and allow-to-discharge contacts

For proper operation, the B-Box battery needs to be able to control the charge current of the solar MPPTs. Which for all modern models is arranged via the VE.Can and VE.Direct digital communication protocols. The very first two BlueSolar Chargers made by Victron, the “BlueSolar MPPT 150/70 CAN-bus” and “BlueSolar MPPT 150/85 CAN-bus” models, do no support such control, and were therefor controlled with a wire: the allow-to-charge wire.

The purpose of this chapter is to serve as reference guide for legacy systems using those two solar charger models. If you have an existing system that is configured using the Allow-to-charge contacts, and it is operating correctly, you do not need to make any changes.

Note that these charges cannot be used with the BYD Premium LV batteries, since they do not feature the required free contacts.

Legacy system wiring details

The Remote On/Off input of the two mentioned solar charger models is used to signal that they can or cannot charge the battery. It needs to be connected to battery positive to enable the charger. Leaving the Remote On/Off input floating or pulling it to ground will disable the charger.

B-Box relays:

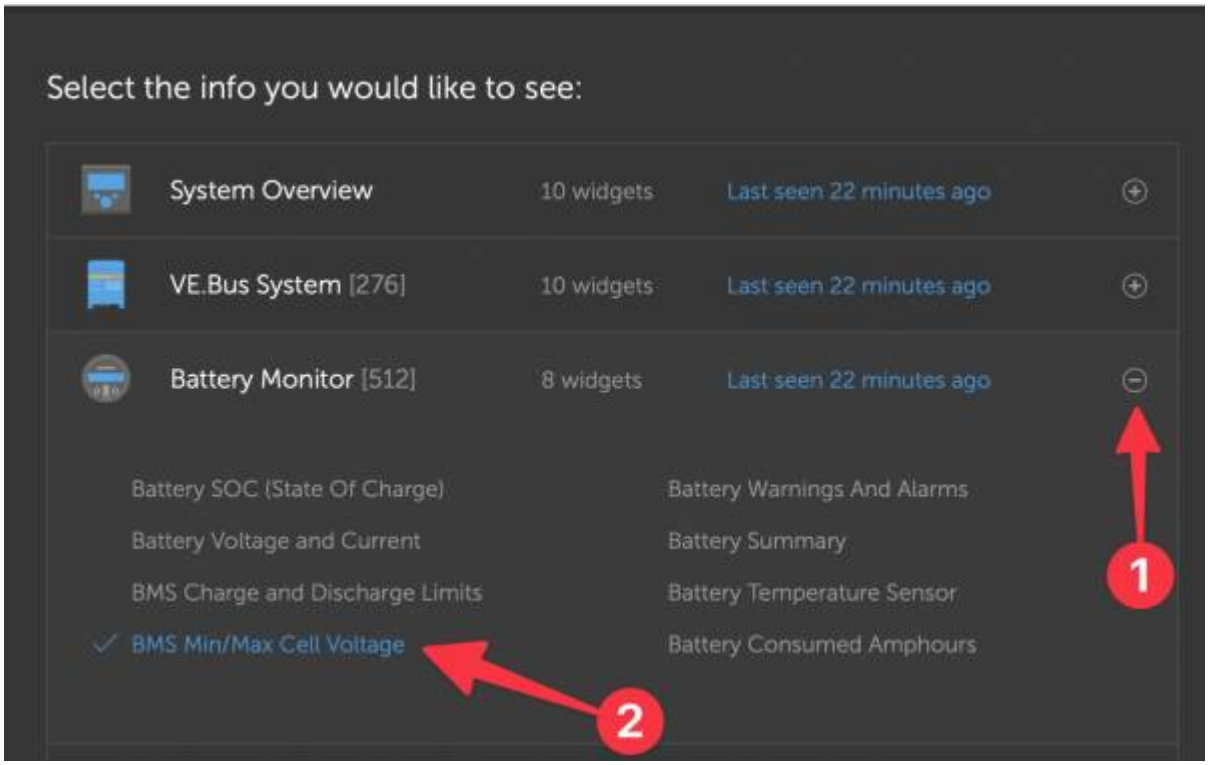
- Relay T1-T2: closed if allowed to discharge
- Relay T4-T5: closed if allowed to charge

Picture showing these connections on the BYD B-Box battery:

12. High cell voltage warning or alarm shown on battery status

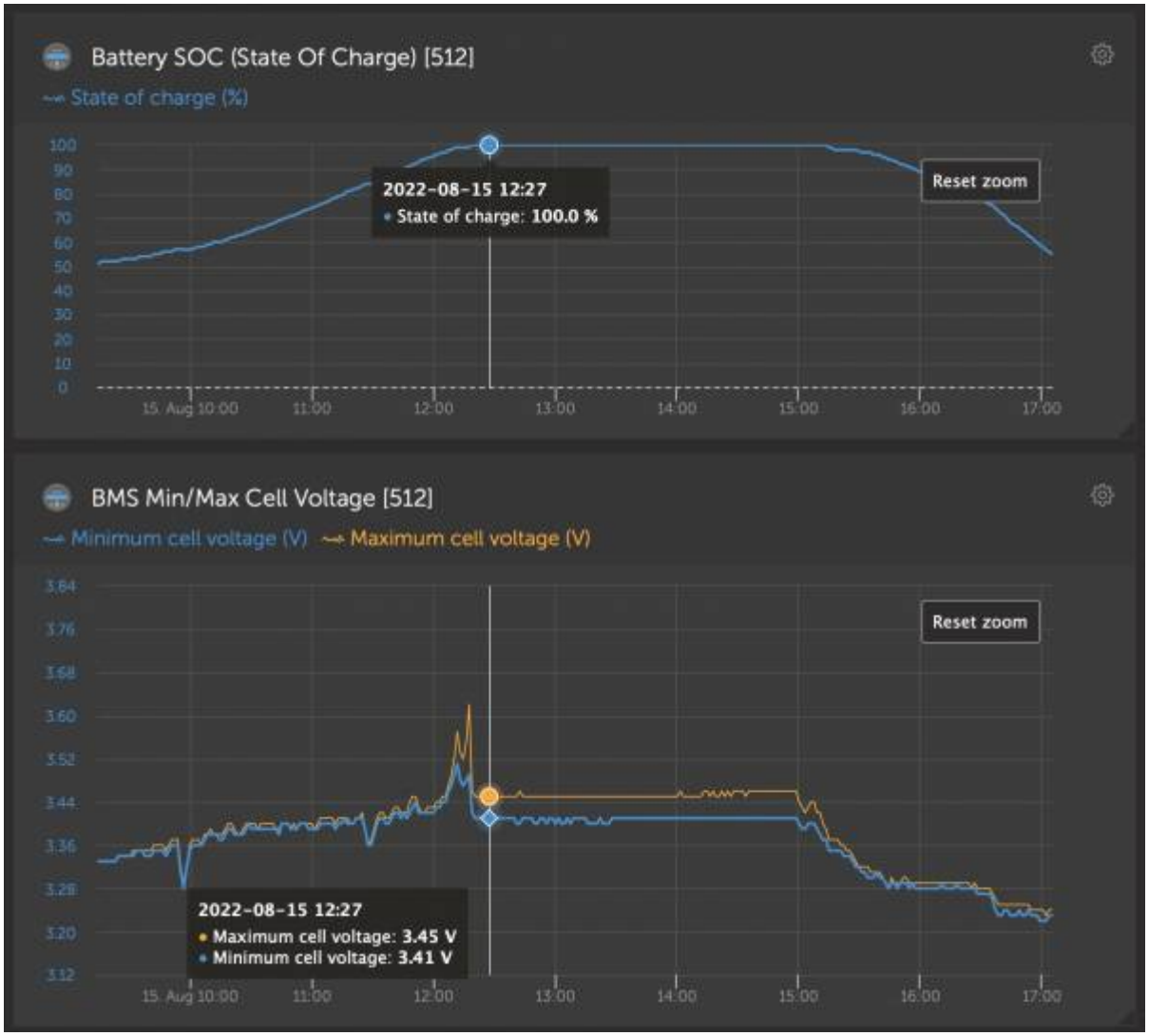
The 'high cell voltage' warning or alarm is not unusual on new batteries that are not yet balanced. While less common, It can also occur on systems that have been installed and previously working reliably as well.

It is easiest to confirm this diagnosis in VRM in the Advanced Widget for the Battery Monitor as it logs this data over time.



It is also possible to see an instantaneous cell max/min on the GX device in the Menu → BYD Battery → Details

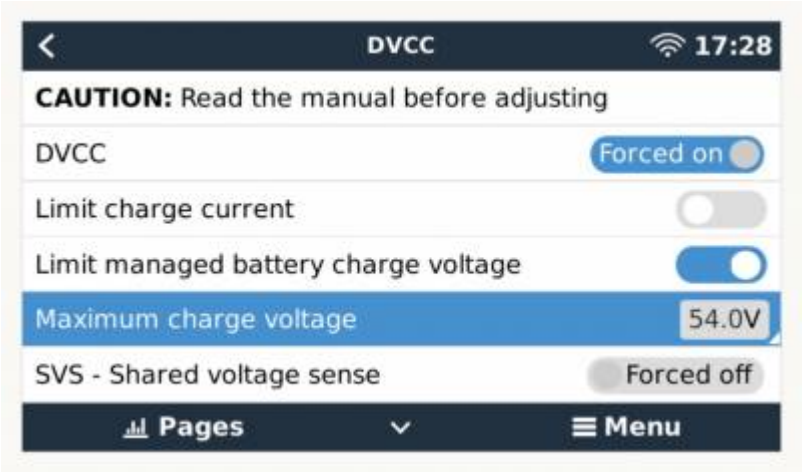
In a normal well balanced battery installation, you can see the minimum and maximum cell voltages rising together through most of the charge cycle (within 10%), and power spikes are absorbed by both min and max cells when the battery is full. Once the battery is at 100%, the max cell voltage should fall back closely in line with the minimum cell voltage.



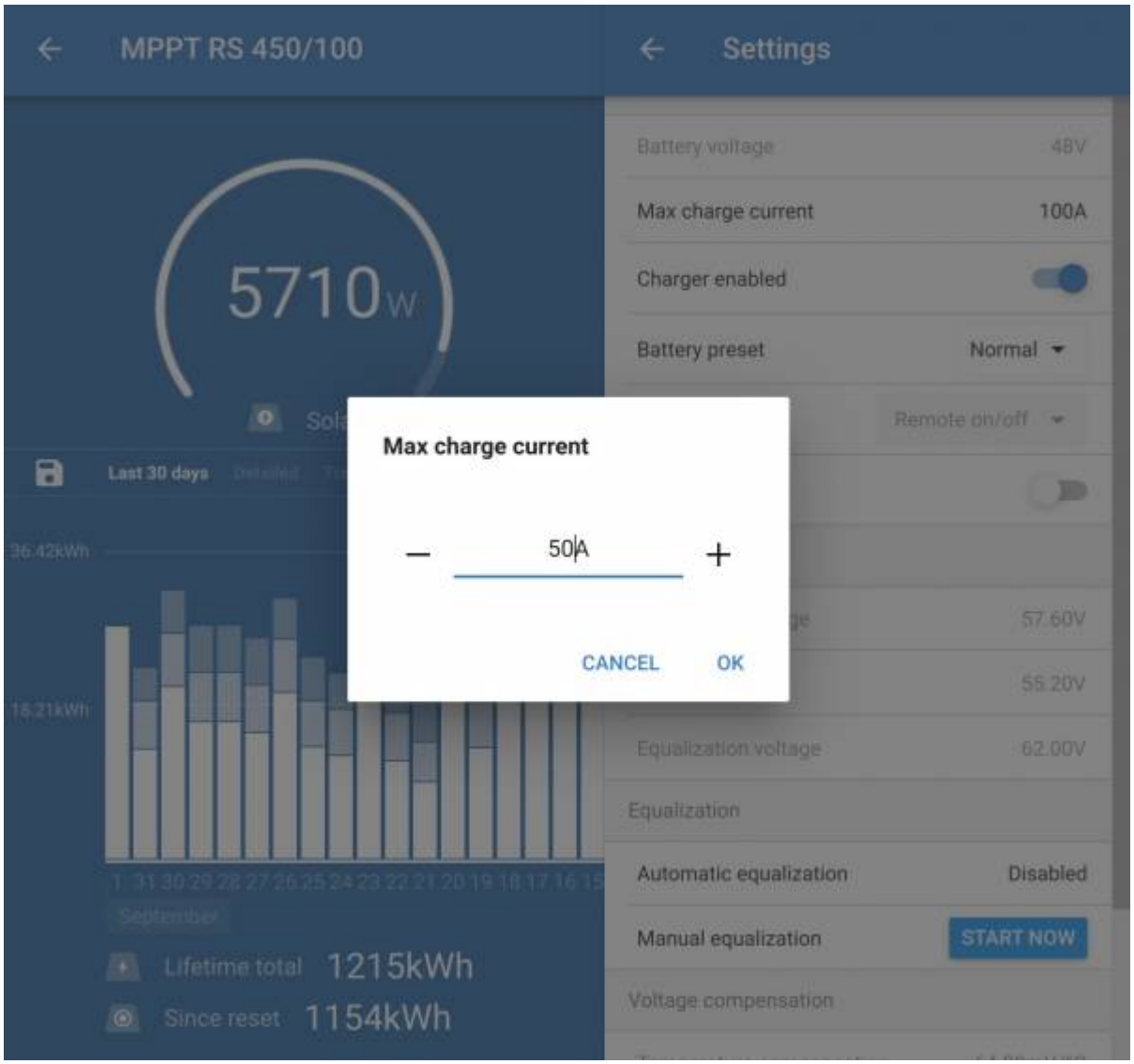
In an imbalanced battery installation, you can see the minimum cell voltage does not rise as much (if at all), compared to the maximum cell voltage. Once the battery is at 100%, the maximum cell voltage does not fall back closely in line with the minimum cell voltage. Any power spikes are disproportionately affecting the high voltage cells, generating alarms, and putting the system at risk of shutting the battery down.

To help the batteries balance quickly, keep the batteries fully charged and the system voltage stable until the errors go away. In an ESS system, set it to 'keep batteries charged', in an off-grid system the fastest way is to either charge / balance the battery before installation, or to fully charge with a generator if not enough solar is available to keep the batteries fully charged.

If you are unable to maintain the target voltage to balance the batteries without the 'high cell voltage' alarm occurring, you may need to temporarily enable and set the “Limit managed battery charge voltage” setting in the DVCC menu of the GX device. Reduce this voltage as necessary until the alarm stops. After sufficient time to balance the batteries, try increasing this value until it can be disabled again for normal operation.



Another method that may also help is limiting the maximum charge current that is provided by the solar chargers. In some cases this can allow a better charge without needing to reduce the overall battery charge voltage as much (or at all), by reducing the high current spikes. Charge current limits can be applied at a system level in DVCC - however they will be much more effective and quicker to react to changing conditions if applied at an individual unit level within the MPPT settings in VictronConnect:



Start with a severe current limit (i.e 50%) and then see if that resolves the issue (while still making

sure the system receives a full charge). If the issue is still not resolved, continue to restrict further. Once the alarms stop, then increase Max Charge Current back to the point where the issue reappears, and then reduce it again by 10%. Note this may also be seasonally affected (if solar window is limited with the changing sun angle).

All of these values can be monitored, and the settings adjustments can be performed remotely with an internet connected system via VRM and VictronConnect Remote.

If it is not possible to raise the voltage or current limits over time, and eventually disable the manual overrides without the alarms reoccurring;

1: If you have 2 or more batteries in your system, you can try shutting down the system once it is as close to fully charged as possible, and then physically connecting the batteries in smaller groups (or even individually) so that balancing can occur on each individual battery without it being masked by the others connected in parallel. It may help you to see the indicator lights on the battery (if available on that model) to find which battery might be out of balance with the others. You can also monitor this in VRM and the GX device using the min/max cell voltage reporting.

2: Contact your BYD dealer for further assistance (they can provide additional software to see even more detailed individual cell level data), or assist with other potential solutions.

13. 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 BYD and Victron can found at Victron Community, use the topic label 'BYD'.

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