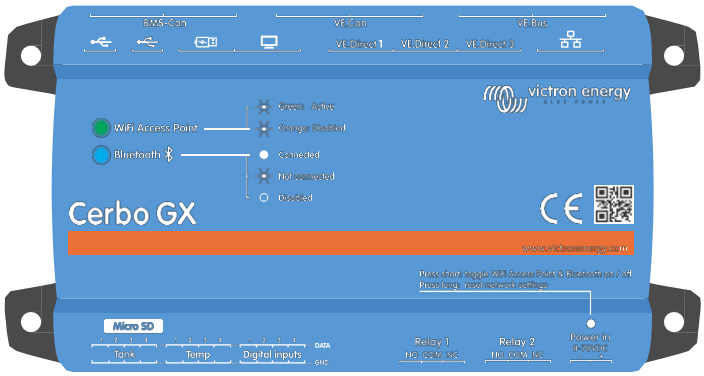
ENGLISH



Cerbo GX Manual

Rev 21 05/2023

This manual is also available in HTML5 format.

Contents

victron energy
BLUE POWER

1. Safety instructions

SAVING THESE INSTRUCTIONS - These instructions contain important information that must be followed during installation, setup, operation, and maintenance.

- Read these instructions carefully before installing and operating the product.
- Check that you have the latest version of the manual. You can download the latest version from the product page.
- Install the product in a heat-resistant environment. Therefore, ensure that there are no chemicals, plastic parts, curtains or other fabrics, etc. in the immediate vicinity of the device.
- Ensure that the device is used under the correct operating conditions. Never use it in a damp environment.
- Never use the product in places where gas or dust explosions could occur.
- This appliance must not be used by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance.

2. Introduction

2.1. What is Cerbo GX?

Cerbo GX is a powerful member of the GX product family with extensive communication ports and the option to add a touchscreen display (GX Touch 50 and GX Touch 70) for extended functionality.

GX products are Victron's state-of-the-art monitoring and control solution, running on our Venus OS operating system. It is the heart of your energy installation. All other system components, such as inverters/chargers, solar chargers and batteries, are connected to it. Cerbo GX ensures that they all work in harmony.

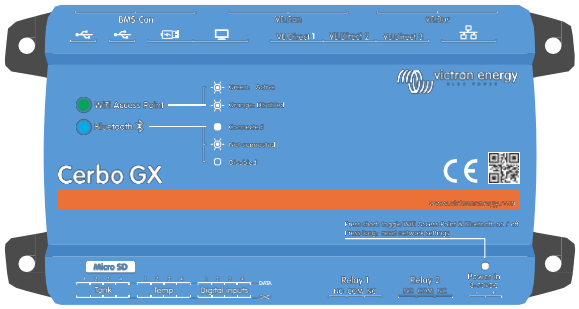
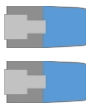
To monitor and control your system, you can easily access it remotely via our Victron Remote Management (VRM) portal from anywhere in the world with an internet connection. Or you can access it directly using the optional GX touchscreen, a web browser, a multifunction display (MFD) [80] or our VictronConnect app.

The remote console [38] serves as the main control centre for monitoring, controlling and managing the system. Cerbo GX also

provides VRM: Remote firmware updates and allows remote configuration changes.

Please note that all information in this manual refers to the latest software. You can check for the latest version in the firmware menu (see chapter Firmware Updates [57]) when the GX is connected to the internet. For installations without internet, you can find the latest version in the Victron Professional app.

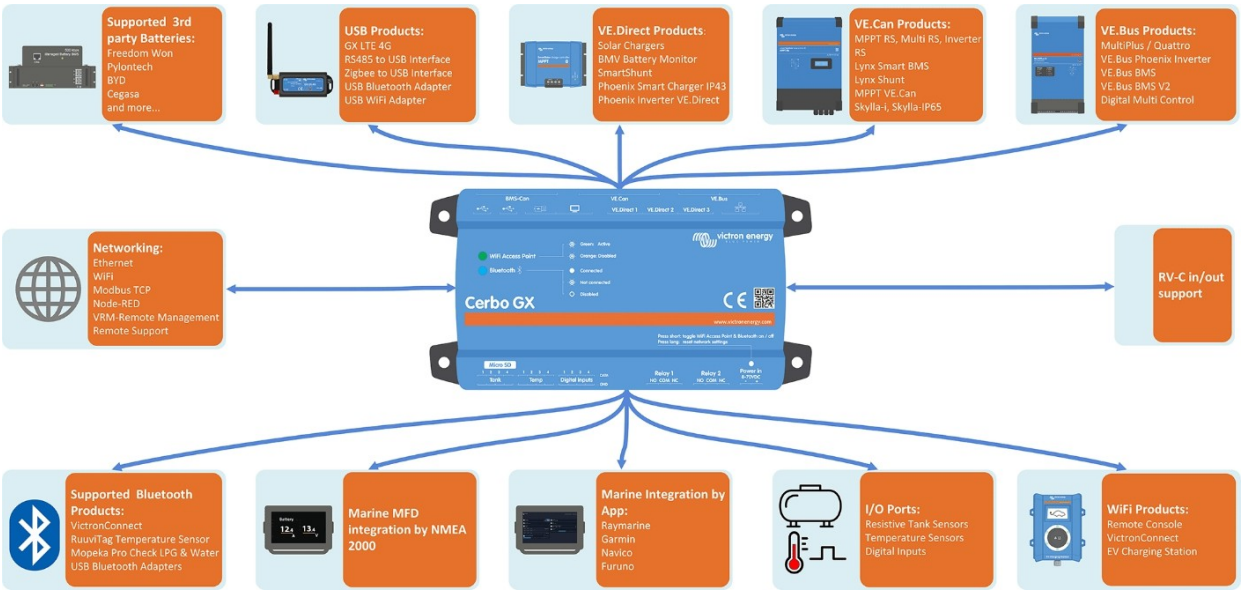
2.2. What's in the box?

Cerbo GX	
Power cable with series fuse and M8 terminal lugs for connection to the battery or DC bus.	
VE.Can terminators (2 pcs)	
Terminal blocks for all connectors on each side: 3x 4-pin, 2x 3-pin, 1x 2-pin.	

Please also watch this video, which shows the unboxing and an overview of the interfaces:

3. Installation

3.1. Cerbo GX Connection overview



Communication ports	IO	Other
3x VE.Direct	4x digital inputs	MicroSD card slot (max. 32 GB)
1x VE.Can (non-isolated) and 1x BMS-Can	4x resistive tank level inputs	Power supply in port (8 - 70 VDC)
1x VE.Bus	4x temperature sensor inputs	HDMI port
Ethernet	2x programmable relays (NO, COM, NC - current limitation: DC up to 30VDC: 6A / DC up to 70VDC: 1A / AC: 6A, 125VAC	
2.4 GHz WiFi (802.11 b/g/n) including WiFi access point		
Bluetooth Smart		
2x USB Host port + 1x USB Power only port		

3.2. Mounting options and accessories

The following mounting options and accessories are available:

- GX Touch 50 and GX Touch 70 displays
- The GX Touch wall mount is available in 5" and 7" sizes
- GX Touch 50 adapter for CCGX cut-out
- Adapter for mounting on DIN35 rail
- Quattro, MultiPlus and GX temperature sensor devices

Watch this video to see all the

mounting options:

3.3. Powering the Cerbo GX device

The device is powered via the *Power in V+* connector. It accepts voltages from 8 to 70 V DC. The device is not powered from any other connection (e.g. mains). The supplied DC power cable includes a built-in 3.15A slow fuse.

If the DC voltage is higher than 60 V, the Cerbo GX is classified as a "built-in product". Installation should be carried out in such a way that the user cannot touch the terminals.

If Cerbo GX is used in an installation with VE.Bus BMS, connect *the V+ power supply* on Cerbo GX to the terminal marked "*Load disconnect"* on the VE.Bus BMS system. Connect both negative wires to the negative terminal of the common battery.

Note on powering from the AC-out terminal of a VE.Bus, Multi or Quattro inverter:

If you power the Cerbo GX from a mains adapter connected to the AC-out port of any VE.Bus product (inverter, Multi or Quattro), the VE.Bus products will shut down for any reason (after any operational fault or during
black start). The VE.Bus devices will not start until the Cerbo GX has power ...but the Cerbo GX will not start until it has power. This deadlock can be resolved by briefly disconnecting the VE.Bus cable from the Cerbo GX, after which you will see that the VE.Bus products start up immediately.

Alternatively, the RJ45 cabling can be modified. For more information, see FAQ Q20 [121].

Please note that, with or without the above modification, powering the monitoring device via the AC output of the inverter/charger (of course) has the disadvantage that if a problem causes the inverter/charger to shut down, all monitoring is disabled. Examples include inverter overload, high temperature or low battery voltage. It is therefore recommended to power the GX device from the battery.

Isolation

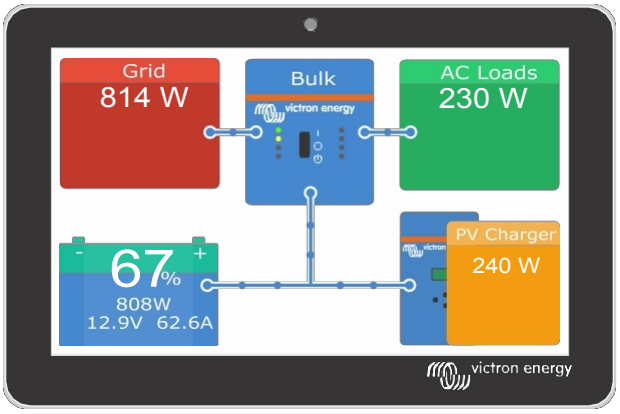
Since the Cerbo GX is connected to many different products, be sure to pay proper attention to isolation to prevent ground loops. In 99% of installations, this will not be a problem.

- VE.Bus ports are isolated
- Direct VE.Direct ports are isolated
- VE.Can ports are not isolated.
- The USB ports are not isolated. Connecting a WiFi dongle or GPS dongle will not cause a problem because it is not connected to another power source. Although installing a separately powered USB hub will create a ground loop, during
  extensive testing, we have not found this to cause any problems.
- The Ethernet port is isolated, with the exception of shielding: use unshielded UTP cables for Ethernet networking.

Expanding USB ports using a self-powered USB hub

Although the number of USB ports can be expanded using a hub, the amount of power that can be provided *by the built-in USB port* is limited. When expanding the number of USB ports, we recommend always using *powered* USB hubs. And to minimise the possibility of problems, be sure to use high-quality USB hubs. Since Victron also offers a VE.Direct to USB adapter, you can use this setup to increase the number of VE.Direct devices you can connect to your system. See this document for limitations on the number of devices that can be connected to various GX devices.

3.4. GX Touch 50 and GX Touch 70



The GX Touch 50 and GX Touch 70 are accessories for the Cerbo GX display. The five-inch and seven-inch touchscreens provide an instant overview of the system and allow you to adjust settings at a glance. Their super-slim, waterproof design, top-mounting configuration and simple installation offer great flexibility in creating a sharp and clean dashboard.

No configuration is required. Once the screen is connected, the GX overview and menu controls are automatically displayed on the device.

Display options are available in the Settings → Display and Language menu. You can set the time after which the display turns off or enable adaptive brightness.

The screen is controlled with your fingertip. You can scroll up and down through menus by dragging your finger, and make selections by tapping. Text and numbers are entered using the on-screen keyboard.

Mounting options

The GX Touch device can be mounted in several different ways:

- using the supplied mounting frames
- using the optional GX Touch wall mount
- or the optional GX Touch 50 adapter for CCGX cut-outs (GX Touch 50 only).
- The supplied protective cover (from serial number HQ2242, can be ordered separately - see catalogue sheet for details) prevents damage from UV radiation during prolonged exposure to sunlight.

Connecting the GX Touch 50 or GX Touch 70 device

The touch screen is connected to the device with a single cable that has an HDMI connector on one end and a USB connector on the other.

1. Mount the touch screen in a suitable location
2. Connect the HDMI connector to the HDMI port on the Cerbo GX device.
3. Connect the USB connector to the USB port located next to the HDMI port (this USB port is only used to power the touch screen and has no other function).

3.5. Deactivating touch input control

To restrict access to the GX system, you can disable touch input control for the connected GX Touch 50 or 70 touch screen. This allows you to mount the GX Touch touch screen in a location where it is visible to system operators, while preventing them from using it to elevate their access level.

Note that this feature only disables touch/mouse control. You can still control the device using the keyboard on remote consoles.

There are two ways to disable the touchscreen function:

1. Using a momentary control button connected to one of the digital inputs.
2. Using an external USB keyboard connected to the Cerbo GX device; the touch function can then be turned on and off by pressing the Pause/Break key.

   If you wish to use this function, ensure that the USB ports and USB keyboard are not accessible.

Deactivating touch control using the momentary press button

1. Go to Settings → IO → Digital inputs → Digital input [digital input number].
2. Scroll down the submenu until you see the Touch input control option.
3. Press the space bar or click/tap to enable touch input control.
4. Connect the momentary push button between the corresponding upper and lower pins of the associated digital input.

   Press the button once to activate (deactivate) touch. Touch input is no longer possible. The display will turn off after the time set in Display Timeout (see Display and Language menu). Touching the display activates the last set page. Pressing the button again deactivates (activates) touch. Note that this pulls the gpio pin to ground.
   Do not apply voltage to the gpio pins.

Deactivating touch input control using an external USB keyboard

1. Connect an external USB keyboard to one of the USB ports on the Cerbo GX device.
2. Press the Pause/Break button to enable/disable touch input control.

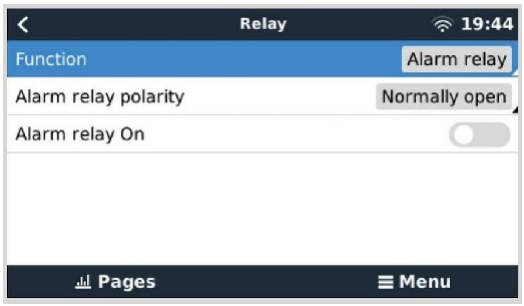
   For keyboards without a Pause/Break key, use one of the alternative key combinations listed in this Wikipedia article.

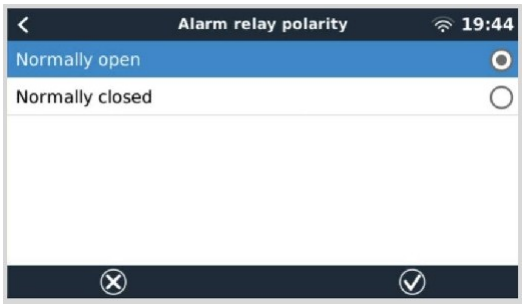
3.6. Relay connection

Cerbo GX has a potential-free normally open (NO) and normally closed (NC) relay function. The relay function can be set via the GX menu, Settings → Relay → Function.

Relay 1 has a special significance because, in addition to manual and temperature-based activation [55] (also applies to relay 2), it can also be used as an alarm relay [44], generator start/stop relay [109] or tank pump relay [44].

If the relay function is configured as an alarm relay, the polarity of the relay can be changed using an additional menu. The default setting is Normally open. Please note that switching the polarity to Normally closed will result in slightly higher current consumption by the GX device.





Observe the voltage and current limits of the relay, which are: DC up to 30VDC: 6A - DC up to 70VDC: 1A - AC: 6A, 125VAC

4. Connecting Victron products

4.1. VE.Bus Multis/Quattro/Inverters

To keep this document concise, we will refer to all Multis, Quattros and inverters as *VE.Bus* products.

The oldest version of VE.Bus devices that can be connected using products: The Product_Acronym abbreviation is 19xx111, where the first two digits represent the microprocessor and the last three digits represent the VE.Bus firmware version.

Microprocessor of the VE.Bus device	Device support GX
18xxxxxx	No
19xx111	Yes
20xx111	Yes
26xxxxx	Yes
27xxxxx	Yes

Please note that remote switching on/off (header on the VE.Bus control board) cannot be used in combination with the Cerbo GX device for Multis, Quattro and EasySolars devices. There should be a wire between the left and middle terminals, as supplied from the factory. If a wired switch is required to switch off the system, use a safety switch assistant instead.

This restriction does not apply to the new generation of VE.Bus inverters/chargers: when using a MultiPlus-II, Quattro-II or EasySolar-II inverter, the Remote on/off terminal header can be used *in combination with Cerbo GX*.

Before connecting any VE.Bus product, take great care not to confuse the VE.Bus ports of the GX device with the Ethernet or VE.Can/BMS-Can port!

Individual VE.Bus products

To connect a single VE.Bus product, connect it to one of the VE.Bus sockets on the rear of the Cerbo GX device. Both sockets are identical, so you can use either one. Use a standard RJ45 UTP cable, see our price list.

Parallel, split and three-phase VE.Bus systems

To connect multiple VE.Bus products configured as a parallel, split or three-phase VE.Bus system, connect the first or last VE.Bus product in the chain to one of the VE.Bus sockets on the rear of the Cerbo GX device. Use a standard RJ45 UTP cable, see our price list.

VE.Bus systems with lithium batteries and VE.Bus BMS

- The following information applies only to VE.Bus BMS v1, not to be confused with its successor, VE.Bus BMS V2.
- Connect the Cerbo GX to the socket labelled "MultiPlus/Quattro" or to one of the Multis/Quattro devices in the system. Do not connect it to the *remote panel* socket *on* the VE.Bus BMS.
- Please note that it will not be possible to control the On/Off/Charger Only switch. This option is automatically disabled in the Cerbo GX menu when the VE.Bus BMS bus is used. The only way to control the Multi or Quattro when using the VE.Bus BMS system is to add a Multi digital control to the system. Input current limitation settings are possible in systems with VE.Bus BMS.
- It is possible to combine the MultiPlus/Quattro system with the VE.Bus BMS system and a digital multifunctional control unit. Simply connect the digital multifunctional controller to the RJ-45 socket on the VE.Bus BMS system labelled *Remote panel*.
- To enable automatic shutdown of the Cerbo GX in case of battery discharge, ensure that the Cerbo GX is powered via the VE.Bus BMS: connect *Power in V+* on the Cerbo GX to *Load disconnect* on the VE.Bus BMS. Connect both negative wires to the negative terminal of the common battery.

Combining Cerbo GX with a digital multifunction controller

Both Cerbo GX and Digital Multi Control can be connected to the VE.Bus system. The option to switch on, switch off or set the product to charger only via Cerbo GX will be deactivated. The same applies to input current limitation: if there is a digital multifunctional controller in the system, the input current limitation set on this control panel will be the main setting and it will not be possible to change it on Cerbo GX.

Only one VE.Bus system can be connected to the VE.Bus ports on the back of the Cerbo GX device. The professional way to monitor multiple systems is to add a second Cerbo GX system.

If you need to connect more than one system to a single Cerbo GX device, use MK3-USB. Functionality will be limited:

- Only systems connected to the built-in VE.Bus ports are used to generate data on the Overview page.
- All connected systems are displayed in the device list.
- All connected systems will be taken into account when calculating energy consumption and distribution (kWh graphs on VRM).
- Only the system connected to the built-in VE.Bus ports is used for generator start/stop logic.
- Only Multi/Quattro units (this can be one unit or multiple units configured together for three-phase/split-phase and parallel connection) connected to the VE.Bus port will be controlled via DVCC. Other systems connected to the GX device via MK3-USB are not controlled by the DVCC and will charge and discharge according to the configuration made in these units.
- In the case of the ESS system, only the system connected to the built-in VE.Bus ports is used in the ESS mechanisms. Others are only displayed in the device list.

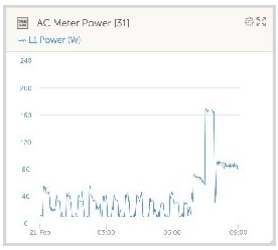
Alternatively, the VE.Bus to VE.Can interface (ASS030520105) can be used. Add one for each additional system. Please note that we do not recommend this; this interface is an obsolete product. Ensure that the VE.Can network is terminated and powered. For information on powering the VE.Can network, see Q17 in our data communication document.

Additional features that the GX device provides to VE.Bus products

A GX device connected to the internet allows remote configuration via the VRM Portal. For more information, system requirements and specific steps to access this feature, please refer to the Remote VE.Configure manual.

GX devices connected to the internet also enable remote firmware updates for VE.Bus products. For details, see the Remote VE.Bus Firmware Update manual.

4.2. AC load monitoring



All types of energy meters can be assigned the role of an AC current meter. This is done in Settings → Energy Meters → [your_energy_meter]. → Role menu, where you can choose between grid meter, photovoltaic inverter, generator and AC meter.
When selecting an AC meter, the load is displayed in the device list and on the VRM in the advanced widgets.

Please note that these measured loads are not used in any calculations, only for monitoring purposes.

4.3. Battery Monitor SmartShunt, BMV-700 series; and MPPT with VE.Direct port

Direct connection using a VE.Direct cable is limited by the number of VE.Direct ports on the device (see Connection Overview [3]). There are two types of VE.Direct cables available:

1. Direct VE.Direct cables, ASS030530xxx
2. VE.Direct cables with an angled connector on one end. They are designed to minimise the depth required behind the panel, ASS030531xxx

VE.Direct cables have a maximum length of 10 metres. They cannot be extended. If you need a longer cable, use the VE.Direct to USB interface with an active USB extension cable.

It is also possible to use the VE.Direct to VE.Can interface, but please note that this only works for BMV-700 and BMV-702. It does not work for BMV-712, MPPT solar chargers and inverters with a VE.Direct port. For more information about this VE.Can interface, see the next paragraph.

Connecting more VE.Direct devices to Cerbo GX than the number of VE.Direct ports

First of all, please note that the maximum number of VE.Direct devices that can be connected is specific to the GX device and is limited by the processor's performance. It may also be reduced in very complex systems, such as many alternating photovoltaic inverters or synchronised inverter chargers, etc. Therefore, always allow for a certain additional reserve in your design. The method of connection, whether via VE.Direct, USB or a USB hub, does not change this maximum. The maximum limit for all GX devices can be found in the Victron GX product range.

For Cerbo GX, this limit is 15.

Option to connect more VE.Direct products than there are VE.Direct ports available:

1. Use the VE.Direct to USB interface. Cerbo GX has built-in USB ports. If additional USB ports are required, use a USB hub.
2. (Only!) BMV-700 and BMV-702 can also be connected using the VE.Direct to VE.Can interface. Please note that BMV-712, MPPT and VE.Direct inverters cannot be connected using this CAN-bus interface, as it does not convert their data to CAN-bus messages. When using the VE.Direct to VE.Can interface, ensure that the VE.Can network is terminated and also powered. For information on powering the VE.Can network, see Q17 in our data communication document. Finally, please note that this CAN-bus interface is obsolete.

Notes on older VE.Direct MPPT

- MPPT 70/15 must be from year/week 1308 or later. Older 70/15 models are not compatible with Cerbo GX, and unfortunately, updating the MPPT firmware will not help. To find the year/week number of your model, look at the serial number printed on the label on the back. For example, the number **HQ1309DER4F** means year 2013, week 09.

4.3.1. DC load monitoring mode

If you want to use the SmartShunt or BMV-712 to monitor individual DC circuits rather than as a battery monitor for the entire system, you can change the monitor mode setting in VictronConnect from Battery Monitor to DC Energy Meter.

When DC Meter is selected, you can choose from the following types (also in VictronConnect):

Solar charger, Wind charger, Shaft generator, Alternator, Fuel cell, Water generator, DC-DC charger, AC charger, Generic source, Generic load, Electric drive, Refrigerator, Water pump, Mine pump, DC system, Inverter, Water heater

After connecting to the Cerbo GX device, the user interface displays the type, amperage and power of the DC load available on the VRM Portal.

When configured as a "DC System", Cerbo GX can do more than just record and visualise:

1. The power displayed in the DC System field is the sum of the power reported by all SmartShunts configured in this way. Enabling multiple meters is done to accommodate, for example, a catamaran, so you can measure DC systems on the port and starboard sides of the hull.
2. When setting DVCC charging current limits for Multis, Quattro and solar chargers, the DC current of the system is compensated. For example, when a load of 50 A is measured and the CCL of the battery is 25 A, the limit set for Multis and solar chargers is 75 A. Improvement for systems with significant DC loads, such as yachts, buses and motorhomes.

Notes and limitations:

- This feature is available for SmartShunts and BMV-712 devices. It does not apply to BMV-700 or BMV-702.
- The meter mode is set using the VictronConnect app on the BMV/SmartShunt device itself. For details, see the BMV-712 or SmartShunt product manual on the Battery Monitor product page.
- The NMEA2000-out function does not support these new types; for example, when using a SmartShunt to measure alternator power, this data is not available in NMEA 2000.

4.4. VE.Can device

To connect a product with a VE.Can port, use a standard RJ45 UTP cable (available with straight and angled connectors).

Be sure to terminate the VE.Can network at both ends using a VE.Can terminator. Each VE.Can product comes with a bag containing two terminators. They are also available separately.

Additional notes:

1. To work with the Cerbo GX device, firmware v2.00 or later must be installed on the MPPT 150/70 device.
2. The Skylla-i control unit can be combined with the Cerbo GX control unit.
3. You can combine the Ion Control control panel with the Cerbo GX device.
4. All VE.Can devices supply power to the VE.Can network, so there is no need to supply power to the VE.Can network separately in this case. All protocol converters, such as the VE.Bus to VE.Can interface and the BMV to VE.Can interface, do not power the VE.Can network.

The following VE.Can products also support VictronConnect-Remote (VC-R) - configuration and monitoring via VRM. For more details, see the VictronConnect manual.

VE.Can product	VC-R	Notes
Lynx Shunt VE.Can	Yes	-
Lynx Smart BMS	Yes	-
RS, Multi RS and MPPT RS inverters	Yes	They also have VE.Direct, but for VC-R they must be connected via VE.Can.
Blue/Smart Solar VE.Can MPPT [1]	Yes	Tr and MC4 models
Skylla-i and Skylla-IP44/-IP65	Yes	Requires firmware v1.11
[1] All VE.Can solar chargers except very old ones (large rectangular box with display) BlueSolar MPPT VE.Can 150/70 and 150/85		

4.5. VE.Can and BMS-Can interfaces

Cerbo GX has two CANbus interfaces. They are **independent** in terms of data and connected devices. They are not electrically isolated. One is labelled VE.Can, the other is labelled BMS-Can, with printing on the top of the unit when it is facing you.
Each corresponds to a VE.Can port and a BMS-Can port listed in the GX Remote Console service menu.

VE.Can is designed for Victron (and Victron-compatible) VE.Can products such as VE.Can MPPT, Skylla-IP65, Lynx Shunt VE.Can and Lynx Smart BMS. These 250 kbit/s VE.Can devices can be daisy-chained together via this bus. Both ends must be terminated with the supplied VE.Can terminators.

BMS-Can is designed for use with compatible managed battery systems such as Pylontech, BYD, Freedomwon and many others. These must be terminated at the Victron end (on the Cerbo GX) with the supplied terminator (the same as used for VE.Can). It may or may not be necessary to terminate on the managed battery, BMS or BMU - this will be documented in the Victron Compatible managed battery manual for that battery. Some batteries terminate automatically.

VE.Can and BMS-Can cannot be combined on the same bus. If you want to use both, you need a GX device with two separate buses, each with 2 RJ45 ports – a total of 4 CANbus ports.

The BMS-Can port cannot be set to anything other than 500 kbit/s or switched off.

The VE.Can port can be set from 250 kbit/s to 500 kbit/s (or one of several other CANbus speeds for other CANbus applications).

By default, VE.Can is set to 250 kbit/s and BMS-Can (if present) to 500 kbit/s.

Other types of batteries and BMS may claim compatibility with BMS-Can or VE.Can, but if they are not on the list of compatible batteries, then they have not been tested and confirmed by Victron.

Another element of possible confusion is that there are some BMS products on the market that use the CANbus-BMS profile with a speed of 250 kbit/s. These BMS products can only be connected to the VE.Can port and must also be set up accordingly (VE.Can & CAN-bus BMS (250 kbit/s) in the VE.Can port service menu. They can be used in the same cable chain as other Victron VE.Can devices.

4.6. RS, Multi RS and MPPT RS inverters

The Inverter RS, Inverter RS Solar and Multi RS inverters have both VE.Direct and VE.Can interfaces. For these specific products, it is only possible to connect a GX device via the VE.Can interface. It is not possible to connect a GX device via the VE.Direct interface.

The VE.Direct interface is only used for these specific products to connect the VE.Direct to USB adapter for programming. This restriction does not apply to the MPPT RS, which can be connected to the GX either via VE.Direct or VE.Can.

4.7. BMV-600 series

- Connect the BMV-600 to the BMV-60xS using a VE.Direct cable. (ASS0305322xx).

4.8. DC Link Box

- Connect the DC Link Box using the supplied RJ12 cable. Then connect the BMV-700 to the Cerbo GX device.

4.9. VE.Can Tank Resistance Sensor Adapter

For details about the adapter, please refer to the VE.Can Tank Resistor Sensor product page.

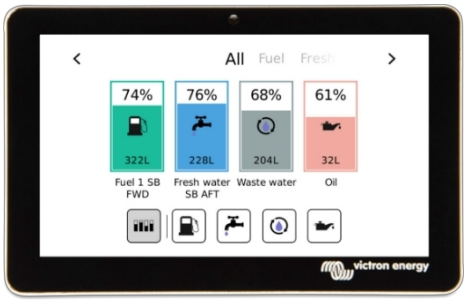
- Use a standard RJ45 UTP cable to connect a product with a VE.Can port.
- Remember to terminate the VE.Can network at both ends using a VE.Can terminator. Each VE.Can product comes with a bag containing two terminators. They are also available separately (ASS030700000). (Available with straight or angled connectors).
- Ensure that the CAN bus is powered; for details, refer to the Power Supply section in the tank sender adapter manual.

4.10. Connecting the GX 140 tank

The GX 140 tank is an accessory for our GX system monitoring product range.

It reads values from up to four level sensors in the tank.

Tank levels can be read locally in the system or remotely via our VRM portal.



The GX Tank 140 is compatible with both current (4 to 20 mA) and voltage (0 to 10 V) sensors. Connection to the GX device is via USB, which is also how the GX Tank is powered: no additional power cables are required.

To make connecting the tank sensor as easy as possible, two of the four inputs provide 24 V power for the sensor. The remaining two channels require an external power supply, and a power terminal with fuse outputs is provided for convenience.

The upper and lower limits are configurable to accommodate transmitters that provide only part of the scale, such as 0 to 5 V.

In marine applications, the GX device can transmit these tank levels over the NMEA 2000 network so that they can be captured by other displays, such as MFDs.

The GX Tank 140 product page refers to the complete documentation for this product.

4.11. Connecting Victron hardwired temperature sensors

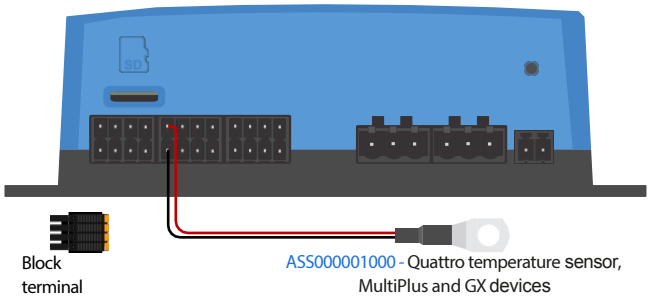
The location and number of temperature sensor inputs can be found in the Connection Overview [3]. They can be used to

measure and monitor all types of temperature inputs.

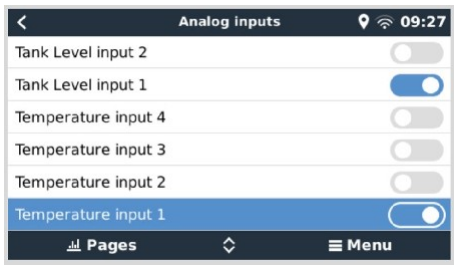
Temperature transmitters are not included. The required sensor is ASS000001000 - Quattro, MultiPlus and GX Device Temperature Sensor. Note that this is different from the BMV temperature measurement accessory.

They do not need to be connected to the battery (even though they look like a battery terminal).

The physical connection of the temperature probes requires a sleeve or exposed copper end of at least 10 mm+ to be inserted into the removable terminal block connector. Once correctly connected, press the orange tab if you wish to remove the secured wire. The sensors are connected with the red wire to the upper part of the connector and the black wire to the lower part.

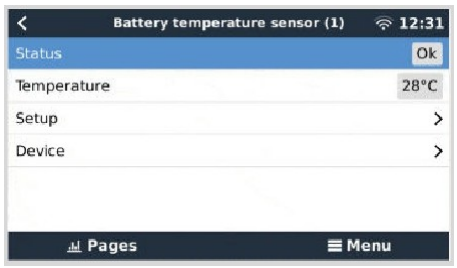


Sensors are enabled (and disabled) in the Settings → I/O → Analogue inputs menu in the GX device settings.



Once activated, data from the temperature sensor is visible in the device list and is also recorded in VRM.

By selecting the temperature sensor in the device list menu, you can then set the temperature type to either Battery, Refrigerator, or General. It is also possible to set a custom name in the device menu.



It is possible to set the temperature offset and scale, but this function is currently limited to users with "superuser" permission level.

5. Connecting supported products from manufacturers other than Victron

5.1. Connecting a photovoltaic inverter

Measuring the power of the photovoltaic inverter provides the user with an overview of the actual power balance and energy distribution. Please note that these measurements are for display purposes only. They are not necessary, nor are they used by the installation for its performance. In addition to monitoring, the GX device can also limit certain types and brands of photovoltaic inverters, i.e. reduce their output power. This is used and required for the zero or limited power consumption function of the ESS.

Direct connections

Type	Zero power consumption	Details at
Fronius	Yes	LAN connection, see GX - GX - Fronius Manual
SMA	No	LAN connection, see GX - GX - SMA manual
SolarEdge	No	LAN connection, see GX manual - SolarEdge
ABB	Yes	LAN connection, see GX - ABB manual

Use of meter

For photovoltaic inverters that cannot be connected digitally, a meter can be used:

Type	Zero power consumption	Details at
Alternating current Sensor	No	Connected to analogue input converter/charger. Lowest cost - lowest accuracy. Energy consumption meter energy consumption
The consumption meter to	No	Cable connection to Cerbo GX device or to German. wirelessly using our Zigbee to USB/RS485 . See the Energy Meter home page
Wireless connection AC Sensors	No	See the manual for the wireless AC sensor current sensor - Discontinued product

5.2. GPS USB device connection

With GPS, you can remotely monitor vehicles or boats on the VRM portal. It is also possible to configure a geofence that automatically sends an alarm when the system leaves a designated area. And gps-tracks.kml files can be downloaded and opened in Navlink and Google Earth, for example.

Victron does not sell USB-GPS modules, but Cerbo GX supports third-party GPS modules that use the NMEA0183 command set - almost all of them. It can communicate at both 4800 and 38400 baud rates. Plug the unit into one of the USB ports. The connection may take a few minutes, but Cerbo GX will automatically recognise the GPS. The unit's location will be automatically sent to the VRM online portal and its location will be displayed on the map.

Cerbo GX has been tested for compatibility with:

- Globalsat BU353-W SiRF STAR III 4800 baud
- Globalsat ND100 SiRF STAR III 38400 baud
- Globalsat BU353S4 SiRF STAR IV 4800 baud
- Globalsat MR350 + BR305US SiRF STAR III 4800 baud

5.3. NMEA 2000 GPS system connection

Instead of USB GPS, NMEA 2000 GPS can be used for remote vehicle or boat tracking in the VRM portal. Third-party

A third-party NMEA 2000 GPS must meet the following requirements:

- The NMEA 2000 device class must be 60, Navigation.
- The NMEA 2000 device function must be 145, Own Position (GNSS).
- The position (latitude, longitude) must be transmitted in PGN 129025.
- Altitude, which is optional, must be transmitted in PGN 129029.
- Course and speed (both optional) must be transmitted in PGN 129026.

Most GPS NMEA 2000 devices are expected to work. Compatibility has been tested with:

- Garmin GPS 19X NMEA 2000

If you want to connect an NMEA 2000 network to the VE.Can port on a GX device that has both connectors of a different type, there are two solutions:

1. VE.Can to NMEA2000 cable. By inserting or removing a fuse, this cable allows you to either power the NMEA 2000 network with a Victron device or not. Please note the warning below.
2. 3802 VE.Can adapter from OSUKL. Its advantage is that it is well suited for connecting a single NMEA 2000 device, such as a tank transmitter, to the VE.Can network. It is also capable of powering the NMEA 2000 network with lower voltage directly from the Victron 48V system.

Note and solution for 24V and 48V systems

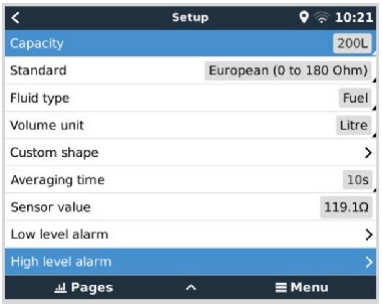
While all Victron components accept input voltages up to 70 V on CAN-bus connections, some NMEA 2000 devices do not accept this voltage. They require a NMEA 2000 connection with a 12 V power supply and sometimes operate with voltages up to 30 or 36 V. Be sure to check the data sheet for all NMEA 2000 devices used. If the system contains NMEA 2000 devices that require a mains voltage lower than the battery voltage, either look at the 3802 VE adapter mentioned above.Can from OSUKL, or alternatively install the VE.Can cable to NMEA 2000 without its fuse and ensure a suitable NMEA 2000 mains power supply, for example using an NMEA 2000 power adapter cable - not supplied by Victron. The VE.Can port on the GX device does not require an external power supply to operate.

5.4. Connecting a Fischer Panda generator

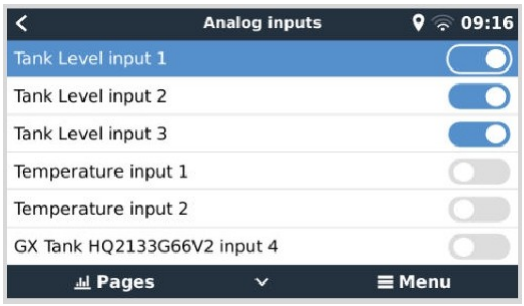
See GX generators - Fischer Panda.

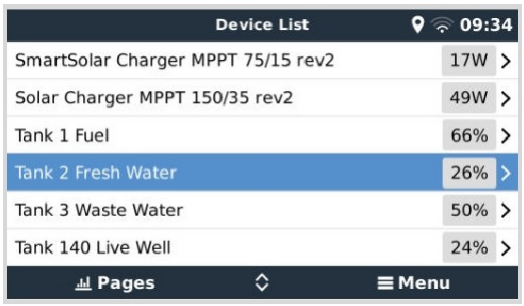
5.5. Connecting tank level sensors to the GX tank inputs

The tank level inputs are resistive and should be connected to a resistive tank level sensor. Victron does not supply tank level sensors. The built-in tank level sensor connections do not support mA or 0-5V sensors; this type will require additional accessories or replacement with a resistive sensor.

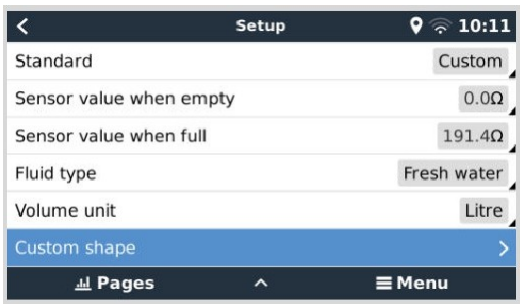


Sensors are enabled (and disabled) in the I/O menu (Settings → I/O → Analogue Input) in the GX device settings. Once enabled, the tank will appear in the device list with options to customise the settings for your specific installation.



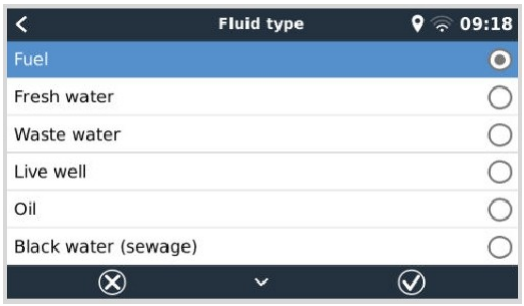


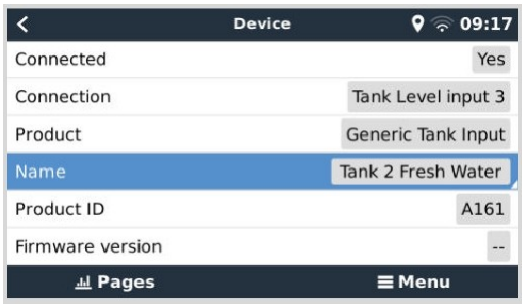
Set the tank volume unit (cubic metre, litre, imperial or US gallon) and capacity. It is also possible to configure custom shapes for non-linear tanks, with up to 10 variants, e.g. 50% of the sensor equals 25% of the volume and 75% of the sensor equals 90% of the volume.



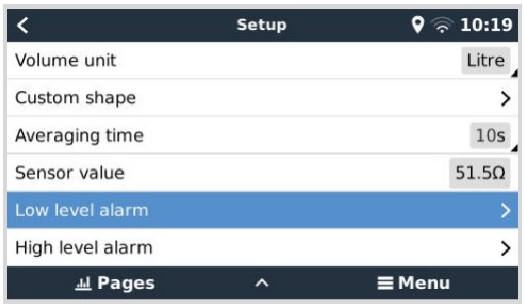
Each of the ports for measuring the level in the tank can be configured to work with European (0 - 180 Ohm) or American standards for tank transmitters (240 - 30 Ohm), or to configure a custom resistance range between 0 and 300 Ohm (requires firmware v2.80 or higher).

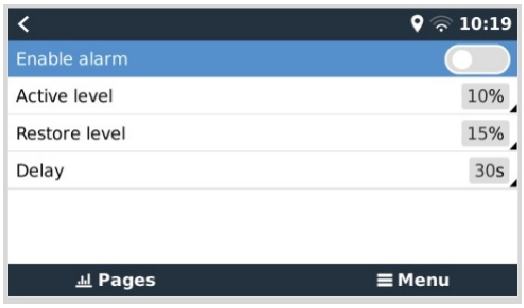
You can set the type of liquid in the tank to Fuel, Fresh Water, Waste Water, Live Well, Oil, Black Water (Waste Water), Petrol, Diesel, LPG, LNG, Hydraulic Oil, and Raw Water, and you can also set a custom name.





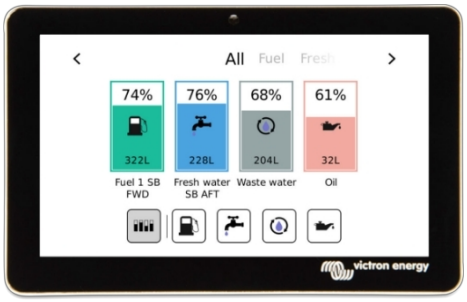
A separate low or high level alarm can be set and activated for each tank sensor.

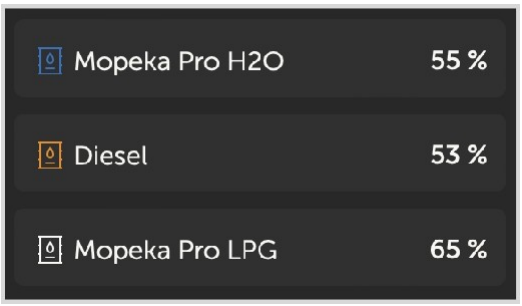




Tank level data is sent to the VRM portal, displayed on the overview display of the boat and motorhome (if connected and enabled), and can be used as a relay trigger if set to "Tank Pump". The tank level can also be monitored at various other locations in the GX environment:

- GX device list
- GX device sensor overview menu
- GX device graphical overview
- VRM dashboard
- VRM advanced menu widgets
- VRM application widgets





Physical connection of probes to the tank requires that a terminal or exposed copper end with a length of at least 10 mm+ be inserted into the removable terminal block connector. After proper connection, an orange tab must be used if you want to remove the secured wire.

5.6. Increasing the number of inputs to the tank using multiple GX devices

5.6.1. Introduction

The number of inputs for tanks on GX devices such as Cerbo GX and Venus GX can be expanded by connecting multiple GX devices to the VE.Can network. To do this, one GX device must be designated as the "master" and the others as "slaves". How this is done in practice is explained below.

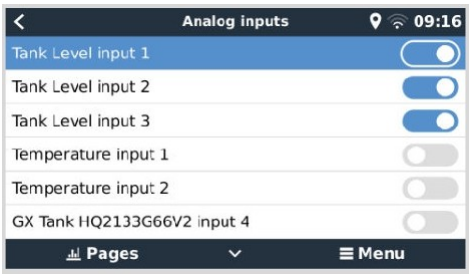
There is virtually no limit to the number of GX devices that can be connected, except for the number of source addresses available in the VE.Can network, which is 252 addresses.
For example, the Cerbo GX with 4 tank inputs uses up to 5 addresses: one for itself and one for each tank input.

5.6.2. Requirements

1. Enable MQTT settings (part of MFD application integration [80]) on only one GX device, not on multiple devices.
2. Connect only the main GX device to the Ethernet network – do not connect other devices. The MFD application in marine multifunction devices is not designed to work with multiple GX devices on a single Ethernet network.
3. If you are using the ModbusTCP protocol: Enable the ModbusTCP protocol on only one of the GX devices.
4. Only connect the main GX device to the VRM; it will also transmit the tank levels received from the secondary units.
5. We recommend connecting all VE.Bus and VE.Direct products to the main GX device. Connection via a secondary device works, but has its limitations. For example, remote configuration does not work, DVCC control does not work, and remote firmware updates do not work either. Extending VE.Direct ports via USB provides full functionality, which is therefore the recommended method. For more information, see the Cerbo GX Power Supply chapter [5].

5.6.3. Step-by-step configuration

1. First, configure all tank inputs on all GX devices in the Settings → I/O → Analogue Input menu, enable only the inputs you are using, and disable the others.



2. In the list of devices → Tank inlet → Device → Name, give each tank inlet its own unique name, i.e. Fresh Water 1, Grey Water SB, Diesel Port, etc.

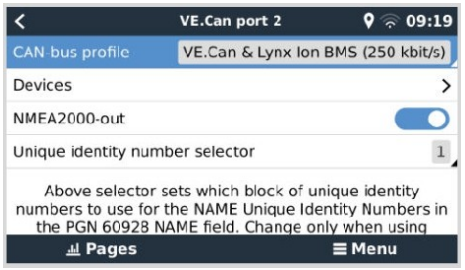
This is the only way to ensure that they are all distinguishable after connection.

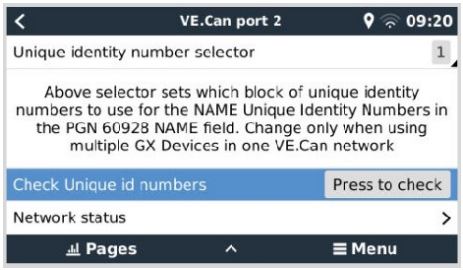
3. Connect each GX device to its VE.Can port and ensure that they are terminated at both ends.

The VE.Can network does not need to be powered externally: GX devices do not power the VE.Can network, but they do power their own internal CAN circuits.

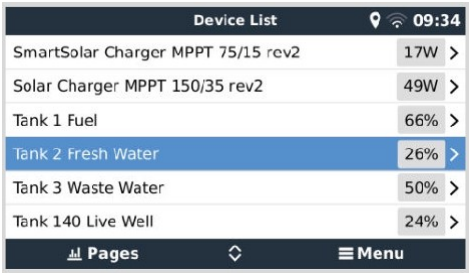
4. Now, on each GX device, go to Settings → Services → VE.Can and there:

1. Check that the VE.Can & Lynx Ion BMS (250 kbit/s) or VE.Can & CAN-bus BMS (250 kbit/s) profile is selected.
2. Enabling the NMEA2000-out function on all GX devices
3. Assign a unique number to each GX device
4. Use the Unique ID Check test function to ensure that everything has been done correctly.





5. Finally, check the GX main unit to ensure that all sensors are displayed in the device list and are functioning correctly.



5.7. Connecting third-party NMEA 2000 tank transmitters

A third-party NMEA 2000 tank transmitter must meet the following requirements to be visible on the GX device:

- NMEA 2000 PGN transmission Liquid level, 127505
- The NMEA 2000 device class must be either General (80) in combination with the Sensor function code (190) or Sensor (170). Alternatively, the NMEA 2000 device class must be Sensors (75) in combination with the Fluid Level (150) function.

Currently, there is no single function that reports multiple fluid levels.

For some tank transmitters, it is also possible to configure the capacity and type of liquid in the GX device menus - for example, Maretron TLA100. This function may also be available on other transmitters from other manufacturers - it is worth trying.

Tested compatible NMEA 2000 transmitters for tanks:

- Maretron TLA100
- Maretron TLM100
- Navico Fuel-0 PK liquid level sensor, part no. 000-11518-001. Please note that you will need a Navico display to configure the Capacity, Liquid Type and other sensor parameters. **See the voltage warning below.**
- Oceanic Systems (UK) Ltd (OSUKL) - 3271 Volume tank transmitter. If it does not work, the firmware needs to be updated. Contact OSUKL. **See the voltage warning below.**
- Oceanic Systems UK Ltd (OSUKL) - 3281 Water Level Sensor. **See voltage warning below**.

Others probably work as well. If you know of one that works well, please contact us at Community -> Modifications. If you want to connect

an NMEA 2000 network to the VE.Can port on a GX device that has both different types of connectors, there are two solutions:

1. VE.Can to NMEA2000 cable. By inserting or removing a fuse, it allows you to either power the NMEA 2000 network with a Victron device or not. Please note the warning below.
2. 3802 VE.Can adapter from OSUKL. Its advantage is that it is well suited for connecting a single NMEA 2000 device, such as a tank transmitter, to the VE.Can network. It is also capable of powering the NMEA 2000 network with lower voltage directly from the Victron 48V system.

Note and solution for 24V and 48V systems

While all Victron components accept input voltages up to 70 V on CAN-bus connections, some NMEA 2000 devices do not accept this voltage. They require a 12 V powered NMEA 2000 connection and sometimes operate up to 30 or 36 V. Be sure to check the data sheet for all NMEA 2000 devices used. If the system contains NMEA 2000 that requires a mains voltage lower than the battery voltage, then either see 3802 VE above.Can Adapter from OSUKL. Alternatively, install a VE.Can cable to NMEA2000 without a fuse and ensure a suitable NMEA 2000 mains power supply, for example using an NMEA 2000 power adapter cable, which is not supplied by Victron. The VE.Can port on the GX device does not require an external power supply to operate.

5.8. Mopeka Pro Check LPG and Water Bluetooth sensors

Support for Mopeka Pro Check-Water and Pro Check-Sensor LPG systems has been added to the VenusOS system. These ultrasonic sensors use BLE (Bluetooth Low Energy), a wireless technology that allows devices to be connected to a network within a range of approximately 10 metres, while consuming significantly less energy compared to conventional Bluetooth technology.

Mopeka Pro sensors are equipped with ultrasonic sensing for water tanks and LPG tanks in horizontal or vertical cylinders and are mounted on the bottom of these tanks using magnets. The liquid level, temperature and battery voltage of the sensor are transmitted wirelessly to the GX device.

In order to connect Mopeka Pro sensors to a GX device via Bluetooth, the GX device must have Bluetooth functionality. Some GX products already have built-in Bluetooth functionality, while all others can be easily retrofitted with a standard USB Bluetooth adapter (see overview of Victron GX products with built-in Bluetooth functionality).

However, an additional USB Bluetooth adapter, which is also designed for GX devices with a built-in Bluetooth interface, allows limited relocation of the Bluetooth radio (via a USB cable extension) to the vicinity of other supported Bluetooth devices that would otherwise be out of reach.

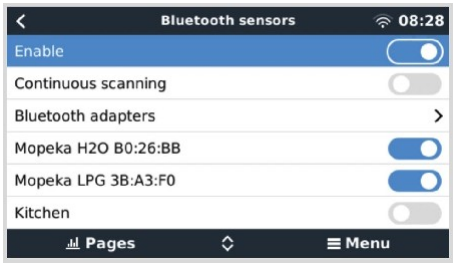
Note for Cerbo GX units with serial numbers up to and including HQ2207: The built-in Bluetooth connection is disabled if the internal processor temperature exceeds 53 °C (due to load and/or ambient temperature). **For reliable operation , a USB Bluetooth adapter must be used**. Devices manufactured later (HQ2208 and newer) do not require an additional USB Bluetooth adapter. Please note that this restriction does not apply to Cerbo-S GX devices.

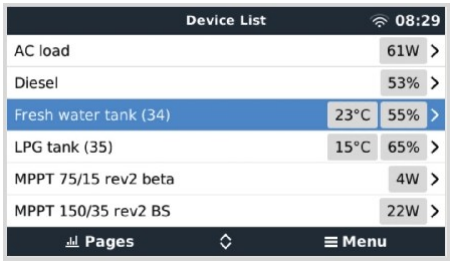
USB Bluetooth adapters that have been tested and work:

USB Bluetooth adapter				
Insignia (NS-PCY5BMA2)	Logilink BT0037	TP-Link UB400(UN)	Kinivo BTD-400	Ideapro USB Bluetooth 4.0 Adapter
Ewent EW1085R4	Laird BT820	Laird BT851	-	-

A list of other adapters that are also being tested, as well as adapters that have been tested and are known not to work, is available here: Victron Community.

5.8.1. Installation



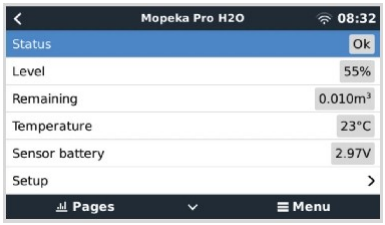


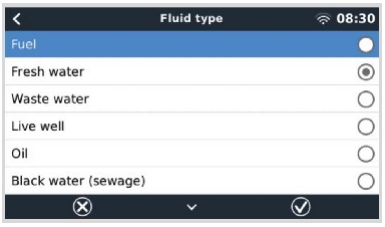
Installing the Mopeka Pro sensor is very simple. However, you must first install the sensor according to Mopeka's installation instructions and configure it using the Mopeka Tank app (available on Google Play and the Apple App Store). Then, installation and configuration are performed on the GX device as described below.

1. Ensure that Bluetooth is enabled in the Bluetooth Sensors menu (it is enabled by default).
2. Go to Settings → I/O → Bluetooth Sensors.
3. Slide the Enable slider to the right to enable Bluetooth sensors.
4. To find your Mopeka Pro sensor, scroll down until you see it.
5. To activate the sensor, slide the slider to the right. It should now appear in the device list.
6. For more than one sensor, repeat steps 1-5.

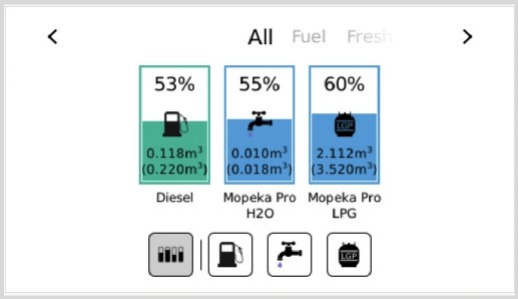
5.8.2. Configuration

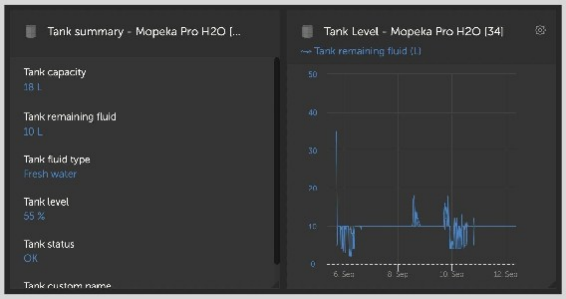
1. Go to the Device List menu.
2. Scroll up or down and select the appropriate sensor.
3. Press the right arrow key or space bar on the sensor to open the Sensor Settings menu.
4. Scroll down to Settings and press the right arrow key or space bar again to open the Sensor Settings menu.
5. In the Settings menu, you can change the tank capacity, select the fluid type and volume unit, set the calibration values for empty and full tanks, and read the current sensor value.
6. After making your settings, return to the Sensor Overview menu.
7. Scroll down, select Devices, and press the right arrow or space bar again to open the device settings menu.
8. In the Device menu, you can assign a custom name to the sensor and view some additional information about the device.
9. To set up additional sensors, repeat steps 1 through 8.





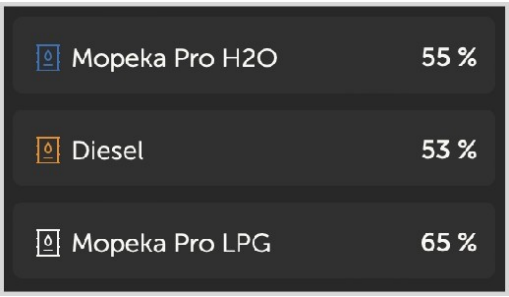
5.8.3. Monitoring the level in the tank





The tank level can be monitored in various places in the GX environment:

- GX device list
- GX device sensor overview menu
- GX device graphical overview
- VRM instrument panel
- VRM advanced menu widgets
- VRM application widgets



5.9. Wakespeed WS500 alternator regulator support

5.9.1. Introduction

The WS500 is an external smart alternator controller with CAN-bus and NMEA 2000 communication, which is particularly suitable for use in marine and recreational vehicles. The Wakespeed WS500 is supported by the Venus OS operating system and offers the ability to monitor alternator performance via GX devices.

5.9.2. Requirements

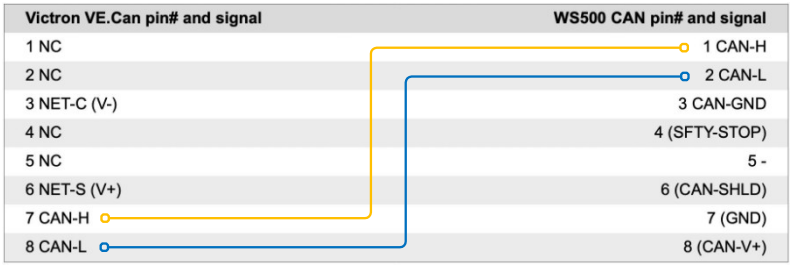
The necessary requirements for WS500 integration are:

1. VenusOS v2.90 or higher firmware installed on the GX device.
2. Wakespeed WS500 firmware 2.5.0 or higher installed on the WS500 control unit.
3. The WS500 must be connected to the VE.Can port of the GX device. When connected to the BMS-Can port of the Cerbo GX device, it is not possible to monitor the WS500.

5.9.3. Connecting the WS500 to VE.Can

Both the WS500 and VE.Can use RJ45 connectors for CAN ports.

However, they have different pinouts. This means that a standard network cable (straight UTP cable) cannot be used. A crossover cable is required. You must make this crossover cable yourself. The following diagram shows the pin layout of both devices.



The important pins to focus on are pin 7 and pin 8 for CAN-H and CAN-L on the VE.Can side and pin 1 and 2 for Can-H and CAN-L on the WS500 side.

Therefore, a cable is required where pins 1 and 2 on one side are connected to pins 7 and 8 on the other side. Pin 7 goes to pin 1 and pin 8 goes to pin 2.

The RJ45 connector with pins 7 and 8 on one end connects to the VE.Can port of the GX device. The other end of the cable with pins 1 and 2 connects to the WS500 control unit. Both ends must be terminated.

The colours of the cable do not matter for DIY cables. Wakespeed also offers a ready-made cable with a blue RJ45 connector on one end, which must be connected to the VE.Can port.

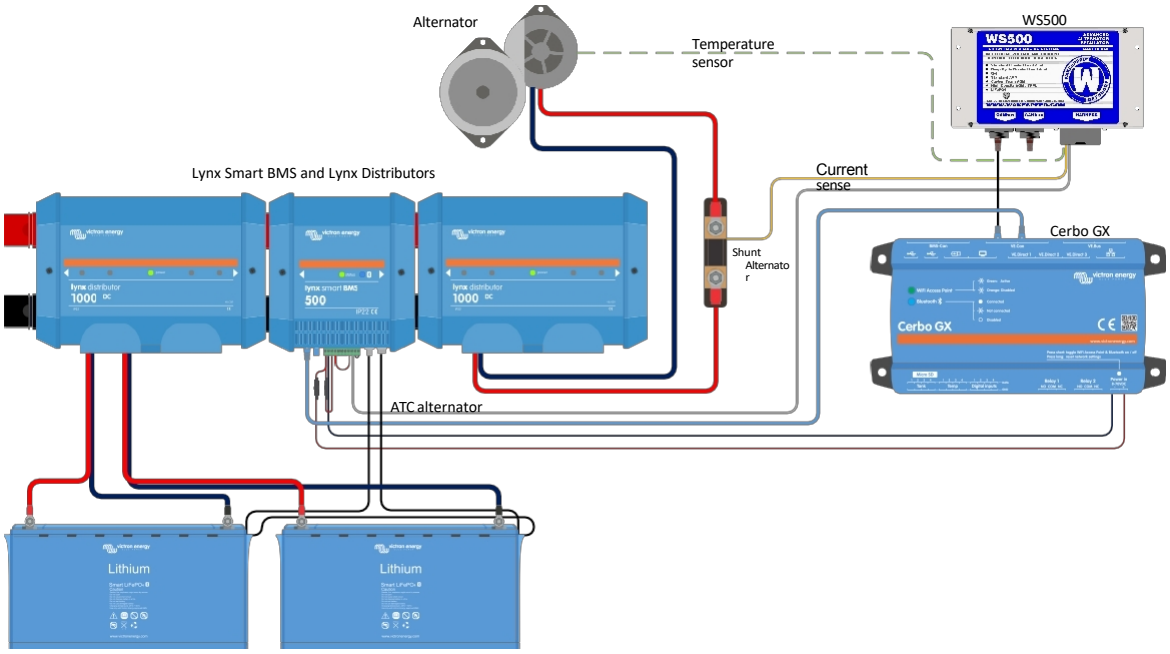
Please note that the black terminators supplied by Wakespeed and the blue terminators supplied by Victron are not interchangeable. Therefore: insert the Victron terminator on the Victron network side and insert the Wakespeed terminator on the Wakespeed network side.

5.9.4. Connection example

The example below shows an overview of the recommended wiring based on an installation with the Lynx Smart BMS system, Lynx switchboards and Cerbo GX.

The correct placement of the alternator shunt (not to be confused with the BMV or SmartShunt shunt) is important here for the correct connection of the current sensing wire.

Complete wiring between the WS500 and the alternator can be found in the WS500 and alternator manuals.



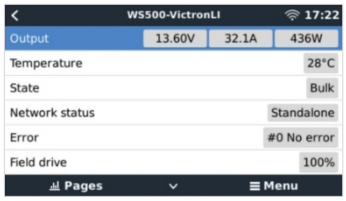
5.9.5. GX device user interface for WS500

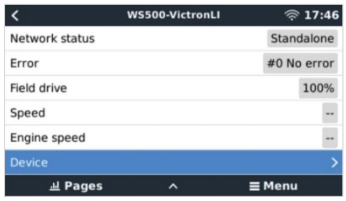
After connecting the WS500 to the GX device, the device list contains an item for the regulator. The WS500

menu then displays the following information and data:

- **Output**: voltage, current and power according to data from the alternator regulator.
- **Temperature**: alternator temperature measured by the WS500 temperature sensor.
- **Status**: WS500 charging status
  - Off when not charging
  - Bulk, Absorption or Float, if WS500 uses its own charging algorithm.
  - External control, if controlled by a BMS system such as Lynx Smart BMS.
- **Network status**:
  - Standalone, if the controller operates independently.
  - Group Master, when it supplies charging targets to another WS500 device.
  - Slave, when receiving charging instructions from another device, such as WS500 or BMS.
- **Error**: reflects any error state that the WS500 may be in. For details on all error codes and messages, refer to the Wakespeed Configuration and Communications manual. See also the appendix for error no. 91 and error no. 92.
- **Field drive**: report on the % of field drive that the WS500 sends to the alternator to connect the field.
- **Speed**: speed in revolutions per minute at which the alternator rotates. This value is reported by the stator slip and, if incorrect, can be adjusted by setting the Alt Poles option in the Wakespeed SCT configuration line.
- **Engine speed**: given in revolutions per minute. It is reported either by
  - a calculation based on alternator speed and the Eng/Alt drive ratio set in the SCT configuration line.
  - NMEA 2000, if the WS500 receives engine speed from PGN127488.
  - J1939, if WS500 receives engine speed from PGN61444

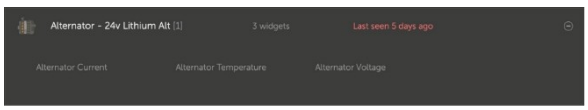
In the device menu, it is also possible to create a custom name for WS500. This will trigger an update of the $SCN configuration line of the WS500 controller.



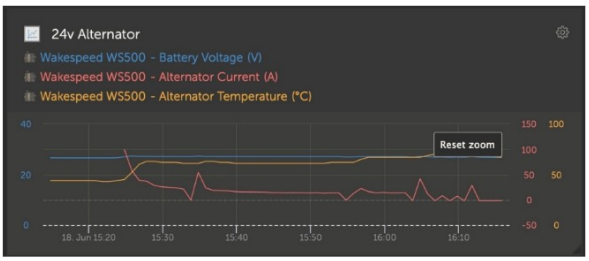


5.9.6. WS500 data on the VRM portal

The WS500 data that can be displayed on our VRM portal is current, voltage and temperature.



There are currently 3 widgets available in VRM



Custom VRM widget displaying WS500 voltage, current and temperature

5.9.7. Troubleshooting and frequently asked questions

For further assistance and troubleshooting, please contact Wakespeed support directly.

Error codes #91 and #92

The Venus operating system will report all errors that can be generated by the WS500, as defined in the Wakespeed Communications and Configuration manual. In systems with integrated BMS, the following errors are critical while the events are active and require special attention.

- **#91: Loss of connection to BMS**

  The WS500 has lost communication with the BMS system and will enter the configured Get Home mode. Once communication with the BMS system is restored, it will return to following the charging targets set by the BMS system.

- **#92: ATC disabled via IN function**

  The BMS system signalled a charging disconnection event via a wire function, and the WS500 therefore returned to the Off state.

The WS500 device menu does not display current and power data.

This is not a problem and is simply related to how the system is installed and intended to work.

- Alternator shunt is not installed[1]
- The alternator shunt is installed but not configured correctly. Check the ShuntAtBat setting and the Ignore Sensor setting using the Wakespeed configuration tools.

[1] An alternator shunt is a shunt that can be installed in series with the alternator and allows the alternator output current and power to be read. Its sensing wiring connects directly to the WS500. This is an optional feature that is for display purposes only. If the shunt is not installed, the GX will display other alternator data such as % field, output voltage, etc., but not the alternator output current and power.

FREQUENTLY ASKED QUESTIONS

Question 1: Is the alternator output current (if actually measured) used for anything other than display purposes?

A1: For now, it is only used for display purposes. Perhaps in the future, DVCC will be integrated, where the GX device will control the amount of current that the WS500 should generate, and the GX device will then distribute the required charging current between the WS500 and, for example, the MPPT.

Question 2: What is the battery output current used for, and can it be read via the CAN bus using the Lynx Smart BMS system, other battery monitors, or even GX devices?

A2: Yes, the current can be read via the CAN bus and Lynx Smart BMS.

In this case, the WS500 shunt can be configured for the alternator to report the amount of current the alternator is producing. The Lynx Smart BMS uses the WS500 to ensure that no more current flows into the battery than the battery needs. So if the battery requires 100 A and the WS500 reports 200 A on the alternator, 100 A will be used to support the load. This offers a significantly improved calculation for DC loads.

Question 3: If the system includes the Lynx BMS smart system, are there any recommendations for wiring?

A3: Yes. We have created extensive system examples that show complete connections and have been supplemented with important additional information. For example, a catamaran system with two WS500s or a system equipped with an additional alternator controlled by one WS500. You can use these examples as a basis for your own system.

You can download these system examples from the Lynx Smart BMS product page.

Question 4: If the system does not include the Lynx BMS smart system, how do you recommend connecting it?

A4: Wakespeed provides a brief user guide showing how to configure the controller using DIP switches and an overview of all cable connections on the cable harness included with the unit.

The WS500 product manual contains additional wiring diagrams that show in detail how the cable harness is connected. Note that

the shunt should be connected to the battery and the WS500 configured with the shunt on the battery.

5.10. Ruuvi Bluetooth wireless temperature sensors

The Ruuvi sensor contains temperature, humidity and atmospheric pressure data, which is transmitted wirelessly to the GX device via Bluetooth.

In order to connect Ruuvi sensors to the GX via Bluetooth, the GX must have Bluetooth functionality. Some GX products already have Bluetooth built-in, while all others can be easily retrofitted with a standard USB Bluetooth adapter (see overview of Victron GX products with built-in Bluetooth).

However, an additional USB Bluetooth adapter, even for GX devices with built-in Bluetooth, allows limited relocation of the Bluetooth radio (using a USB extension cable) to the vicinity of other supported Bluetooth devices that would otherwise be out of reach.

Note for Cerbo GX units with serial numbers up to and including HQ2207: The built-in Bluetooth connection is disabled if the internal processor temperature exceeds 53 °C (due to load and/or ambient temperature). **For reliable operation**
A USB Bluetooth adapter is required. Devices manufactured later (HQ2208 and newer) do not require an additional USB Bluetooth adapter. Please note that this restriction does not apply to Cerbo-S GX devices.

External USB Bluetooth adapters that have been tested and are known to work:

USB Bluetooth adapter				
Insignia (NS-PCY5BMA2)	Logilink BT0037	TP-Link UB400(UN)	Kinivo BTD-400	Ideapro USB Bluetooth 4.0 Adapter
Ewent EW1085R4	Laird BT820	Laird BT851	-	-

A list of other adapters that are also being tested, as well as adapters that have been tested and are known not to work, is available in this community thread.

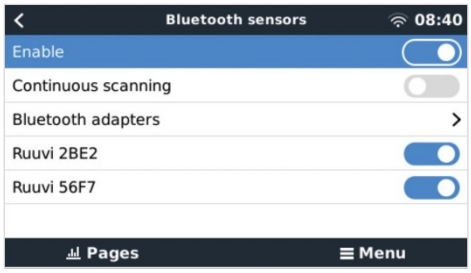
Installation procedure

Ensure that Bluetooth is enabled in the Bluetooth menu (it is enabled by default).

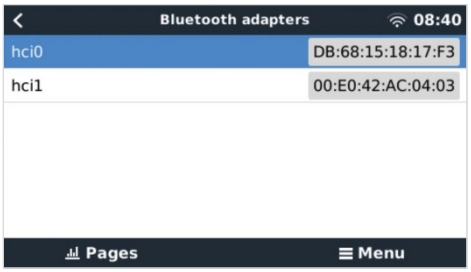
Go to Settings → I/O → Bluetooth Sensors and click Enable to enable Bluetooth temperature sensors.

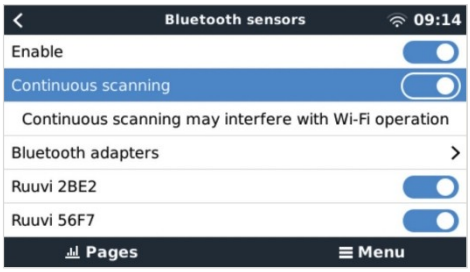
Ruuvi sensors come with a removable plastic tab. This prevents them from discharging when stored on a shelf. Pull out the plastic tab and the unit will start transmitting temperature information.

The sensor should appear in the "Ruuvi ####" menu - with 4 hexadecimal device IDs, enable the specific Ruuvi sensor.

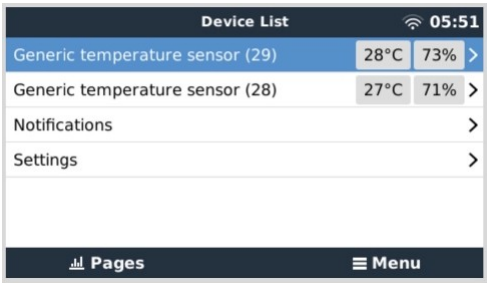


The Bluetooth Adapters submenu displays a list of available Bluetooth adapters. The Continuous Scan option continuously searches for new Bluetooth sensors. Please note that this option affects the WiFi performance of GX devices. Only enable this option if you need to search for new Bluetooth sensors. Otherwise, leave this option disabled.





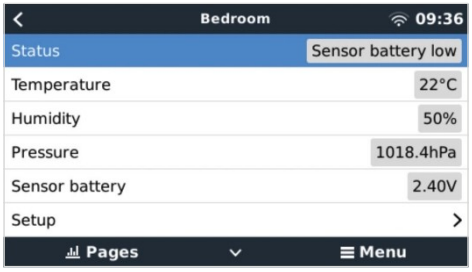
If you have multiple sensors, you can physically write this device ID on the sensor case itself for easy reference. The sensor should now be visible in the main menu - by default, it is labelled "Generic temperature



sensor (##)".

In the temperature sensor menu, you can set the type and also your own name.

Ruuvi sensors last for an estimated 12 months on a single replaceable 3V Li coin cell battery CR2477. The internal battery voltage and battery status are displayed in the menu of the respective sensor. Status "Ok" = battery voltage ≤2.50V. Status "Sensor battery is low" = battery voltage ≥2.50 V.



The Ruuvi device firmware can be updated using a separate Ruuvi phone app, but this is not necessary unless you are experiencing problems.

5.11. Connection of IMT solar radiation, temperature and wind speed sensors

Ingenieurbüro Mencke & Tegtmeyer GmbH (IMT) offers a range of Si-RS485 series digital silicon irradiance sensors that are compatible with Victron GX devices.

Compatibility

Optional/additional external temperature, ambient temperature and wind speed modules are also supported.

Optional/additional external sensors are either connected to the solar sensor using pre-installed connectors or are pre-wired to the solar sensor (external module and ambient temperature only). If external sensors are connected via
All measured data is transferred to the Victron GX device via a single interface cable.

Each solar sensor model in the Si-RS485 series has different options for connecting external sensors (or comes with a pre-connected external sensor), so carefully consider any future wishes/requirements before making your first purchase.

It is also possible to connect an independent IMT Tm-RS485-MB module temperature sensor (visible as "cell temperature") or an IMT Ta-ext-RS485-MB ambient temperature sensor (visible as "outside temperature") directly without a solar sensor or as an addition to it.

Operation

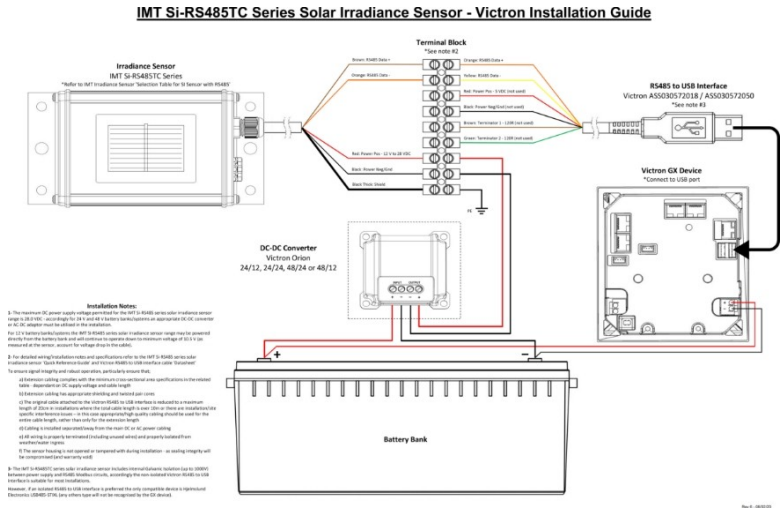
The IMT Si-RS485 series solar radiation sensors operate with an RS485 electrical interface and Modbus RTU communication protocol.

The Victron GX device must have version 2.40 or later.

The IMT sensor must have firmware version 1.52 or higher – for more information about this requirement, please contact IMT. The physical connection to the Victron GX device is made via the USB port and requires a Victron RS485 to USB interface cable. A suitable external DC power supply (12 to 28 VDC) is also required - the sensor is NOT powered via USB.

Cabling connection

The diagram below in the installation manual shows the wiring configuration in a typical installation.



Wiring connections

Si sensor	Victron RS485 to USB interface	Signal
Brown	Orange	RS485 Data A +
Orange	Yellow	RS485 Data B -
Red	-	Power supply - 12 to 28 VDC
Black		Power supply Neg/Gnd - 0 VDC
Black (thick)	-	Grounding / cable shielding / PE

-	Red	Power Pos - 5VDC (not used)

Si sensor	Victron RS485 to USB interface	Signal
-	Black	Power supply Neg/Gnd - 0VDC (not used)
	Brown	Terminator 1 - 120R (not used)
	Green	Terminator 2 - 120R (not used)

Installation notes

The maximum permissible DC supply voltage for IMT Si-RS485 series solar sensors is 28.0 V DC - for 24V and 48V battery banks/systems, a suitable Victron DC-DC converter (24/12, 24/24, 48/12 or 48/24) or an AC-DC adapter must be used in the installation.

For 12V battery banks/systems, the IMT Si-RS485 series of solar sensors can be powered directly from the battery bank and will operate down to a minimum voltage of 10.5V (measured at the sensor, taking into account the voltage drop across the cable).

Detailed connection/installation instructions and specifications can be found in the "Quick Reference Guide" for the IMT Si-RS485 series solar sensor and in the "Data Sheet" for the Victron RS485 to USB cable.

To ensure signal integrity and robust operation, pay particular attention to the following:

- Extension cabling meets the minimum cross-section specifications in the relevant table - depending on the DC supply voltage and cable length.
- The extension cabling has suitable shielding and twisted pair wiring.
- The original cable connected to the Victron RS485 to USB interface is shortened to a maximum length of 20 cm in installations where the total cable length exceeds 10 m or where there are interference issues specific to the installation/location.location - in such cases, suitable/high-quality cabling should be used for the entire length of the cable, not just for the extension length.
- The cabling is installed separately from the main DC or AC power cabling.
- All electrical installations are properly terminated (including unused wires) and properly insulated against weather/water ingress.
- During installation, the sensor cover is not opened or tampered with - this would compromise the integrity of the seal (and void the warranty).

The IMT Si-RS485TC series solar sensor includes internal galvanic isolation (up to 1000 V) between the power supply and the RS485 Modbus circuits, making Victron's unisolated RS485 to USB interface suitable for most installations.

However, if you prefer an isolated RS485 to USB interface, the only compatible device is the Hjelmslund Electronics USB485-STIXL (the GX device will not recognise any other type).

Multiple sensors

Multiple IMT Si-RS485 series solar sensors can be connected to a single Victron GX device, but a separate Victron RS485 to USB interface is required for each unit.

Multiple units cannot be combined on a single interface (as this is not supported by the Venus OS software).

Configuration

Usually, no special/additional configuration is required – the default configuration "as delivered" is compatible for communication with the Victron GX device.

However, in cases where the IMT Si-RS485 series solar sensor has previously been used in another system and/or its settings have been changed for any reason, it is necessary to restore the default configuration before further use.

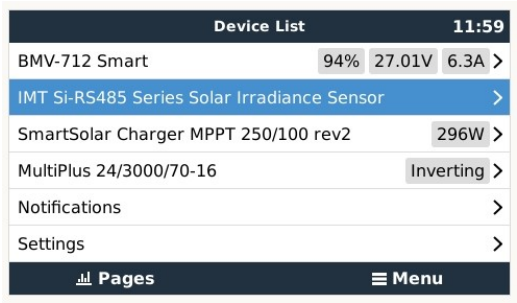
To change the configuration, download the IMT "Si-MODBUS-Configuration" software tool. Follow the instructions in the IMT "Si Modbus Configurator" documentation and check/update the following settings:

- MODBUS address: 1
- Baud rate: 9600
- Data format: 8N1 (10 bits)

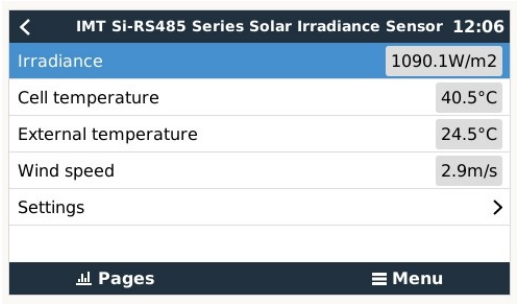
For further support regarding the configuration of IMT Si-RS485 series radiation sensors, please contact IMT Solar directly.

User interface - GX device

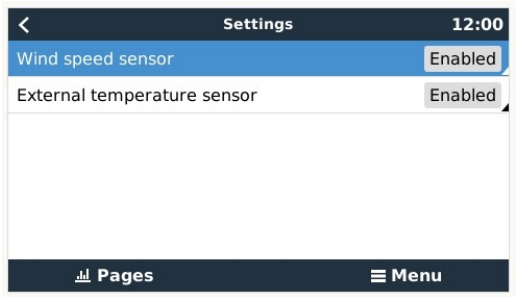
After connecting to the Victron GX device and switching on the power supply, the IMT Si-RS485 series radiation sensor will be automatically detected within a few minutes and will appear in the "Device List" menu.

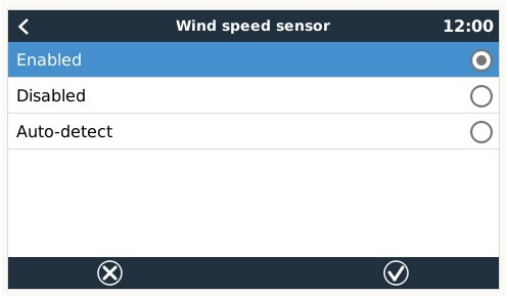


The "IMT Si-RS485 Series Solar Radiation Sensor" menu automatically displays all available parameters (depending on the connected sensors) and updates them in real time.



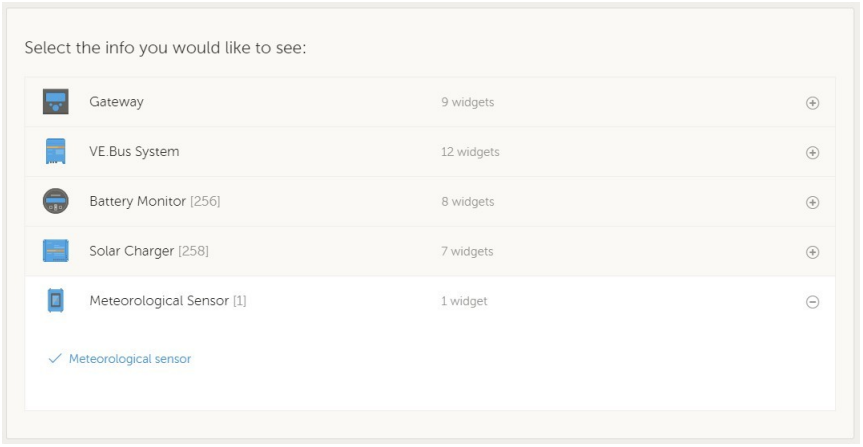
In the "Settings" submenu, you can manually enable and disable all optional/additional external sensors connected to the IMT Si-RS485 series radiation sensor.



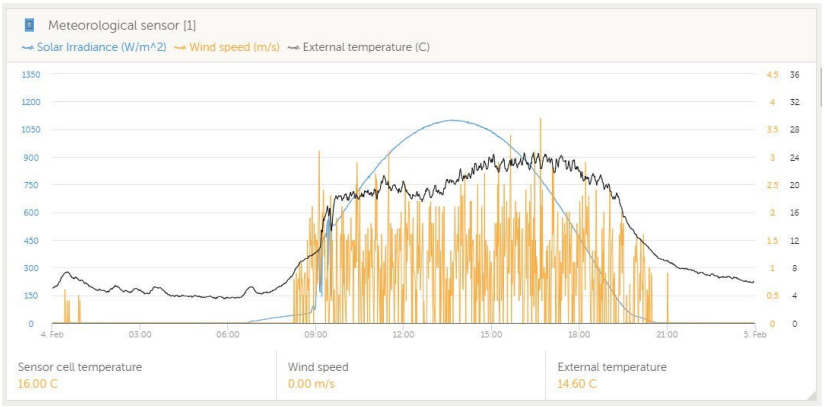


5.11.1. Data visualisation - VRM

To view recorded historical data on the VRM portal, expand the "Weather Sensor" widget list and select the "Weather Sensor" widget.



Data from all available sensor types is automatically displayed in a graph. Individual sensors/parameters can also be turned off/on by clicking on the sensor name/legend.



6. Connecting to the internet

Connect Cerbo GX to the internet and enjoy all the benefits of the VRM portal. Cerbo GX sends data from all connected products to the VRM portal, where you can monitor energy consumption, view the current status of connected products, configure email alerts, and download data in CSV and Excel formats.

To monitor this data from your smartphone or tablet, download the VRM app for iOS or Android.

In addition to remote monitoring, an active internet connection allows Cerbo GX devices to regularly check for new firmware versions, which are automatically downloaded and installed (depending on the settings).

There are several ways to connect the Cerbo GX device to the internet:

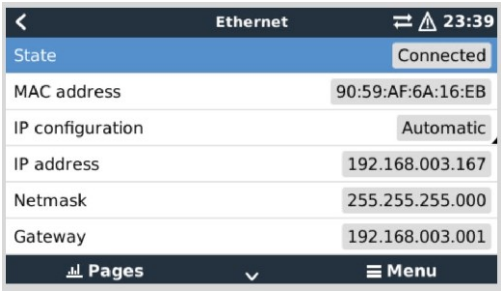
- A network cable between the router and the Cerbo GX device's Ethernet LAN port.
- Wireless connection to a router via WiFi
- Via a mobile (cellular) network using a GX LTE 4G mobile USB modem or a 3G or 4G router.
- USB tethering via a mobile phone

This video explains how to connect to a LAN, WiFi and GX GSM network (also applies to GX LTE 4G):

6.1. Ethernet LAN port

After connecting the Ethernet cable between the router and the Cerbo GX device, confirm the connection on the Settings → Ethernet page of the Cerbo GX device.

Before connecting the Ethernet cable, be very careful not to confuse the Ethernet port of the GX device with the VE.Bus or VE.Can/BMS-Can ports!



6.2. WiFi

The Cerbo GX has built-in Wi-Fi. Wi-Fi can be used to connect to secure WEP, WPA and WPA2 networks. It is also possible to connect a supported external USB Wi-Fi dongle (for example, to increase the range of the wireless network outside the cabinet).

There are several supported USB WiFi keys. Two of them are also available from Victron Energy:

- Part no. BPP900100200 - CCGX WiFi module simple (Nano USB), small, inexpensive.
- Part no. BPP900200300 - Asus USB-N14, slightly higher price and also better reception than Nano USB. Supported from software version 2.23.
- Partno. BPP900200400 - Long-range WiFi module (Netgear AC1200) - higher price and also better reception than Nano USB. Wireless AC, Wireless G and Wireless N connectivity; 2.4 GHz and 5 GHz.

WiFi modules that are no longer available but are still supported are:

- Part no. BPP900200100 - Startech USB300WN2X2D
- Part no. BPP900100100 - Zyxel NWD2105
- Part no. BPP900200200 - Gembird WNP-UA-002, slightly higher price and also better reception.
- Part no. BPP900200400 - Netgear A6210-100PES.

Although other WiFi keys may work, they have not been tested and we do not offer support for other keys.

The WiFi menu displays available networks. After selecting a network, you can enter the password (if not already known) and connect to the network. WPS (WiFi Protected Setup) configuration is not supported.

If Cerbo GX finds multiple WiFi networks whose passwords are known, it will automatically select the strongest network. If the signal of the connected network is too weak, it will automatically switch to a stronger network – provided it knows the password for that network.

6.3. GX LTE 4G

See the GX LTE 4G manual

6.4. Mobile (cellular) network using a 3G or 4G router

To connect the Cerbo GX device to a mobile (cellular) network, such as a 3G or 4G network, use a mobile router. Connect the Cerbo GX device to this router either via a LAN cable or via the router's WiFi network.

Ensure that you are using a router that is designed for unattended setup. Do not use cheap consumer-grade routers designed for business or leisure travel. A more expensive professional router will quickly pay for itself, and you will not have to make unnecessary trips just to reconfigure it. Examples of such professional routers include the H685 4G LTE from Proroute and the range of industrial 4G routers from Pepwave.

For more information, see this post.

Please note that Cerbo GX does not support USB 3G/4G dongles, except for the GX GSM and GX LTE 4G accessories available from Victron.

6.5. Connection via USB using a mobile phone

When it works, it's a useful feature, but don't rely on it, as it hasn't proven to be very reliable. You can find tethering instructions for your phone and its specific operating system on the internet. We've heard that it works on:

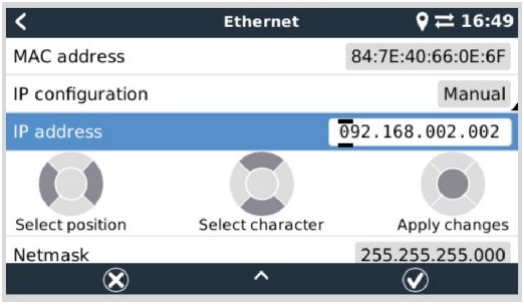
- Samsung Galaxy S4

...but not on:

- iPhone 5s with iOS 8.1.1

6.6. Manual IP configuration

In almost no installation is it necessary to enter the IP address configuration manually, as most systems support automatic IP configuration (DHCP) - and this is also the default setting for Cerbo GX. If you need to configure the address manually, select the following template:



For complete information on IP requirements and port numbers used, see the VRM FAQ - Ports and Connections Used [120] Cerbo GX.

6.7. Ethernet and WiFi connection (failover)

The Cerbo GX device can be connected to both Ethernet and WiFi. In this case, Cerbo GX will attempt to determine which interface provides an active Internet connection and then use that interface. If both Internet connections are active, the Ethernet connection will be used. If there are any changes to the interfaces, Cerbo GX will automatically recheck the active Internet connection.

6.8. Minimising Internet traffic

In situations where Internet traffic is expensive, such as with satellite connections or GSM or mobile phone roaming charges, you can minimise Internet traffic. The steps to take are as follows:

- Disable automatic firmware updates [57]
- Do not enable remote support [121]
- Reduce the recording interval (Settings → VRM Online Portal → Recording Interval) to a very low frequency. Note that status changes (charging → inversion or bulk → floating) and alarms will cause additional messages to be sent.

To find out how much data allowance you need, it is best to let the system run for a few days and monitor it.
Internet RX and TX counters in your 3G or 4G router. Or better yet, some mobile companies report data usage via their websites.

The amount of data used is also highly dependent on the system:

More products connected to the Cerbo GX device will generate more data.

- A change in status (for example, from inverter to charger) triggers data transfer, so a system with very frequent status changes will also tend to generate more data. This is particularly true for some Hub-1 and Hub-2 systems.

We recommend setting up a data plan to avoid costly charges for excess data. Make sure you set an upper limit on data usage or use a prepaid plan.

One customer, who was burdened with global costs of twenty cents to several euros per MB of data, came up with a clever solution: Using a VPN, he modified the IP address so that all traffic to and from the GX device was routed through his VPN network. Using a firewall on the VPN server allows him to control traffic based on time, connection type, location, and destination. Although this is beyond the scope of this guide, it works, and with the help of a Linux and networking expert, it can work for you too.

6.9. More information about setting up your internet connection and VRM

- Setting up a VRM account
- Alarms and monitoring of the VRM portal
- VRM Portal - Frequently Asked Questions

7. Accessing the GX device

The GX device can be accessed via a smartphone, tablet or computer. This access is called a remote console. The remote console is the central element for performing or changing the settings of the GX device.

On GX devices with a display, this Remote Console feature may be disabled by default and must be enabled.
GX devices without a display have the Remote Console feature enabled by default. Access can be gained in

several ways:

Access type	GX Colour Management	Venus GX	Cerbo GX / Cerbo-S GX	Ekrano GX
VictronConnect via Bluetooth[4]	- [1]	- [1]	Yes	Yes
Built-in WiFi access point WiFi access point [40]	- [2]	Yes	Yes	Yes
Local network LAN/WiFi [41]	Yes	Yes	Yes	Yes
VRM portal [3]	Yes	Yes	Yes	Yes

[1] Neither CCGX nor VGX have built-in Bluetooth. This feature can be easily added by connecting a USB Bluetooth dongle.

[2] CCGX does not have built-in WiFi. This feature can be easily added by connecting a USB WiFi dongle.

[3] Requires a GX device connected to the internet.

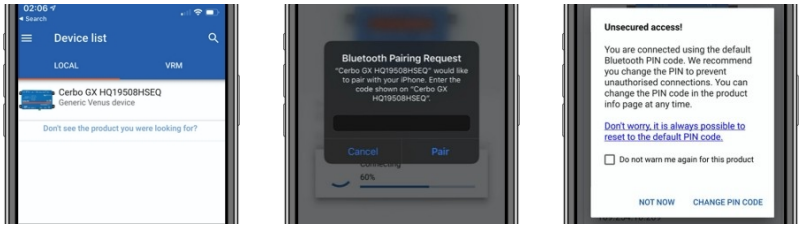
[4] The Bluetooth functionality of the GX is limited to assisting with initial connection and network configuration. Bluetooth cannot be used to connect to a remote console or other Victron products (e.g. SmartSolar charge controllers). For more information on connecting other Victron products, see Connecting Victron products [9].

7.1. Using VictronConnect via Bluetooth

If you are new to VictronConnect, you can get started with the VictronConnect manual.

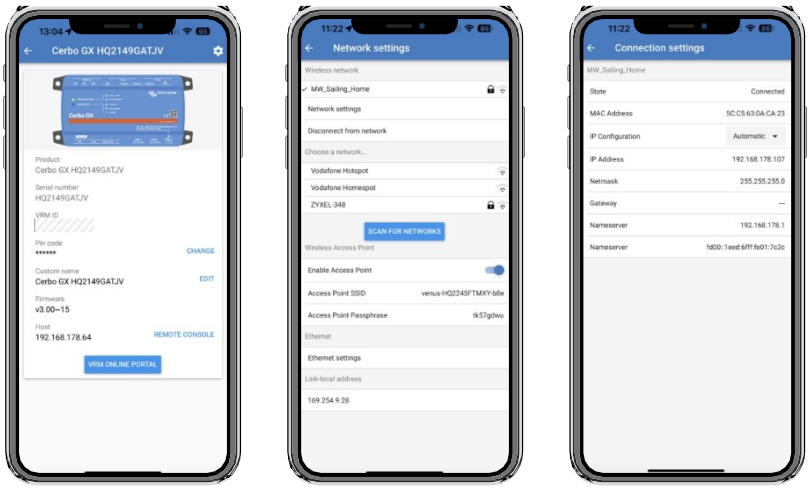
1. Download the latest version of the VictronConnect app to a Bluetooth-compatible device (phone or laptop) and ensure that Bluetooth is enabled.
2. Check that the Cerbo GX is switched on and that the Bluetooth indicator light is flashing.
3. Open the VictronConnect app within 10 metres of the Cerbo GX device and wait for nearby devices to be found.
4. Once found, click or tap on Cerbo GX.
5. When connecting for the first time, you will be prompted to enter the Bluetooth PIN code.

   For GX devices with a serial number lower than HQ2242, the default PIN code is 000000. GX devices with a serial number equal to or higher than HQ2242 have a random six-digit PIN code printed on the label (on the back of the GX device).
6. For GX devices that use the default PIN code, you will be prompted to change this insecure default PIN code to a more secure unique code. Set your unique code and then store it in a secure password location in case you forget it.



From the device's main screen, you can change network and Ethernet settings, enable or disable the built-in WiFi access point, view the system in VRM, or open the remote console (requires a WiFi connection to your local network or the GX device's access point).

To configure network settings, tap the gear icon or tap it.



Bluetooth can only be used for initial connection and network configuration and cannot be connected to other Victron products, such as SmartSolar charge controllers. If you need to connect other Victron products, please refer to the chapter Connecting Victron products [9].

7.2. Access via the built-in WiFi access point

This method requires the VictronConnect app to be installed on your smartphone, tablet or laptop.

Steps for automatic connection using a QR code:

1. Locate the sticker with the QR code on the side of the Cerbo GX device.
2. Scan the QR code using your phone's camera or a QR code scanning app.
3. If your phone supports it, you will be prompted to connect to the WiFi access point.
4. Once connected, open the VictronConnect app.
5. Select the GX device from the list
6. Open the remote console

Steps for manual connection:

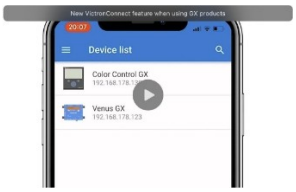
1. Stand as close as possible to the Cerbo GX device, no more than a few metres away.
2. Go to the Wi-Fi settings on your phone, tablet or laptop.
3. After searching, Cerbo GX will appear in the list as Venus-HQ1940DEFR4-3b6. Where HQ... is the serial number printed on the side of the box.
4. Connect to WiFi using the "WiFi key" printed on the side of the box ...and also on the card in the plastic bag. Keep this in a safe place.
5. Open the VictronConnect app, which will automatically start scanning the WiFi network.
6. Once found, select GX from the list of devices.
7. Opening the remote console

Notes:

- If you cannot use VictronConnect, you can use a web browser and go to the IP address http://172.24.24.1 or http:// venus.local.
- For added security, you can disable the WiFi access point. See Settings → Wi-Fi → Create access point in the remote console.

Instructional video

Watch the video for step-by-step instructions on how to connect to your GX device using the VictronConnect app:



7.3. Accessing the remote console via a local LAN/WiFi network

This section explains how to connect to the remote console when Cerbo GX is connected to the local computer network via an Ethernet cable or when it is configured to connect to the local WiFi network.

This method does not require an internet connection. A local computer network is sufficient.

Once connected, connect to the GX device by launching the VictronConnect app on your phone, tablet or laptop. Note that it must be connected to the same computer network as the Cerbo GX device.

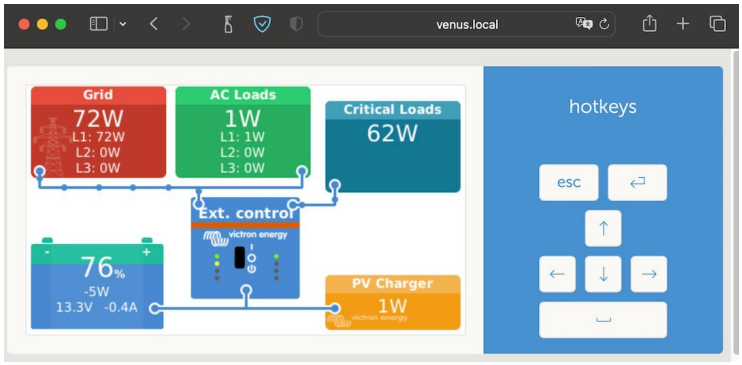
This video shows you how to do this.

7.3.1. Alternative ways to find the IP address for the remote console

If VictronConnect cannot be used, here are some other methods to find Cerbo GX, i.e. its IP address.

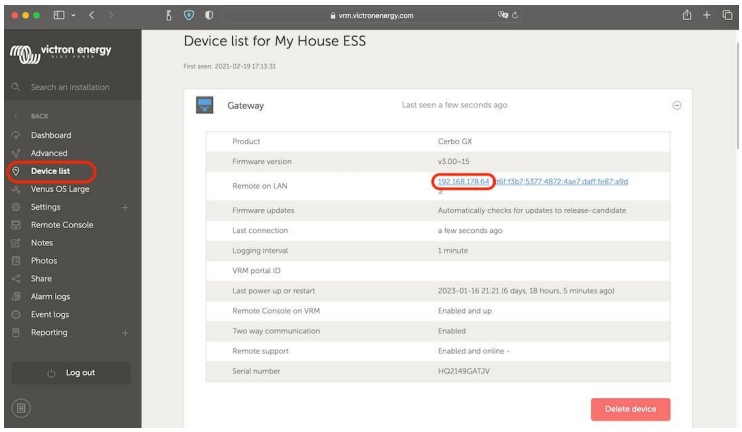
Local address link - Venus.local

If the Remote Console on LAN setting is enabled, a direct connection is possible (via a network cable without a router or DHCP server). You can access the GX device by entering venus.local or http://venus.local in your web browser or in the VictronConnect app when connected to the same network. Only enable this feature on trusted networks or when connected directly. Ensure that you have disabled password checking or set a password first.



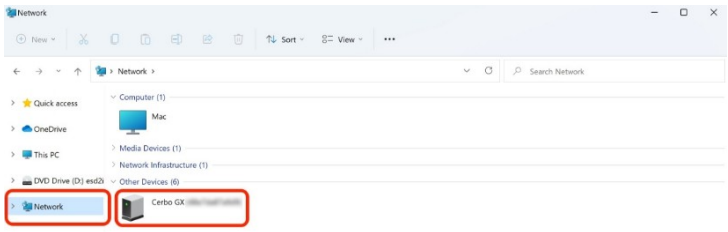
IP address on VRM

On the VRM portal, you can find the IP address on the Device List page in the installation. Note that this requires the Cerbo GX device to be connected to the internet.

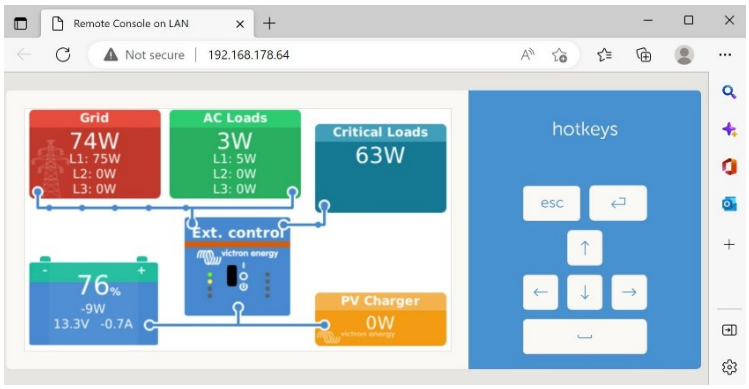


Network (in Microsoft Windows)

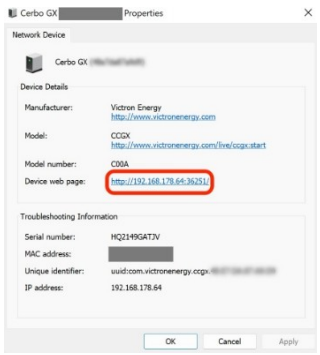
On a local network, such as at home, you can also find Cerbo GX in the Windows "Network" overview (using UPnP (Universal Plug-and-Play) technology):



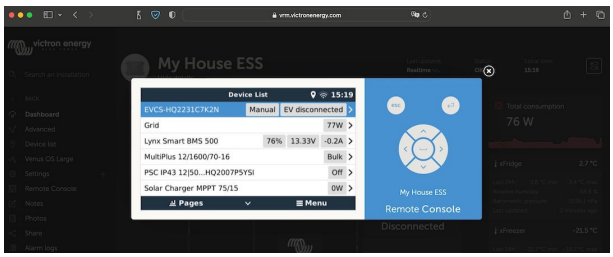
Double-clicking on the icon opens the Remote Console in the LAN.



Right-click on the icon to open the "Properties" window and display the IP address.



7.4. Access via VRM



This method requires a working Internet connection on both your phone, tablet or laptop and the Cerbo GX device. For a new installation, this means that it must be connected via an Ethernet cable.

Step-by-step instructions:

1. First, connect the Cerbo GX device to the internet by connecting it to a working Ethernet network that has a DHCP server (like most networks) and is connected to the internet.

   The Cerbo GX will immediately connect to VRM.

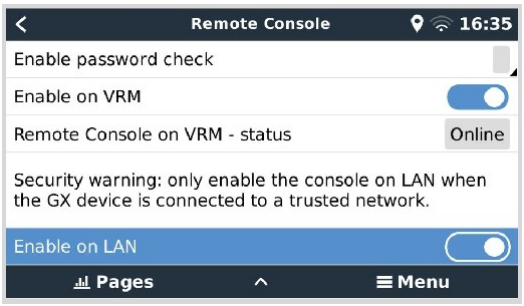
2. Now go to the VRM portal, https://vrm.victronenergy.com/, and follow the instructions to add the device.

3. Then, once it appears in VRM, click on the Remote Console link in the left-hand menu.

   The result will look similar to the image above.

For more technical information, see the related troubleshooting chapter: Remote Console on VRM - Troubleshooting [78].

7.5. Remote Console Menu



The Remote Console menu (Settings → Remote Console) contains options for controlling access to the remote console via LAN/WiFi and VRM, and displays the online status of the remote console in VRM.

Detailed information about the options:

1. **Disable password check:**

   If this option is disabled, no password is checked when accessing the remote console.

2. **Enable password check:**

   To enable password verification, you must first assign a password. Use this password when accessing the remote console. Keep it in a safe place.

3. **Enable on VRM:**

   If this feature is enabled, the remote console can be used via the VRM portal from anywhere in the world. If password verification is enabled (recommended), this also applies.

4. **Remote console on VRM - status:**

   Displays the online status of the remote console in the VRM module.

5. **Enable on LAN:**

   When this feature is enabled, the remote console can be used via the local LAN/WiFi network. Please note the security warning.

Please note that after changing any of these settings, the GX device must be restarted manually (Settings → General → Restart).

8. Configuration

8.1. Offer structure and configurable parameters

After completing the installation and setting up the Internet connection (if required), go through the menu from top to bottom and configure Cerbo GX:

Item	Default	Description
General		
Access Level	User and Installer	Set this value to "User" to prevent accidental and unwanted configuration changes. The installer has additional permissions and, when changed from the default, it requires a password. The password is available from your dealer.
Remote Support	No	No / Yes - Enable this feature to allow Victron technicians to access your system in case of a problem.
Restart?		Restarts the GX device
Audible alarm	Yes	If an alarm appears on the Cerbo GX device or on a connected product, the Cerbo GX device will beep – unless this setting is set to 'Off'.
Demo mode	Barrier-free	Demonstrates the features of the product and installation to a client or at an exhibition. This simulation mode allows for a better understanding without (yet) changing the settings. Note that this will add simulated devices to the VRM installation. Samples are available for ESS, boat, and motorhome.

Firmware - Read the full description of the function [57]

Firmware version	x.	xxDisplays the currently installed firmware version.
Build date/time		xxxDisplays the build number.

Please note that for most system applications, we recommend keeping automatic updates disabled, which is also the factory default setting.

Instead, update the system at a convenient time when people are on site and ready to revert to the previous system and/or troubleshoot any issues if problems arise.

Online updates: the server	If this option is enabled, the GX device will check the whether a new version is available. It is possible to set it to disable, or set to automatically update
Online updates: participate in test versions	Use the default setting if you do not wish to . End-user systems should definitely be set to "Latest". release".
Online updates: Large image adds the	ImageNormalChoice between normal and large image. the typeNode-RED and Signal K-Server functions to the image.
Online update: Check a new firmware update.	Press to check Click or press the space bar to check for available.
Installing firmware from an SD card/USB	Use this menu to install a new version from a microSD card or USB flash drive. Insert the card or memory card containing the new firmware file .swu file is stored.
Saved firmware backup	This function allows you to revert to a previously installed firmware version.

Date and time

UTC date/time	Automatically from and nternet	
Local date/time	Automatically from	When connected to the Internet, the time is automatically synchronised via the Internet regardless of this setting.
	Switch this setting to	manually enter the time if an internet connection is not available.

Time zone Select the correct local time zone.

Remote Console - Read the full description of the function [38]

Disable password check Password authentication is not required to access the remote console.

Item	Default	Description
Enable	password check	Select a password to enable access to the remote console.
Enable on VRM		No/Yes - Enabling on VRM will allow you to connect to Cerbo GX from anywhere via the VRM portal. See also Troubleshooting VRM Remote Console Issues [78].
Remote console on VRM - Status		-Displays the connection status of the VRM remote console feature: Off, Online, Offline, Disabled.
Enable on LAN		No / Yes - Enabling this will allow direct connection to Cerbo GX by entering its IP address or Venus.local in a web browser or in the VictronConnect app, if it is connected to the same network. Only enable this feature on trusted networks. Disable password verification or set a password first.
System settings		
System name		Automatic System name selection - preset or user-defined
AC Input 1		Generator Select Not Available, Generator, Mains or Shore Power. Note: Further configuration is required to fully set up these options.
AC Input 2		Grid Same options as above.
Grid failure monitoring	Off	Monitors the loss of AC input and triggers an alarm if detected. The alarm is cancelled when the AC input is reconnected.
Battery monitor		AutomaticSelect the SoC source. This feature is useful when there is more than one BMV. Options: Automatic, No battery monitor battery and available battery monitor sources. For more details, see Battery State of Charge (SoC) [51].
Has a direct current system		OffEnable this feature for boats, vehicles, and equipment with DC loads and chargers - except for Multi and MPPT chargers. This will not apply to most off-grid installations; and any discrepancies may become apparent. The DC current measured by the Multi and BMV will be assigned to a "DC system". This could be, for example, the current supply from the alternator or the current draw from the pump. A positive value indicates consumption. A negative value indicates charging, for example by an alternator. Note that the value shown is always approximate and is affected by differences in sampling frequency between individual system components.
Measurement screen	batteryNot	setIn this menu, you can define which battery measurements should be displayed on the VRM portal and MFD HTML5 application.
System status	On/Off	The following parameters are only diagnostic indicators. See Detailed information in the System Status Menu [53] VE.Bus SoC bus synchronisation with battery Use of solar charger current to improve VE.Bus SoC Solar charger voltage control Solar charger current control BMS control
DVCC - Read the full description of the function [65]		
DVCC		DisabledEnabling the DVCC function changes the GX device from a passive monitor to an active controller. The default setting is No. If no compatible battery controlled by the BMS-Can system is connected, the setting is set and locked according to the manufacturer's specifications.
Charging current limitation		DisabledUser-configurable maximum charging current setting for the entire system in amperes.
Controlled battery charging voltage limitation		SVS - Shared Voltage Sense

Prohibited: Only use this option	for 15s Pylontech batteries during the first balancing. Use for other purposes may have undesirable
Off	

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Item	Default	Description
STS - Shared temperature meaning	Off	The GX device sends the measured battery temperature to the device. of the inverter/charger and all connected solar chargers.
Temperature sensor	Automatic	Select the temperature sensor to be used for shared temperature sensory measurement.
SCS - Shared current Purpose	No	Transmission of the battery current measured by the battery monitor. Connected to the GX device, to all connected solar chargers.
BMS system control	Automatic	Select the BMS system that controls the battery.
SCS status	-	Describes whether the SCS system is enabled or why it is disabled.
Display and language		
Adaptive brightness	Yes	Use the ambient light sensor to adjust the screen brightness (only on devices available after connecting the GX Touch device)
Brightness		Brightness settings range from 0 to 100%
Display of switch-off time	-	Set the time until shutdown within the range of 10s / 30s - 1m / 10m / 30m - or never
Demonstration boat & motorhome Overview	Wheelchair accessible	Enabling this option will display a page with an overview of mobile equipment that is designed in such a way. for marine applications and applications for remotely controlled vehicles. This overview provides direct access to the AC current limiter and the *on/off/ charger* settings and pump control. It also displays up to four levels in the tank.
Language	English	You can choose between English, Dutch, Chinese, German and Spanish, French, Italian, Swedish, Turkish, Czech, Danish, Polish, Russian and Arabic.
Units	°C	Celsius and Fahrenheit options are available. Please note note that this setting does not affect the temperature unit in VRM. portal.
VRM Online Portal - Read the full feature description [73]		
Logging enabled	Enabled	Enable or disable logging
VRM portal ID	-	Use this value when registering GX devices with VRM. Portal
minutes	Logging interval15	Set the value between 1 minute and 1 day. Select longer times in systems with unreliable connections. Note that this setting does not affect problem and status change reports (bulk → absorption) to the VRM portal. These events initiate immediate transfer of all parameters.
Use of a secure connection (HTTPS)	Yes	This encrypts communication between the GX device and the server. VRM server
Last contact	-	Time since last contact with the VRM server
Error	connectionNo error	Displayed if there was an error in VRM communication. See here for more details on resolving VRM errors. [75]
Two-way VRM communication	Disabled	Enable for VRM: Remote VEConfigure and VRM: Remote Firmware update
Restart device when not Contact	Disabled	The GX device resets itself to attempt to correct a potential error. Network issue if the internet connection is lost for the the set delay period. period
No contact reset delay (hh:mm)	01:00	How long the unit must be offline before it restarts itself.
storage	Storage location Internal	Shows whether an external storage device (e.g. USB drive or microSD card) is connected. is connected) or internal storage is being used.
Free disk space	-	The number of bytes available on the storage device

microSD/USB	-	Choose whether to safely eject the external microSD or USB memory (if available). is connected) before physically removing it. Failure to do so may cause data loss.
Stored recordings	-	How many recordings are stored locally when there is no internet connection available? The GX device will store as many recordings as it can locally and then upload them when the internet is available again.

Item	Default	Description
Oldest age recorded	-	If no internet/VRM is available, the oldest record stored in the GX device will be displayed.
ESS - An Energy Storage System (ESS) is a specific type of energy system that integrates a connection to the electrical grid with a Victron inverter/charger, GX device and battery system. Read the full description of the function.		
Mode	Optimised (with BatteryLife), BatteryLife)	Optimised (with BatteryLife) and Optimised (without Keep batteries charged, External control
Grid measurement -		Leave the default setting unless an external Victron grid meter is installed.
AC output used		of the inverter. Setting this value to "No" will hide the AC
output graph in the overview pane		. Multi-phase control - Use the
phase compensation setting		in systems with three-phase regulation. Phase connection to the power grid.
Minimum SOC (if not supply load from failure)		grid) 10% Configurable minimum SoC limit. ESS will grid once SoC drops to the configured value - except when there is a power grid failure and the system is in inverter mode.
Active SOC	limit10%Using	this setting, you can view the current SoC BatteryLife level.
Status	BatteryLifeSelf-ConsumptionSelf-consumption	, Discharge Off, Slow Charge, Maintain, Recharging
Charging power limitation direct current for the battery.		OffThis setting limits the flow of energy from AC to charging from the AC-in input.
Inverter power limitation consumed by the Multi device.		OffLimit the power consumed by the Multi device: i.e. limit the power converted from direct current to alternating current.
Mains setting when		50W This sets the point at which power is drawn from the mains the installation is in self-consumption mode.
	Mains power supply - settings	and grid power supply restrictions: Limit supply to grid: Surplus photovoltaic power supply with alternating voltage, Surplus photovoltaic power supply with direct voltage, Limit supply to the grid.
Scheduled charge levels	InactiveAllows you to set up to	five scheduled periods during which the system draws energy from the grid and charges the battery.
Energy consumption meters - Read the full description of the function		
Role	Grid meter	Grid meter, photovoltaic inverter, generator, AC meter
Phase type	Single-phase	Multi-phase or single-phase
Photovoltaic inverters -	re description	
Read the full description	-	Displays connected AC photovoltaic inverters
Inverters:		
Inv: Position	AC input 1	AC input 1, AC input 2, AC output
Inv: Phase	L1	
Inv: Display	Yes	
Search for photovoltaic inverters	-	Searching for available photovoltaic inverters
Detected IP addresses	-	Displays the IP addresses of the photovoltaic inverters found.
Manually adding an IP address	-	If the converter has a manually assigned IP address, you can add it directly here.
Automatic scanning	Enabled	This setting will continue to search for photovoltaic inverters, which may be useful if you are using an IP address assigned via DHCP, which may change.

Wireless AC sensors

Select the location for each AC sensor (PV inverter on AC input 1, 2 or on AC output). More information about wireless AC sensors.

Modbus TCP devices

Automatic scanning	Enabled	Automatic Modbus TCP device search
Device search	-	Manual Modbus TCP device scan
Devices	-	Displays a list of found Modbus TCP devices and their IP addresses.

Ethernet - read the full description of the function [34]

Status	Unplugged	The status is either disconnected, connected, or connected.
MAC address	-	

Item	Default	Description
IP Configuration	AutomaticOptions	: Automatic (DHCP) and manual IP address assignment
IP address	-	
Network mask	-	
Gateway	-	
DNS server	-	
Link-local IP address	-	
WiFi - Read the full feature description [35]		
Access point creation	EnabledDisables the internal WiFi access point	
WiFi networks to view.		-Displays a list of available Wi-Fi networks and/or the network you want to which the GX device is connected
Name		-SSID of the WiFi network
Status	Connected	
Forget network		-Press to "forget" the network if you want to connect to another network. Network or troubleshooting
Signal strength	%	
MAC address	-	
IP configuration	AutomaticOptions	: Automatic (DHCP) and manual IP address assignment IP
address	-	
Network mask	-	
Gateway	-	
DNS server	-	
GSM modem - Read the full description of the Bluetooth function		
Bluetooth		
Enabled	Yes	
Pincode	0000	
GPS - Read the full description of the function [15]		
GPS information , number of points.	-Status	, latitude, longitude, speed, course, altitude Satellites
Device		-Displays information related to diagnostic equipment
Format minutes	DDD.	DDDDD°C Choice between decimal degrees, degrees and decimal or display degrees, minutes and seconds
Speed unit		km/hChoice between km/h, metres per second, miles per hour or knots.
Generator start/stop - Read the full description of function [109]		
Status		StoppedShows whether the generator is running or not.
	Error	errorDisplayed if an error has occurred (e.g. the generator should be running, but no AC input is detected)
Total operating time	hh:	mmTotal time the generator has been running since reset.
Time until next test counter in days	hh:	mmIf periodic operation is programmed, this is displayed and hours until it occurs.
Automatic start function configured		DisabledEnable or disable the automatic start function, which can be further configured in the Generator → Settings → Conditions menu
Manual start		-Start generator, Start at hh:mm
Daily operating time in operation.		-The submenu displays the history of the time the generator has been Runtime (in minutes) each day for the previous 30 days.
Start/stop generator → Settings		

Generator start/stop → Settings → Conditions		
When communication is lost	communicationStop generatorStop	, Start, Keep generator running

Item	Default	Description
Do not start the generator when AC1 is in operation.		NoThis option is ideal for backup systems where mains electricity is connected to the AC-in 1 terminal and the generator is connected to the AC-in 2 terminal. If this option is enabled, the genset will only start after a mains failure.
	Battery SOC No Use	Battery SOC value for start/stop -
		No / Yes Start when SOC is lower than - %.
		Start value in idle hours - % (to cancel programmed idle hours if absolutely necessary)
		Stop when the battery SOC value is higher than - %.
		Shutdown value during off-peak hours - % (allows for shorter operating time during off-peak hours once the system is restored)
		Do not use start/stop value - No / Yes Start when value is higher
Battery current		than - Amps / Volts / Watts Start value during quiet hours - Amps
Battery voltage		/ Volts / Watts (to
AC output		cancel programmed quiet hours if absolutely necessary).
		Start when condition is reached for - seconds (to allow momentary spikes to pass without starting).
		Stop when value is lower than - Amps / Volts / Watts
		Stop value during quiet hours - Amps / Volts / Watts (allows for shorter run time during quiet hours once the system recovers)
		Stop after reaching the condition for - seconds (to allow for short-term drops without stopping the running generator).
		Do not start when warning value is - No / Yes
High inverter temperature		Start when the alert has been active for - seconds (to allow momentary spikes to occur without triggering).
Inverter overload		When the alert is cancelled, stop after - seconds (to allow for short-term drops without stopping the running generator).
Generator start/stop → Settings → Conditions → Periodic operation		
Regular operation	No	Enable - No / Yes
		Run interval
		Skip run if it has been running for
		Start date of run interval Start time
		Run duration (hh:mm)
		Run until the battery is fully charged
Start/stop generator → Settings		
Minimum running time	Minimum number of minutes that the generator will run each time it is started, even after stopping.	
Generator detection at AC input	No	/ Yes - the alarm will sound when the inverter input no power is detected no power from the generator is detected at the inverter input. Ensure that the correct AC input for the generator is set on the system settings page.
Silent	hours0 Quiet	hours prevent the generator from starting under normal conditions. For some settings, it is possible to enter overriding values for quiet hours (for example, starting an extremely low battery voltage that prevents the system from shutting down).
Resetting daily operating time counters		Option to reset the generator operating time counters, for example, if they are used for servicing or if the generator is replaced or fundamentally repaired.
Total generator operating time (in hours)		Total time the generator has been in operation since the counter was reset.

Pump in tank - Configuration of automatic pump start and stop based on tank level information (transmitter). Automatic pump start/stop using Color Control GX

Pump status	Cerbo-ZGoXbrMazaunjeu,ázl da whether the pump is in operation or not.

Item	Default	Description
Mode	Auto	The options Auto, On and Off are available. This is manual control to start and stop the level after connecting the tank sensor.
Tank sensor	Automatic	Select the tank sensor used to start the pump tank. 'No If no tank sensor is connected, "Sensor detected". Detected,
Initial level	50%	Tank level trigger point for starting the pump in the tank (closing of the relay button).
Stop level	80%	Tank level start point for stopping the pump in the tank (opening of the relay button).
Relay		
Function	Alarm relay	Select the relay function. Possible functions are "Alarm relay", "Generator start/stop", "Tank pump", "Temperature" and "Manual".
Polarity	Normally open	Select the polarity of the relay on the rear of the Cerbo GX device. "Normally open" or "Normally closed". Note that setting the value to Normally closed increases the power consumption of the Cerbo GX. This option is only available if it is configured as an alarm relay.
Services		
ModbusTCP	Off	This setting enables the ModbusTCP service. For more information about ModbusTCP in this document and in the communication https://www.victronenergy.com/upload/ white paper documents/Whitepaper-Data-communication-with-Victron-Energy-products_EN.pdf
MQTT on LAN (SSL)	At	Enables MQTT on the LAN - More information about MQTT is available. on the Victron Community website.
MQTT in a LAN (plain text)	Off	This setting must be enabled when connecting a Marine vessel. MFD
VE.Can port	VE.Can	CAN bus profile (Disabled, VE.Can & Lynx Ion BMS 250 kbit/s, VE.Can & Can-bus BMS 250 kbit/s, CAN-bus BMS 500 kbit/s, Oceanvolt 250 kbit/s, RV-C 250 kbit/s). Other options: Device, NMEA2000-out, Unique identification number selection, Check unique identification numbers, network status
Port BMS-Can	-	CAN-bus BMS (500 kbit/s) or disabled and network status
CAN bus		CAN bus profile, sending data to VE.Can, unique device number for VE.Can, Unique number check
I/O		
Analogue inputs	At address	Available tank level sensors On/Off, Available Temperature Sensors on/off
Digital inputs	Off	Available digital inputs Off, door alarm, bilge pump, below deck alarm, burglar alarm, smoke alarm, fire alarm, CO2 alarm, Generator
Bluetooth sensors	Barrier-free	Enable scanning of supported Bluetooth sensors (Ruuvi and Mopeka Pro). Other options: Enable or disable found Bluetooth and find out which Bluetooth adapters are currently available. Connected

8.2. State of charge (SoC)

8.2.1. What device should I use to calculate SoC?

There are three types of products that calculate state of charge (SoC). Cerbo GX does not calculate SoC itself, it only obtains it from connected devices. The three products that calculate SoC are:

1. Battery monitors such as BMV, SmartShunt, Lynx Shunt VE.Can, Lynx Smart BMS or Lynx Ion BMS.
2. Multi and Quattro inverters/chargers
3. Batteries with a built-in battery monitor and connection (usually BMS-Can) to Cerbo GX.

When to use what?

If you have a battery with a built-in battery monitor, such as a BYD or Freedomwon battery, it's easy: just use it. If not, then the options depend on the type of system:

1. If the MultiPlus or Quattro inverter/charger is the only source of battery charging and the only load, then it can function as a basic battery monitor, as it calculates what goes into the batteries and what comes out of them. There is no need for a special battery monitor such as a BMV.
2. If the systems consist of an inverter/charger, MPPT and GX device, there is no need to add a special battery monitor.
3. For other types of systems, such as boats or motorhomes with DC lights and other DC loads, a special battery monitor will be required.

8.2.2. Detailed explanation of various solutions

1. **Battery and Multi or Quattro (typical backup system)**

   No battery monitor is required: Multi or Quattro is the only product connected to the battery and has full control over all charging and discharging currents. Therefore, it can calculate the correct SoC value itself.

   Configuration:

   1. Enable and configure the battery monitor in the VEConfigure tool.

   2. In the Cerbo GX, under Settings → System Settings, verify the selected battery monitor. It should be set to Multi or Quattro.

2. **Batteries with Multi or Quattro solar chargers and MPPT or EasySolar with built-in GX device.**

   If all MPPT solar chargers are Victron products and are connected to Cerbo GX, no battery monitor is required. Cerbo GX will continuously monitor the current charging current from all solar chargers and send the total sum to the Multi (or Quattro) device, which will then use this information in its SoC calculations.

   Configuration:

   1. Enable and configure the battery monitor in the VEConfigure tool.

   2. In the Cerbo GX, under Settings → System Settings, verify the selected battery monitor. It should be Multi or Quattro.

   3. In the System status menu, check that the Use solar charger current to improve VE.Bus SOC option is set to On. Please note that this is not a setting – it is merely an indicator of an automatic process.

   Note that this feature requires the latest firmware version on both Multis or Quattro units (minimum 402) and Cerbo GX units (minimum v2.06).

3. **Batteries with built-in battery monitors**

   In cases where the system includes a battery that has a built-in battery monitor and SoC calculation – as is the case with many of the batteries listed here – a special battery monitor is not necessary.

   Configuration:

   1. Connect the battery communication cable to the Cerbo GX device according to the instructions.

   2. In the Cerbo GX, under Settings → System Settings, verify that the battery monitor is selected.

   Note that the battery monitor setting in VEConfigure is irrelevant. For systems such as this, changing this setting will have no effect on charging or any other parameters of this type of system.

4. **Other system types**

   If more chargers or loads than just Multi or MPPT solar chargers are connected to the battery, a special battery monitor is required. Examples are:

- Household loads in a marine or vehicle system.
- PWM solar chargers
- AC chargers, such as Skylla-is, Phoenix Smart IP43 chargers, chargers other than Victron, etc.
- Alternators
- DC-DC chargers
- Wind turbines
- Water turbines

If a battery with a built-in monitor is used, as explained in point (3), this is a dedicated battery monitor. See section (3). Otherwise, install a BMV, SmartShunt or Lynx Shunt VE.Can.

Configuration:

1. Configure the battery monitor according to its documentation.
2. In the Cerbo GX device, under Settings → System Settings, verify the selected battery monitor.
3. It should be a BMV, SmartShunt, Lynx Smart BMS, or Lynx Shunt battery monitor.
4. Done.

> Note that the battery monitor settings in VEConfigure are irrelevant. For systems such as this, changing these settings will have no effect on charging or any other parameters of this type of system.

8.2.3. Notes on SoC

- Note that this is more about displaying the exact charge status to the user than a requirement for an efficient system. The SoC percentage is not used for charging the battery. However, it is required when the generator needs to be started and stopped automatically based on the battery's SoC.

Further information:

VRM portal FAQs - difference between BMV SOC and VE.Bus SOC

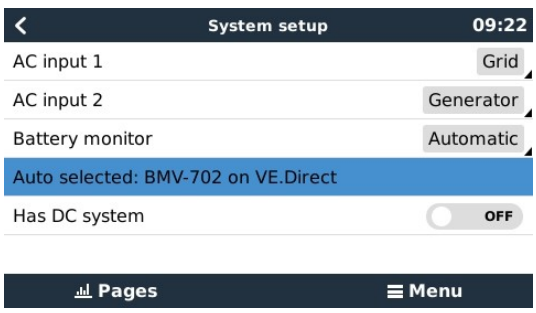
See the Configurable Parameters section [44] on selecting a battery monitor and Has DC system.

8.2.4. Selecting the SoC source

(Settings → System settings → Battery monitor)

In the image above, you can see a number of options for SoC values that are displayed on the main Overview screen. Select the source you want to display on the main Overview screen of the Cerbo GX device.

In the same image, we have selected the Automatic setting. After selecting Automatic, the System Settings screen will appear, as shown in the image below.



The "Automatic" function uses the following logic:

1. If available, it will use a dedicated battery monitor, such as BMV, SmartShunt, Lynx Smart BMS, or Lynx Shunt VE.Can, or a battery with a built-in battery monitor.
2. If more than one is connected, a randomly selected one will be used – however, you can select it manually.
3. If no special battery monitor is available, the VE.Bus SoC will be used.

When should I use the "No battery monitor" option?

Use it in systems where:

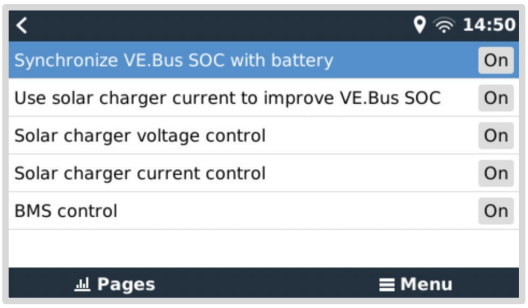
1. a Multi or Quattro system is installed
2. no BMV or other battery monitor is installed
3. the system has other DC loads or other chargers connected to the same battery that are not connected to the Cerbo GX.

Brief explanation: In the situation described, the SoC bus VE.Bus determined by the Multi or Quattro device is incorrect because it does not take into account the discharge and charge currents of these additional DC loads and also unmonitored chargers.

8.2.5. Details about VE.Bus SOC

- When the inverter/charger is in bulk charging mode, the SoC will not increase above the value set in the VEConfigure settings for "State of Charge". when bulk operation is complete" on the General tab; default value 85%. In a system with solar chargers, make sure that the absorption voltage configured in the MPPT is slightly higher than the same setting in the inverter/charger. The inverter/charger must recognise that the battery voltage has reached the absorption level. If this does not happen, the SoC will get stuck at the previously mentioned End-of-bulk percentage, default value is 85%.

8.2.6. System Status Menu



The System Status menu (Settings → System Settings → System Status) contains diagnostic indicators that can be useful in diagnosing system problems. Note that nothing can be configured here. The indicator on/off depends on how the system is set up and what devices it contains.

Their detailed meanings are as follows:

1. **VE.Bus SoC synchronisation with the battery:**
   - When enabled, this means that the activated battery monitor in the Multi/Quattro device synchronises its SoC with better sources (BMV or BMS in the system). The system does this automatically.
2. **Using solar charger current to improve VE.Bus SoC:**
   - In a VE.Bus system without an additional battery monitor (no BMS, no SmartShunt, no controlled battery), but with solar chargers, the solar charging current is taken into account and helps to improve the SoC calculation of the Multi/Quattro's internal battery monitor. The system does this automatically and signals that it is active by displaying "on".
3. **Solar charger voltage control:**
   - If enabled, it means that the solar chargers are not controlled by their own internal charging algorithm. They obtain the set voltage value from elsewhere. Either
     - the managed battery or
     - in the ESS system, they obtain it from Multi/Quattro.
4. **Solar charger current control:**
   - This means that solar chargers are current-limited by the system. In most cases, the limiting device is the managed battery or the user-defined maximum charging current in the DVCC menu.

5. **BMS control:**
    - This means that the BMS controls the set charging voltage value (and does not use the value set for absorption and float voltage in the Multi/Quattro system or solar charger).

8.3. Logo customisation on the Boats and Motorhomes page

You can use your own logo on the Boats and Motorhomes page.

Enter the following address into the web browser of a device connected to the same network and use this address as the default. Template: http://venus.local/logo.php or http://[ip-here]/logo.php (insert the IP address of your device in square brackets).

You can find the IP address in Settings → Ethernet or WiFi. After loading the page, select an image file from your device.
Restart the GX device.

8.4. LEDs and button

8.4.1. LEDs

There are two LEDs on the side of the Cerbo GX device. During start-up, they go through the following states:

System startup

The behaviour of the LEDs during start-up depends on whether the Wi-Fi and Bluetooth access points were activated before the system was started up or not.

- Phase 1: Both LEDs are off for approximately 4 seconds.
- Phase 2: The Wi-Fi access point LED indicator starts flashing red for approximately 40 seconds.
- Phase 3: The Wi-Fi access point LED indicator starts flashing green for approximately 10 seconds (or remains off if the access point was turned off before startup).
- Stage 4: The Bluetooth LED will start flashing blue (or remain off if Bluetooth was turned off before starting).

During operation

- The WiFi access point LED flashes red: the built-in WiFi access point is turned off.
- WiFi access point flashes green: built-in WiFi access point enabled (default setting)
- Bluetooth LED is off: Bluetooth is disabled
- Bluetooth LED flashes blue: Bluetooth enabled
- Bluetooth LED is lit blue: Bluetooth connection to the VictronConnect app established

8.4.2. Small recessed button above the Power in terminal block

Short press: Turns the WiFi and Bluetooth access point on/off

A single short press turns the internal WiFi and Bluetooth access point on or off. The LED indicates their status: if the WiFi access point LED flashes red and the Bluetooth LED is off, then the built-in access point and Bluetooth are turned off. When the WiFi Access Point LED flashes green and the Bluetooth LED flashes blue, then the built-in WiFi Access Point and Bluetooth are enabled.

Long press: Reset all network settings to factory defaults

Press and hold the small button for at least four seconds. The LEDs will remain lit for 2 seconds to indicate that a long press has been recognised; then release the button as soon as the WiFi access point LED flashes green rapidly.

All network settings will be reset to their default values:

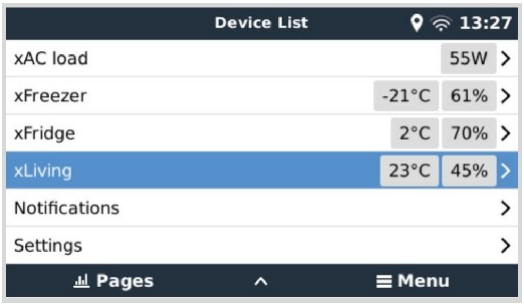
- Ethernet is reset to DHCP
- WiFi access point is enabled
- Remote console password is disabled
- Remote console on the LAN and in the VRM module is enabled.

Please note that after restoring the factory default settings, it is necessary to power cycle the Cerbo device (i.e. remove the power connector for a few seconds) to reactivate the Bluetooth function and WiFi access point in order to access the GX device, as described in the chapter Accessing the GX device [38].

8.5. Temperature relay configuration

Built-in relay 1 and, if applicable, relay 2 can be configured to activate and deactivate depending on the temperature.

For compatibility and connection instructions, see Connecting temperature sensors. Check that the temperature sensors are connected correctly and that they report the temperature in the device list.

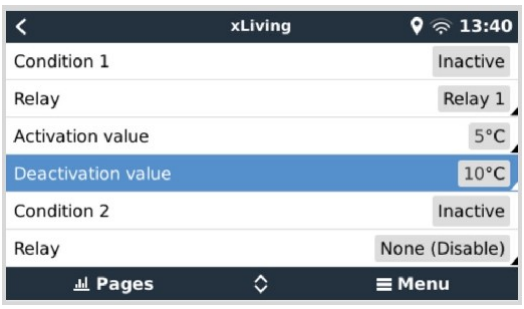


The temperature relay is controlled from the Settings → Relay → Function (Relay 1/2) → Temperature menu. Once activated, the Temperature Control Rules menu will appear in the Relay menu, displaying the detected temperature sensors.

Each temperature sensor can be used to control a relay. Select the temperature sensor you want to use to control the relay. Unused temperature sensors will display "No action". In this menu, you can enable or disable temperature relay control for each temperature sensor.

For GX products where two relays are available (Cerbo GX & Cerbo-S GX, Ekrano GX), it is possible for one temperature sensor to control both relays. It is also possible for one relay to control multiple different temperature sensors. For example, Cerbo GX has two lithium battery-powered temperature sensors, both of which are used simultaneously only when necessary.

1. In the menu Relay → Temperature control rules → Temperature sensor
2. Enable relay activation at temperature
3. Assign relay control to relay 1
4. Set the activation value to 5 degrees
5. Set the Deactivation value to 10 degrees



If this is not enough to keep the battery temperature above 5 degrees, you can also connect a second thermal pad contactor to relay 2.

1. Move the menu down to condition 2
2. Assign relay control to relay 2
3. Set the activation value to 4 degrees
4. Set the Deactivation value to 6 degrees

This means that relay 1 will be active if the battery temperature drops to 5 degrees. If the temperature continues to drop below 5 degrees to 4 degrees, then the second heating pad is activated via relay 2. If this is sufficient to raise the temperature back to 6 degrees, relay 2 is deactivated and relay 1 remains active until the battery temperature returns to 10 degrees.

Note that physical connection contacts are available for both relay 1 and relay 2 in normally open and normally closed configurations.

Please note the relay power rating limits. If the power requirements exceed the relay power rating specification, it may be necessary to connect the loads via an additional contactor.

9. Firmware updates

9.1. List of changes

The list of changes is available on the Victron Professional website in the Firmware → Venus OS directory. You must register (free of charge) to access Victron Professional.

9.2. Via the internet or using a microSD card/USB flash drive

There are two ways to update the firmware:

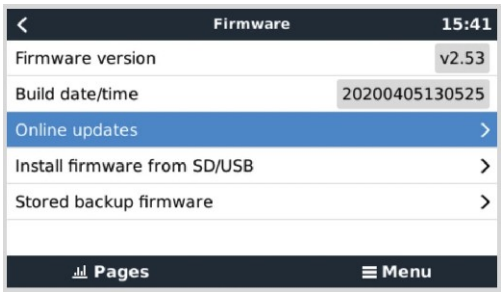
1. Update it via the internet, either manually or by checking for new updates every day.
2. Update it from a microSD card or USB flash drive.

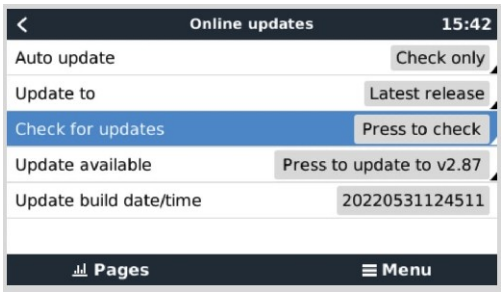
9.2.1. Direct download from the internet

For GX devices without a display (i.e. Venus GX or Cerbo GX without GX Touch), you can access the menus below using the Remote Console.

1. To update from the Internet, go to: **Settings → Firmware → Online Update.**
2. Press the "Check for Updates" button.
3. If a newer firmware version is available, it will be displayed in the "Update available" section. Press the button to update to the new firmware version.
4. After updating your GX device to the new firmware version, check the installation settings.

Please note that for most system applications, we recommend keeping automatic updates turned off, which is also the factory default setting. Instead, update the system at a convenient time when people are on site and ready to revert to the previous system and/or troubleshoot any issues if problems arise.





9.2.2. MicroSD card or USB flash drive

Updating using a microSD card or USB memory is called an "offline update". Use this when updating a device that is not connected to the internet.

1. **Download the latest swu file:**

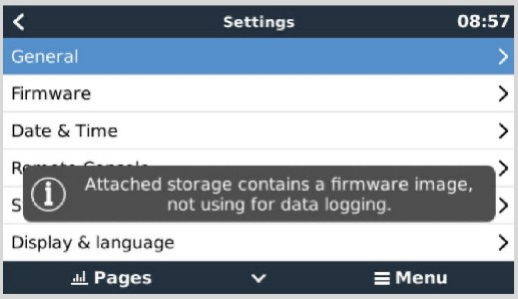
- Cerbo GX - venus-swu-einstein.swu

Note that the same files and list of changes are available in the Victron Professional app. There is also a Dropbox connection available that allows you to link your Dropbox to our shared folder, so you always have the latest firmware files available on your laptop.

2. **Installation on a microSD card or USB flash drive**

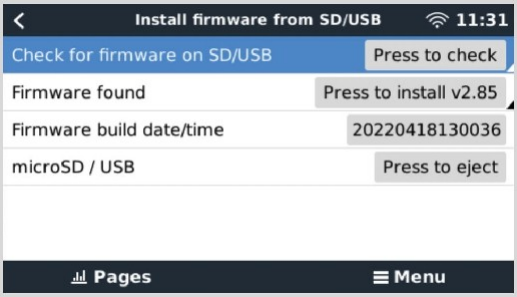
- Save the file to the root folder of the USB flash drive or microSD card.

3. **Insert the device**



Please note that a warning will appear stating, "The connected storage contains a firmware image; do not use it for data recording." You can safely ignore this warning.

4. **Starting the update**



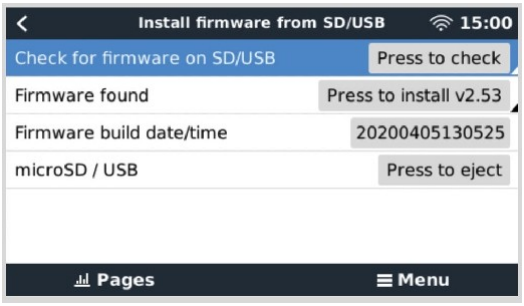
- Go to **Settings → Firmware → Install firmware from SD/USB.**
- Press the "Check firmware on SD/USB" button.
- If the firmware on the microSD card or USB flash drive is newer than the one currently in use, the message "Firmware found" will appear. Press this to start the update process.

9.3. Returning to the previous firmware version

There are two ways to revert to a previous firmware version:

1. Using the saved firmware backup function or
2. by downloading a specific firmware file, saving it to a microSD card or USB, and installing it from SD/USB.

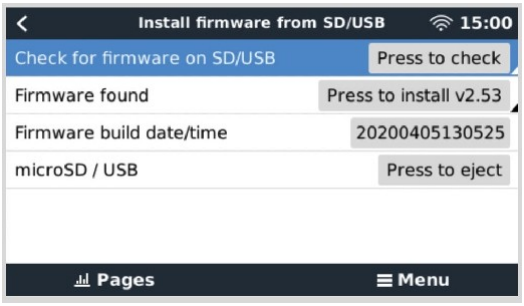
9.3.1. Saved firmware backup function



This option allows you to switch between the current and previous firmware versions. No internet connection or SD card is required.

1. Go to **Settings** → **Firmware** → **Saved Firmware Backup**.
2. The following screen displays the currently running firmware version and the firmware version that can be loaded.
3. Click "Press to boot" to start the system with the saved firmware version.
4. The stored firmware version will now start up and the previous firmware version will be stored in its place.

9.3.2. Installing a specific firmware version from SD/USB



There may be reasons why it is necessary to manually download and install a specific firmware version (e.g. an older firmware version that is not stored in the "Stored backup firmware" item on the GX device). This chapter explains how to do this.

1. Older versions of Venus OS firmware are available for download here: https://updates.victronenergy.com/feeds/venus/release/ images/
2. For Cerbo GX, use the einstein folder.
3. Download the .swu file for the desired version.
4. Save the .swu file to the root folder of the USB flash drive or MicroSD card.
5. Insert the USB flash drive or MicroSD card into the GX device.
6. Note that a warning will appear stating, "The connected storage contains a firmware image, do not use for data recording." You can safely ignore this warning.
7. Go to **Settings** → **Firmware** → **Install firmware from SD/USB**.
8. The specific firmware version should be displayed in the "Firmware found" section. Tap on it to install it.

Please note that although rolling back generally does not pose any problems, some settings may be reset to their default values. Be sure to check this.

9.4. Venus OS Large image

In addition to the standard Venus OS firmware, it is also possible to install Venus OS Large, an extended build of Venus OS that adds Node-RED and Signal K Server.

Among other things, Node-RED offers a fully customisable control panel that can be displayed in a web browser – both locally and remotely via VRM servers.

The Signal K server is designed for yachts and multiplexes data from NMEA 0183, NMEA 2000, Signal K and other sensors. Data from all devices connected to the GX device is automatically available in SignalK for further processing.

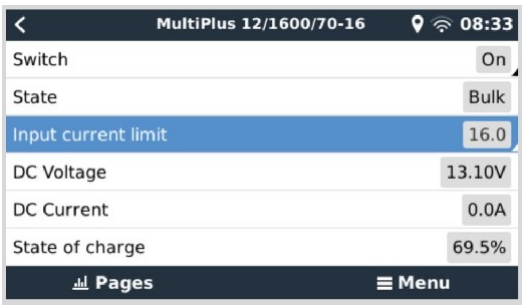
Please note that there is no official support for the extended features included in the Venus OS Large image, nor will there be any in the future.

After installing the standard firmware version, the "Image Type" option is available in the "Online Update" menu, which also allows you to select "Large" for the Venus OS Large image type and update the firmware as described in this chapter.

A detailed description of all functions and the installation method can be found in our document Venus OS Large image: Signal K and Node-RED.

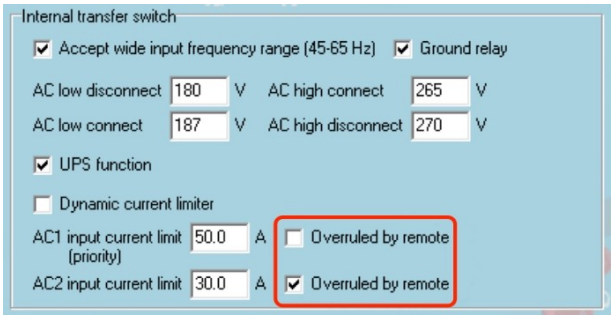
10. VE.Bus Monitor inverter/charger

10.1. Input current limiter settings



This chapter explains the consequences of enabling or disabling user control of the input current limiter settings, as shown in the menu above (Device list → [your inverter/charger]).

The limit set by the user in Cerbo GX will be applied to all inputs for which the "**Overruled by remote**" setting is enabled in the VEConfigure tool:



Using the example of a boat with two AC inputs and a Quattro, where:

1. A 50 A generator is connected to input 1;
2. Shore power is connected to input 2 (available power depends on the rated value of the shore power source).

Configure the system exactly as shown in the VEConfigure screenshot above. Input 1 takes precedence over input 2, so the system will automatically connect to the generator whenever it is running. A fixed input current limit of 50 A will be applied. And when the generator is not available and the grid is available on input 2, the Quattro will use the input current limit configured in the Cerbo GX.

Two more examples: (In both cases, if you disable the 'Overruled by remote' function, the current limit setting in Cerbo GX will have no effect. And if you enable 'Overrule by remote' for both inputs, the current limit set in Cerbo GX will apply to both inputs.)

Minimum input current limits

If the PowerAssist function is enabled in the VEConfigure tool, a minimum input current limit is set. The actual limit varies between models. After setting the input current to a value lower than the limit, it will automatically increase back to the limit.

Note that it is still possible to set the input current limit to 0. When set to 0, the system will be in bypass mode (charger off).

Parallel and three-phase systems

The configured AC input current limit is the total limit per phase.

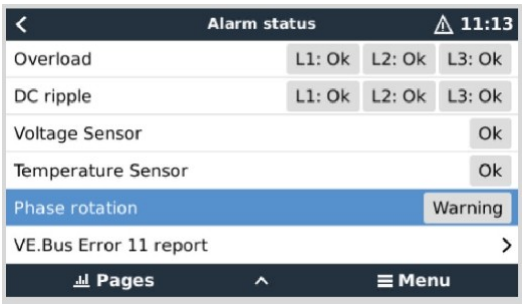
10.2. Phase rotation warning

The AC power supply, whether from a generator or the grid, to a three-phase inverter/charger system must be in the correct rotation, also known as sequence. If this is not the case, the inverter/chargers will not accept the AC power and will remain in inverter mode.

In this case, a phase rotation warning will be displayed. You can solve the problem by changing the connection at the AC input: swap one of the phases, changing the rotation from L3 → L2 → L1 to L1 → L2 → L3. Alternatively, reprogram the Multis and adjust the assigned phases to match the connection.

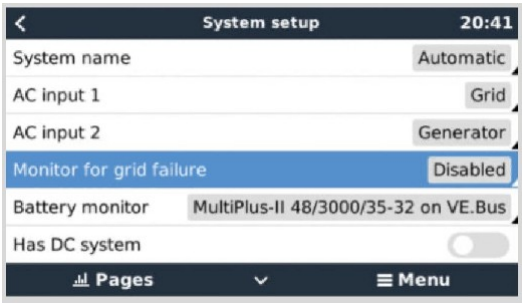
In the GX device itself, the warning is displayed as a notification in the graphical user interface:

It is also visible in the menus:



It is visible on the VRM portal in the VE.Bus Alarms and Warnings widget on the Advanced page and will be listed in the VRM alarm log. In addition, an e-mail will be sent using the VRM alarm monitoring system.

10.3. Network fault monitoring



If this feature is enabled, an alarm will be triggered if the system has not been connected to an AC input configured as Grid or Shore for more than 5 seconds.

- The alarm will be displayed as a notification in the graphical user interface and as an alarm on the VRM portal. It is also available on ModbusTCP/MQTT.
- We recommend using it for backup systems. But also for yachts or vehicles on shore power.

Please note that this setting monitors whether the system is connected to the grid/shore. Generator monitoring is already available as part of the Generator Start/Stop function and is not included in this function.

Do not use this function in systems that use the Ignore AC Input setting in our inverters/chargers: when the system ignores the AC input, i.e. runs in island mode as intended, even when the grid is available, it will report a grid failure.

10.4. Extended menu

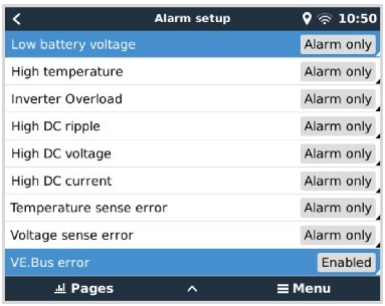
The Advanced menu can be accessed from Device List → [Multi or Quattro] → Advanced and contains options for balancing, redetection and restarting the VE.Bus system and displays the status of the ESS relay test.

- **Alignment:** Starts alignment. For details, refer to the Multi or Quattro documentation.
- **Redetect VE.Bus system:** Used to clear the Cerbo GX cache, which stores certain VE.Bus system data, in order to minimise system start-up time. Use this function, for example, if the system previously included a VE.Bus BMS system that is no longer in use or has been replaced by a Lynx Smart BMS system. When using the Redetect VE.Bus system function, the inverter/charger does not switch off for a few seconds, as it would when using the Restart VE.Bus system function.
- **Restart VE.Bus system:** Restarts the inverter/charger (just like switching it off and on again with the main rocker switch at the front) if it failed to restart automatically (after 3 attempts), for example after a (very) severe overload or after three consecutive overloads. Any permanent errors, such as a repeated and irreparable overload error, will be deleted.
- **AC Input 1 is ignored:** Status of AC Input 1 flag
- **ESS relay test:** Shows the status of the ESS relay test. Only relevant if it is an ESS system. For details, see Q9 in the ESS manual FAQ.

10.5. Alarm status monitoring

The alarm status monitoring page can be accessed from the Device List → [Multi or Quattro] → Alarm Status menu. It displays diagnostic information about specific parameters to assist in troubleshooting and provides additional information about VE. bus error 8/11.

10.6. VE.Bus alarm settings menu



When using the VE.Bus system, it is possible to configure the severity of problems in the VE.Bus system that should cause a notification to be displayed on the Cerbo GX device (and its beeping).

To change the VE.Bus warning and alert messages, proceed as follows:

1. On the remote console, go to Device List → [your VE.Bus product] → Alarm Settings.
2. For each alarm, you can choose from the following notification settings:
   - **Disabled**: Cerbo GX will never beep or display a notification. Not recommended.
   - **Alarm only** (default setting): Cerbo GX will sound an audible alarm and display a warning only if the VE.Bus system shuts down in alarm condition. Warnings are ignored.
   - **Alarms and warnings**: Cerbo GX will sound an audible alarm and display a warning for all selected alarms and warnings.
3. Scroll to the end of the list and enable or disable notifications for VE.Bus errors.

When finished, remember to change the access level to user if necessary.

10.7. Device menu

The Device menu (Device List → [Multi or Quattro] → Device) offers device-related parameters such as custom name settings, firmware version, serial numbers (in the submenu) and other parameters that can be used for diagnostics.

11. DVCC - Distributed Voltage and Current Control

11.1. Introduction and functions

Enabling the DVCC function changes the GX device from a passive monitor to an active controller. The available functions and effects of enabling DVCC depend on the type of battery used. The effect also depends on the Victron components installed and their configuration. Two examples:

CAN-bus controlled batteries: In systems with a connected CAN-bus controlled battery, the BMS receives the charging voltage limit (CVL), charging current limit (CCL) and discharge current limit (DCL) from this battery and passes them on to the connected inverters/chargers and solar chargers. These then switch off their internal charging algorithms and simply do what the battery tells them to do.

Lead-acid batteries: For systems with lead-acid batteries, DVCC offers features such as a configurable system-wide charge current limit, where the GX actively limits the inverter/charger if the solar chargers are already charging at full power, as well as shared temperature sensor (STS) and shared current sensor (SCS) features.

This table shows the recommended settings for different battery types:

	Lead-acid battery	VE.Bus BMS V1 Lithium	VE.Bus BMS V21[1] Lithium	Supported batteries managed by third 2[1]
Automatic configuration	No	No	No	[2]
System charging current	Yes	Yes	Yes	[2]
Should you enable SVS?	Yes	[3], [4]	[3], [4]	[2]
Should you allow STS?	Yes	No	No	[2]
If you enable the SCS system	Yes	[3], [4]	[3], [4]	[2]
Fill level check method	NOT APPLICABLE NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	[2]
Wire ATC and ATD	NOT APPLICABLE APPLICABLE	Yes	[5]	[2]

[1] In order for the GX device to control solar chargers, RS or Multi RS inverters in a system with VE.Bus BMS V2, DVCC must be enabled.

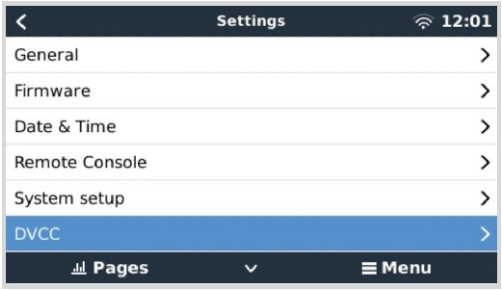
[2] Refer to the Battery Compatibility Guide to find out which parameters need to be set and which are set automatically.

[3] In an ESS system, the VE.Bus device is already synchronised with the solar chargers, so we recommend leaving SVS and SCS disabled.

[4] For all other systems: If a BMV or SmartShunt is installed, we recommend enabling SVS and SCS. In all other cases, leave SVS and SCS disabled.

[5] Solar chargers, inverters/chargers, Multi RS and Inverter RS do not require connection. All other loads and chargers must be connected and controlled via ATC/ATD.

To enable or disable DVCC, go to the GX device and select Settings → DVCC:



11.2. DVCC requirements

1. **Battery compatibility**

   - For batteries connected to the CAN bus, check the relevant page in the Battery Compatibility manual to see if DVCC has been tested with your battery type and is supported. **If DVCC is not mentioned in the notes for your battery, do not enable DVCC**.
   - DVCC can be used without any problems for gel, AGM, OPzS and other lead-acid batteries. The same applies to Victron Energy Smart lithium batteries with VE.Bus BMS, Lynx Ion + Shunt BMS or Lynx Ion BMS. DVCC is forced enabled for the Lynx Smart BMS system.

2. **Firmware version**

   Do not use DVCC if these requirements are not met. In all cases, we recommend installing the latest available firmware during commissioning. Once properly commissioned, there is no need to proactively update the firmware without reason. In case of problems, the first step is to update the firmware.

   Required minimum firmware versions:

Victron product	Minimum firmware version
Multi/Quattro	422
MultiGrid	424
Multi RS, Inverter RS, MPPT RS	v1.08
GX device	v2.12
VE.Direct MPPT	v1.46
VE.Can MPPT with VE.Direct	v1.04
Older VE.Can MPPT solar chargers (with display)	Cannot be used
Lynx Ion + Shunt	v2.04
Lynx Ion BMS	v1.09
Lynx Smart BMS	v1.02

   From Venus firmware version 2.40 onwards, when using DVCC, the warning message "Error #48 - DVCC with incompatible firmware" will be displayed if one of the devices has incompatible firmware. For more information on error #48, see the Error Codes chapter [117].

   For ESS systems, ESS Assistant must be version 164 or later (released in November 2017).

11.3. Impact of DVCC on the charging algorithm

In standalone mode, our inverters/chargers and MPPT solar chargers use their own internal charging algorithm. This means that they determine themselves how long to stay in absorption mode, when to switch to float charging mode, and when to return to bulk charging or storage mode. And in these different phases, they use the parameters configured in the VictronConnect and VEConfigure applications.

In ESS systems and battery-controlled systems (see Battery Compatibility Guide), the internal charging algorithm is deactivated and the charger then operates with an externally controlled charging voltage setpoint. This table explains the various options:

Guide selection			Resulting charge algorithm	
System type	**Battery type**	**DVCC**	**Converter/charger**	**Solar charger**
ESS assistant1[1)]	Smart battery	At	Battery	Battery
		Off	Do not do this; instead, enable DVCC	
	Normal battery	At	Internal	Converter/charger
		Off	Internal	Converter/charger
Standard	Smart battery	At	Battery	Battery
		Off	Do not do this; instead, enable DVCC	
	Normal battery	At	Internal	Internal
		Off	Internal	Internal

[1)] The ESS Assistant is only installed in a specific type of energy system that integrates grid connection with a Victron inverter/charger, GX device and battery system. It should not be confused with an off-grid system, which is used, for example, in boats or motorhomes.

Details at

- **Internal**
  - The internal charging algorithm (bulk → absorption → float → re-bulk) and configured charging voltages are active.
  - The inverter/charger indicates the state of charge: bulk, absorption, float, etc.
  - The MPPT solar charger indicates the state of charge: bulk, absorption, float, and so on (firmware version v1.42 and higher. Earlier versions have a bug that causes the MPPT solar charger to display "Ext. Control" even when it is only current-limited; its internal charging algorithm is still active).
- **Inverter/charger (applies to MPPT only)**
  - The internal MPPT charging algorithm is disabled; instead, it is controlled by the set charging voltage value, which comes from the inverter/charger.
  - The MPPT solar charger indicated the charge status: Ext. control.
- **Battery**
  - The internal charging algorithm is disabled and the device is controlled by the battery instead.
  - Indicated charge status of the inverter/charger: Ext. control.
  - MPPT solar charger indicated charge status: (LEDs continue to show volume and absorption, never floating).

11.3.1. Effects of DVCC when connecting more than one Multi/Quattro device

Only Multi/Quattro devices (this may be a single device or multiple devices configured together for three-phase/split-phase and parallel connection) connected to the VE.Bus port will be controlled via DVCC. Other systems connected to the GX device via MK3-USB are not controlled by DVCC and will charge and discharge according to the configuration made in these units.

This applies to all types of systems with DVCC enabled. For example, a system that does not contain a controlled (CAN-Bus) battery and only uses DVCC charging current limitation: this charging current limitation only applies to the Multi or Quattro connected to the VE.Bus port.

11.4. DVCC functions for all systems

These functions apply to all types of systems when DVCC is activated; with or without ESS assistant, with lead-acid or other conventional batteries, and even when an intelligent battery connected to the CAN-bus BMS is installed:

11.4.1. Charging current limitation

The charging current limit is a user-configurable setting for the maximum charging current. It works throughout the entire system. MPPT solar chargers are automatically prioritised over mains/generator chargers.

This setting is available in the Settings → DVCC menu on the GX device.

Details:

1. If a CAN bus BMS system is connected and the BMS system requests a maximum charging current that differs from the user-configurable setting, the lower of the two values will be used.

2. This mechanism only works for Victron inverters/chargers, including Inverter RS, Multi RS and solar chargers, including MPPT RS. Other chargers, such as Skylla-i, are not controlled and their charging current is also not taken into account. The same applies to devices that are not connected to a GX device, such as an alternator. In other words, only the total charging current of the inverter/chargers and all MPPT solar chargers will be controlled, nothing else. Any other sources will represent additional charging current that is not taken into account. This is also the case when installing a BMV or other battery monitor.

3. DC loads do not need to be taken into account if SmartShunt or BMV-712 is not installed and correctly configured as a DC current meter. For example, without a DC load monitor configured with a maximum charging current of 50 A and DC loads drawing 20 A, the battery will be charged with a current of 30 A, not the full 50 A allowed. With a SmartShunt configured as a DC current meter, the maximum charging current configured to 50A, and a DC system shunt reporting a draw of 25A, the chargers are set to charge at 50 + 25 = 75A.

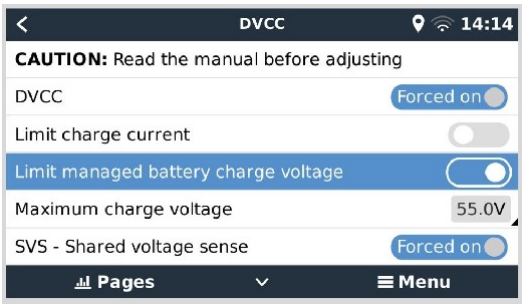
   If you have one or more shunts configured for the "DC system" (if there are more than one, they are added together), then the DVCC charging current limit compensates for both the loads and the chargers. It adds additional charging current if there is a load in the system and subtracts it if there is another charger in the DC system. DC "loads" and "sources" are not compensated in either direction.

4. The current drawn from the system by the inverter/charger is compensated. For example, if 10 A is drawn to power AC loads and the limit is set to 50 A, the system will allow MPPT solar chargers to charge at a maximum current of 60 A.

5. In all situations, the maximum charging limit set in the device itself will still apply, i.e. the charging current limit set using VictronConnect or VEConfigure for MPPT solar chargers or inverters/chargers. Example for illustration: if there is only an inverter/charger in the system and a charging current of 50 A is set in the VEConfigure or VictronConnect application. And if a limit of 100 A is configured in the GX device, then the working limit will be 50 A.

6. The DVCC charging current limit does not apply to DC MPPT when ESS is enabled with the Allow DC MPPT to export function. This is in order to obtain the maximum power from the solar panels for export.

11.4.2. Controlled battery charging voltage limitation



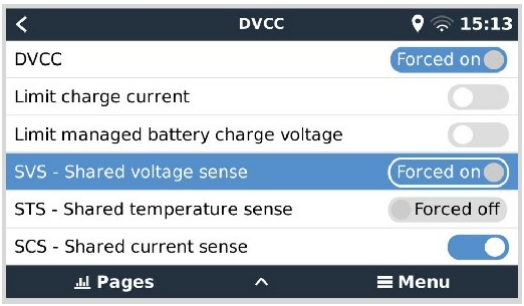
Some batteries (e.g. BYD and Pylontech) that are supplied from the factory will take some time to settle in, and you may

you may need to operate them at **a lower voltage for** the first two weeks to allow them to equalise.

This is what the battery's limited controlled charging voltage is for. Switching it on allows you to reduce the maximum charging voltage until the cells are balanced.

Do not use it for other purposes, as it may have undesirable side effects, such as the balancing failing or not starting at all if the charging voltage is set too low, which over time will cause a serious imbalance in the battery cells. It is also not possible to set a value higher than the charging voltage limit (CVL) sent by the battery.

11.4.3. Shared Voltage Sensor (SVS)



Works with VE.Bus devices, VE.Direct and VE.Can MPPT solar chargers, as well as Inverter RS and Multi RS devices.

The system automatically selects the best available voltage measurement. If possible, it uses the voltage from the BMS system or BMV battery monitor, otherwise it uses the battery voltage reported by the VE.Bus system.

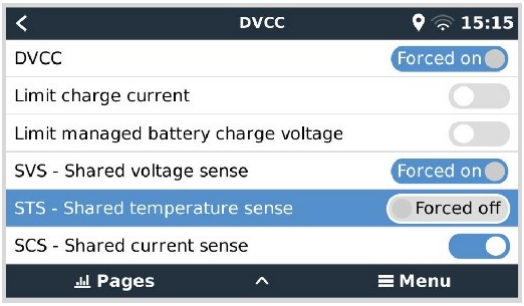
The voltage displayed in the graphical user interface reflects the same voltage measurement.

The Shared Voltage Sensor (SVS) is enabled by default when the DVCC function is enabled. It can be disabled with a switch in the Settings →

DVCC menu. SVS (and DVCC) is forcibly enabled for Lynx Smart BMS and cannot be changed.

Please note that SVS is forcibly disabled on some batteries. Please refer to the compatibility page for your battery.

11.4.4. Shared Temperature Sensor (STS)



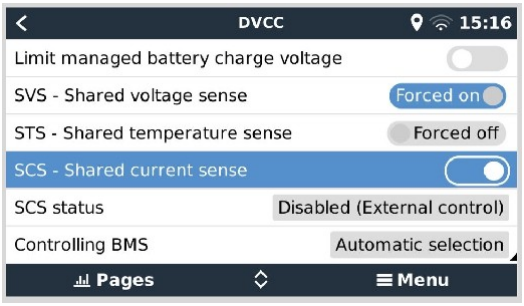
Select the temperature sensor you want to use, and the GX device will send the measured battery temperature to the inverter/charger system and all connected solar chargers.

The following sources can be selected for battery temperature:

- BMV-702 Battery Monitor
- BMV-712 battery monitor
- SmartShunt
- Lynx Shunt VE.Can battery monitors
- Temperature inputs on Cerbo GX devices (and the same applies to other GX devices that have temperature inputs)
- Multi/Quattro inverter/charger
- Solar chargers (if equipped with a temperature sensor)

Please note that the STS system is forcibly disabled on the Lynx Smart BMS system and some batteries. Please refer to the compatibility page for your battery.

11.4.5. Shared Current Sensor (SCS)



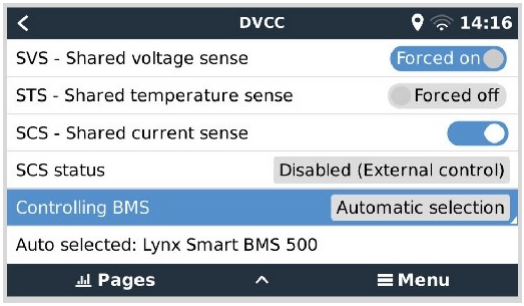
This feature passes the battery current measured by the battery monitor connected to the GX device to all connected solar chargers.

Solar chargers can be configured to use the battery current for their end-of-charge mechanism, which terminates absorption when the current is lower than the configured threshold. For more information, refer to the solar charger documentation.

This feature only applies to systems that are not ESS and/or do not have a controlled battery, as in both of these cases the MPPT is already controlled externally.

Requires solar charger MPPT firmware v1.47 or later.

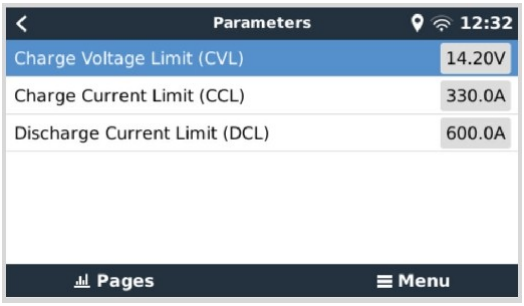
11.4.6. BMS system control



For systems with multiple connected BMSs, it allows you to select which BMS to use for DVCC. It also allows you to use BMV or SmartShunt for SoC monitoring by selecting BMV as the battery monitor (Settings → System Settings), while the BMS is still used for DVCC.

This setting is available in the Settings → DVCC menu on the GX device.

11.5. DVCC function when using a battery BMS with a CAN bus



This chapter applies to all systems where an intelligent BMS battery is installed and which are connected via a CAN bus. Please note that this does not apply to the Victron VE.Bus BMS system.

Such an intelligent BMS sends the following parameters to the GX device:

1. **Charge voltage limit (CVL)**: the maximum charge voltage that the battery currently accepts.
2. **Charge current limit (CCL)**: the maximum charge current required by the battery.
3. **Discharge current limit (DCL)**: the maximum discharge current required by the battery.

For all three parameters, some battery types transmit dynamic values. For example, they determine the maximum charging voltage based on cell voltage, state of charge or temperature. Other brands and types use a fixed value.

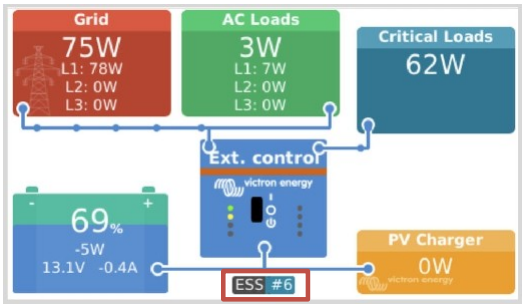
For such batteries, it is not necessary to connect the charge enable (ATC) and discharge enable (ATD) terminals to the AUX inputs of the Multi or Quattro.

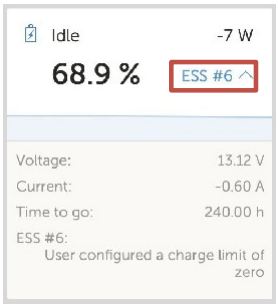
In inversion mode, i.e. island mode, Multis and Quattros switch off when the maximum discharge current is zero. They restart automatically as soon as the AC mains returns or as soon as the BMS system increases the maximum discharge current again.

For details on how the maximum charge current is used, how it prioritises solar energy, and other information, see the previous section Limit charge current [68], a user-configurable setting for the maximum charge current.

The above means that setting charging voltages or charging profiles in the VEConfigure or VictronConnect programme is not necessary and will have no effect. Multis, Quattro, Multi and Inverter RS and MPPT solar chargers will charge with the voltage they receive via the CAN bus from the battery. This also applies to systems with Lynx Smart BMS connected to the GX device.

11.6. DVCC for systems with ESS Assistant





- ESS mode Keep batteries charged will only work correctly with DVCC enabled.
- A fixed solar offset of 0.4 V (value for a 48 V system, divided by 4 for 12 V) is applied when the ESS mode is set to Optimised in combination with the Feed-in solar charger surplus setting enabled, or when the ESS mode is set to Keep batteries charged.
- For systems with ESS mode Optimised and Optimised (with BatteryLife): The system automatically recharges the battery (from the grid) when the SoC falls 5% or more below the "Minimum SoC" value in the ESS menu. Recharging stops as soon as the Minimum SoC value is reached.
- Displaying the ESS status in the GX device overview and on the VRM: In addition to the charging status (external control or bulk/absorption/float), the following statuses can be displayed:

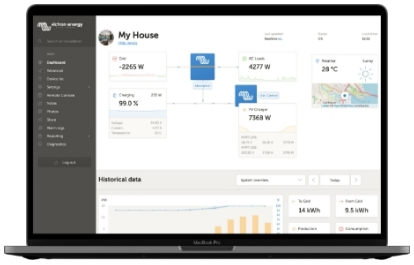
ESS status	Meaning
#1	Low SoC: discharge shutdown
#2	BatteryLife is active
#3	Charging disabled by BMS system
#4	Discharging prohibited by the BMS system
#5	Slow charging in progress (part of BatteryLife, see above)
#6	User has configured zero charge limit
#7	The user has configured the discharge limit to zero

- Note: If DC power surplus from PV is enabled with ESS, the DVCC system will not enforce the DVCC charging current limit from PV to the battery. This behaviour is necessary to enable export. Charging voltage limits will still apply.

  Charging current limits set at the level of individual solar chargers also still apply.
- If the BMS is disconnected in the ESS system, the solar chargers will stop and display error #67 - No BMS (for more information, see MPPT Solar Charger Error Codes).

12. VRM Portal

12.1. Introduction to the VRM portal



Once connected to the internet, the GX device can be used in combination with the Victron Remote Management (VRM) portal, which allows you to:

- Easy remote access to all statistics and system status online
- Remote console on VRM [42]: access the system and its configuration as if you were standing next to it.
- Remote firmware update: Update the firmware of connected solar chargers and other Victron products.
- Remote VEC configuration: Downloading and uploading Remote VEConfigure files from and to a Multi/Quattro device connected to the GX device.
- Remote control: Control devices such as electric vehicle charging stations, inverters/chargers, GX relays, power generators and ESS systems remotely via VRM.
- Using the VRM app for iOS and Android, including VRM APP widgets on the home screen of your mobile device

See the Internet Connection chapter [34] to learn how to connect your device to the Internet. For a complete

overview of all VRM portal features and capabilities, see the VRM portal documentation.

12.2. Registering with VRM

Detailed instructions can be found in the Getting Started with the VRM Portal document.

Please note that each system must first be able to successfully send data to the VRM portal. Until a successful connection is established, it will not be possible to register the system to your VRM user account. In this case, see the section Troubleshooting data logging issues [75] and the section Remote console on VRM - troubleshooting [78] below.

12.3. Data logging to VRM

Data logs are transferred to the VRM portal via the internet, if available. All related settings are available in the VRM Online Portal menu (Device List → Settings → VRM Online Portal).

Data log transmission has been designed to work even with a poor Internet connection. A connection with a permanent packet loss of up to 70% is still sufficient to get the data out, albeit with a partial delay.

Adding an external storage device

If logs cannot be transferred, the GX device stores them in non-volatile storage (i.e. data is not lost during a power failure or restart).

The GX device has internal buffer memory to store logs for several days. To extend this time, insert a microSD card or USB storage device. You can view the status of the internal storage in the settings.

Please note that when such a memory device is inserted, all internally stored logs are automatically transferred to the inserted memory card: no data is lost.

Whether an external memory device is inserted or not, the GX device will always attempt to connect to the portal and transfer all pending logs. This means that even if there are several months of pending records, all pending records will be sent once the internet connection is re-established. The data is sent in compressed form: sending a large amount of pending data uses significantly less bandwidth than sending data with a continuously available internet connection.

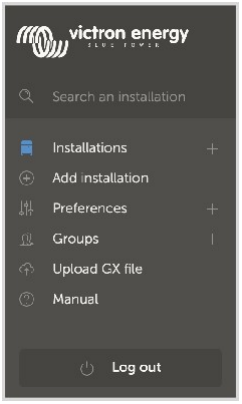
Storage device requirements

- Supported file systems for MicroSD cards or USB flash drives are FAT (12, 16, 32), ext3, ext4 and exFAT.
- SD and SDHC microSD cards with a capacity of 32 GB and less are sold in FAT12, FAT16 or FAT32 format. They can be used without any problems unless they are subsequently reformatted to an unsupported file system.

Manual transfer of data logs to VRM

For devices that are permanently offline, data can be removed and then uploaded manually from a laptop.

1. Go to Settings → VRM Online Portal and click Eject Storage. Be careful never to remove the SD card/USB key without first ejecting it, as this may result in damage and data loss.
2. Remove the storage device and insert it into a computer or laptop connected to the internet.
3. Open your web browser and go to the VRM portal.
4. Log in and go to the Installation menu:



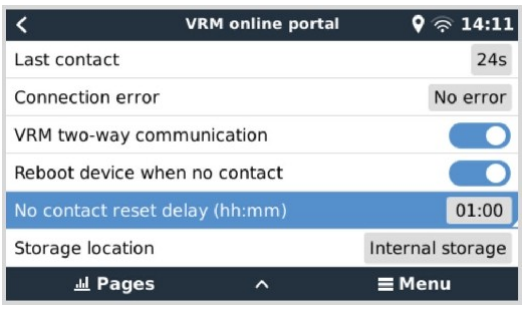
5. Click on the "Upload GX File" option and follow the instructions:

6. Remove the file from the storage device and reinsert it into the GX device. Note that uploading the same data twice does not cause any problems, but it is still better not to do so.

With a recording interval of once per minute, the required storage space is approximately 25 MB per month, depending on the number of connected products. Therefore, with a 1 GB microSD card, you can store approximately 3 years of recordings. In other words, any microSD card or USB memory should be sufficient to store 6 months of data stored by the VRM. Once the storage device is full, no more data will be recorded.

If multiple storage devices are inserted, the GX device will store data on the one that was inserted first. Once it is removed, it will not use the second one. Instead, it will create an internal buffer. Only when a new device is inserted will it switch back to using external storage.

Network watchdog: automatic restart



This feature, which is disabled by default, allows the GX device to automatically restart if it fails to connect to the VRM portal.

12.4. Troubleshooting data recording issues

This chapter explains what to do if your GX device cannot transmit data to the VRM portal. The following

communication is required to send logs to the VRM portal:

1. Working DNS
2. Correct IP address
3. Working internet connection
4. Outgoing http(s) connection to http://ccgxlogging.victronenergy.com on ports 80 and 443. Note that this should never be an issue unless you are dealing with highly specialised corporate networks.

Please note that Cerbo GX does not support proxy server settings. For more details on the required network connection, please refer to FAQ Q15: What type of network connection does Cerbo GX use (TCP and UDP ports)? [120].

Step 1: Update the GX device to the latest available firmware

- See the Firmware Update section [57].

Step 2: Verify your network and Internet connection

In the Settings → Ethernet or Settings → WiFi menu, check the following:

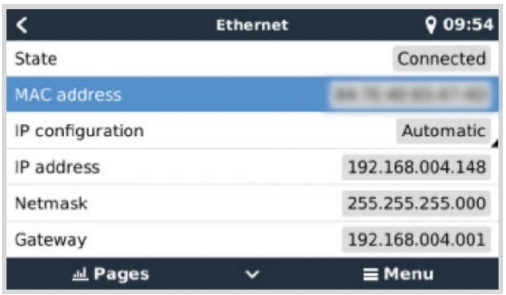
1. The status must be "Connected
2. There must be an IP address that does not start with 169.
3. There must be a gateway
4. There must be DNS servers

For GX GSM or GX LTE 4G devices, see the Troubleshooting Guide in the GX LTE 4G manual.

If the IP address begins with 169, check whether a DHCP server is running on the network. In 99% of all networks, a DHCP server is running and enabled by default on all known ADSL, cable, and 3G/4G routers. If a DHCP server is not running, configure the IP address manually.

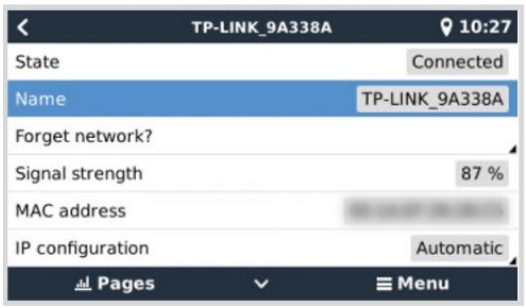
Ethernet

- If you are using an Ethernet network and the status shows "Unplugged", check that the Ethernet network cable is not faulty: try another one. The two lights on the back of the Cerbo GX device, where the RJ45 Ethernet cable is connected, should be lit or flashing. Two unlit lights indicate a connection problem.



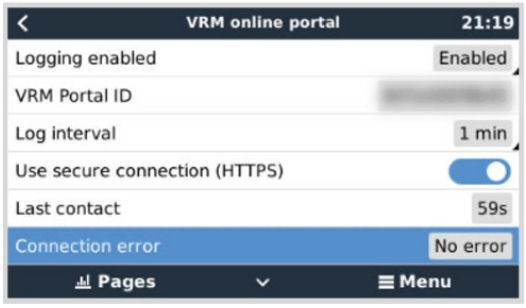
WiFi

- If you are using WiFi and the message "No WiFi adapter connected" appears in the menu, check the USB connection to the WiFi dongle. Try removing the dongle and reinserting it.
- If you are using WiFi and the status shows "Failure", it is possible that the WiFi password is incorrect. Press the "Forget network" button and try connecting again with the correct password.



Step 3. Verify your connection to the VRM portal

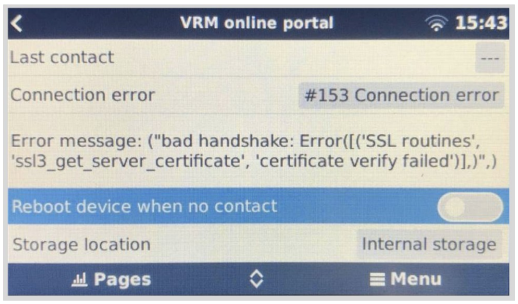
- Go to Settings → VRM Online Portal and check the connection error status:



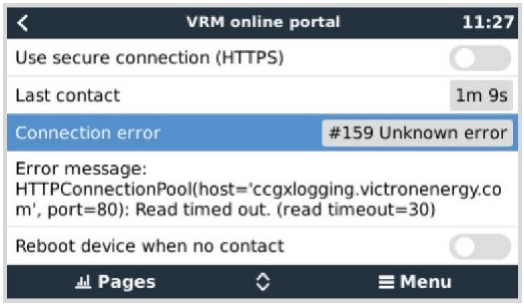
If a connection error is displayed, Cerbo GX cannot connect to the VRM database. The connection error will display an error code that indicates the nature of the connection problem. Details of the error message will also be displayed to facilitate on-site IT professionals in diagnosing the problem.

- **Error No. 150 Unexpected response text:** http/https call was successful, but the response was incorrect. This means that there is a WiFi or network login page, sometimes called a "captive portal". Such pages are sometimes seen at airports, hotels, ports, or caravan parks. There is no solution for getting the GX device to work on a WiFi network that requires such a login page and/or acceptance of terms of use.
- **Error #151 Unexpected HTTP response:** Connection failed: The connection was successful, but the response did not indicate a successful HTTP status code (usually 200). This may indicate that the connection is being handled by a transparent proxy server. See #150 above for examples.
- **Error #152 Connection timeout**: This may indicate poor Internet connection quality or a restrictive firewall.
- **Error #153 Connection error**: may indicate a routing problem. See the displayed error message for details:

- **Error #153 Connection problem**, specifically an issue related to the SSL protocol, as shown in the screenshot below: check the date and time settings on your Gx device, as well as the time zone. And check that the router does not display a special rejection, login or acceptance page, as is often seen at airports, hotels and other public Wi-Fi networks.



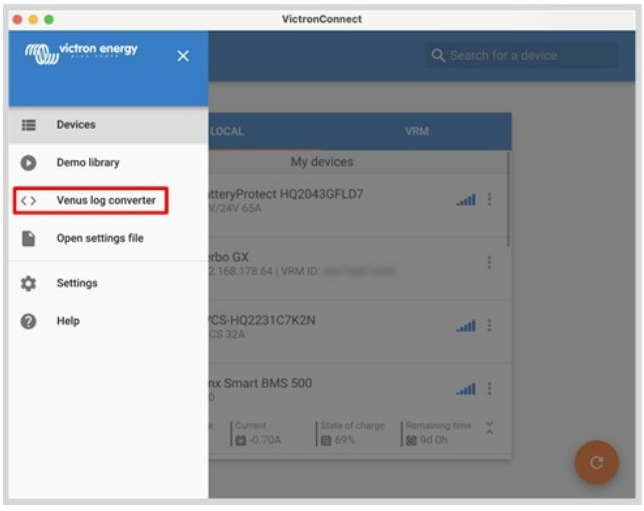
- **Error #154 DNS failure:** Check that a valid DNS server is configured in the Ethernet or WiFi menu. It is usually automatically assigned by the DHCP server on the network.
- **Error #155 Routing error:** VRM is unavailable. This error occurs when an ICMP error is received indicating that there is no route to the VRM server. Check that the DHCP server is assigning a functional default route or that the gateway is correctly configured for static configurations.
- **Error #159 Unknown error:** This is a generic error for errors that cannot be directly classified into a specific category. In such cases, the error message will provide information about the problem.



Tick the "Last contact" box. If dashes appear here, it means that the GX device has not been able to contact the VRM portal since it was switched on. If it shows the time but the error is still displayed, then the GX device was able to send data but has since lost contact.

The "Buffer" item indicates the number of logs stored for later transmission. If it is greater than 0, it means that Cerbo GX cannot connect to the VRM portal. All data is sent according to the First in First out principle: the VRM portal will display the most recent information only after all old data has been sent.

12.5. Offline data analysis, without VRM



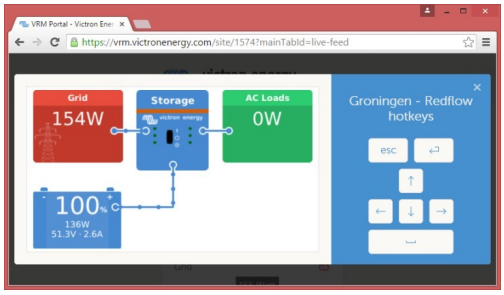
In some cases, such as very remote locations where there is no internet connection, it may be useful to analyse data without first uploading it to the VRM portal.

1. Installing the VictronConnect application on a Windows or Apple laptop
2. Insert the storage device containing the log file(s).

3. Open VictronConnect and use the Venus Log Converter function to convert them to Excel sheets. Please note that the Venus Log Converter function is not available in the VictronConnect version for iOS and Android. For more details, see Importing and converting the GX product line database file in the VictronConnect manual.

12.6. Remote console on VRM - settings

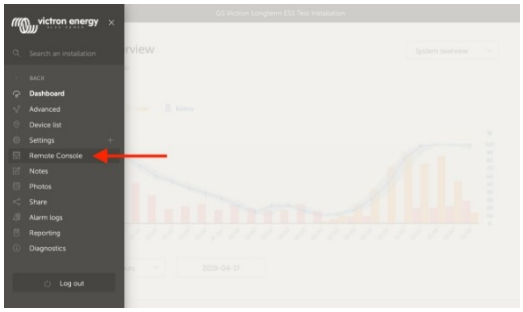
This feature allows full remote control of GX devices via the internet:



The remote console in the VRM module is disabled by default. Activate it by following these steps:

1. Enable the function in the Settings → Remote Console menu. For details, see the Remote Console menu [43].
2. Set a password or disable the password.
3. Restart the GX device.

The Remote Console option will now appear in the VRM portal menu. Click on it to open the Remote Console:



12.7. Remote Console on VRM - Troubleshooting

When troubleshooting with the remote console in the VRM module, follow these steps:

1. Check that logging to the VRM portal is working, see the chapter Logging data to VRM [73] and Troubleshooting data logging [75]. Without this, the remote console on VRM will not work.
2. After enabling the Remote Console function, do not forget to set (or disable) the password.
3. After setting (or disabling) the password, please remember to restart Cerbo GX.
4. Ensure that Cerbo GX is updated to the latest firmware version. The latest stability improvements for Remote Console were made in version v2.30.
5. After restarting, check whether Remote Console on VRM shows online or a port number. If it shows offline or port number 0, Cerbo GX was unable to connect to the Remote Console server. This is usually caused by a (corporate) firewall blocking the connection. The solution is to configure an exception rule in the firewall.
6. Verify that your web browser, in which you are using VRM, has access to both of the URLs below. Click on both links and check them. *Note that if an error is displayed, everything is fine*. A good error is "Error response, error code 405, method not allowed". If a timeout or other (browser) error is displayed, the connection may be blocked by a firewall. https:// vncrelay.victronenergy.com & https://vncrelay2.victronenergy.com/

Technical background

For the remote VRM console to work, a connection must be established between the web browser and the GX device. This connection is designed so that in almost all situations, no special configuration or firewall opening is required. Situations where it does not work immediately out of the box account for 0.1%, such as large corporate networks with special security or expensive satellite or radio-supported networks with long range, such as those found in rural areas of Africa and other remote

areas.

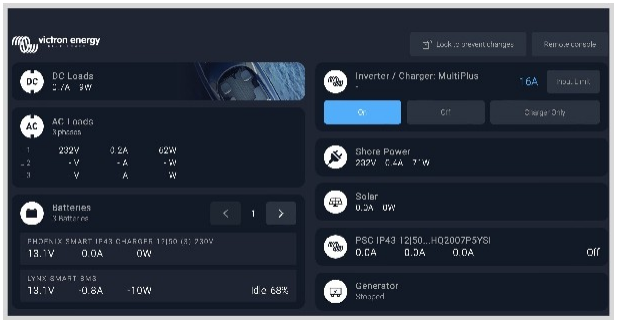
If the Remote Console on VRM feature is enabled, the GX device will open and maintain a connection to any of the servers listed at supporthosts.victronenergy.com. This currently resolves to several IP addresses (84.22.108.49, 84.22.107.120, 3.25.10.245, 13.244.154.199 or 35.165.124.40, depending on your location) and possibly others in the future. The technology used is SSH, and it will attempt to connect using ports 22, 80, and 443, only one of which needs to be working. The reason it tries all three is that in most networks, at least one of them will be allowed by the local firewall.

After connecting to one of the supporthost servers, this reverse SSH tunnel waits for a connection from someone who needs the connection. This could be your browser or a Victron technician, as the same technology is used for the remote support function; see above for more information.

When using the Remote Console on VRM, the browser connects to either vncrelay.victronenergy.com or vncrelay2.victronenergy.com using web sockets on port 443. For more details on the connections used by the GX device, see Q15 in the frequently asked questions [120].

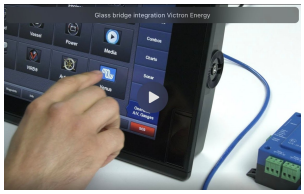
13. Marine MFD integration using the app

13.1. Introduction and requirements



The glass bridge is an MFD (multifunction display) that integrates the ship's systems and navigation status into a large screen or screens at the ship's helm, eliminating the need for multiple gauges, brackets and cabling complications.

The Victron system can be easily integrated into MFDs, as shown in this video:



Features:

- Monitor the status of shore power and generator.
- Monitor the battery status for one or more batteries. Using the voltage of battery chargers, for example, it can also display secondary batteries, such as generator starter batteries.
- Monitor energy conversion devices: chargers, inverters, converters/chargers.
- Monitor solar energy production using an MPPT solar charger.
- Monitor AC load and DC load.
- Check the input current limitation of shore power.
- Inverter/charger control: switch it off, switch it on, or set it to charging only.
- Optionally, open the Victron remote console panel, which allows access to additional parameters.

Please note that monitoring and control of AC chargers connected via VE.Direct or VE.Can (this applies to Phoenix IP43 Smart Chargers and the Skylla series) only works when shore power is connected.

Victron device compatibility:

- All Victron inverters/chargers: From single-phase 500VA devices to large three-phase 180kVA systems, including Multis, Quattro, 230VAC and 120VAC models.
- Battery monitors: Lynx Shunt VE.Can, Lynx Ion BMS, Lynx Smart BMS.
- All Victron MPPT solar charge controllers

Required components:

- Battery system
- Victron GX device (all models are compatible)
- Victron inverter/charger

- Victron battery monitor
- Ethernet network cable connected between the MFD and the GX device
- Special Ethernet adapter cable for MFD (only for certain brands, see detailed information in the links below)

13.2. Compatible multifunction devices and instructions

Instructions for Garmin MFD

Instructions for Navico navigation devices (Simrad, B&G, Lowrance) Instructions

for Raymarine

Instructions for Furuno

Using the application for other purposes

The application visible on multifunction devices is an HTML5 application hosted on the GX device. It can also be accessed from a standard computer (or mobile device) by entering the following address in your browser: http://venus.local/app/ or replacing venus.local with the IP address of the GX.

13.3. Raymarine MFD integration

13.3.1. Introduction

This chapter explains how to connect to Raymarine multifunction devices using an Ethernet connection. The last chapter also explains the specifics of Raymarine when connecting to NMEA 2000.

The integration technology used is called LightHouse Apps from Raymarine.

Note that there is an alternative connection method, which is NMEA 2000. See the NMEA2000 chapter in the main manual and the last chapter of this manual.

13.3.2. Compatibility

MFD integration is compatible with Axiom, Axiom Pro and Axiom XL MFDs running LightHouse 3 and LightHouse 4. eS and gS series multifunction displays that have been updated to LightHouse 3 are not compatible.

Raymarine MFDs require at least LightHouse v3.11, released in November 2019, for compatibility.

On the Victron side, all GX devices (Cerbo GX, Colour Control GX, Venus GX, etc.) can be used and are compatible. For detailed product compatibility with regard to inverters/chargers and other components, please refer to the main chapter on Marine Multifunction Device Integration using the app [80].

13.3.3. Connection

The MFD must be connected to the GX device via Ethernet. Connection via WiFi is not possible. A RayNet adapter is required for Ethernet connection.

RayNet adapters can be purchased from Raymarine:

Raymarine part number	Description
A62360	RayNet (F) to RJ45 (M) - 1m
A80151	RayNet (F) to RJ45 (M) - 3m
A80159	RayNet (F) to RJ45 (M) - 10m
A80247	RayNet (F) to RJ45 (F) adapter
A80513	RayNet male to RJ45 adapter cable

To connect your GX device to the internet, use WiFi. If your Axiom multifunction device is connected to the internet (via WiFi), it will automatically share its connection with your GX device via Ethernet.

Connecting the Axiom multifunction device to a network router via Ethernet leads to IP address conflicts due to the integrated DHCP server in the Axiom multifunction device.

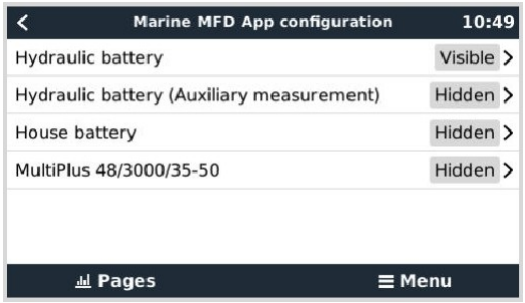
Due to the integrated DHCP server in the Axiom multifunction device, it is not possible to use GX GSM or GX LTE 4G.

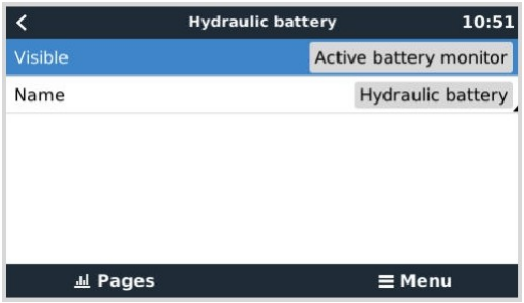
From Raymarine LightHouse v3.15 onwards, it is possible to switch DHCP off. Switching this option off does not mean that the Axiom multifunction device will work with third-party network routers. For more information, see this post on the Victron Community website.

13.3.4. GX device configuration

1. On the Victron GX device, go to Settings → Services and enable both MQTT on LAN (SSL) and MQTT on LAN (Plaintext).

2. Next, go to Menu → Settings → System Settings → Battery Measurement and set which batteries you want to display on the MFD and under what name.





3. For boats, motorhomes and other applications with DC loads such as lighting and an installed battery monitor, be sure to enable the "Has DC system setting" setting. For more information, see the chapter Menu Structure and Configurable Parameters [44].

No further settings, such as IP addresses and the like, are necessary because Axiom multifunction devices have an integrated DHCP server.

13.3.5. Configuring multiple battery measurements

This video explains how to set up multiple battery measurements and how to name them.

13.3.6. Step-by-step installation

1. Connecting the RayNet adapter cable to the MFD
2. Connect the RJ45 end of the RayNet adapter cable to the Ethernet port of the GX device.
3. Go to the Applications section on the MFD and select the Victron logo.

4. And... you're done. You can now view all the information on a single screen, which is:

   DC loads, battery information, shore power connection, solar panel production, AC loads, inverter and generator control, and the ability to open a remote console.

   This video shows the exact procedure:

After connecting the Ethernet cable, the GX device will receive an IP number from Axiom DHCP. If you launch the Victron application on the Axiom device and "hardware device not found" appears, simply restart the Axiom device and you will see... it works!

13.3.7. NMEA 2000

In addition to connecting via Ethernet, Raymarine multifunction devices can also be connected to the Victron system using NMEA 2000. If you are new to NMEA 2000 and Victron, please read the NMEA 2000 and MFD integration guide.

The sections below explain the specifics of NMEA 2000 when connecting Victron to Raymarine MFD.

13.3.8. General and supported PGNs

To set up data sources on your Raymarine device, go to Settings > Network > Sources > Advanced. If you have more than 1

battery, be sure to adjust the Axiom device settings to the correct number of batteries. Raymarine supports the following Victron-

related PGNs:

PGN	Description
127505	Liquid level (tank level)
127506	Detailed DC status (charge status, time to end of operation)
127507	Charger status
127508	Battery status (battery voltage, battery current)
127509	Inverter status

Please note that Raymarine does not support *J1939 - AC data*.

If GPS data is available on the NMEA 2000/STNG network, the GX device recognises it as a GPS source and is able to use the GPS position in VRM.

13.3.9. Instantiation requirements when using Raymarine

Fluid instantiation details:

- Raymarine i70: maximum number of tank levels is 5; fluid instances 0-4 and type must be fuel.
- Raymarine i70s: maximum number of tank levels is 5; liquid instances 0-4 and type must be fuel.
- MFD Axiom: according to Lighthouse version 4.1.75, a maximum of 16 tanks can be connected; liquid instances 0-15.

13.3.10. Before LightHouse 4.1.75

If there is more than one SmartShunt or solar charger device on the NMEA 2000 network and SmartShunt or another device is transmitting the same PGN type, the data instances of these PGNs must be changed so that each data instance is unique.

This is usually the Battery instance used in the Battery Status and DC Detailed PGNs.

The procedure can be found here: NMEA 2000 Instances, Data Instances section. This requires an Actisense NGT-1 NMEA 2000 interface to your PC (USB).

This requirement for data instances to be globally unique for PGNs is specific to Raymarine. Other brands do not require this. And although it may not be essential, it is not required by the NMEA 2000 standard either. More specifically, it states: "Data instances must be unique within the same PGN transmitted by a device. Data instances do not need to be globally unique on the network."

13.3.11. LightHouse 4.1.75 and later

From LightHouse 4.1.75 onwards, battery instances no longer need to be unique. This means you can leave the default battery instance value, which is usually set to 0. Batteries are automatically detected by the Axiom display.

13.4. Navico MFD Integration

13.4.1. Introduction

Navico is the umbrella brand behind B&G, Simrad and Lowrance MFDs.

This chapter explains how to connect to a Navico multifunction display using an Ethernet connection. Be

sure to also review the chapter on Marine MFD Integration Using Applications [80].

Note that there is an alternative connection method, which is NMEA2000. See the NMEA2000 chapter in the main manual.

13.4.2. Compatibility

Compatible Navico hardware:

	Product	Display size						Notes
Simrad	NSO EVO3				16	19	24	
	NSO EVO2				16	19	24	
	NSS EVO3	7	9	12	16			
	Go to	7*	9	12				5 Not compatible No Ethernet port *Go7 YSE Not compatible = Go7 XSR only
B&G	Zeus3 glass helmet				16	19	24	
	Zeus3	7	9	12	16			
	Zeus S	7	9	12				
	Zeus 3S		9	12	16			
	Zeus 3S glass helm				16	19	24	
	Vulcan	7	9	12				
Lowrance	HDS Live	7	9	12	16			
	HDS Carbon	7	9	12	16			
Displaying information	IDS		9	12				

Please note that this feature also works on Simrad NSS evo2 and B&G Zeus2 devices, but only to a limited extent. Furthermore, it is not officially supported by Victron or Navico, and no new software versions will be released to fix any issues that may arise. In other words, this is not a configuration supported by Navico, but consumers can use it without concern (if they contact Navico or Victron support, our team will inform them that this is not a supported configuration). Further testing and user feedback will need to show what works and what does not on the evo2/Zeus2.

Currently, it is not possible to control the Victron MFD application other than via the touchscreen. This means that the following cannot be used:

- Local controls, i.e. the WheelKey button and arrow keys
- Simrad OP50

- B&G ZC2

13.4.3. Connection

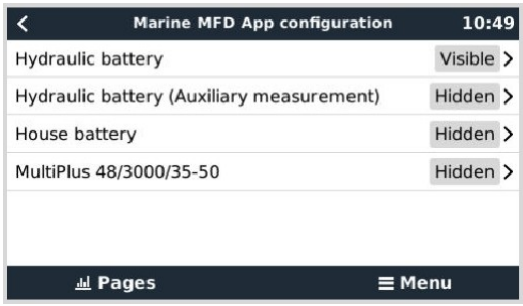
Navico devices must be connected to the GX device via Ethernet. Connection via WiFi is not possible. A Navico adapter is required for Ethernet connection, as Navico multifunction devices have a round waterproof connector on the back.
Adapters can be purchased from Navico:

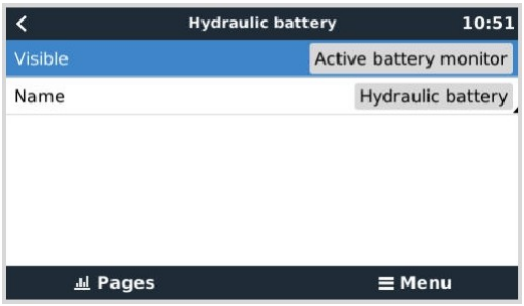
- ETHADAPT-2M 127-56
- RJ45M-5F ETH ADPTR NONWATERPRF CABLE

13.4.4. GX device configuration

1. On the Victron GX device, go to Settings → Services and enable both MQTT on LAN (SSL) and MQTT on LAN (Plaintext).

2. Next, go to Menu → Settings → System Settings → Battery Measurement and set which batteries you want to display on the MFD and under what name.





3. For boats, motorhomes and other applications with DC loads such as lighting and an installed battery monitor, be sure to enable the "Has DC system setting" setting. For more information, see the chapter Menu Structure and Configurable Parameters [44].

No further settings, such as IP addresses, etc., are required. GX devices and Navico devices connect to each other using a technology called linklocal addressing.

The router can be connected to the same LAN, thereby connecting the GX device to the internet. The GX device can also be connected to the internet via WiFi or using GX LTE 4G.

Please note that GX LTE 4G can only be used if the MFD and GX devices are directly connected to each other without a router.

13.4.5. Multiple battery measurement configuration

This video explains how to set up multiple battery measurements and how to name them.

13.4.6. Step-by-step installation

1. Connect the UTP cable to the MFD
2. Connect the other end of the UTP cable to the Ethernet port of the GX device.
3. Go to Applications on the MFD and select the Victron Energy logo, which will appear after a few seconds.
4. And... you're done. You can now view all the information on one screen, which is:

   DC loads, battery information, shore power connection, solar production, AC loads, inverter and generator control, and the ability to open a remote console.

   This video shows the exact procedure:

13.4.7. NMEA 2000

In addition to Ethernet connectivity, Navico multifunction devices can also be connected to the Victron system via NMEA 2000. If you are new to NMEA 2000 and Victron, please read the NMEA 2000 & MFD integration guide.

The MFD can be easily configured to display data from GX devices. No instances need to be changed. To set up data sources on the

MFD, go to Settings > Network > Sources > Advanced.

13.4.8. General and supported PGNs

To set up data sources on the Navico MFD, go to Settings > Network > Sources >

Advanced. The following Victron-related PGNs are supported:

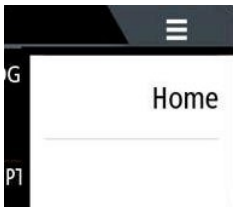
PGN	Description
127505	Liquid level (tanks)
127506	Detailed DC status (charge status, time to end of operation)
127507	Charger status
127508	Battery status (battery voltage, battery current)
127509	Inverter status

PGN	Description
J1939	AC PGN

13.4.9. Troubleshooting

Question 1: The MFD page displays outdated information or a page with a connection problem, but the GX device is running and connected, and the Victron icon is present on the home page.

A1: Try reloading the page by pressing the menu in the top right corner and selecting HOME.



13.5. Garmin MFD Integration

13.5.1. Introduction

This chapter explains how to connect to a Garmin multi-purpose navigation device using an Ethernet connection.
The integration technology used is called Garmin OneHelm.

Be sure to also review the chapter on Marine MFD Integration by Application [80].

Note that there is an alternative connection method, NMEA2000. See the NMEA2000 chapter in the main manual.

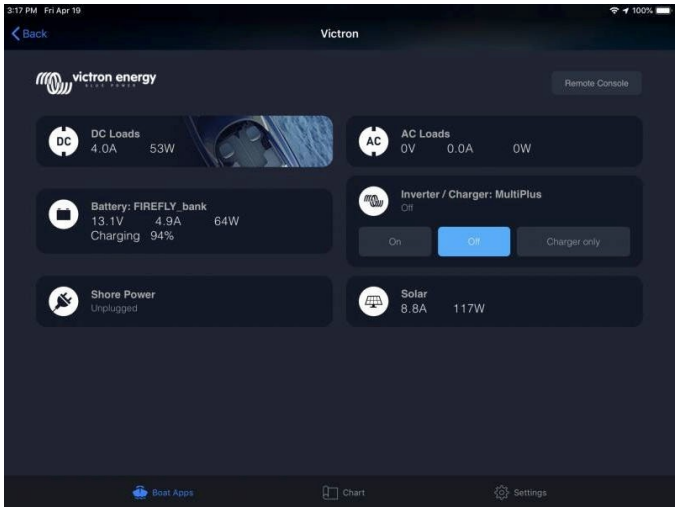
13.5.2. Compatibility

The OneHelm system is currently available for the following models:

- GPSMAP® 8400/8600 MFD series
- GPSMAP® 722/922/1222 Plus MFD series

The ActiveCaptain app is also supported. The image below shows the ActiveCaptain app with the Victron app.

All GX devices (Cerbo GX, Colour Control GX, Venus GX, etc.) from Victron can be used and are compatible. For detailed product compatibility with inverters/chargers and other components, please refer to the main chapter on Marine Multifunction Device Integration using the app [80].



13.5.3. Connection

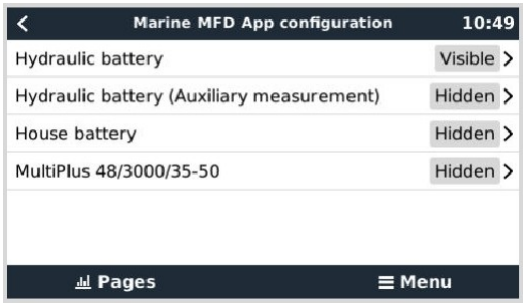
The Garmin MFD must be connected to the GX device via Ethernet. Connection via WiFi is not possible. A Garmin adapter is required for Ethernet connection:

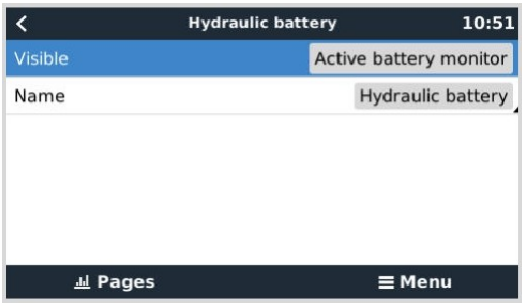
Garmin part name	Length	Garmin part number
Cables for marine networks	6 feet	010-10550-00
Cables for marine networks	20 feet	010-10551-00
Cables for marine networks	40 feet	010-10552-00
Cables for marine networks	500 feet	010-10647-01

13.5.4. GX device configuration

1. In the Victron GX device, go to Settings → Services and enable both MQTT on LAN (SSL) and MQTT on LAN (Plaintext).

2. Next, go to Menu → Settings → System Settings → Battery Measurement and set which batteries you want to display on the MFD and under what name.





3. For boats, motorhomes and other applications with DC loads such as lighting and with a battery monitor installed, be sure to enable the "Has DC system setting" setting. For more information, see the section Menu Structure and Configurable Parameters [44].

No special network settings are required. Not on the Garmin device and not on the Victron GX device.

Garmin multifunction devices run a DHCP server, and GX devices are configured to use DHCP by default. After connecting the cable, the Victron Energy icon will appear after 10 to 30 seconds.

To connect your GX device to the internet and the VRM portal while its Ethernet port is already being used to connect to a Garmin device, use WiFi. For more information, see the chapter Connecting to the Internet [34].

Connecting a Garmin multifunction device to a network router via Ethernet leads to IP address conflicts due to the integrated DHCP server.

Due to the integrated DHCP server in the Garmin multifunction device, it is not possible to use GX GSM or GX LTE 4G.

13.5.5. Configuring multiple battery measurements

This video explains how to set up multiple battery measurements and how to name them.

13.5.6. Step-by-step installation

1. Connect the UTP cable to the MFD
2. Connect the other end of the UTP cable to the Ethernet port of the GX device.
3. Go to Applications on the MFD and select the Victron Energy logo, which will appear after a few seconds.
4. And... you're done. You can now view all the information on one screen, which is:

   DC loads, battery information, shore power connection, solar panel production, AC loads, inverter and generator control, and the ability to open a remote console.

   This video shows the exact procedure:

13.5.7. NMEA 2000

In addition to connecting via Ethernet, Garmin MFD devices can also be connected to the Victron system using NMEA 2000. If you are new to NMEA 2000 and Victron, please read the NMEA 2000 & MFD integration guide.

The MFD can be easily configured to display data from GX devices. No instances need to be changed.

To configure NMEA 2000 on the MFD, go to Settings > Communication > NMEA 2000 Settings > Device List. Here you can view information about connected products and change their names. Note that names are stored on the MFD, not on the NMEA 2000 device.

13.5.8. General and supported PGNs

The following PGNs related to the Victron system are supported:

PGN	Description
127505	Fluid level (tank)
127506	Detailed DC status (charge status, time to end of operation)
127508	Battery status (battery voltage, battery current)

Supported PGNs may vary depending on the model. Please refer to the MFD manual for a list of supported PGNs.

13.6. Furuno MFD integration

13.6.1. Introduction

This chapter explains how to connect to a Furuno multifunctional navigation device using an Ethernet

connection. Be sure to also review the chapter on Integrating Marine MFDs Using Applications [80].

Note that there is an alternative connection method, which is NMEA 2000. See the NMEA 2000 chapter in the main manual. Currently, Furuno MFDs only support PGNs for liquid levels transmitted by Victron devices.

13.6.2. Compatibility

MFD integration is compatible with the following Furuno MFDs:

- NavNet TZtouch3 TZT12F
- NavNet TZtouch3 TZT16F
- NavNet TZtouch3 TZT19F
- Navnet TZtouch2 TZT2BB Black Box

Please note that NavNet TZtouch3 multifunction devices require at least software version v1.08. Navnet TZtouch2 TZT2BB MFDs require at least software version v7.01.

Please also note that Navnet TZtouch2 TZTL models are not supported.

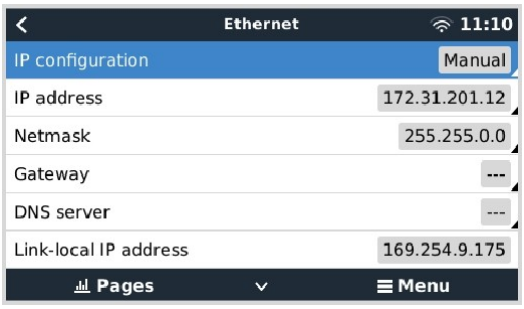
All GX devices (Cerbo GX, Colour Control GX, Venus GX, etc.) can be used with Victron and are compatible. For detailed product compatibility with inverters/chargers and other components, please refer to the main chapter on Integrating Marine Multifunction Devices using the App [80].

13.6.3. Connection

The Furuno device must be connected to the GX device via Ethernet. Connection via WiFi is not possible. A standard Ethernet cable can be used for the Ethernet connection. The GX device can be connected either directly to the MFD or via a network router/switch.

13.6.4. Configuration

Ethernet network configuration



On the Victron GX device, ensure that the Ethernet cable is connected, then go to Settings → Ethernet and set the following configuration:

Settings	Value
IP configuration	Manual
IP Address	172.31.201.12
Network mask	255.255.0.0
Gateway	0.0.0.0 or the IP address of the router in your network.
DNS server	0.0.0.0 or the IP address of the router in your network.

You can connect a router to the same LAN to connect your GX device to the internet. Ensure that
The gateway and DNS server settings in the GX device are set to the router's IP address, and the router has a LAN IP address

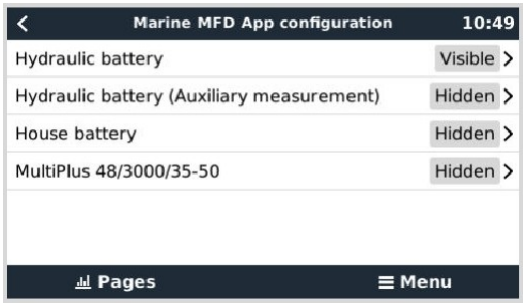
configured in the same subnet.

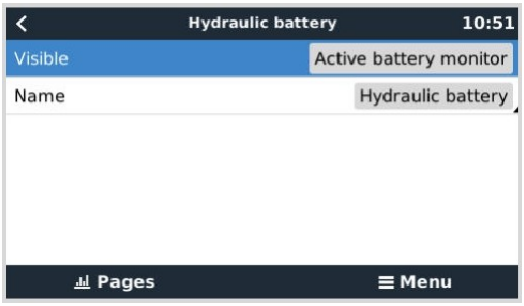
It is not possible to use GX GSM or GX LTE 4G.

GX device configuration

1. On the Victron GX device, go to Settings → Services and enable both MQTT on LAN (SSL) and MQTT on LAN (Plaintext).

2. Next, go to Menu → Settings → System Settings → Battery Meters and set which batteries you want to display on the MFD and under what name.





3. For boats, motorhomes and other applications with DC loads such as lighting and an installed battery monitor, be sure to enable the "Has DC system setting" setting. For more information, see the section Menu Structure and Configurable Parameters [44].

13.6.5. Configuring multiple battery measurement

This video explains how to set up multiple battery measurements and how to name them.

13.6.6. NMEA 2000

In addition to Ethernet connectivity, Furuno multifunction devices can also be connected to the Victron system via NMEA 2000. If you are new to NMEA 2000 and Victron, please read the NMEA 2000 and MFD integration guide.

This chapter documents the specifics of displaying Victron NMEA 2000 information on Furuno multifunction devices. Please note that this is not a comprehensive guide. It is simply the result of our research and development, which tested everything on Furuno MFDs. Functionality is (mostly) dictated by Furuno software and may therefore change and improve as Furuno changes its software.

The MFD can be easily configured to display data from the GX device. No instances need to be changed to display tank data. To correctly display battery/DC data from the Victron device, the Data PGN instances that are sent need to be changed.

The procedure for doing this can be found here: NMEA 2000 instance changes, Data instances section.

To view NMEA 2000 devices on the MFD, go to Settings > Initial Setup > Data Collection > Sensor List. Here you can view basic information and change device instances and custom names.

13.6.7. General and supported PGNs

The following PGNs related to the Victron system are supported:

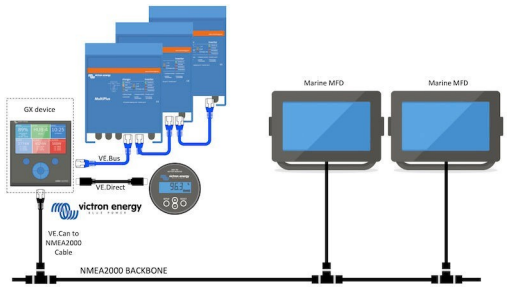
PGN	Description
127505	Fluid level (tank)
127506	Detailed DC status (charge status, time to shutdown)[1)]
127508	Battery status (limited support); voltage, current [(1, 2)]

[1)] The tested Furuno MFD firmware supports a maximum of 4 batteries, no more.

[2)] Due to an error in the MFD firmware, negative battery current (i.e. during discharge) is displayed as --- (three dashes).

14. Integrating Marine Multifunction Devices Using NMEA 2000

14.1. Introduction to NMEA 2000



Victron Energy GX devices are equipped with NMEA 2000-out functionality: when enabled, the GX device acts as a bridge, making all battery monitors, inverters/chargers and other products connected to the GX device accessible on the NMEA 2000 network.

Using this function and after connecting the GX device to the NMEA 2000 network, marine multifunction devices can read this data and visualise it for the user. Often in a highly configurable manner.

To connect your GX device to the NMEA 2000 network, use our VE.Can to NMEA2000 micro-C male cable.

Comparison with application integration

Compared to MFD integration using an application, as explained in the previous chapter, integration via N2K offers more customisable configuration options. The disadvantage of integration via N2K is that it is more labour-intensive to create such a configuration and to ensure support and compatibility of all PGNs and fields between the Victron system and the MFD.

More information

In addition to this chapter, be sure to read:

1. Introductory blog post
2. Our main guide to NMEA 2000 and MFD integration for marine applications
3. The NMEA 2000 chapter in the Victron manual for the MFD you are using (Navico/Simrad/Lowrance/B&G, Raymarine, Garmin or Furuno).

Yes, it's a lot to read, but that's basically NMEA 2000 itself: for example, some of these MFDs support the display of alternating data received via NMEA 2000 cabling, while others do not. Some require a change of Data instances, others do not, etc.

14.2. Supported devices / PGN

NMEA 2000 defines several messages.

- Messages are identified by a parameter group number (PGN).
- The text description of the message is publicly available on the NMEA 2000 website (http://www.nmea.org/).
- Detailed protocol specifications and definitions of messages or parts thereof can be ordered online from the NMEA 2000 website.
- NMEA 2000 is based on and compatible with SAE J1939. All AC information messages are in AC status message format as defined in J1939-75. The specification for these messages can be purchased from the SAE website (http://www.sae.org/).
- A detailed list of PGNs can be found in our white paper Data Communication with Victron Energy Products.

Inverters/chargers

- All inverters/chargers that connect via the VE.Bus port are supported. This includes Multis, Quattro, MultiPlus-II and other (similar) Victron inverters/chargers.
- Data is transferred and it is possible to set the shore power, switch the inverter/charger on and off, and activate inverter-only and charger-only modes.

The interface has two functions:

- The "153 Inverter" function represents the AC output.
- The "154 AC Input" function monitor represents the AC input.

Reports on the status of the charger will be sent by the converter function. Both functions have their own network address. Since both functions transmit the same PGN, such as PGN AC Status containing voltage, current and other information, NMEA 2000 data consumers, such as general displays, will need to be able to distinguish between them based on their network address. Depending on the function associated with this network address, it must be interpreted as either converter input or converter output.

- Displays that are not capable of this consider the data to belong to the network (utility). The inverter output is then interpreted as utility no. 0 and the inverter input as utility no. 1. These default instance numbers can be changed if necessary using the network configuration tool.
- The battery temperature measured by the converter (/charger) is also transmitted.
- All VREG communication must be sent to the address representing the converter function. The second address, AC input, does not support VREG requests: this address only transmits information related to the AC input.

Inverters

- Both converters connected via the VE.Bus bus and converters connected via the VE.Direct cable, whose information is available on the NMEA 2000 network, are supported.

Battery monitors

- Supported. This includes any battery monitor supported by the GX device.
- The battery selected as the system battery in the GX device (Settings → System Settings → Battery Monitor) is transferred with a fixed device and battery instance of 239 to ensure that the main (system) battery always has the same instance, instead of the system using instance 0 for e.g. Lynx Smart BMS (with built-in battery monitor) and a system with, for example, SmartShunt would use different instances.

Solar chargers

- Supported. Values related to batteries and photovoltaic array voltage and current are available on the NMEA 2000 network.

AC chargers

- Phoenix Smart IP43 120-240 V and 230 V charger models are supported. Only the 120-240 V model allows remote control (switching on/off and limiting the input current) from a compatible MFD.

Tank level data

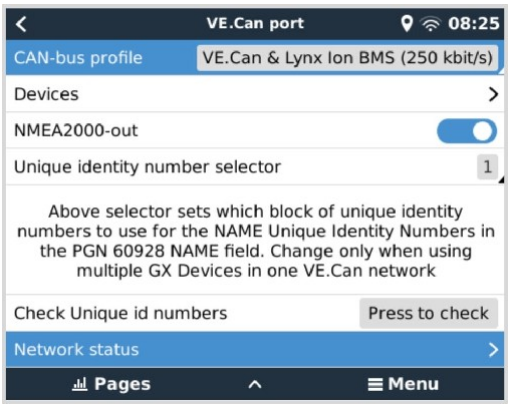
- All tank levels visible on the GX device, including GX Tank 140 and Mopeka sensors, are transmitted to the NMEA 2000 network. The PGN used is 127505 Liquid Level, which includes the liquid instance (aka data instance), liquid type (fuel, fresh water, waste water, live well, oil, black water, gadolin, diesel, LPG, LNG, hydraulic oil, and raw water) and the liquid level as a percentage of tank volume and tank volume.

  Be careful when using the LNG, LPG, diesel and hydraulic oil liquid types: these are relatively new types in the NMEA 2000 standard and not all MFDs and chartplotters support them yet.
- Tank labelling on multi-purpose devices must be done on each multi-purpose device. The custom name configured in the Victron system is transferred in the Installation Description No. 1 field in PGN 126996 - Product Information, but is not used by multi-purpose devices.
- The GX device automatically numbers each tank with a unique device instance and tank instance. They are created in the same way. This automatic numbering is done specifically and only for tank levels to make the process of displaying them correctly on all different brands and types of MFDs as simple as possible.

Additional data and product types

- Not supported. The types explicitly mentioned above are the only ones currently supported.

14.3. NMEA 2000 configuration



Settings	Default	Description
CAN bus profile	VE.Can	Defines the type and transmission speed of the CAN bus network. For use in combination with NMEA 2000, ensure that you select one of the profiles that includes VE.Can and has a speed of 250 kbit/s.
NMEA2000-out	Off	Enables and disables the NMEA2000-out function.
Selecting a unique identification number	1	Selects the block of numbers to be used for unique NAME identification numbers in the PGN 60928 NAME field. For the GX device itself, and if the NMEA2000-out function is enabled, also for virtual devices. Only change this when installing multiple GX devices on the same VE.Can network. There are no other reasons to change this number. For more details on the unique identification number, see the last section of this chapter.
Checking unique identification numbers		Searches for other devices that use the same unique number. When the search is complete, it will respond with either OK or the text: *Another device is connected to this unique number, please select another one.* Note that there is usually no reason to use this function: the GX device automatically and continuously checks the uniqueness of the numbers used and alerts you in case of a conflict. This setting is available for quick confirmation that everything is OK after changing the settings.

14.4. Configuring multiple tank level measurements via NMEA2000 output for Raymarine MFD multifunction devices

Modern Raymarine Axiom MFDs are capable of displaying up to 16 levels in tanks, and smaller MFDs such as the i70 or i70 can display up to 5 tanks.

The following restrictions apply:

1. Currently, Axiom can only display the following liquid types: Fuel (default), Fresh Water, Waste Water (aka Grey Water), Live Well, Black Water, and Petrol. Other liquid types, such as LNG, LPG, hydraulic oil, and diesel, are not displayed. This is a Raymarine limitation that may change with a future firmware update.

   However, it is possible to configure the fluid type of a specific tank transmitter in the GX device menu to one of the supported types and then rename the tank in the Axiom tank settings (Vessel Details > Tank Configuration > Tank Settings) to any type, e.g. LPG, which will then be displayed on the dashboard as an LPG tank.

2. The i70 and i70s models display up to 5 tanks, which must be of the Fuel liquid type. All other liquid types are not displayed.

3. Instantiation requirements can be found below in the section Instantiation requirements when using Raymarine [83].

4. All tank transmitters listed in the Victron Product Connectivity [9] and Third-Party Product Connectivity [15] sections are supported.

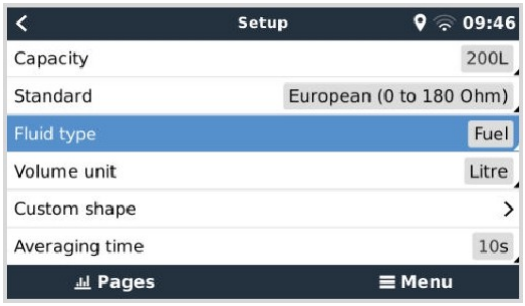
Step-by-step configuration

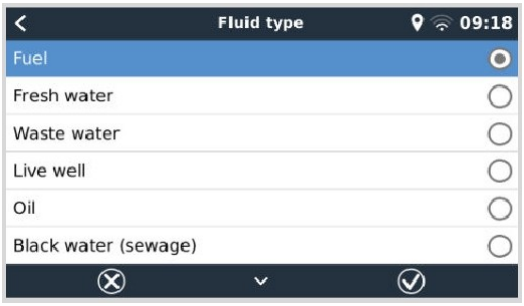
Before proceeding with the following steps, you must connect the GX to the NMEA 2000 network to which the multifunction device is connected. To connect the GX to the NMEA 2000 network, use our VE.Can to NMEA 2000 micro-C male cable and ensure that the NMEA2000-out function of the VE.Can port is enabled on the GX.

The procedure below does not replace the Raymarine manual; be sure to read the Raymarine documentation that came with

your Raymarine MFD. Visit the Raymarine manuals and documentation website for the latest version.

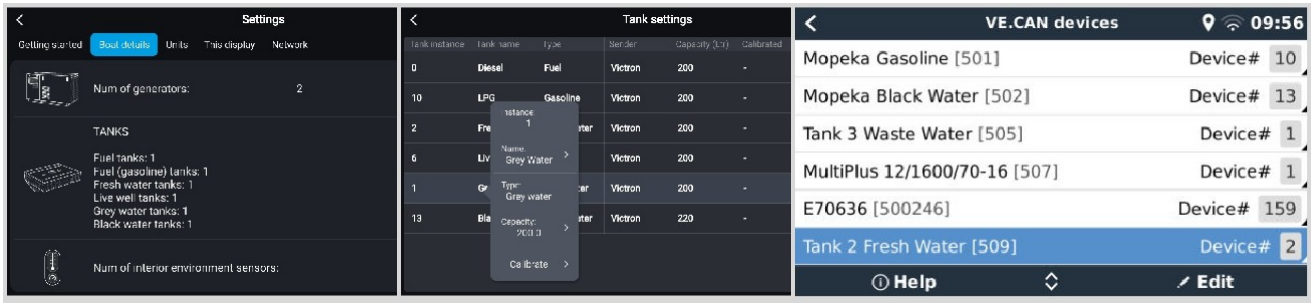
1. Connect the tank sensors to the GX device.
2. Ensure that the tank sensors are set to the fluid type supported by your MFD.





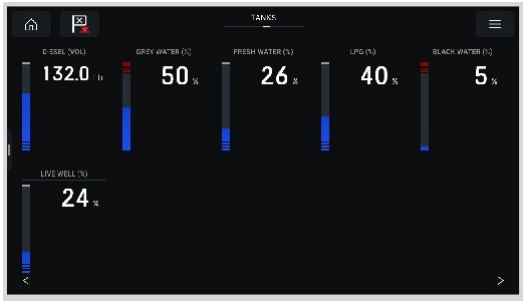
This is done in the tank sensor settings menu in the remote console - Device List → [your_tank_sensor] → Settings → Fluid Type.

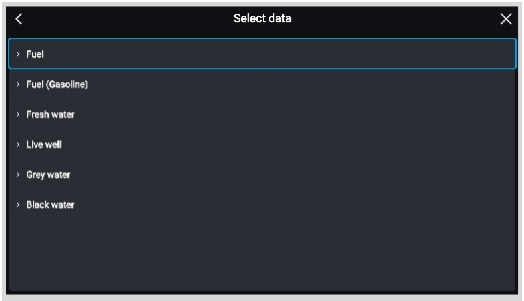
3. On the Axiom multifunction device, go to Settings > Boat Details > Tanks > Tank Configuration and check that all tank sensors are listed.



You can change the name of a tank to something meaningful by briefly tapping on it; this name will then be displayed on the dashboard.

4. Open the TANKS control panel or set up a new page to display the tanks.





By long-tapping one of the tanks, you can perform additional configurations, such as selecting the tank to be displayed or changing the unit from percentage to volume, if available.

14.5. Configuring multiple tank level measurements via NMEA2000 output for Garmin MFD

Modern Garmin MFDs, such as the GPSMAP 84xx series, are capable of displaying various types of tank levels. The following restrictions apply:

1. Currently, GPSMAP can only display the following liquid types: Fuel (default setting), Fresh Water, Waste Water (aka Grey Water), Live Well, Oil, Black Water, and Generator. Other liquid types, such as LNG, LPG, and diesel, are not displayed. This is a Garmin limitation that may change with a future firmware update to your MFD.

   However, in the GX device menu, you can configure the fluid type of a specific tank transmitter to one of the supported types and then rename the tank in the GPSMAP tank settings to any type, such as LPG, which will then be displayed on the dashboard

as an LPG tank.

2. All tank transmitters listed in the Victron Product Connectivity [9] and Third-Party Product Connectivity [15] sections are supported.

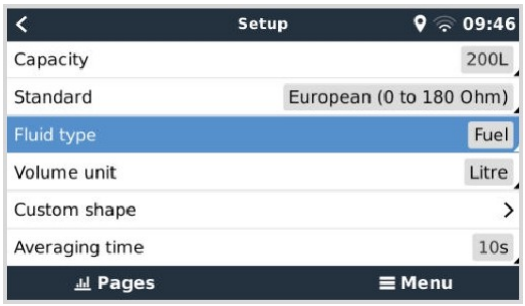
Step-by-step configuration

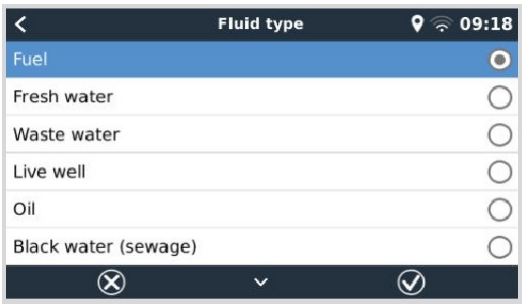
Before proceeding with the following steps, you must connect the GX device to the NMEA 2000 network to which the multifunction device is connected. To connect the GX device to the NMEA 2000 network, use our VE.Can to NMEA 2000 micro-C male cable and ensure that the NMEA2000-out port VE.Can function is enabled on the GX device.

The procedure below does not replace the Garmin manual; be sure to read the Garmin documentation that came with your multifunction device; there are some differences in the navigation of the menus of different multifunction devices.

1. Connect the tank sensors to the GX device.

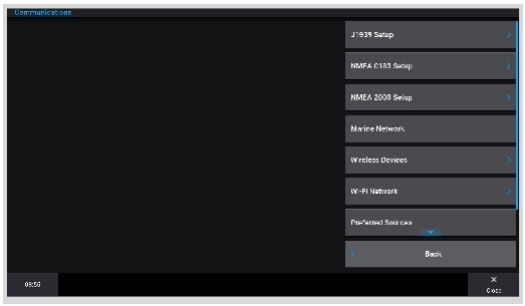
2. Ensure that the tank sensors are set to the type of liquid supported by your MFD.

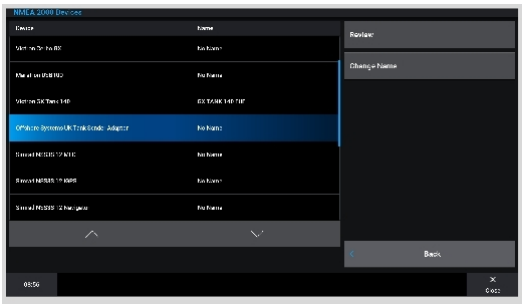




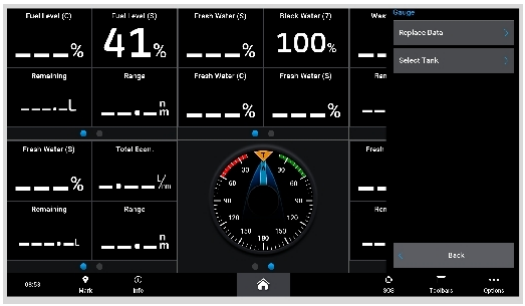
This is done in the tank sensor settings menu in the remote console - Device List → [your_tank_sensor] → Settings → Fluid Type.

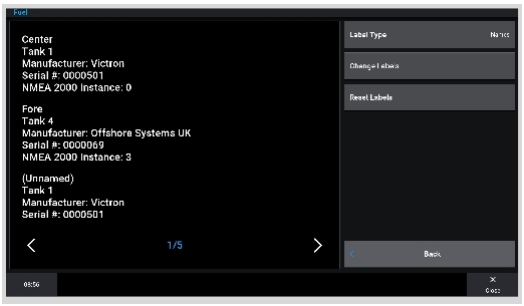
3. On your Garmin multifunction device, go to Settings > Communication > NMEA 2000 Settings > Device List and verify that all tank sensors are listed.





4. To configure the tank level sensors, open the gauges screen and then select Menu > Tank Preset, where you can select the tank level sensor you want to configure, change the name, type, style, capacity and location of the tank.





14.6. Configuring multiple tank level measurements via NMEA2000 output for Navico MFDs

Modern Navico MFDs, such as the Simrad NSO EVO3 series, are capable of displaying various types of levels in tanks. The

following restrictions apply:

1. Currently, compatible Simrad multifunction devices can only display the following types of liquids: Fuel (default setting), Water, Waste water (also known as grey water), Live well, Oil and Black water. Other liquid types, such as LNG, LPG and diesel, are not displayed. This is a Simrad limitation that may change with future firmware updates to your MFD.

   However, in the GX device menu, it is possible to configure the liquid type of a specific tank transmitter to one of the supported types and then rename the tank in the MFD tank settings to any type, e.g. LPG, which will then be displayed on the dashboard as an LPG tank.

2. All tank transmitters listed in the chapter Connecting Victron products [9] and Connecting supported non-Victron products [15] are supported.

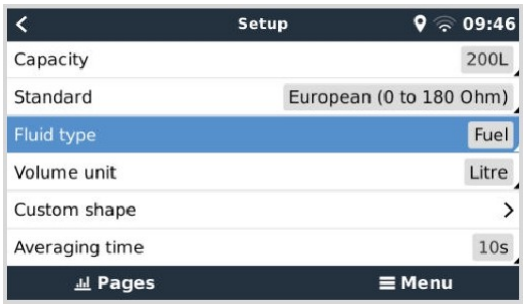
Step-by-step configuration

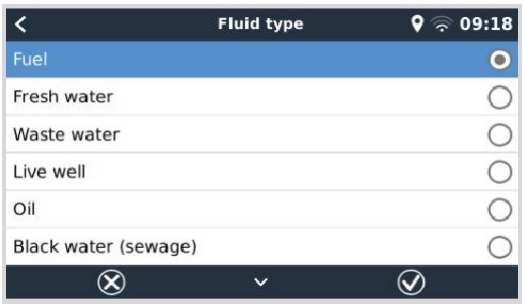
Before proceeding with the following steps, you must connect the GX device to the NMEA 2000 network to which the multifunction device is connected. To connect the GX device to the NMEA 2000 network, use our VE.Can to NMEA 2000 micro-C male cable and ensure that the NMEA2000-out function of the VE.Can port is enabled on the GX device.

The procedure below does not replace the Simrad manual; be sure to read the Simrad documentation that came with your MFD; there are some differences in the navigation of the menus on different MFDs.

1. Connect the tank sensors to the GX device.

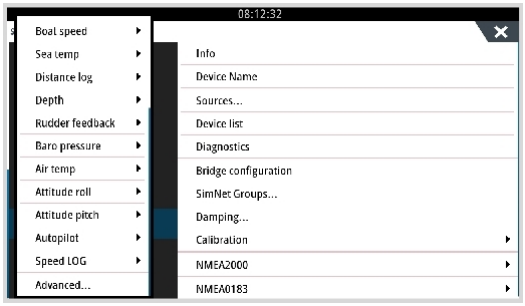
2. Check that the tank sensors are set to the type of liquid supported by your MFD.

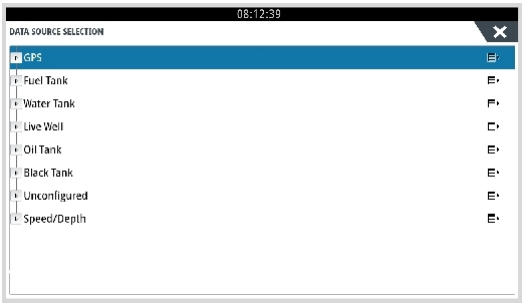




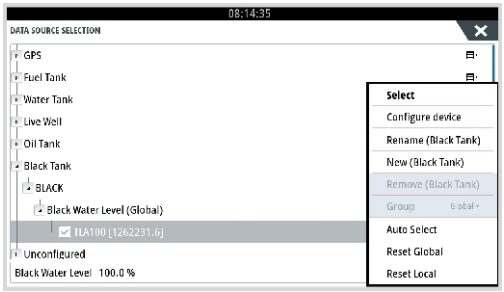
This is done in the tank sensor settings menu in the remote console - Device list → [your_tank_sensor] → Settings → Fluid type.

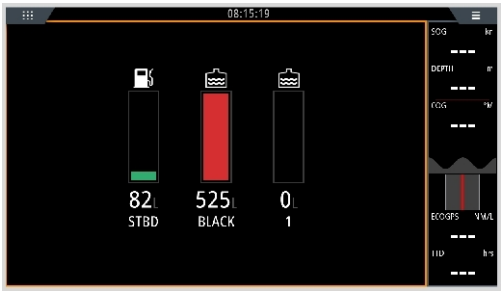
3. On your Simrad multifunction device, go to Settings > Network > Sources > Advanced > Data Source Selection and check that all tank sensors are listed. Tank sensors should be automatically identified by the system. If this is not the case, enable this feature in the System Settings dialogue box under Advanced.





4. Selecting a tank sensor in the Data Source Selection menu will display additional details and configuration options, such as fluid type, location, or custom name. Finally, open the dashboard or create a custom dashboard and place the tank sensors as desired.





14.7. Configuring multiple tank level measurements via NMEA2000 output for Furuno MFDs

Modern Furuno MFDs, such as the NavNet TZtouch3 series, are capable of displaying various types of tank levels. The following

limitations apply:

1. Currently, the NavNet TZtouch3 series can only display fuel (default setting), fresh water and black water, with up to 6 tanks for each of these three types of liquids.

   However, the nickname can be changed for each individual tank in the Engine & Tank Manual Setup menu.

2. All tank transmitters listed in the Victron Product Connections [9] and Connecting Supported Non-Victron Products [15] chapters are supported.

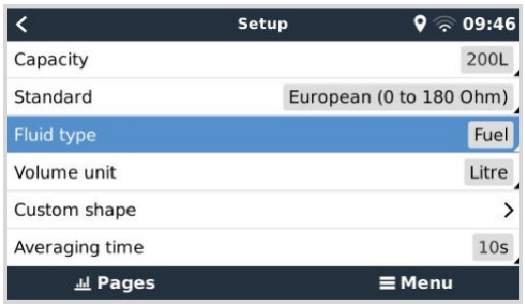
Step-by-step configuration

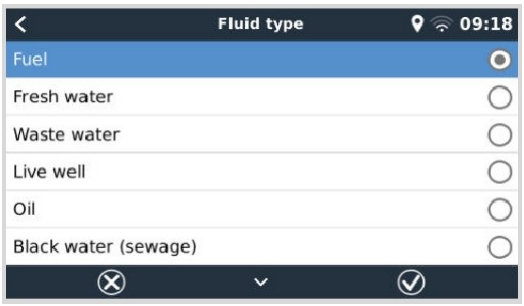
Before proceeding with the following steps, you must connect the GX device to the NMEA 2000 network to which the multifunction device is connected. To connect the GX device to the NMEA 2000 network, use our VE.Can to NMEA 2000 micro-C male cable and ensure that the NMEA2000-out port VE.Can function is enabled on the GX device.

The procedure below does not replace the Furuno manual; be sure to read the Furuno documentation that came with your MFD; there are some differences in the navigation of the various MFD menus.

1. Connect the tank sensors to the GX device.

2. Check that the tank sensors are set to the type of liquid supported by your MFD.





This is done in the tank sensor settings menu in the remote console - Device List → [your_tank_sensor] → Settings → Fluid Type.

3. The Furuno MFD automatically detects tanks connected to the same NMEA 2000 network. If this is not possible (see the Engine & Tank Automatic Setup menu), the tanks can be set manually using the Engine & Tank Manual Setup menu.

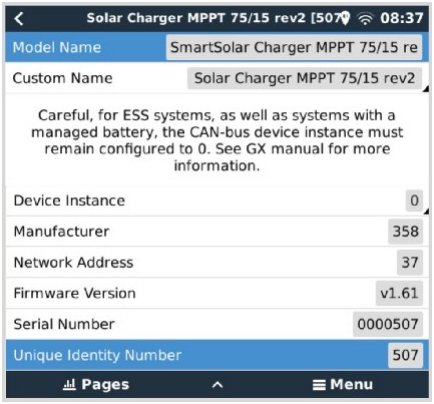
4. Set the "Instrument Display" according to your preference and add the relevant tanks to the instrument display as "Indications" (as described in the operating manual).

14.8. Configuring NMEA 2000 device instances

The VE.Can Devices submenu provides access to a list of all detected devices in the VE.Can / NMEA 2000 network:

- For each item, the name is displayed first – either the product name listed in our database or, if configured, the custom name that was configured during installation.
- Then, a unique identification number is displayed between square brackets.
- On the right, you can see the VE.Can device instance, which is the same as the NMEA 2000 device instance.

Press the Enter key to edit a specific device instance, or press the space bar/right cursor to go one step deeper in the menu structure to the page with all general data available for the device:



14.9. Technical data about NMEA2000-out

14.9.1. NMEA 2000 glossary

Here is a glossary to help you understand this text:

- **Virtual device**: a battery monitor, inverter or other Victron device that does not have a CAN-bus port itself and is "virtually" available on the CAN bus via the NMEA2000-out function of the GX device.
- **CAN bus**: VE.Can port on the GX device, which in the context of this chapter is probably connected to the NMEA 2000 network.
- **NMEA2000-out**: A software function in the GX device described in this chapter.
- **NMEA 2000:** CAN bus protocol for marine transport, based on J1939.
- **Instance:** there are many types of instances, which are explained in detail below.
- **J1939: J1939:** a set of standards defining the CAN bus protocol, defined by the SAE organisation.
- **Address Claim Procedure (ACL)**: A mechanism specified in J1939 and used in NMEA 2000 devices on a network to negotiate and assign unique network addresses to each device on the network. This is a number from 0 to 252. Three special network addresses are defined:
  1. 0xFD (253) - Reserved
  2. 0xFE (254) - Cannot claim an address - for example, when all others are in use.
  3. 0xFF (255) - Broadcast address

14.9.2. NMEA 2000 virtual device

When the NMEA2000-out function is enabled, the GX device acts as a bridge: it makes each battery monitor, inverter/charger or other connected device accessible individually on the CAN bus. Individually, as each has its own network address, device instance, function codes, etc.

For example, a GX device with two BMVs connected to the VE.Direct port and an inverter/charger connected via VE.Bus will make the following data available on the CAN bus:

Address	Class	Function	Description
0xE1	130 (Display)	120 (Display)	GX device itself
0x03	35 (power generation)	170 (battery)	1. BMV
0xE4	35 (electricity generation)	170 (batteries)	2. BMV
0xD3	35 (electricity generation)	153	Inverter/charger (AC output)
0xD6	35 (electricity generation)	154	Inverter/charger (AC input)

14.9.3. NMEA 2000 classes and functions

According to the NMEA 2000 specification, they define the types of transmitters and devices connected to the CAN bus. Classes are the main categories, and functions specify them in more detail.

14.9.4. NMEA 2000 instances

NMEA 2000 defines three different instances:

1. **Data instances**
2. **Device instances**
3. **System instances**

All of the above instance types are available for all battery monitors and other devices that the GX device makes accessible on the CAN bus, and they can be configured individually.

For each virtual device, there is one device instance and one system instance. Depending on the type of virtual device, there are one or more data instances.

For example, for the BMV-712, there are two data instances, one DC instance for the main battery and another for the starter battery voltage.

The way instances are configured depends on the device and software used to read them from the CAN bus. Examples of devices and software include MFDs such as Garmin, Raymarine or Navico, as well as more software-oriented solutions such as Actisense and Maretron.

Most of these solutions identify parameters and products by requiring unique device instances or using unique PGN 60928 NAME identification numbers, rather than relying on data instances being globally unique.

However, there are a few exceptions:

- For Raymarine and Furuno multifunction devices, the Data instance must be changed in order for the data to display correctly. For further details, please refer to the MFD integration page.

The NMEA 2000 specification states the following: "Data instances must be unique within the same PGN transmitted by a device. Data instances do not need to be globally unique across the network. Field programmability is achieved using PGN 126208, the field group write function."

In other words, data instances must be unique only within a single device. There is no requirement for them to be globally unique – the only exception is the "Engine Instance", which, at least for now, must be globally unique in order to be compatible with older devices (e.g. Port = 0, Starboard = 1). For example, some of our BMV battery monitors can measure two voltages, one for the main battery and one for the starter battery, and this is where data instancing is used. The same applies to battery chargers with multiple outputs.
Note that it is not necessary for the installer to change these data instances, as these products are pre-configured to transmit the relevant PGNs with unique data instances (in this case, the battery instance and the detailed DC instance).

Although it is possible to change data instances, changing them on a Victron device will prevent other Victron devices from reading that device correctly.

Note on device instances: it is not necessary to assign a unique device instance to each device on the CAN bus.
It is not a problem for the battery monitor and solar charger to be configured with (default) device instance 0. Also, in the case of multiple battery monitors or solar chargers, it is not always necessary to assign a unique device instance to each of them. If necessary at all, they only need to be unique among devices that use the same function.

Please note that changing the device instance in Victron may alter its functionality, see below.

System instance

According to the NMEA 2000 specification, this instance is a 4-bit field with a valid range from 0 to 15, which indicates the occurrence of the device in other network segments, redundant or parallel networks, or subnetworks.

The System Instance field can be used to facilitate multiple NMEA 2000 networks on these larger marine platforms. NMEA 2000 devices behind a bridge, router, gateway, or as part of a network segment could indicate this using the System Instance Field.

ECU instances and function instances

Some documentation and software tools use different terminology:

- ECU Instance
- Function instance
- Lower device instance
- Upper device instance

Here is how they are related: the terminology *ECU Instance* and *Function Instance* comes from the SAE J1939 and ISO 11783-5 specifications. They do not appear in the NMEA 2000 definition. However, they all define the same fields in the same scope.
CAN-bus messages, which NMEA 2000 defines as *device instances*.

In more detail: The field that J1939 defines as ECU Instance is renamed *Device Instance lower* in the NMEA 2000 specification. The Function Instance field is renamed *Device Instance Upper*. Together, they form *Device Instance*, the NMEA 2000 definition.

Although different terms are used in both standards, these are the same fields. Device Instance Lower has a length of 3 bits and Device Instance Upper has a length of 5 bits, for a total of 8 bits. This is one byte, which is an NMEA 2000 device instance.

Unique Instance

Unique Instance is another term used to describe almost the same information. It is used by Maretron and can be made visible in its software by turning on a column. Maretron software itself chooses between Device Instance and Data Instance.

14.9.5. Changing NMEA 2000 instances

Data instances

Although we recommend not changing data instances (see explanation and WARNING above), it is possible to change them.

There is no option to change them in the Venus operating system – a third-party tool is required, and the only tool we know of that can do this is the Actisense NMEA2000 reader.

To change Data instances, read the section Changing NMEA2000 instances.

Device instances

To change device instances, read the section Changing NMEA2000 instances.

NOTE: these (Victron) functions depend on the Device Instance:

1. In the case of an ESS system with solar chargers connected to the VE.Can network, these solar chargers must continue to be configured to the default device instance (0) in order to function properly. This does not apply to solar chargers connected to the VE.Direct network, which are made available on the CAN bus as virtual devices using the NMEA2000-out function. Unless the GX device instance is reconfigured to a different device instance. This is technically possible, but not recommended and never required. In such a situation, however, the chargers must be configured to the same instance as the GX device.
2. The same applies to systems with controlled batteries.
3. Solar chargers and battery chargers connected to AC power synchronise with the VE.Can network after connection, synchronising their operation, charge status and so on. For this function to work, all chargers must be configured to the same device instance.

In summary, for most systems, we recommend leaving the default device instance value at 0.

14.9.6. PGN 60928 NAME Unique identification numbers

The GX device assigns an individual unique identification number to each virtual device. The assigned number is a function *of the PGN 60928 NAME Unique Identity Number* alias *Unique device number for VE.Can* block configured in the GX device settings.

This table shows how changing this setting affects the virtual devices available on the CAN bus:

Configured unique identity block:	1	2	3	4
GX device	500	1000	1500	2000
1st virtual device (e.g. BMV)	501	1001	1501	2001
2nd virtual device (e.g. other BMV)	502	1002	1502	2002
3rd virtual device (e.g. third BMV)	503	1003	1503	2003

15. RV-C Support

15.1. RV-C Introduction

Starting with Venus OS v2.90 firmware, Victron supports the RV-C protocol.

What is the RV-C protocol?

The RV-C (Recreation Vehicle-CAN) protocol is to recreational vehicles what NMEA 2000 (also known as N2K) is to boats: a communication protocol based on the CAN (Controller Area Network bus) and used primarily in recreational vehicles in the US to enable communication and cooperation between recreational vehicle devices and appliances.

There are two basic functions, RV-C out and RV-C in.

- The RV-C output allows you to control and monitor compatible Victron devices from the RV-C control panel.
- The RV-C in function allows data from one or more compatible RV-C devices to be displayed on the GX device.

To summarise this function on a GX device connected to an RV-C network, the RV-C control panel can read Victron data, e.g. from a BMV or inverter/charger, and display it to the user or even control some of it. Compatible RV-C devices are simultaneously displayed on the GX unit's display.

The RV-C is based on SAE J1939.

15.2. Limitations

VE.Can devices

The RV-C and VE.Can protocols are not compatible with each other: the VE.Can port on the GX device can be configured for either the VE.Can profile or the RV-C profile, but not both at the same time.

Using a GX device with only one fully functional VE.Can port means that there are limitations on which devices can be used in the system if an RV-C connection is required.

Typical products for motorhomes that cannot be used in the situation described above:

- Lynx Smart BMS cannot be used because it must be connected via VE.Can. Instead, use BMS VE.Bus (connects to the VE.Bus port).
- Lynx Smart Shunt cannot be used; use SmartShunt instead (connects via VE.Direct).
- The Wakespeed alternator controller cannot be connected to monitoring by a GX device.
- MPPT charge controllers with higher power ratings must be connected using their VE.Direct connection. Not in the VE.Can network.

Depending on the system, this currently limits the choice of suitable GX devices:

- Color Control GX (CCGX), MultiPlus-II GX and EasySolar-II GX: it only has one VE.Can port, so it can be configured for either VE.Can or RV-C, but not both. For this reason, it is not possible, for example, to create a system with Lynx Smart BMS (which must be connected to the VE.Can port) and at the same time have it connected to RV-C.
- Cerbo GX and Cerbo-S GX: the current generation has only one (fully functional) VE.Can port. As above, either VE.Can or RV-C, not both.

  In mid-2023, we expect to see the launch of an improved version of Cerbo GX with two fully functional VE.Can ports instead of one fully functional and one limited to BMS-Can.

  > Please note that the BMS-Can port on Cerbo GX is limited and cannot be used as an RV-C port.

- Venus GX: has two VE.Can ports. It can therefore be connected to both networks, VE.Can and RV-C, at the same time.
- Ekrano GX: has two VE.Can ports. It can therefore be connected to both networks, VE.Can and RV-C, simultaneously.

15.3. Supported devices

Venus v2.90 adds RV-C out support for the following products:

Product Victron	Notes
VE.Bus inverter/charger	The inverter and charger can be controlled separately (on/off) from the RV-C. Shore input current limits can also be set.
Phoenix Smart IP43 120-240V charger	Can be activated/deactivated (on/off) using the RV-C. Shore current limits can also be set.
Phoenix Smart IP43 230V charger	The Phoenix Smart IP43 230V charger cannot be controlled and is read-only.
Skylla-i and Skylla-IP44/IP65	Please note that this requires two fully functional CAN-bus interfaces. Currently, only the Venus GX and Ekrano GX models have these two interfaces.
Phoenix VE.Direct converter	
Phoenix Inverter Smart and Inverter RS	
Solar chargers including MPPT RS	
Batteries: BMV, SmartShunt, Lynx Shunt, Lynx Ion BMS, Lynx Smart BMS	
Tanks; tank level transmitters connected to: tank level input on GX devices and GX Tank 140 VE.Can port and/or NMEA 2000 port of GX devices.	

VenusOS also supports RV-C in data for:

- RV-C tank sensors

  Please note that Garnet SeeLeveL II 709 does not have absolute tank level and volume. Therefore, we only show relative level. Tanks from other GX devices will have absolute level and capacity, but cannot be configured via RV-C.

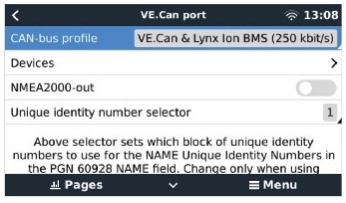
- RV-C Batteries: See Appendix [126] for advanced RV-C parameters and programming.

15.4. RV-C Configuration

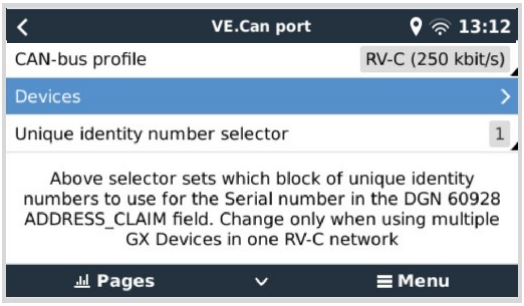
The RV-C configuration is performed via the GX device:

1. Open the remote console and go to Settings → Services → VE.Can Ports → CAN-bus Profile.
2. Open the CAN-bus profile and select the RV-C profile (250 kbit/s).

   The RV-C profile will start working and the previously selected profile will be disabled (associated devices, such as VE.Can devices, will become unavailable in the graphical user interface).

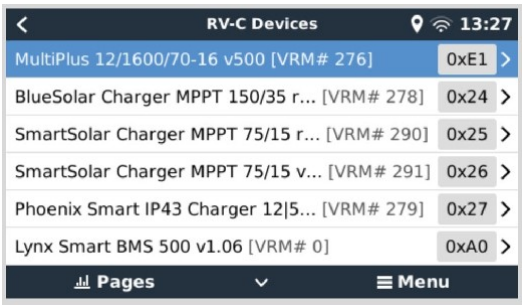


15.4.1. Configuring RV-C output devices

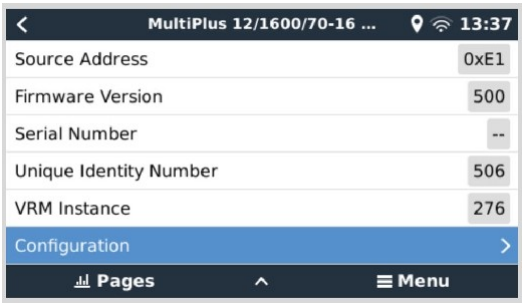


The RV-C out device can be configured in the Devices submenu in the VE.Can port menu.

The Devices submenu contains all RV-C network devices, including RV-C output devices. These are identified by their instance [VRM#], which can be used to identify "real" devices from the GX root device menu. The hexadecimal number on the right is the source address.



After entering the RV-C device submenu, general information about the RV-C device is displayed, and most importantly, the configuration menu is displayed when you scroll to the bottom of the page. Viewing the configuration menu requires at least user and installer access levels, see the chapter Menu Structure and Configurable Parameters [44].



The instance for the relevant DGN can be changed in the Configuration submenu.

15.5. Support for Garnet SeeLevel II 709-RVC and Victron GX devices

Thanks to RV-C support in the Venus OS operating system, it is also possible to use the Garnet SeeLevel 709-RVC device and display its data on GX and VRM devices. All 709-RVC and SeeLevel Soul models are compatible with GX.

Please note the limitations described in the Limitations section [103]. This means that when using the CAN bus port on the GX device for RV-C, it cannot be used for other purposes at the same time, such as for shared VE.Can and NMEA 2000 functions. It is either VE.Can/N2K or RV-C, unless it is a Venus GX device, which has two full-fledged VE.Can ports. If this limits the further use of the GX device in terms of connectivity via VE.Can too much, it is recommended to use the Garnet SeeLevel 709-N2K device instead.

Please also note that the tank level shown on the Victron GX display is in percent, not in actual volume in litres, gallons or other volume units.

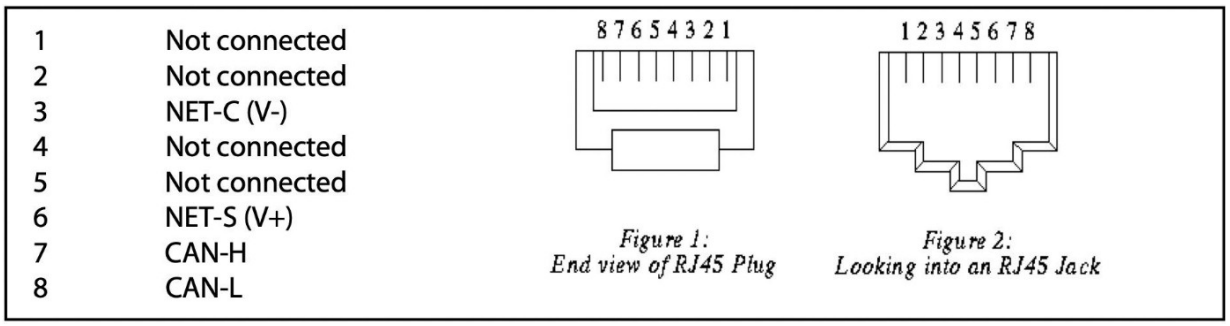
15.5.1. Connecting the Garnet SeeLevel II 709-RVC tank level sensor to the GX device

Before connecting to the GX device, ensure that the Garnet SeeLevel 709-RVC device is correctly installed and configured according to Garnet's installation instructions.

While the VE.Can port requires an RJ45 connector, the Garnet SeeLevel panel is equipped with either a multi-pin RV-C connector or a cable connection with one black, one blue and one white wire. In order to connect the two connectors together, an adapter cable must be assembled according to the pin assignment in the table below.

A commonly available CAT5 Ethernet cable is best suited for this purpose, with one of the two ends first cut off and then connected to the Garnet panel.

Garnet panel wire colour code	RV-C connector	Victron VE.Can RJ45	Colour coding of network cables Ethernet CAT5	Signal
Black	4	3	Green/white	Land
Blue	3	8	brown	CAN-L
White	2	7	Brown/white	CAN-H



Victron VE.Can pin layout

15.5.2. Installation and configuration

1. Run the cable from the Garnet panel to the GX device.
2. Ensure that both the Garnet and GX devices are switched off.
3. Connect the RJ45 plug to the VE.Can port on the GX device and the other end of the adapter cable to the Garnet panel.
4. Check that the bus termination is correct. For GX devices: Can RJ45. Correct bus termination is mandatory for Garnet SeeLevel devices if it is the only RV-C device.
5. Once everything is correctly installed, switch on both devices.
6. To correctly configure the VE.Can port for the RV-C profile, follow the instructions in the RV-C Configuration section.

16. Digital inputs

The Cerbo GX digital inputs are listed in the Connection Overview. [3]

The inputs are non-isolated. They operate at 3V3 and can withstand input voltages up to 5V. Each input has an internal 10k pull-up resistor to 3V3. We recommend connecting them to a potential-free relay or otherwise open collector/optocoupler output.

16.1. Configuration

Each of the digital inputs can be configured as one of a number of predefined sensors, which can also be configured as alarms. Note: Pulse counters are not supported in the Cerbo GX system.

The following functions can be configured:

Function	States
Door alarm	Open/closed
Chamber Pump	On/off
Alarm in the lower deck	OK/Alarm
Burglar alarm	OK/Alarm
Smoke alarm	OK/Alarm
Fire alarm	OK/Alarm
CO2 alarm	OK/Alarm
Generator	Started/stopped

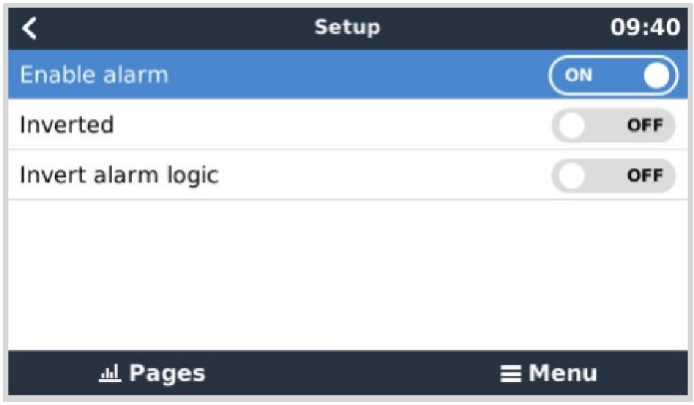
The function of each input can be configured in the remote console under Settings → I/O → Digital Inputs.

Once an input has been configured for its intended purpose, it will be visible to other devices.

Additional parameters related to this function can be configured by entering the device menu and selecting Settings.

For sensors and alarms, you can decide whether the input should be considered an alarm condition, whether the labels should be inverted, and whether the logic levels should be inverted.

- To swap the labels attached to the alarm, set Inverted to On.
- If a logically low input (0 V) is to be considered a positive state, set Inverted Alarm Logic to On.



16.2. Reading digital inputs via Modbus TCP

The values/states of the digital inputs are available on Modbus TCP. For more detailed information, refer to the "Modbus-TCP Register List" document, which can be downloaded from our website. Also, refer to our frequently asked questions about the Modbus-TCP protocol in the GX Modbus-TCP manual.

17. GX - Automatic generator start/stop

17.1. Implementing automatic generator start/stop

The internal relay on the GX device (e.g. Cerbo GX) can be used to automatically start and stop the generator. This relay - or switch - can be 'tripped' by a number of user-defined conditions. This chapter explains what conditions are available to you and guides you through the steps required to set up this useful feature.

For more general information about using a generator in combination with a Victron generator, see the frequently asked questions about the MultiPlus generator.

17.2. Wiring

First, connect the relay to the generator. The relay is located on the back of the Cerbo GX – it is labelled as a relay. If you are using a Cerbo GX, you will see two relays on the bottom of the unit – only relay 1 can be used for the automatic start/stop function of the generator.

The connection between Cerbo GX and the generator must be "permanent" so that the generator can continue to run and automatic shutdown is possible when the parameters for automatic shutdown are met.

In addition to controlling the internal relay, the automatic start/stop function can also be activated to directly control supported Fischer Panda generators. For more information on connecting Fischer Panda generators, please refer to the GX - Fischer Panda Generators documentation.

There are many connection options on the generator side, and you should also consult the generator manual or your supplier regarding the configuration of remote wired start-up.

17.3. Enabling the start/stop function

Go to: Settings → Relay and set the function options to Generator start/stop.

Relay

After activating this function, all settings related to the automatic start/stop function of the generator can be found in the main menu under: Generator in the Settings menu → Start/stop generator.

Fischer Panda generators

1. Enable the "AutoStart" function in the Fischer Panda generator control panel.
2. Go to the Fischer Panda Generator page and set the mode to Automatic start/stop.

Once the mode is set, all settings will be available in the Automatic Start/Stop menu at the bottom of the page.

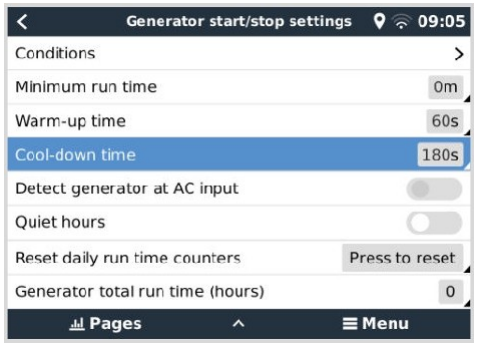
17.4. General start/stop menu

Go to Settings → Generator start/stop:

- **Generator status:** Current generator status.
- **Error:** Description of the error.
- **Running time:** The running time of the generator since it was last started.
- **Total operating time:** Total running time since the first start-up.
- **Time until next test run:** This item displays the time remaining until the next test run.
- **Daily operating time:** Daily time: Running time history for the last 30 days.
- **Settings:** This is the gateway to all other functions.

17.5. Settings menu

In the generator start/stop menu, scroll down and press the space bar on the Settings button to display the Settings menu.



Conditions: See chapter Conditions [111].

Minimum operating time: It is advisable to allow the generator to warm up to operating temperature after start-up. This setting is ignored during manual start-up.

Warm-up and cool-down time: Allows you to set a configurable warm-up or cool-down time for the generator using relay control when the AC input relay is open and no inverter/charger is connected to it. Please note that this function requires the VE.Bus inverter/charger to be updated to firmware 502 or later.

AC input generator detection: Enabling this feature will trigger an alarm on the GX device and also trigger an alarm e-mail from the VRM portal:

- whenever no power is detected at the AC input terminal of the inverter/charger. This function alerts you to a variety of problems, such as lack of fuel or a mechanical or electrical fault in the generator. This function is not available for Multi/Quattro devices connected to VE.Can.
- Requires automatic alarm monitoring to be enabled in the VRM module, which is the default setting.

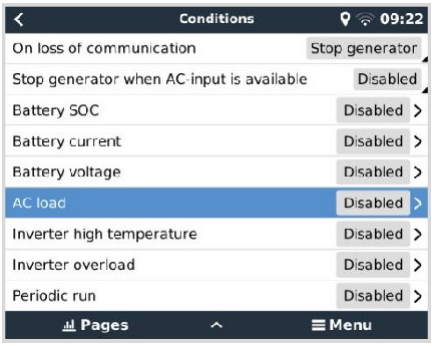
Quiet hours: See section Quiet hours [114] in chapter Conditions [111].

Reset daily running time counters: Resets the 30-day running time history.

Total generator operating time: Reset or adjust the total number of operating hours.

17.6. Conditions: User-definable parameters that trigger automatic generator start/stop.

To go to the Conditions page from the main menu, go to: Settings → Generator start/stop → Settings → Conditions



About communication loss: If communication between the Cerbo GX and the VE. Bus inverter/charger is lost, and parameters that depend on this information have been set, select one of the following actions:

- **Stop generator:** If the generator is running, it will stop (default setting).
- **Start generator:** If the generator is not running, it will start.
- **Continue running:** If the generator is running at the time of data loss, this setting will keep it running.

Stop the generator when AC input is available: This option is ideal for backup systems where the mains is connected to the AC-in 1 or AC-in 2 terminal and the generator is connected to the other AC-in terminal. If this option is enabled, the genset will not stop until mains voltage is restored after a mains failure. This feature is not available for Quattros connected to VE.Can.

The following parameters can be user-defined to start the automatic start/stop of the generator:

- Manual [113]
- Stop generator when AC input is available [111]
- Battery SoC [111]
- AC load* [112]
- Battery current [112]
- Battery voltage [112]
- High converter temperature [113]
- Inverter overload [113]
- Periodic operation [113]

(* The value measured here is the total AC power consumption in the system.)

The condition parameters are listed in the order shown above. If several conditions are met simultaneously, only the condition with the highest priority will be displayed as active. All enabled conditions will be evaluated, even if the generator is already running. When an active condition is met, the unmet parameter in the lower priority condition will keep the generator running.

17.6.1. Stopping the generator when AC input is available after a power failure.

- Barrier-free
- AC input 1
- AC input 2

17.6.2. Battery-activated relay SoC

- **Use battery SoC value to start/stop:** Switch this function on or off.
- **Start when battery SoC is lower than:** Set the depletion level for automatic start.

- **Start value during quiet hours: During** *quiet hours*, it may be desirable to delay automatic start until it is truly unavoidable. If a *Quiet Hours* value has been defined, set a lower, more critical level for autostart.
- **Stop when battery SoC is higher than:** Set the recharge level for automatic stop.
- **Stop value during quiet hours:** If a value has been defined for *quiet hours,* set a lower automatic stop level to achieve shorter generator running times.

17.6.3. Battery current-triggered relay

- **Use battery voltage value for start/stop:** Enable or disable the function.
- **Start when battery voltage is lower than:** When there is a high demand for AC power that will soon drain the battery, the generator can be automatically started to help meet that demand. Set the current level at which this will occur.
- **Start value in idle hours:** If an *idle hour* value has been defined, set a higher, more critical current value.
- **Start after reaching condition for:** Set the delay before automatic start-up. Some AC devices draw a short-term current with a high peak value when starting up. Setting a delay before auto-start will prevent unnecessary generator start-up.
- **Stop when battery current is lower than:** Set the current for automatic shutdown.
- **Stop value in idle hours:** If an *idle hour* value has been defined, set a higher current level to achieve a shorter generator running time.
- **Stop when condition is met:** Set a delay to ensure that the current reduction condition is stable.

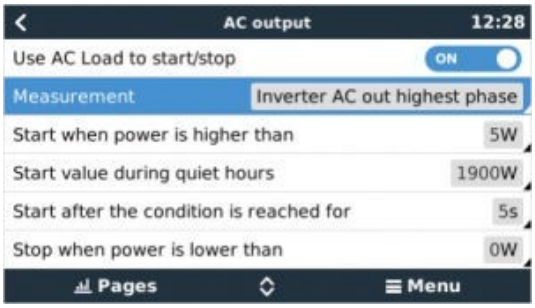
17.6.4. Battery voltage-triggered relay

- **Use battery voltage value for start/stop:** Enable or disable the function.
- **Start when battery voltage is lower than:** When the battery voltage drops below the specified value, the relay starts the generator.
- **Start value in idle hours:** If the *idle hours* value has been defined, enter a lower (more critical) value so that the generator only starts automatically when absolutely necessary.
- **Stop after reaching condition for:** This function calculates the delay before stopping the generator after reaching the "stop" value. This is to ensure that the voltage increase is stable.

17.6.5. Relays triggered by alternating load

AC load starters work similarly to other starters, but the function is specified by the Measurement setting. The Measurement setting is available in firmware v2.0 and later and has three possible values:

1. **Total consumption (default option)**
2. **Total AC out**
3. **Inverter AC out peak**



17.6.6. Inverter-triggered relay High temperature

- **Run when high temperature warning is active:** Switch this function on or off.
- **Start when warning is active for:** Set a delay to prevent temporary temperature increases caused by short-term high AC demands.
- **Stop after warning is cleared:** Set a delay to ensure that the reduction in converter temperature – usually caused by lower power consumption – is stable.

17.6.7. Relay triggered by inverter overload

- **Trigger on overload warning:** This function can be enabled or disabled.
- **Trigger when warning is active for:** Set a delay to ensure that the inverter overload warning is not triggered solely by short-term high AC current consumption.
- **After clearing the warning, stop:** Set a delay to ensure that the reduction in AC consumption is stable.

17.6.8. Automatic regular "test run

This function allows the generator to be started automatically at regular intervals as a "test run".

- **Test** interval**:** Set the interval between tests.
- **Skip test run if started:** The test will be skipped if, during the test run interval, the generator has been running for at least as long as it would have run during a "test run".
- **Test interval start date:** The "test run" interval counter starts from the date entered here. No test run will be performed until the date entered here is reached.
- **Start time:** The time when the generator's "trial operation" will commence.
- **Test duration:** The duration of the test.
- **Operate until battery is fully charged: When** this function is enabled, the "test run" will continue until the battery is fully charged, rather than for a fixed period of time.

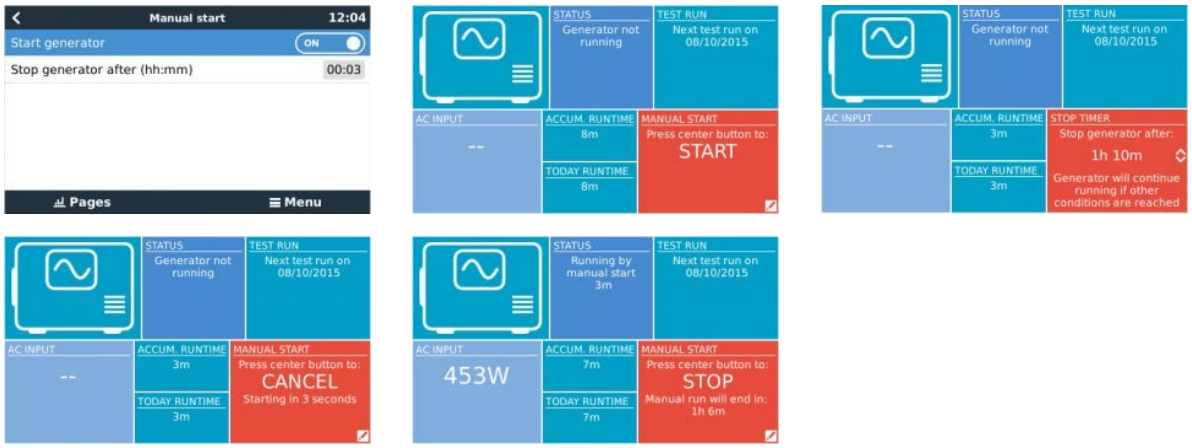
17.6.9. Manual start function

Use the manual start function to start the generator remotely. You can also press the Start function when the generator is already running - this ensures that the generator does not stop automatically once the condition that caused it to start has been met. In other words, the Manual Start function overrides the automatic stop parameters.

There are two ways to start the generator manually:

1. **Using the manual Start menu:** Go to Start/Stop Generator → Manual Start and switch the graphics for starting the generator.

2. **Using the GX generator graphic "Home page":** Press the upper left button on the Cerbo GX or on the Cerbo GX remote console to open the Generator page. Then press the middle button. First, you must select how you want to stop the generator - manually or by entering the running time. After making your selection, a five-second countdown will start, during which you can interrupt the manual start by pressing the centre button.



NOTE: If the generator is started manually (remotely) without using the stop timer, it will run until the "Off" button is manually pressed.

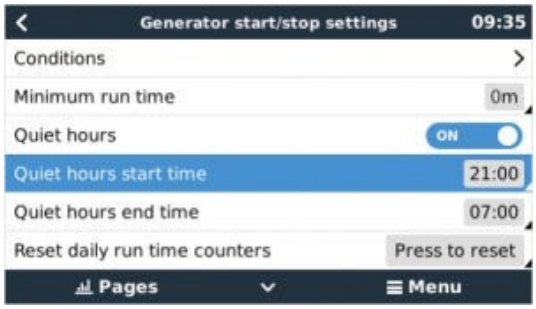
The stop timer is available for both methods of manual remote start-up of the generator, and its use will ensure that the generator stops automatically... and is not accidentally left running.

Please note that manual stopping of the generator can only be performed if no unfulfilled "run" condition is active. If you want to force the generator to stop, you must first disable the function that keeps it running - or disable the Start/Stop Generator function.

17.6.10. Quiet hours

Silent Hours allows you to define periods during which noise from a running generator would be disruptive and set various condition values that would cause automatic start-up during these periods - ensuring that the generator only starts during silent periods when absolutely necessary.

In the main menu, go to Settings → Generator Start/Stop → Settings and then turn on the *Silent Hours* function. Define the start and end times *for silent hours* in the fields that appear below.



Quiet *hours* become permanent (if enabled) when the defined "start" and "end" times are the same.

Using quiet hours as a tool to define two sets of user preferences

Alternatively, the *Quiet Hours* feature can be used to define how the system should respond to different circumstances, for example:

- **Early morning/low SoC:** Battery SoC is often lowest in the morning. When you add cloudy weather to this – or west-facing panels, which tend to work better in the afternoon – you have a situation where the generator may automatically start in the morning based on low battery SoC, but later, when it clears up, solar energy is unnecessary because the generator has already done its job. Setting the *Quiet Hours* feature for this period, along with lower autostart conditions, will help prevent unnecessary generator autostarts.

- **Holiday home:** Holiday homes that are only occupied part-time consume much more energy when they are in use. Using the *Quiet Hours* function, you can set much lower autostart parameters when the house is in use than when it is empty. When the house is occupied, a permanent state should be set (see above) and the *Quiet Hours* function can be switched to "off" whenever the house is empty.

17.7. Troubleshooting

Fischer Panda: The generator does not start and the error "Remote control switch disabled" is displayed.

Enable the "Automatic start" function in the Fischer Panda control panel.

Fischer Panda: The automatic start/stop function has stopped working after an error

Ensure that the problem is resolved, then clear the error and the automatic start/stop function will work again.

18. Restoring the default factory settings

The GX device is reset to factory settings by inserting a USB memory device or SD card with a specific reset file. Resetting to factory settings requires Venus firmware version 2.12 or higher. No buttons or screen are required.

How to restore the default factory settings of your GX device:

1. Download the venus-data.tgz file.
2. Copy the venus-data.tgz file to an empty, freshly formatted FAT32 USB drive/SD card (do not unzip, extract, or rename the file).
3. Start your computer with the USB drive/SD card inserted and wait for the GX device to fully boot up.
4. Remove the USB drive/SD card from the GX device.
5. Shut down the device or, alternatively, if possible, use the Restart function in the Settings → General menu.

This will restore the default factory settings of the GX device.

There are several technical reasons for doing this, such as:

- If the device has been locked by setting and then forgetting the remote console password on a model that does not have a screen.
- The customer has no problem, but wants a clean start.
- The GX device has been used in a test environment and the service technician wants to clear the residual memory (e.g. discovered AC photovoltaic inverters).
- The GX device is behaving strangely and restoring the default settings may rule out the possibility of incorrect settings.
- The data partition is full; this should only occur if someone has modified their device.
- Some unexpected error that probably only occurs in beta test versions.

Previously saved WiFi access credentials will be reset - for devices without a physical interface that use WiFi to connect, consider how you will regain access to reconfigure.

After restoring factory settings, it may also be necessary to restore the VRM authorisation token. After resetting, open the website in VRM - if a token reset is required, a notification will appear in VRM and you can follow the instructions provided.

Restoring factory settings DOES NOT change the VRM site ID or data stored on the VRM device. If you wish to sell your GX device to someone else or install it in another system and want to clear the history, you can do so on the VRM portal by selecting Site Settings -> General -> Remove this installation.

19. Troubleshooting

19.1. Error codes

Various causes of errors

In the GX device, some of the error codes displayed will originate from the GX device itself; in this case, refer to the list below. Like the system control panel, it also displays error codes from connected devices, e.g.:

- Multi and Quattro inverters/chargers: VE.Bus error codes
- MPPT solar chargers: MPPT solar charger error codes

GX error #42 - Storage damaged

- This error means that the flash memory inside the GX device is damaged.
- The device must be sent for repair/replacement. This problem cannot be fixed in the field or by updating the firmware.
- The affected flash memory is a partition that stores all user settings and factory data, such as serial numbers and WiFi codes.

GX Error #47 - Data partition problem

- The internal storage in the GX device is probably damaged: this causes configuration loss.
- Please contact your dealer or installer; see our Victron Energy support page.

GX error #48 - DVCC with incompatible firmware

This error occurs when the DVCC function is enabled and not all devices in the system have been updated to sufficiently current firmware. For more information about DVCC and the minimum required firmware versions, see the DVCC section [66] of this manual.

- **Note for systems with Pylontech and BMZ batteries:**

  In VenusOS v2.80, we have enforced DVCC activation for Pylontech and BMZ batteries. This may cause the same error on very old systems that have never been updated.

  Solution:

  - Disable automatic updates; Settings → Firmware → Online Updates.
  - Return to version 2.73. To return to a previous firmware version, see Installing a specific firmware version from SD/USB [60].
  - Then consider purchasing an installer that updates all firmware.

- **Note for systems with BYD, MG Energy Systems, and Victron Lynx Ion BMS batteries:**

  Since version 2.40 of the Venus OS, released in December 2019, the DVCC function is automatically enabled when the system detects a supported battery/BMS type connected. In systems that require DVCC to be enabled by battery manufacturers, it is no longer possible to disable the DVCC function.

  This poses a problem for systems installed and commissioned before DVCC was available, as these systems may not have the additional components or firmware necessary to function properly with the feature enabled.

  Solution:

  - Disable automatic updates; Settings → Firmware → Online Updates.
  - Return to version 2.33; to return to a previous firmware version, see Installing a specific firmware version from SD/USB [60].
  - Check that the DVCC function is disabled again.

  Please consult your installer to determine whether the battery system is controlled by two-wire control (an earlier alternative to DVCC) or not:

  If there is no connection for charging and discharging between the BMS, inverters/chargers and charge controllers, then DVCC is required for the above battery brands, which also has certain minimum firmware requirements for connected inverters/chargers and solar charge controllers.

Error GX #49 - Grid meter not found

This warning appears in the ESS system when the network measurement is configured to use an external meter, but no meter is available. This alerts installers and end users that the system is not configured correctly or cannot function properly because it cannot communicate with the electricity meter in the network.

19.2. FREQUENTLY ASKED QUESTIONS

19.2.1. Question 1: I cannot turn the Multi/Quattro system on or off

To resolve the issue, first determine how the system is connected, then follow the step-by-step instructions below. There are two ways to connect the Multi/Quattro system to the Cerbo GX. In most systems, they will be connected directly to the VE.Bus port on the back of the Cerbo GX. The second option is that in some systems they are connected to the Cerbo GX via the VE.Bus to VE.Can interface.

Step-by-step instructions for connecting to the VE.Bus port on the Cerbo GX

1. Update the Cerbo GX to the latest available version.

   See our blog posts at https://www.victronenergy.com/blog/category/firmware-software/.

2. Do you have a Digital Multi Control or VE.Bus BMS system? In this case, it is normal for switching off/on to be disabled. See also the notes on the VE.Bus in the Cerbo GX manual.

3. If you had a digital multifunction controller or VE.Bus BMS bus control unit connected to the system, Cerbo GX remembers them and even after removing these accessories, the switch will remain off. To clear the memory, run the Redetect system command in the remote console menu for Multi or Quattro.

   For details, see the Advanced Menu [63] section.

4. For parallel/three-phase systems consisting of more than 5 units: depending on the temperature and other circumstances, it may not be possible to restart the system after switching it off using Cerbo GX. As a solution, you will need to disconnect the VE.Bus cable from the rear of the Cerbo GX device. After starting the VE.Bus system, reconnect it. The
   The real solution is to install the "Cerbo GX dongle for large VE.Bus systems", part number BPP900300100. For details, please refer to its connection instructions.

Step-by-step instructions for connecting to Cerbo GX via VE.Can.

1. Update Cerbo GX to the latest available version. See our blog posts in the firmware category.

2. Update the VE.Bus to VE.Can interface to the latest version. The easiest way to do this is to use a remote firmware update: this means you do not need a special piece of hardware, CANUSB.

3. Do you have Digital Multi Control or VE.Bus BMS in your system? In that case, it is normal that switching off/on is disabled. See also the notes on the VE.Bus in the Cerbo GX manual.

4. If you had a Digital Multi Control or VE.Bus BMS system connected to the system and it is no longer connected, the Canbus interface remembers it. Therefore, even after removing these accessories, the switch will be on/off. Unfortunately, it is not possible to clear this memory yourself, so please contact us so that we can help you.

19.2.2. Question 2: Do I need a BMV to determine the correct battery charge status?

It depends. For details, see the section on Battery State of Charge (SoC) [51].

19.2.3. Question 3: I don't have internet access. Where can I insert the SIM card?

The GX device does not have a 3G or 4G modem, and therefore no SIM card slot. Go to your local store and buy a 3G/4G router with Ethernet ports. For more information, see the blog link below, especially the comments section, as several users are trying out different devices:

https://www.victronenergy.com/blog/2014/03/09/off-grid-color-control-gx-to-vrm-portal-connectivity/

19.2.4. Question 4: Can I connect both GX and VGR2/VER devices to a Multi/Inverter/Quattro device?

No. Instead of this combination, we recommend using Cerbo GX and adding a 3G/4G or similar mobile router. See the section on Internet connection [34].

19.2.5. Question 5: Can I connect multiple Cerbo GX units to a Multi/Inverter/Quattro?

No.

19.2.6. Question 6: The Cerbo GX display shows incorrect current (ampere) or power data.

Examples:

- I know that the load from the Multi is drawing 40 W, but the Cerbo GX shows 10 W or even 0 W.
- I see that Multi supplies a load of 2000W in inverter mode, but only 1850W is drawn from the battery. Where does the remaining 150W come from?

The general answer is: Multi and Quattro are not measuring devices, they are inverters/chargers, and the measurements shown are the best possible supply.

In more detail, there are several causes of measurement inaccuracies:

1. Part of the energy taken from the battery by the inverter is lost in the inverter and converted into heat: efficiency losses.
2. The Multi device does not actually measure the power drawn from the battery. It measures the current at the inverter output and then estimates how much power is being drawn from the battery.
3. Watts vs. VA: depending on the Multi/Quattro firmware version and also on the Cerbo GX firmware version, you will either see VA (the result of alternating voltage * alternating current) or watts. To see WATTS on the Cerbo GX on the Cerbo GX device, update the Cerbo GX device to the latest version (v1.21 or later). Also, make sure that the firmware version on your Multi device supports Watt reading; the minimum versions are xxxx154, xxxx205 and xxxx300.
4. Multis/Quattros connected to Cerbo GX via the VE.Bus to VE.Can interface will always report VA, not (yet) watts.
5. If the current sensor assistant is loaded in the Multi/Quattro device and no sensor is connected, invalid power/kWh values will be returned.
6. If the current sensor assistant is inserted in the Multi/Quattro device, ensure that the position is set correctly and that the scale matches the dipswitches on the sensor itself.
7. The current sensor assistant measures and reports VA, not watts.

Notes on systems with multiple parallel units:

1. Cerbo GX versions prior to v1.20 use the power and current reported by the phase control unit and multiply them by the number of devices in that phase. From v1.20 onwards, the values of all devices are added up for each phase and should therefore be more accurate.
2. This revealed an error in the firmware of the multifunction device during parallel operation. Ccgx v1.21 solves this by reverting to the original behaviour when it detects the affected firmware version. For better readings, the multi should be updated. The bug has been fixed in VE.Bus firmware versions xxxx159, xxxx209, xxxx306. This firmware was released on 17 February 2015.
3. More firmware versions from 26xx207 / xxxx300 may also freeze power values at a certain point in time.

Tips to prevent measurement problems:

1. Do not connect VEConfigure when Cerbo GX is connected.
2. The VE.Bus is not a 100% plug-and-play system: if you disconnect Cerbo GX from one Multi device and connect it to another very quickly, erroneous values may occur. To ensure that this does not happen, use the "redetect system" option in the Multi/Quattro menu on Cerbo GX.

19.2.7. Question 7: Instead of the product name VE.Bus, there is an item called "Multi" in the menu.

The VE.Bus system can be completely switched off, including its communication. If you switch off the VE.Bus system and then reset the Cerbo GX, the Cerbo GX cannot obtain the detailed product name and will display "Multi" instead.

To retrieve the correct name again, go to the Multi menu on the Cerbo GX and set the Switch menu item to On or, if a digital multifunction control is present, set the physical switch to On. Please note that if a BMS is available, the above procedure only works within the battery's operating voltage range.

19.2.8. Question 8: There is an item called "Multi" in the menu, even though no inverter, Multi or Quattro is connected.

If the Cerbo GX has ever seen a VE.Bus BMS or Digital Multi Control (DMC) system, it will remember them until you run the "Redetect system" function in the Cerbo GX menu. After one minute, restart the Cerbo GX: Settings → General → Restart.

19.2.9. Question 9: When I enter the IP address of the Cerbo GX device into my browser, will a web page with the word Hiawatha appear?

Our plan is to at least launch a web page where you can change settings and view the current status. If everything goes as planned, a fully functional version of the VRM online portal could appear, running locally on Cerbo GX. This will allow people without an internet connection or with an intermittent internet connection to have the same features and functionality available to them.

19.2.10. Question 10: I have several MPPT 150/70 solar chargers running in parallel. Which one will I see the relay status for in the Cerbo GX menu?

From randomly selected ones.

19.2.11. Question 11: How long should the automatic update take?

The size of the downloaded file is usually around 90 MB. After downloading, the files will be installed, which may take up to 5 minutes.

19.2.12. Question 12: I have a VGR with an IO Extender. How can I replace it with Cerbo GX?

The IO Extender function cannot be replaced at this time.

19.2.13. Question 13: Can I use remote configuration with VEConfigure, as I did with VGR2?

Yes, see the VE Power Setup manual.

19.2.14. Question 14: The blue power panel can be powered via the VE.Net network. Can this also be done with Cerbo GX?

No, the Cerbo GX must always be powered independently.

19.2.15. Question 15: What type of network does Cerbo GX use (TCP and UDP ports)?

Basics:

- The Cerbo GX device must have a valid IP address, including a functional DNS server and gateway. By default, this is obtained from the DHCP server. Manual configuration is also possible.
- DNS port 53 UDP and TCP
- NTP (time synchronisation) port UDP 123. NTP uses a pool of servers provided by ntp.org, so it connects to a number of servers.

VRM portal:

- Data is transferred to the VRM portal via HTTPS POST and GET requests to port 443 http://ccgxlogging.victronenergy.com. There is an option to use HTTP on port 80 instead. Note that in this case, sensitive data such as access keys related to the remote console will still be sent via HTTPS/443.

Firmware update:

- Cerbo GX connects to https://updates.victronenergy.com/ on port 443.

Remote support and remote console in the VRM module:

- If one or both of these features are enabled, an outgoing reverse SSH connection is established to supporthosts.victronenergy.com. The supporthosts.victronenergy.com record resolves to multiple IP addresses, and the DNS system resolves it to the nearest server using geolocation. This outgoing SSH connection tries multiple ports: port 22, port 80, or port 443. The first one that works is used, and if it loses connection, it tries them all again.
- No port forwarding or other internet router configuration is required to use these features.
- For more information about the Remote Support feature, see the next section of frequently asked questions.
- For more information on troubleshooting issues with the VRM remote console, see [78].

Bidirectional communication (remote VEConfig update and remote firmware update):

- Prior to version 2.20: Uses HTTPS protocol (port 443) to Pubnub servers.
- v2.20 and later: Connects to the mqtt-rpc.victronenergy.com server on port 443 and also connects to the mqtt{1 to 128}.victronenergy.com server farm. For more information, see this document.

MQTT on LAN:

- If this function is enabled, a local MQTT broker will be started that accepts TCP connections on ports 8883 (SSL) and 1883 (plain text).
- Depending on this, Cerbo GX will also (attempt to) connect to Victron MQTT cloud servers. This connection always uses SSL and port 8883.

Remote console on the LAN:

- A remote console on the LAN requires port 80 (a small web page hosted by the GX device). It also requires port 81, which is the listening port for the web tunnel to VNC.

Modbus TCP:

- When this feature is enabled, the ModbusTCP server listens on the common port designated for Modbus TCP, which is 502.

SSH root access:

- Port 22 – see the documentation for accessing the root directory of the Venus operating system.
- This is a feature for software developers.

19.2.16. Question 16: What function is hidden behind the Remote Support (SSH) menu item in the Ethernet menu?

When enabled, the Cerbo GX will open an SSH connection to our secure server and back-tunnel to the Cerbo GX. Through this tunnel, Victron technicians can log into your Cerbo GX and perform remote support. This feature works when the Cerbo GX is installed on an internet connection. The connection will also work if it is installed behind a firewall.

The SSH connection will be outgoing, on port 80, 22 or 443 at supporthosts.victronenergy.com, which resolves to multiple IP addresses depending on your location. The remote support feature is disabled by default.

19.2.17. Question 17: I do not see support for VE.Net products in the list. Will it still be available?

No.

19.2.18. Question 18: What is the data usage of the Cerbo GX device?

Data usage depends largely on the number of connected products and how these products are used. The measurements below are indicative only and come from a system with one Cerbo GX, one Multi, one BMV and one MPPT. The recording interval is set to 15 minutes. If you have an expensive data plan, take some precautions against failure.

Monthly data consumption:

- VRM logging: 15 MB download, 45 MB upload
- Remote support: 22 MB download, 40 MB upload
- Update checks: (Does not include the update itself): 8 MB download, 0.3 MB upload.
- Two-way communication: 26 MB download, 48 MB upload

The megabytes mentioned do not include the Cerbo GX firmware update download. Firmware updates of 60 MB are not unusual.

19.2.19. Question 19: How many AC current sensors can I connect to a single VE.Bus system?

The current maximum is 9 sensors (as of Cerbo GX v1.31). Note that each must be configured separately using the wizard on the Multi or Quattro device to which it is connected.

19.2.20. Q20: Problems starting the Multi device after connecting Cerbo GX / Warning when powering Cerbo GX from the AC-out terminal of the VE.Bus, Multi or Quattro converter

Check that the latest firmware version is installed on the GX and MultiPlus devices.

If you power the Cerbo GX from a mains adapter connected to the AC-out port of any VE.Bus product (inverter, Multi or Quattro), a lock-up may occur when the VE.Bus products are switched off for any reason (after any operational fault or during a black start). The VE.Bus devices will not start until the Cerbo GX has power... but the Cerbo GX will not start until it has power. For more information on this issue, please refer to the frequently asked questions.

This deadlock can be resolved by briefly disconnecting the Cerbo GX VE.Bus cable, which will cause the VE.Bus products to start up immediately.

There are two ways to prevent this deadlock:

1. Power the Cerbo GX from the battery; or
2. Cut pin 7 on the VE.Bus cable connected to the Cerbo GX device.

Cutting/removing pin 7 of the VE.Bus cable to the Cerbo GX device (brown/white according to the standard colour coding of an RJ45 Ethernet cable) allows VE.Bus products to be started without having to wait for the Cerbo GX device to start first.

Note that when using a Redflow ZBM2/ZCell battery, pin 7 should be disconnected even when the Cerbo GX is powered by DC to prevent the same lockout when the Redflow battery cluster is at 0% SoC.

The disadvantage of disconnecting pin 7 is that the VE.Bus device will be less efficient: it will stop charging and inverting, but it will still be in standby mode and therefore draw more current from the battery than if pin 7 were left in place. This is usually only relevant in marine or automotive systems, where it is common practice to switch off VE.Bus devices regularly. For these types of systems, we recommend not disconnecting pin 7, but simply powering the Cerbo GX from the battery.

19.2.21. Q21: I love Linux, programming, Victron and Cerbo GX. Can I do more?

Yes, you can! We intend to release almost all of the code as open source, but we are not there yet. What we can offer today is that many parts of the software are in scripts or other uncompiled languages, such as Python and QML, and are therefore available in your Cerbo GX and can be easily modified. The root password and other information are available here.

19.2.22. Question 22: How do I change the logo?

Enter the following address into the web browser of a device connected to the same network. Using this address as Template: http://[ip-here]/logo.php (insert the IP address of your device in square brackets). You can find the IP address in Settings → Ethernet or Wi-Fi. After loading the page, select the image file from your device. Restart the Cerbo GX device.

19.2.23. Q23: Multiple restarts throughout (every 10 seconds)

Check the connection of the remote switch on the multifunction control circuit board. There should be a wire bridge between the left and middle terminals. Cerbo GX switches the line that powers the Multi control board. After 10 seconds, this line is released and the Multi should take over control. If the remote switch connection is not connected, the Multi device is unable to take over its own power supply. The Cerbo GX will try again, the Multi will start and stop after 10 seconds, and so on.

19.2.24. Question 24: What is error no. 42?

If the GX device displays error no. 42 - Hardware fault, the flash memory in the device is damaged. As a result, settings are not saved (restarting restores the default settings) and other problems arise.

This error cannot be fixed in the field or in repair departments. Please contact your dealer for replacement.

Firmware versions up to 2.30 do not report the error. From version 2.30 onwards, it is visible in the device itself (in the graphical user interface) and on the VRM portal.

19.2.25. Question 25: My GX device restarts itself. What is causing this behaviour?

There are several reasons why a GX device may restart itself. One of the most

common causes is loss of communication with the VRM online portal.

However, this only applies if the "Restart device when no contact is made" option is enabled in the VRM online portal settings (disabled by default). If no contact is made with the VRM portal for the period set in the

"Reset delay without contact", the GX device will

automatically restarted. This process is repeated until communication with the VRM portal is restored. See also chapter Data logging to VRM [73] - Network monitor: automatic restart.

1. Check the network connection between the GX device and the router. See Troubleshooting data logging [75].
2. It is best to use an Ethernet connection between the GX device and the router.
3. Connections via tethering or hotspots, e.g. using a mobile phone, are unreliable and often disconnect or fail to reconnect automatically after a loss of connection. Therefore, they are not recommended.

Other common reasons that cause the GX device to restart automatically are:

- System overload (processor, memory, or both).

The RTT (Round Trip Time) parameter of the D-Bus, available on the VRM portal, is used for reliable detection of system overload. See the image below for how to set it up in the VRM system.

An RTT value between 1 and 100 ms is acceptable, although 100 ms is already a relatively high value.

Occasional RTT spikes are not a problem. Persistent exceedances of 100 ms are a problem and require further investigation. If

the cause is system overload, there are two solutions:

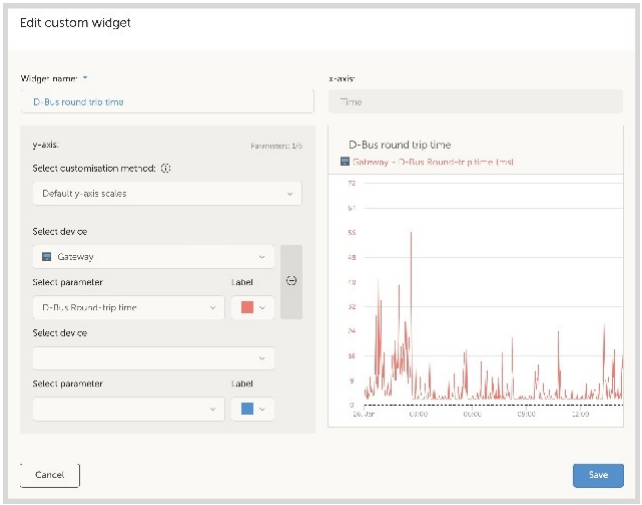
1. Disconnect devices to reduce the load, which has its disadvantages.
2. Or replace the GX device with a more powerful one. In the current product range - see our Victron GX range - the Cerbo GX & Cerbo-S GX are (much) more powerful than both the CCGX and Venus GX.

Occasional reboots do not affect the service life or performance of the system. The main effect is a (temporary) disruption of monitoring.

How to create your own widget on the VRM portal for reading bus travel time D-Bus:

1. Connect to the VRM portal using your browser.
2. In the menu on the left, click on the Advanced tab.
3. Click on the widget icon in the top right corner.
4. Scroll down to Custom Widget and click on it to create a new custom widget.
5. Give it the correct name, select "Gateway" in the Select device list and "D-Bus round trip time" in Select parameter.
6. After clicking the Save button, the new widget will appear in the Advanced tab.

Tip: To achieve high resolution for the round trip time, keep the time interval under investigation as small as possible.



19.2.26. GPL note

The software included in this product contains copyrighted software that is licensed under the GPL. You can obtain the corresponding source code from us for a period of three years from the last delivery of this product.

20. Technical Specifications

20.1. Technical Specifications

Cerbo GX[1]	
Supply voltage	8 - 70 V DC
Mounting	Wall or DIN rail (35 mm)[2]
Communication ports	
VE.Direct ports (always isolated)	3 (max. possible number of VE.Direct devices: 15)[3]
VE.Bus (always isolated)	2 parallel RJ45 sockets
VE.Can	Yes - non-isolated
BMS-Can port	Yes
Bluetooth	Yes [4]
Bluetooth frequency and power	2.402 - 2.48 GHz | 5.2 mW
WiFi	Yes
WiFi frequency and power	2.4 GHz WiFi | Range: 2.412 - 2.462 GHz | 88.1 mW
IO	
Resistance inputs for tank level	4
Temperature sensing inputs	4
Digital inputs	4
Relays [5]	2 x NO/NC DC up to 30VDC: 6A DC up to 70VDC: 1A AC: 6A, 125VAC
Other	
External dimensions (H x W x D)	78 x 154 x 48 mm
Operating temperature range	-20 to +50 °C
IP rating	IP20
Standards	
Safety	IEC 62368-1
EMC	EN 301489-1, EN 301489-17
Automotive	ECE R10-6
GX Touch 50 / GX Touch 70	
Installation	With included mounting accessories
Display resolution	GX Touch 50: 800 x 480 GX Touch 70: 1024 x 600
External dimensions (H x W x D)	GX Touch 50: 87 x 128 x 12.4 mm GX Touch 70: 113 x 176 x 13.5 mm
IP rating	IP54 (without connectors)
Cable length	2 metres

[1] For more detailed information about Cerbo GX and GX Touch devices, please visit the Victron GX product line page.

[2] DIN rail mounting requires an additional accessory - DIN35 adapter.

[3] The maximum specified in the table above is the total number of connected VE.Direct devices, such as MPPT solar charge controllers. The total includes all directly connected devices plus devices connected via USB. The limit is usually determined by

by the processing power of the processor.

Please note that there is also a limitation for other types of devices that are often connected in larger numbers: photovoltaic inverters. The CCGX can typically monitor up to three or four three-phase inverters. Devices with higher CPU power can monitor more.

(4) The Bluetooth function is intended to assist with initial connection and network configuration. Bluetooth cannot be used to connect to other Victron products (e.g. SmartSolar charge controllers).

(5) There are two relays in the Cerbo GX hardware. Currently, relay 1 can be programmed as an alarm relay, a generator start/stop relay, a tank pump relay, a temperature control relay, or a manual control relay. Relay 2 can be programmed as a temperature-controlled relay or for manual operation in the Relay menu in the GX system (requires firmware 2.80 or higher).

21. Appendix

21.1. RV-C

21.1.1. Supported DGN

This chapter describes which data from supported devices are available and the corresponding DGNs (Data Group Numbers).

RV-C defines several messages. Detailed protocol specifications and message definitions are publicly available on the RV-C.com website.

21.1.2. RV-C out

General

The main RV-C GX interface and all virtual devices report the minimum required DGN:

DGN	DGN#	Description
PRODUCT_ID	0xFEEB	Manufacturer, product name, serial number
SOFTWARE_ID	0xFEDA	Software version
DM_RV	0x1FECA	Diagnostics
DM01*	0x0FECA	Diagnostics

* In addition to DGN DM_RV 0x1FECA, DGN J1939 DM01 0x0FECA is also declared for all RV-C output devices, which supports older RV-C control units that do not support DGN DM_RV.

Main interface

The main GX interface is identified in RV-C as "Control Panel" (DSA=68) and is responsible for requesting and processing data from all RV-C nodes.

Direct current source messages

All devices connected to DC power are capable of reporting DC_SOURCE_STATUS_1. This includes inverter/charger services, converters, chargers, batteries, and solar chargers. The inverter/charger and battery/BMS VE.Bus report DC current and voltage, while all other devices report voltage only.

According to the RV-C specification, only one node may broadcast DC source messages from the same instance. Each device type has its own priority, which is used to determine which node must broadcast DC source messages. Consider the following system:

- Converter/charger (DC source instance 1, price 100)
- Solar charger (DC source instance 1, prio 90)
- Mains charger with 3 outputs (DC source instances 1, 2 and 3, prio 80)
- Battery monitor (DC source instance 1, prio 119)

In this case, the battery monitor transmits DC source data with instance 1, as this has the highest priority. In addition, the AC charger transmits DC source data with instances 2 and 3 (outputs 2 and 3), as there are no other devices with these instances. For more information on DC source messages, refer to the RV-C specification manual. Chapter 6.5.1 explains the priority mechanism.

VE.Bus converter/charger

Device

Only VE.Bus MultiPlus/Quattro. Phoenix Inverter VE.Bus is also exported by this service, but with the number of AC inputs set to 0. DSA is set to 66 (inverter no. 1).

Instance

- Converter: default instance 1, configurable from 1...13
- Charger: default instance 1, configurable from 1...13
- Line no. 1: default instance 0 (L1), configurable from 0...1
- Line no. 2: default instance 1 (L2), configurable from 0...1
- DC source: default instance 1, configurable from 1...250

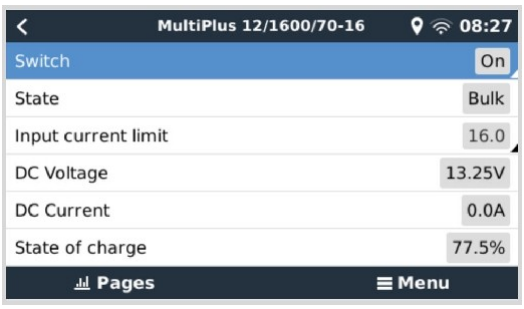
Status

DGN	DGN#	Hodn ota
INVERTER_AC_STATUS_1	0x1FFD7	L1 AC output voltage, current, frequency L2 AC output voltage, current, frequency **L2 data is not sent if it is not configured.**
INVERTER_STATUS	0x1FFD4	Inverter status
CHARGER_AC_STATUS_1	0x1FFCA	L1 Input AC voltage, current, frequency L2 Input AC voltage, current, frequency **L2 data is not sent if it is not configured.**
CHARGER_AC_STATUS_2	0x1FFC9	Input current limitation
CHARGER_STATUS	0x1FFC7	Charger status
CHARGER_STATUS_2	0x1FEA3	DC voltage, current
CHARGER_CONFIGURATION_STATUS	0x1FFC6	Maximum charging current
CHARGER_CONFIGURATION_STATUS_2	0x1FF96	Input current limit, Maximum charging current (%)
DC_SOURCE_STATUS_1	0x1FFFD	DC voltage, current **Fixed priority 100 (converter/charger)**

Commands

DGN	DGN#	Value
INVERTER_COMMAND [1)]	0x1FFD3	Enable/disable converter
CHARGER_COMMAND [1)]	0x1FFC5	Enable/disable charger
CHARGER_CONFIGURATION_COMMAND	0x1FFC4	Maximum charging current **Note: This is a non-persistent setting that will reset to the value the unit was configured to after restarting the inverter/charger.**
CHARGER_CONFIGURATION_COMMAND_2	0x1FF95	Charger input current limitation

[1)] You can control the charger and inverter separately from the RV-C. These two on/off values are then combined into a single switch value (as shown on the VE.Bus page in the GX user interface, see the top item in the image below). If the inverter/charger is on, turning off the charger will only affect the inverter. Switching off the inverter will only switch off the charger (when shore power is connected).



Victron defines the following control options for the combined inverter/charger:

State	Notes
Off	Both the inverter and charger are switched off.
Inverter only	Only the converter is switched on.
Only Charger	Only the charger is switched on
At the address	Both the inverter and charger are switched on.

This is reflected in the Switch menu:

Converter

Device

The Phoenix VE.Direct inverter and RS. DSA inverter are set to 66 (inverter no. 1).

Instance

- Inverter: default instance 2, configurable from 1...13
- Line: default instance 0 (L1), configurable from 0...1
- DC source: default instance 1, configurable from 1...250

Status

DGN	DGN#	Value
INVERTER_AC_STATUS_1	0x1FFD7	L1 Output AC voltage, current, frequency
INVERTER_STATUS	0x1FFD4	Inverter status
DC_SOURCE_STATUS_1	0x1FFFD	DC voltage **Fixed priority 60 (converter)**

Commands

DGN	DGN#	Value
INVERTER_COMMAND	0x1FFD3	Enable/disable converter/load sensing load

Mains charger

Device

Skylla-I, Skylla-IP44/IP65, Phoenix Smart IP43 charger. DSA is set to 74 (converter no. 1).

Instance

- Charger: default instance 2, configurable from 1...13
- Line: default instance 0 (L1), configurable from 0...1
- DC power supply no. 1: default instance 1, configurable from 1...250
- DC source #2: default instance 2, configurable from 1...250
- DC source #3: default instance 3, configurable from 1...250

Status

DGN	DGN#	Value
CHARGER_AC_STATUS_1	0x1FFCA	Alternating current
CHARGER_AC_STATUS_2	0x1FFC9	Input current limitation
CHARGER_STATUS	0x1FFC7	Charger status
CHARGER_STATUS_2	0x1FEA3	DC power source #1: voltage, current output 1 DC power source #2: voltage, current output 2 DC power source #3: voltage, current output 3 **Instances 2 and 3 are not sent if they are not present**
CHARGER_CONFIGURATION_STATUS_2	0x1FF96	Input current limitation
DC_SOURCE_STATUS_1	0x1FFFD	DC source #1: voltage DC source #2: voltage DC source #3: voltage **Instances 2 and 3 are not sent if they are not present.** **Fixed priority 80 (charger)**

Commands

DGN	DGN#	Value
CHARGER_COMMAND	0x1FFC5	Enable/disable charger
CHARGER_CONFIGURATION_COMMAND_2	0x1FF95	Input current limitation

Solar charger

Device

BlueSolar, SmartSolar, MPPT RS. DSA is set to 141 (Solar Charge Controller).

Instance

- Charger: default instance 1, configurable from 1...250
- DC source: default instance 1, configurable from 1...250

Status

DGN	DGN#	Value
SOLAR_CONTROLLER_STATUS	0x1FEB3	Operating status
SOLAR_CONTROLLER_STATUS_5	0x1FE82	Total yield
SOLAR_CONTROLLER_BATTERY_STATUS	0x1FE80	Battery voltage, current
SOLAR_CONTROLLER_ARRAY_STATUS	0x1FDFF	PV voltage, current

DGN	DGN#	Value
DC_SOURCE_STATUS_1	0x1FFFD	Direct current voltage **Fixed priority 90 (charger + 10)**

Battery/BMS

Device

BMV, SmartShunt, Lynx Shunt, Lynx Ion, Lynx Smart BMS, BMS-Can battery. DSA is set to 69 (Battery State of Charge Monitor).

Instance

- Main: default instance 1, configurable 1...250; default priority 119, configurable 0...120
- Starter: default instance 2, configurable 1...250; default priority 20, configurable 0...120

Status

DGN	DGN#	Value
DC_SOURCE_STATUS_1	0x1FFFD	Voltage, current **The starter instance is not sent if the starter battery is not available**
DC_SOURCE_STATUS_2	0x1FFFC	Temperature, SOC, remaining time
DC_SOURCE_STATUS_4	0x1FEC9	Required maximum voltage, current

Tanks

Equipment

Built-in tanks, GX tanks, N2K tanks. DSA is set to 73 (LPG) for LPG tanks and 72 (water/waste tank system) for all other tank types.

Instance

- Tank: default instance 0, configurable from 0...15

Status

DGN	DGN#	Value
TANK_STATUS	0x1FFB7	Fluid type, relative level, absolute level, tank size Resolution is fixed at 100

RV-C supports only 4 tank types (0..3), while Victron supports up to 11 tank types. The table with additional tank types is specific to Victron and is compatible with the tank types we use.

Supported tank types:

Venus / NMEA 2000		RV-C
Liquid type	**Fluid code**	**Type**
Fuel	0	4 (defined by seller)
Fresh water	1	0
Waste (grey) water	2	2
Livewell	3	5 (defined by seller)
Oil	4	6 (defined by seller)
Black water	5	1
Petrol	6	7 (defined by the seller)
Diesel	7	8 (defined by the seller)
LPG	8	3
LNG	9	9 (defined by the seller)

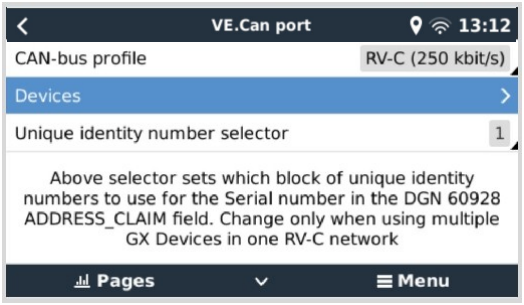
Hydraulic oil	10	10 (defined by supplier)
Raw water	11	11 (defined by the vendor)

Note: Vendor defined means that these types are not defined in RV-C, but are only used for Victron RV-C devices.

21.1.3. DGN 60928 Unique identification numbers

The GX device assigns each virtual device an individual unique identification number. Only change this if you are using multiple GX devices in a single RV-C network.

The unique identification number is used for the internal "database" of CAN-bus GX devices to compare devices when determining the address. To avoid collisions on the CAN-Bus, it is necessary to set the second GX device to a unique identification number in the range of 1000-1499. This can be done by setting the unique identity selector to 2 (2 * 500). It works exactly the same as with VE.Can, see section PGN 60928 NAME Unique Identity Numbers [102].



21.1.4. RV-C in

Tanks

Tested using Garnet SeeLeveL II 709 and tanks from the RV-C out function of another GX device.

Batteries

Lithionics is the only supported RV-C battery (including DVCC support).

21.1.5. Device classes

This section provides a basic overview of how each device class will contribute to the RV-C specification. In each case, "Level 1" (basic operation) integration is largely supported, with possible enhancements.

Standalone AC chargers

- AC-based chargers report their operating status and configuration status using a group of CHARGER_xx RV-C messages. User control must include basic switching on and off via RV-C, as well as setting the limits of the shore (AC) power supply.

Standalone AC inverters

- This class of AC converters reports its operating status using the RV-C INVERTER_xx message group. The incoming command is limited to switching on/off (power on/off) via RV-C.

Mains charger/inverter

- Combined converter/charger - reports both CHARGER_xx and INVERTER_xx messages.

Solar controllers

- Solar chargers will report their operating status in real time.

SOC meters

- SOC meters can be used to report the current battery status via RV-C: voltage, current, temperature, SOC, etc. RV-C requires that only ONE device speaks for a given battery, so if the correct BMS is installed, it will be the source of the data.

BMS (Victron or Victron-supported third party)

- In many cases, the battery in the system will be connected directly to the Victron Cerbo GX or Cerbo-S GX system, either through Victron devices or through supported compatible third-party BMS systems. Such batteries should be represented in the RV-C environment through DC_SOURCE_STATUSxx messages.

Tank level gauges

- Tank gauges will be converted to RV-C messages that will carry the existing VRM tank/instance ID numbers.

21.1.6. Instance translation

RV-C uses instances in several ways:

- DC source instances
- AC power lines
- Device instance (depends on context)

Each use of an instance has a specific meaning, and a given device may sometimes use one or more of these instances.

DC source instance

In the context of RV-C, a DC source is something that can generate and (possibly) store energy. This is usually a battery, but it can also be a fuel cell or the output side of a DC contactor/disconnector.

A DC source can be thought of as a battery system and the physical bus associated with it, such as a domestic battery, DC busbar and DC line. DC source instances are used to assign downstream devices (e.g., chargers or inverters) to the "DC bus" to which they are connected.

This way, it is possible to map how all devices are connected to their DC bus via the DC Source Instance value (starter battery and its alternator, home battery and its chargers, etc.).

Note that in some cases (e.g., DC-DC converter or contactor), a device may be connected to two different DC source instances. For example, a DC-DC converter may be assigned to two different batteries to which it is connected, while a contactor may be assigned to the battery to which it is connected; the DC bus on the load side of the contactor then has its own DC Source Instance.

Although the Victron system can support more than one battery (house and starter battery), it primarily focuses on one battery. The dbus-rvc module displays the "primary" battery to the RV-C as "DC Source Instance = 1" (house battery).

If other Victron sensing devices are present, they will be presented using DC Source Instances 2. An example is the optional sensing of starter battery voltage on SmartShunts.

Alternating current wiring

AC wiring is much simpler, as RV-C assumes a limited AC system, usually defined as 1-wire or 2-wire. Victron supports three-phase systems, which are not covered by the RV-C specification. All installations with three-phase systems are not supported by the dbus-RVC module, and RV-C messages related to AC power are suppressed.

Device instances

A device instance is a way to separate different physical devices of the same type. Example: If an installation contains two AC chargers connected to the same battery, each will be assigned a separate device instance, while both will share the same DC source instance. Each charger would also be assigned to an AC line, which may or may not be the same. In this way, the AC charger is fully described in terms of how it is connected on the AC and DC sides, while also being uniquely identifiable through its Device Instance.

Device instances are relevant within a given device class. An AC charger may define device instances 1 and 2 that are unrelated to device instances 1 and 2 of a DC motor controller.

With the exception of tank monitoring, device instances are hard-coded as 1 for each specific device class, unless otherwise specified in the PGN table. This is because the AC charger has a hard-coded instance of 2 to allow coexistence with an inverter/charger with a charger instance of 1.

21.1.7. RV-C fault and error handling

RV-C fault reporting:

- Fault conditions are reported using DGN DM_RV (0x1FECA) and J1939 DM01 (0x1FECA).
- In version 1, operating status bits, yellow and red light fields are supported because they are stored in the DSA.
- SPN is set to 0xFFFFFF under normal conditions and to 0x0 whenever there is a warning or fault condition in a supported Victron device.
- FMI is always set to 0x1F (fault mode is not available).

This simple mapping allows external user displays to indicate an alarm or fault condition of the Victron device, at which point the user should consult Victron's diagnostic tools for further information.

21.1.8. RV-C device priority

An important concept in the RV-C system is the use of *device priorities*.

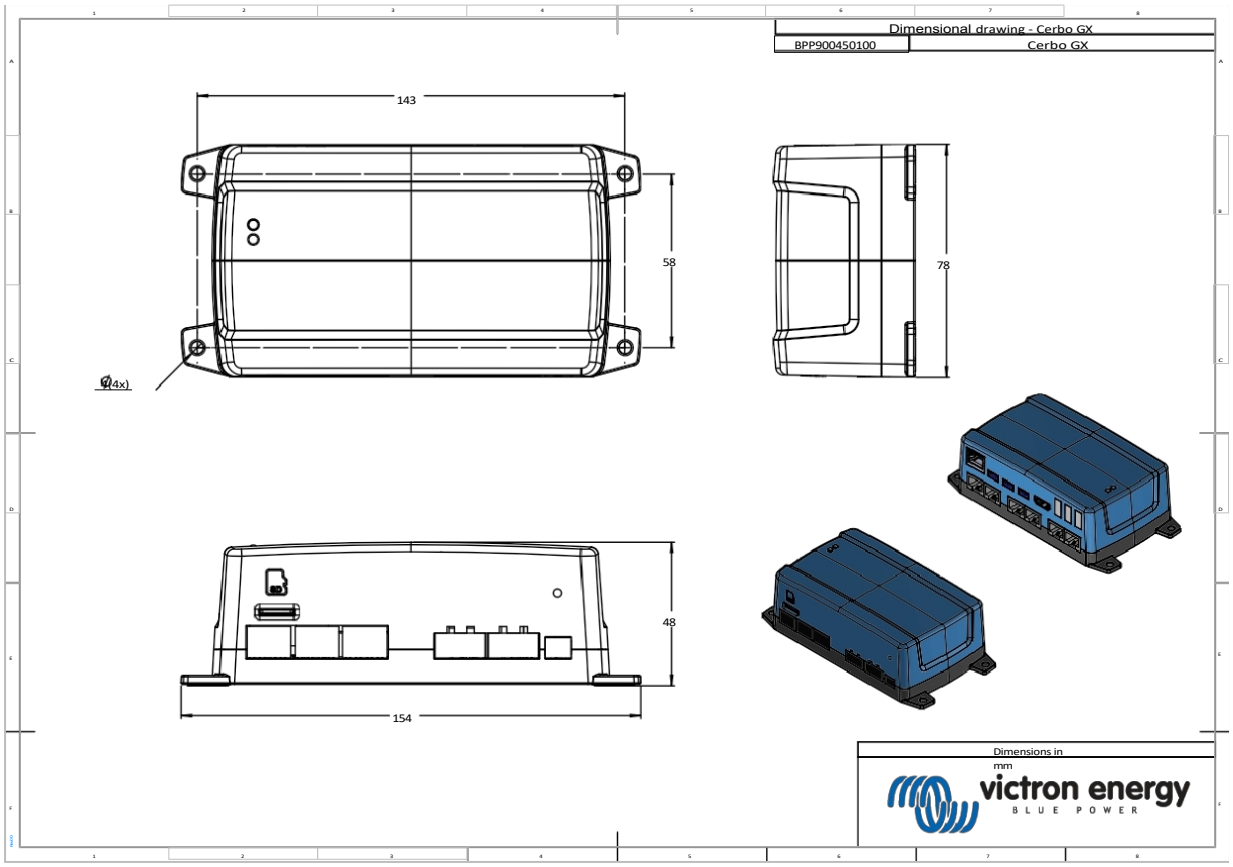
When used, the priority of a given device will influence whether it is allowed to broadcast DGN (e.g., a BMS with higher priority should broadcast battery status details, while an MPPT controller with lower priority should withdraw).

Device priority is also sometimes used to favour one node over another; for example, it may be desirable to use AC power from the shore over the inverter.

In the dbus-rvc implementation, the following priorities will be hard-coded into the transmitted messages:

- DC_SOURCE_STATUS_xx messages: Priority = 119 (SOC/BMS) to give native RV-C batteries higher priority.
- SOLAR_xx messages: Charger priority = 110
- CHARGER_xx messages (inverters/chargers): Charger priority = 100
- CHARGER_xx messages (AC chargers): Charger priority = 80

21.2. Cerbo GX Dimensions



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