



ENGLISH



# VE.Direct 230 V inverter usage guide

HW15

rev 02 - 2026.01.  
This manual [HTML5](#) also available in format.

# Table of contents

|                                                                |           |
|----------------------------------------------------------------|-----------|
| <b>1. Scope</b>                                                | <b>1</b>  |
| <b>2. Safety instructions</b>                                  | <b>3</b>  |
| <b>3. General description</b>                                  | <b>4</b>  |
| 3.1. Inverter                                                  | 4         |
| 3.2. ON/OFF/ECO switch                                         | 4         |
| 3.3. LED diagnostics and monitoring                            | 4         |
| 3.4. The VictronConnect application                            | 5         |
| 3.5. Bluetooth                                                 | 5         |
| 3.6. VE.Direct port                                            | 5         |
| 3.7. Remote control                                            | 5         |
| <b>4. Installation</b>                                         | <b>6</b>  |
| 4.1. Physical installation                                     | 6         |
| 4.1.1. Location                                                | 6         |
| 4.1.2. Recording                                               | 6         |
| 4.2. Electrical installation                                   | 7         |
| 4.2.1. AC output connection                                    | 7         |
| 4.2.2. Grounding the house                                     | 7         |
| 4.2.3. Remote control connector                                | 7         |
| 4.2.4. VE.Direct connection                                    | 8         |
| <b>5. Configuration</b>                                        | <b>9</b>  |
| 5.1. AC output voltage and frequency                           | 9         |
| 5.2. ECO mode and ECO settings                                 | 9         |
| 5.3. Low battery alarm and charging detection settings         | 9         |
| 5.3.1. Dynamic shutdown                                        | 9         |
| 5.4. Firmware update                                           | 11        |
| 5.5. Reset settings to default values                          | 11        |
| <b>6. Operation</b>                                            | <b>12</b> |
| 6.1. Inverter                                                  | 12        |
| 6.1.1. ECO mode                                                | 12        |
| 6.2. Power and Alarm LED Meaning and Troubleshooting           | 12        |
| 6.3. Protection functions and automatic restarts               | 14        |
| 6.4. Monitoring via VictronConnect app                         | 15        |
| 6.5. Monitoring using GX device, GlobalLink and VRM portal     | 16        |
| <b>7. Technical data</b>                                       | <b>17</b> |
| 7.1. Technical data VE.Direct 230 V inverter                   | 17        |
| <b>8. Appendix</b>                                             | <b>19</b> |
| 8.1. AC output                                                 | 19        |
| 8.2. Connection Overview                                       | 20        |
| 8.3. Installation information: grounding the neutral conductor | 20        |
| 8.4. Dimensions 250 and 375 models                             | 22        |
| 8.5. Dimensions 500 models                                     | 23        |
| 8.6. Dimensions 12/800 model                                   | 24        |
| 8.7. Dimensions 24/800 and 48/800 models                       | 25        |
| 8.8. Dimensions 12/1200 model                                  | 26        |
| 8.9. Dimensions: 24/1200 and 48/1200 models                    | 27        |
| 8.10. Dimensions 12/1600 model                                 | 28        |

# 1. Scope

This manual applies to the following products with the following part numbers:

- Inverter 12/250 230 V VE.Direct IEC - PIN121251110
- Inverter 12/250 230 V VE.Direct SCHUKO - PIN121251210
- Inverter 12/250 230 V VE.Direct AU/NZ - PIN121251310
- Inverter 12/250 230 V VE.Direct UK - PIN121251410
- Inverter 12/375 230 V VE.Direct IEC - PIN121371110
- Inverter 12/375 230 V VE.Direct SCHUKO - PIN121371210
- Inverter 12/375 230 V VE.Direct AU/NZ - PIN121371310
- Inverter 12/375 230 V VE.Direct UK - PIN121371410
- Inverter 12/500 230 V VE.Direct IEC - PIN121501110
- Inverter 12/500 230 V VE.Direct SCHUKO - PIN121501210
- Inverter 12/500 230 V VE.Direct AU/NZ - PIN121501310
- Inverter 12/500 230 V VE.Direct UK - PIN121501410
- Inverter 12/800 230 V VE.Direct IEC - PIN121801110
- Inverter 12/800 230 V VE.Direct SCHUKO - PIN121801210
- Inverter 12/800 230 V VE.Direct AU/NZ - PIN121801310
- Inverter 12/800 230 V VE.Direct UK - PIN121801410
- Inverter 12/1200 230 V VE.Direct IEC - PIN122121110
- Inverter 12/1200 230 V VE.Direct SCHUKO - PIN122121210
- Inverter 12/1200 230 V VE.Direct AU/NZ - PIN122121310
- Inverter 12/1200 230 V VE.Direct UK - PIN122121410
- Inverter 12/1600 230 V VE.Direct IEC - PIN122161100
- Inverter 12/1600 230 V VE.Direct SCHUKO - PIN122161200
- Inverter 12/1600 230 V VE.Direct AU/NZ - PIN122161300
- Inverter 12/1600 230 V VE.Direct UK - PIN122161400
- Inverter 24/250 230 V VE.Direct IEC - PIN241251110
- Inverter 24/250 230 V VE.Direct SCHUKO - PIN241251210
- Inverter 24/250 230 V VE.Direct AU/NZ - PIN241251310
- Inverter 24/250 230 V VE.Direct UK - PIN241251410
- Inverter 24/375 230 V VE.Direct IEC - PIN241371110
- Inverter 24/375 230 V VE.Direct SCHUKO - PIN241371210
- Inverter 24/375 230 V VE.Direct AU/NZ - PIN241371310
- Inverter 24/375 230 V VE.Direct UK - PIN241371410
- Inverter 24/500 230 V VE.Direct IEC - PIN241501110
- Inverter 24/500 230 V VE.Direct SCHUKO - PIN241501210
- Inverter 24/500 230 V VE.Direct AU/NZ - PIN241501310
- Inverter 24/500 230 V VE.Direct UK - PIN241501410

- Inverter 24/800 230 V VE.Direct IEC – PIN241801110
- Inverter 24/800 230 V VE.Direct SCHUKO – PIN241801210
- Inverter 24/800 230 V VE.Direct AU/NZ - PIN241801310
- Inverter 24/800 230 V VE.Direct UK – PIN241801410
- Inverter 24/1200 230 V VE.Direct IEC – PIN242121110
- Inverter 24/1200 230 V VE.Direct SCHUKO - PIN242121210
- Inverter 24/1200 230 V VE.Direct AU/NZ – PIN242121310
- Inverter 24/1200 230 V VE.Direct UK – PIN242121410
- Inverter 24/1600 230 V VE.Direct IEC – PIN242161100
- Inverter 24/1600 230 V VE.Direct SCHUKO – PIN242161200
- Inverter 24/1600 230 V VE.Direct AU/NZ – PIN242161300
- Inverter 24/1600 230 V VE.Direct UK – PIN242161400
- Inverter 48/250 230 V VE.Direct IEC – PIN481251110
- Inverter 48/250 230 V VE.Direct SCHUKO – PIN481251210
- Inverter 48/375 230 V VE.Direct IEC – PIN481371110
- Inverter 48/375 230 V VE.Direct SCHUKO - PIN481371210
- Inverter 48/375 230 V VE.Direct UK – PIN481371410
- Inverter 48/500 230 V VE.Direct IEC - PIN481501110
- Inverter 48/500 230 V VE.Direct SCHUKO - PIN481501210
- Inverter 48/500 230 V VE.Direct AU/NZ - PIN481501310
- Inverter 48/800 230 V VE.Direct IEC - PIN481801110
- Inverter 48/800 230 V VE.Direct SCHUKO - PIN481801210
- 48/800V 230V VE.Direct Inverter AU/NZ - PIN481801310
- Inverter 48/1200 230 V VE.Direct IEC - PIN482121110
- Inverter 48/1200 230 V VE.Direct SCHUKO - PIN482121210
- Inverter 48/1200 230 V VE.Direct AU/NZ - PIN482121310
- Inverter 48/1200 230 V VE.Direct UK - PIN482121410
- Inverter 48/1600 230 V VE.Direct IEC – PIN482161100
- Inverter 48/1600 230V VE.Direct SCHUKO - PIN482161200
- Inverter 48/1600 230 V VE.Direct AU/NZ - PIN482161300
- Inverter 48/1600 230 V VE.Direct UK - PIN482161400

## 2. Safety instructions

### General

Please read the documentation provided with the product first to familiarize yourself with the safety signs and instructions before using the product. This product has been designed and tested in accordance with international standards. The equipment should only be used for its intended purpose.



- **WARNING – These maintenance instructions are for use by qualified personnel only. To reduce the risk of electric shock, do not perform any maintenance other than those specified in the operating instructions unless you are qualified to do so.**
- **WARNING – RISK OF ELECTRIC SHOCK**–The product is used with a permanent power source (battery). The input and/or output terminals may be dangerously live, even when the equipment is switched off. Always disconnect the battery before performing maintenance or servicing on the product.



- There are no user-serviceable parts inside the product. Do not remove the front panel or operate the product with any covers removed. All servicing should be performed by qualified personnel.
- Before installing the equipment, please read the installation instructions in the installation manual.
- This is a safety class I product (equipped with protective earth terminals). The housing must be earthed. The earthing point is located on the outside of the product. If there is a risk that the earthing protection is damaged, the product must be switched off and secured against accidental switching on; please contact qualified service personnel.
- AC output is isolated from DC input and housing **unless the appliance is equipped with a ground fault circuit interrupter (GFCI)**. This connection should be checked by a qualified installer as it is necessary for the GFCI to function properly.  
Local regulations may require the use of a true neutral wire. In this case, one of the AC output wires must be connected to the power supply **to connect, and the building to be reliably grounded**. Please note that a true neutral conductor is required for the earth leakage circuit breaker to function properly.
- Make sure you use the equipment under the correct environmental conditions.  
**Never operate the product in a wet or dusty environment.**  
**Never use the product in places where there is a risk of gas or dust explosion.**
- Ensure that there is sufficient free space (10 cm) around the device for ventilation and check that the ventilation openings are not blocked.
- This appliance is not intended for use 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 by a person responsible for their safety.
- Children should be supervised to ensure that they do not play with the appliance.
- The use of accessories not recommended or sold by the manufacturer of the navigation unit may present a risk of fire, electric shock, or personal injury.

### Transport and storage

Before storing or transporting the product, ensure that the power and battery cables are disconnected. We are not responsible for any damage that may occur during shipping if the equipment is not shipped in its original packaging.

Store the product in a dry environment; the storage temperature should be between -20°C and 60°C.

Refer to the battery manufacturer's manual for battery transportation, storage, charging, recharging, and disposal.

## 3. General description

### 3.1. Inverter

#### Proven reliability

The inverter uses a full-bridge circuit with a toroidal transformer structure that has proven its reliability over the years. It is short-circuit proof and protected against overheating, whether caused by overload or high ambient temperatures.

#### High starting power

For starting loads such as: LED lights, incandescent lamps or power supplies for power tools.

#### AC output socket

This inverter model is available in different versions, each with a different AC output socket, namely: Schuko, UK, AU/NZ or IEC-320 (with male plug).

#### ECO mode

ECO mode reduces the inverter's power consumption by approximately 85% by switching to standby mode when no load is connected to the inverter. When the inverter is in ECO mode, it switches to standby mode when the load drops below a preset value. In standby mode, the inverter checks every few seconds whether the load has increased again. If the load has increased, the inverter exits standby mode and resumes normal operation. The sensitivity of ECO mode is configurable.

#### Fully configurable

- AC output voltage and frequency.
- Low battery voltage shutdown and restart levels.
- ECO mode on/off and ECO mode sensitivity level.

#### To transfer the load to another AC source: The automatic transfer switch

For inverters, the [Filax2](#) we recommend our automatic transfer switch. Filax2 has an extremely short transfer time (less than 20 milliseconds), so computers and other electronic equipment can continue to operate without interruption. Alternatively, use a power supply with a built-in transfer switch. [inverter/charger](#).

### 3.2. ON/OFF/ECO switch

The inverter is equipped with a 3-position switch that performs the following functions:

- ON – Turns on the inverter.
- OFF – Turns off the inverter.
- ECO – Switches the inverter to ECO mode.

### 3.3. LED diagnostics and monitoring

The inverter LEDs indicate basic operating information and alarms:

- Inverter status.
- Overload warning or alarm.
- Overheating warning or alarm.
- Low battery voltage warning or alarm.
- High DC ripple warning or alarm.

Additional parameters can be monitored using VictronConnect:

- Inverter status.
- Battery voltage.
- AC output voltage.

- Percentage of rated AC load.
- Warnings and alerts.

For a complete list of all LED indications and monitoring parameters, see [Operation \[12\]](#) in chapter.

### 3.4. The VictronConnect app

The VictronConnect app is used to monitor, control and configure the inverter. The app can be installed on a smartphone, tablet or computer. The app is available for Android, iOS, Windows and macOS. The app communicates via Bluetooth or USB to the VE.Direct port.

For more information about the app and to download the app, visit [VictronConnect product page](#).



### 3.5. Bluetooth

The inverter does not have built-in Bluetooth. To communicate via Bluetooth, use the (optional) [VE.Direct Bluetooth Smart dongle](#).

Bluetooth (but also VE.Direct connection) can be used to communicate with the VictronConnect app.

### 3.6. VE.Direct port

The inverter is equipped with a VE.Direct port. This port can be used to connect the inverter to:

- The [For VictronConnect app](#) or [one VE.Direct-USB interface](#) through.
- The [VictronConnect app with VE.Direct Bluetooth Smart dongle](#) through.
- For a GX monitoring device, such as the [For Cerbo GX](#). Note that this requires an additional [VE.Direct for cable](#) is needed.
- The [GlobalLink 520](#). Remember that this requires an additional [VE.Direct for cable](#) is needed.

### 3.7. Remote on/off

The inverter can be turned on or off remotely in the following ways:

- Via the VictronConnect app.
- With an (optional) external switch connected to the remote connector.
- Connected to the remote control connector (optional) [Inverter Control VE.Direct](#) with panel.
- Using a BMS (battery management system) connected to the remote connector.
- Using a GX device and/or the VRM portal (optional).

For more information, see ["Remote control connector \[7\]"](#) chapter.

## 4. Installation



- This product must be installed by a qualified electrician.
- During installation, make sure that the remote control connector with the wire jumper is removed (or the remote control on/off switch is turned off, if applicable) to prevent the inverter from turning on unexpectedly.

### 4.1. Physical installation

See the manual for the dimension drawing of the frequency converter.<sup>[19]</sup> Annexebony.

#### 4.1.1. Placement

To ensure trouble-free operation of the frequency converter, it must be used in locations that meet the following requirements:

- Avoid contact with water. Do not expose the inverter to rain or moisture.
- Install the inverter in a dry and well-ventilated location.
- For best operating results, the inverter should be mounted on a flat surface.
- Install the device as close to the batteries as possible. To minimize voltage loss in the cables, try to reduce the distance between the product and the battery as much as possible.
- For cooling, leave at least 10 cm of free space around the device. Do not obstruct the airflow around the inverter. If the inverter overheats, it will shut down. When the inverter reaches a safe temperature level, the device will restart automatically.
- Do not expose the device to direct sunlight. The ambient temperature must be between -20°C and 40°C (humidity <95%, non-condensing). Please note that in extreme situations the temperature of the inverter housing may exceed 70°C.

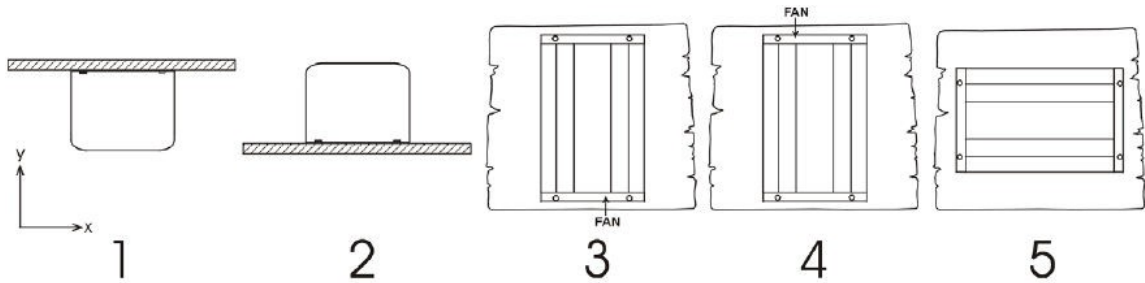


- Excessively high ambient temperatures may cause the inverter to shorten its service life, reduce its rated peak power, or cause the inverter to stop.
- Never mount the inverter directly above the batteries.
- For safety reasons, this product must be installed in a heat-resistant environment when used with equipment that converts significant amounts of energy. Make sure that there are no chemicals, synthetic parts, curtains or other textiles, etc. in the immediate vicinity.

#### 4.1.2. Installation

Mount the inverter on a solid wall or horizontally on a suitable ground surface.

Mount the inverter with four screws vertically up or down, or horizontally up or down. The best mounting options are shown in the table and figure below.



Assembly instructions.

| # | Mounting type                | Recommended? | IP rating | Notes |
|---|------------------------------|--------------|-----------|-------|
| 1 | Ceiling equipment (reverse). | Not          | n/a       |       |
| 2 | Base mounting                | Yes          | IP21      |       |

| # | Mounting type                              | Recommended? | Protective degree | Notes                                                                              |
|---|--------------------------------------------|--------------|-------------------|------------------------------------------------------------------------------------|
| 3 | Vertical wall mounting, fan at the bottom. | Yes          | IP20              | Warning: small objects or dust into the inverter through the ventilation openings. |
| 4 | Vertical installation, fan on top.         | None         | n/a               |                                                                                    |
| 5 | Horizontal wall mounting.                  | Yes          | IP20              |                                                                                    |

## 4.2. Electrical installation

See the inverter connection overview diagram [a Connection overview \[20\]](#) in the appendix.

### 4.2.1. AC output connection

Depending on the type of switch, the switch has the following AC connectors:

- Schuko (CEE 7/4).
- IEC-320 (including plug connector).
- UK (BS 1363).
- AU/NZ (AS/NZS 3112).

See photo of AC outlet type [the AC outlet](#) in the appendix entitled [\[19\]](#).

The inverter AC output is not fused. The AC wiring is protected in the event of a short circuit by a fast-acting current limiter and an overload detection mechanism that mimics the characteristics of a fuse (i.e. faster shutdown in the event of a larger overload). It is important to size the wiring according to the inverter's rated power.

Never connect the inverter's AC output to another AC source, such as a household AC wall outlet or generator.



- The switch has a floating ground. To ensure proper operation of a GFCI (or RCCB, RCB or RCD) to be installed in the AC output circuit of the switch, an internal or external neutral-to-ground connection must be made. For more information, see ["Installation information: neutral-earth connection" appendix \[20\]](#).

### 4.2.2. Grounding the house

#### Wire size required for grounding the gearbox housing:

The cross-section of the ground wire from the ground terminal on the frame to the ground must be at least half the cross-section of the wires used to connect the battery.

The maximum wire size that can fit on the ground terminal is 25 mm<sup>2</sup>. Use the table below to find the appropriate cross-section for the ground wire.

The AC output is isolated from the DC input and chassis. Local regulations may require a true neutral conductor. See the appendix for instructions: [Installation information – neutral grounding \[20\]](#).

### 4.2.3. Remote control connector

Remotely turning the inverter on/off can be accomplished with a simple on/off switch connected to the inverter's remote connector.

The inverter turns on when the ON/OFF/ECO switch is set to ON or ECO mode, and if:

- A connection is made between the H (left) and L (right) terminals of the remote connector, for example using a wire jumper, a switch or the inverter control panel.
- A connection is made between the remote connector H (left) and the positive terminal of the battery.
- A connection is made between the L (right) terminals of the remote connector and the negative terminal of the battery.

Some examples of uses for the remote control connector:

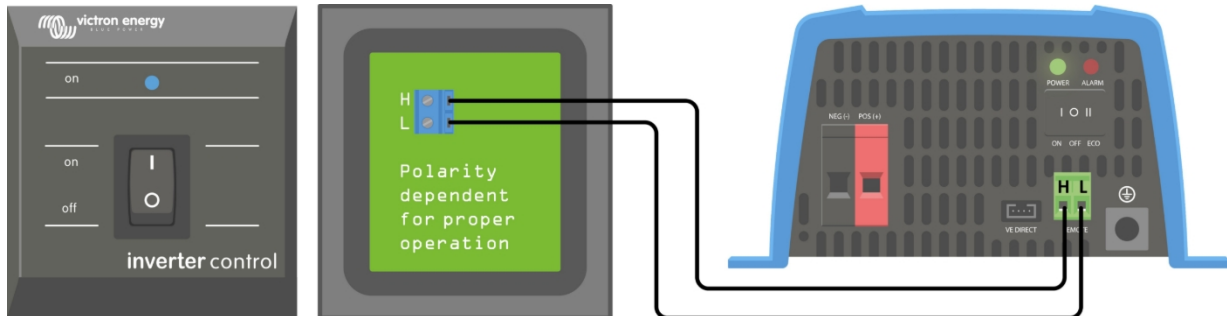
- If the inverter is located in a vehicle and can only operate when the engine is running. Connect the H (right) terminal of the remote connector to the vehicle ignition switch.
- If the inverter is connected to a lithium battery, the inverter can be controlled by the lithium battery's BMS.



- For safety reasons, the inverter can be completely switched off by removing the remote connector. To do this, pull the remote connector out of the socket. This ensures that the inverter can no longer be switched on via its switch or Bluetooth. The user can therefore be sure that the inverter is completely switched off and cannot be switched on again by another user.

#### Inverter control panel

If [VE.Direct inverter](#) If you are using a control panel, it must be connected to the remote terminal of the inverter as shown in the image below. Please note that the connection is polarity dependent for proper operation.



#### 4.2.4. VE.Direct connection

The VE.Direct connection can be used to monitor the inverter via a GX device or to connect to the VictronConnect app.

The following devices can be connected:

- GX device or GlobalLink 520 [With VE.Direct cable](#).
- GX device [VE.Direct-USB interface](#) through.
- Computer running VictronConnect application [VE.Direct-USB interface](#) through.
- A phone or tablet running the VictronConnect app [VE.Direct Bluetooth Smart dongle](#) with the help of.

## 5. Configuration

The inverter is ready for use with the factory default settings (see “Technical data” [17] chapter).

The inverter is [VictronConnect app](#) can be configured using. Connect via smartphone or tablet via Bluetooth (This requires a [VE.Direct-Bluetooth Smart dongle](#)), or via a computer via USB and [VE.Direct-USB interface](#) through.



- The settings may only be changed by a qualified engineer.
- Read the instructions carefully before making any changes.

### 5.1. AC output voltage and frequency

The inverter default setting is 230 VAC, 50 Hz.

The AC output voltage and frequency can be set to different values according to the table below.

### 5.2. ECO mode and ECO settings

The inverter has an ECO mode. ECO mode can be activated via the VictronConnect app or the inverter's main switch.

When the inverter is in ECO mode, it reduces its energy consumption by approximately 85% when no load is connected to it.

When the inverter is in ECO mode, it will enter a search state when there is no load or very low load. In the search state, the inverter is turned off and turns on for a short period of time (adjustable) every 3 seconds. When the inverter detects a load of a certain size (adjustable), it will return to normal operation. As soon as the load drops below a certain level, the inverter will return to ECO mode.

The table below shows the default settings and setting range of the ECO parameters:

| Parameter                | Default value | Province                            |
|--------------------------|---------------|-------------------------------------|
| Wake-up minimum power    | 15W           | 15 W – inverter nominal performance |
| ECO mode search interval | 3 seconds     | 0-64 seconds                        |
| ECO mode search time     | 0.16 seconds  | 0.08-5.00 seconds                   |



- Please note that the required ECO mode settings depend largely on the type of load: inductive, capacitive, non-linear. Some loads may require adjustment.

### 5.3. Low battery alarm and charging detection settings

The inverter has two low battery voltage shutdown modes:

- Low battery shutdown based on battery voltage. This is the “low battery shutdown” voltage.
- Low battery shutdown depending on battery voltage and load. This mode is disabled by default. For more information, see the following chapter: [Dynamic shutdown](#) [9].

After the inverter has stopped due to low battery (regardless of mode):

- The inverter will restart as soon as the battery voltage exceeds the “restart and alarm at low battery voltage” level.
- The inverter will clear the low battery alarm as soon as it senses that the battery is charging. This is the “charge sensing” voltage.

| Battery voltage | Low battery voltage shutdown   | Low battery voltage restart and alarm | Charging detection            |
|-----------------|--------------------------------|---------------------------------------|-------------------------------|
| 12V             | Default: 9.3V<br>Range: 0-100V | Default: 10.9V<br>Range: 0-100V       | Default: 14V<br>Range: 0-100V |

#### 5.3.1. Dynamic shutdown

The “Dynamic Shutdown” function makes the shutdown protection due to low battery voltage a function of the ratio between the current drawn from the battery and the battery voltage.

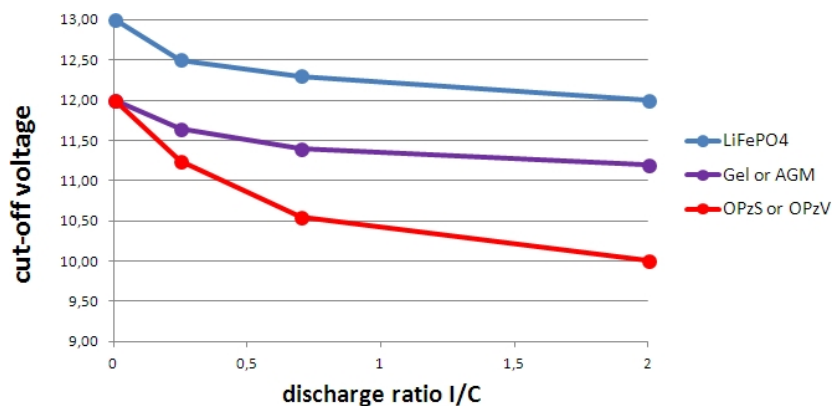
If a high current is being drawn from the battery, a lower cut-off voltage threshold is used, such as 10 V. Similarly, if the battery is only slowly discharging, a higher cut-off voltage is used, such as 11.5 V.

Thus, the voltage drop caused by the battery's internal resistance is compensated for, making the battery voltage a much more reliable parameter for deciding when to stop discharging the battery.

The “Dynamic cut off” function is most useful for batteries with high internal resistance, such as OPzV and OPzS batteries. It is less relevant for GEL and AGM batteries, and perhaps not at all for lithium batteries. The figure below shows the

The curve between discharge rate and battery voltage for different battery types. It can be seen that the lithium curve (LiFePO4) is almost flat compared to the OPzV and OPzS curves.

The curve can be set in the VictronConnect app.



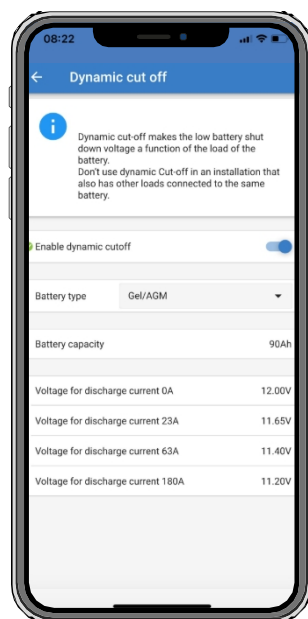
Dependence of the discharge rate of different 12 V battery types on the battery voltage (multiply by 2 for a 24 V system and by 4 for a 48 V system).



- Do not use the “Dynamic Shutdown” function in a system where other loads are connected to the same battery. In such systems, the battery voltage may drop due to the other loads. The inverter's dynamic shutdown algorithm does not take these loads into account and will shut down the inverter prematurely due to a low voltage alarm.

#### VictronConnect settings

- The “Dynamic cut off” function is turned off by default.
- Enable the “Dynamic cut off” feature to use and configure it.
- Select the battery type. You can choose from OPzV/OPzS, GEL/AGM, LiFePO4 or Custom.
- Enter the battery capacity.
- Enter the voltages for the different discharge currents. These values are already set to the common voltages for the battery type selected earlier. Only change these settings if necessary, and you know exactly what you are doing or if you are using a custom battery.



VictronConnect app with “Dynamic cut off” settings

## 5.4. Firmware update

The firmware can be updated in the inverter product settings:

- Click the gear icon in the upper right corner.  symbol to access the inverter settings.
- Click on the three dots in the top right corner  symbol.
- Select "Product Settings" from the menu.
- The firmware section displays the firmware version and a button to perform a firmware update.

## 5.5. Reset settings to default values

You can reset the inverter settings to default values as follows:

- Click the gear icon in the upper right corner.  symbol to access the inverter settings.
- Click on the three dots in the top right corner  symbol.
- Select "Restore Default Settings" from the menu and the settings will be reset to their default values.

## 6. Operation

### 6.1. Inverter

The inverter can be switched on in the following ways:

- ON/OFF/ECO switch.
- The VictronConnect app.
- Remote terminal with wired loop.
- Remote switch connected to the remote terminal (optional).
- Inverter Control VE.Direct panel connected to the remote terminal (optional).
- A GX device and the VRM portal (optional).

#### 6.1.1. ECO mode

The inverter can be set to ECO mode via the VictronConnect app or the “ON/OFF/ECO” switch.

When the inverter operates in ECO mode, it reduces power consumption in no-load (standby) mode. The inverter automatically turns off when it detects that there is no load connected. It then turns on briefly every 3 seconds to sense the load. If the output power exceeds the set level, the inverter continues to operate.

For more information about ECO mode, see [ECO mode and ECO settings \[9\]](#) chapter.

### 6.2. Power and Alarm LED Description and Troubleshooting



| LEDs | The LEDs behavior                                            | Mode                                                                                                                          | Troubleshooting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | Green POWER LED does not light.<br>The red ALARM LED is off. | The inverter has been turned off, either directly or via the remote on/off connector, or the inverter is not receiving power. | <p>Check the ON/OFF/ECO switch: it must be in the ON or ECO position.</p> <p>To check the operation of the inverter, turn the switch to OFF and then to ON.</p> <p>If it doesn't work, check the following:</p> <ul style="list-style-type: none"><li>• Check the remote control connector. Have you put the wire loop in place or turned on the remote switch or remote control panel?</li><li>• Check the DC cable connections and external fuses. The inverter<br/>Are you measuring the battery voltage at the battery connection?</li><li>• If the internal fuse is blown, the inverter must be sent for service.</li></ul> |
|      | Green POWER LED lights up.<br>Red ALARM LED Who.             | The inverter is turned on and operational.                                                                                    | n/a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| LEDs                                                                                | LED behavior                                                                                                           | Mode                                                                                                                                                                                                                                                                  | Troubleshooting                                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p>The green POWER LED flashes slowly, briefly.</p> <p>flashes with pulses.</p> <p>The red ALARM LED is off.</p>       | <p>The gearbox has switched to ECO mode and is in a “search” state. In other words: the load on the gearbox lower than the “Wake up power” setting. The switch is regularly sends a search pulse at intervals to check if a load has been connected or turned on.</p> | <p>If the inverter keeps turning on and off while a load is connected, the load may be too small for the actual ECO mode settings. Increase the load or adjust the “wake-up power” setting.</p>                                                                                                                                |
|    | <p>Green POWER LED lights up.</p> <p>The red ALARM LED is lit.</p>                                                     | <p>Overload warning.</p> <p>The inverter indicates that the AC load exceeds the inverter's rated power, and if this situation persists, the inverter will turns off due to overload alarm.</p>                                                                        | <p>Reduce AC load</p>                                                                                                                                                                                                                                                                                                          |
|    | <p>The green POWER LED flashes twice quickly.</p> <p>flashes with pulses.</p> <p>The red ALARM LED is lit.</p>         | <p>Overload alarm.</p> <p>The inverter has stopped due to prolonged overload and will not restart automatically.</p>                                                                                                                                                  | <p>Eliminate the cause of the overload, then turn the frequency converter off and on again.</p> <p>For more information, see <a href="#">Protections and automatic restarts [14]</a> chapter.</p>                                                                                                                              |
|    | <p>Green POWER LED lights up.</p> <p>The red ALARM LED flashes slowly.</p>                                             | <p>Low battery voltage warning.</p> <p>The battery voltage has dropped below the “Low Battery Voltage Alarm”. If the battery voltage continues to drop, the inverter will shut down due to the “Low Battery Voltage Alarm”.</p>                                       | <p>Charge the battery and/or turn off the AC loads. Also check that the battery cable connections are tight. Are the battery cables of the correct thickness, is the battery fully charged?</p> <p>battery and is it still working properly?</p>                                                                               |
|  | <p>Green POWER LED lights up.</p> <p>THE RED ALERT LED flashes quickly.</p>                                            | <p>High battery voltage warning.</p> <p>The battery voltage is too high. If the battery voltage continues to rise, the inverter will shut down and give a “High Battery Voltage Alarm” signal.</p>                                                                    | <p>Reduce the direct current input voltage, check that the battery voltage is correct and that the battery pack is connected correctly. Also check for a faulty or inadequate charger or equipment with a faulty charge controller.</p>                                                                                        |
|  | <p>Green POWER LED lights up.</p> <p>The red ALARM LED flashes twice rapidly.</p> <p>flashes with pulses.</p>          | <p>High temperature warning.</p> <p>The internal temperature is too high. If the temperature continues to rise, the inverter will shut down due to a “High Temperature Alarm”.</p>                                                                                    | <p>Reduce the AC load and/or move the switch to a better ventilated location.</p>                                                                                                                                                                                                                                              |
|  | <p>Green POWER LED lights up.</p> <p>The red ALARM LED is a fast, single flashes with pulses longer at intervals.</p>  | <p>High DC ripple warning.</p> <p>The DC voltage ripple is too high. If the ripple continues to increase, the inverter will trip due to a “High DC Ripple” alarm.</p>                                                                                                 | <p>Check that all battery cable connections are properly tightened. Are the battery cables the correct thickness? DC ripple is related to the voltage drop across the battery cables. Learn more about DC ripple and its</p> <p>For more information on prevention, see <a href="#">In the book Wiring Unlimited</a> find.</p> |
|  | <p>The green POWER LED flashes twice quickly.</p> <p>flashes with pulses.</p> <p>The red ALARM LED flashes slowly.</p> | <p>Low battery voltage alarm.</p> <p>The inverter has stopped due to low battery voltage.</p>                                                                                                                                                                         | <p>To restart the inverter, charge the battery or turn the inverter off and then on again.</p> <p>Check the battery voltage at the inverter battery terminals. Also check the DC fuses, cables and cable connections.</p> <p>For more information, see <a href="#">Protections and automatic restarts [14]</a> chapter.</p>    |

| LEDs                                                                                | The LEDs behavior                                                                                                                                            | Operating mode                                                                                  | Troubleshooting                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p>The green POWER LED flashes twice quickly.<br/>flashes with pulses.</p> <p>THE RED ALERT LED flashes quickly.</p>                                         | <p>High battery voltage alarm.</p> <p>The inverter has stopped due to high battery voltage.</p> | <p>Reduce the direct current input voltage, check that the battery voltage is correct and that the battery pack is connected correctly. Also check for a faulty or inadequate charger or equipment with a faulty charge controller.</p> <p>The inverter will automatically turn back on when the battery voltage drops to an acceptable level.</p> <p>For more information, see <a href="#">Protections and automatic restarts [14]</a> chapter.</p>                             |
|    | <p>The green POWER LED flashes twice quickly.<br/>flashes with pulses.</p> <p>The red ALARM LED flashes twice rapidly.<br/>flashes with pulses.</p>          | <p>High temperature alarm.</p> <p>The inverter has stopped due to high temperature.</p>         | <p>Wait for the inverter to cool down.</p> <p>The switch will automatically turn back on when its internal temperature drops to an acceptable level.</p> <p>Check the environment of the gearbox: can the ventilation be improved or can the gearbox be moved to a cooler location?</p> <p>For more information, see <a href="#">Protections and automatic restarts [14]</a> chapter.</p>                                                                                        |
|  | <p>The green POWER LED flashes twice quickly.<br/>flashes with pulses.</p> <p>The red ALARM LED is longer at intervals fast, with single pulses flashes.</p> | <p>DC ripple alarm.</p> <p>The inverter has stopped due to high DC ripple.</p>                  | <p>Check that all battery cable connections are properly tightened. Are the battery cables the correct thickness? DC ripple is related to the voltage drop across the battery cables. For more information on DC ripple and how to prevent it, see <a href="#">In the book Wiring Unlimited</a> find.</p> <p>To restart the switch, turn the switch off and then on again.</p> <p>For more information, see <a href="#">Protections and automatic restarts [14]</a> chapter.</p> |
|  | <p>The green POWER LED and red ALARM LED alternately fast they are flashing.</p>                                                                             | <p>Firmware update is active.</p>                                                               | <p>Wait for the update to complete.</p> <p>If the firmware update fails, try again.</p>                                                                                                                                                                                                                                                                                                                                                                                          |
|  | <p>The green POWER LED and red ALARM LED alternately, flashes slowly.</p>                                                                                    | <p>Calibration or parameter error.</p>                                                          | <p>Contact your Victron distributor for assistance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                          |

## 6.3. Protection functions and automatic restart

### Overload

Some loads, such as motors or pumps, draw a high inrush current when starting. Under such conditions, the inrush current may exceed the overcurrent trip threshold of the frequency converter. In this case, the AC output voltage is rapidly reduced to limit the output current of the frequency converter. If the overcurrent trip threshold is continuously exceeded, the frequency converter stops, waits for 30 seconds, and then restarts.

After 3 restarts, followed by another overload within 30 seconds of the restart, the frequency converter will stop and remain in the off state. The LEDs will indicate the overload stop. To restart the frequency converter, turn it off and then on again.

### Low battery voltage (adjustable)

The inverter will stop if the DC input voltage drops below the “Low Battery Voltage Shutdown” parameter. The LEDs will indicate a low battery voltage shutdown. The inverter will restart automatically after a delay of at least 30 seconds when the battery voltage rises above the “Low Battery Voltage Restart” parameter.

After three restarts, followed by another low battery shutdown within 30 seconds of the restart, the inverter will shut down and remain in the off state. The LEDs will indicate the low battery shutdown. To restart the inverter, turn it off and then back on. Alternatively,

charge the battery. The inverter will automatically restart when the battery voltage rises above the “Charge Detection” parameter for at least 30 seconds.

The default low battery shutdown and restart thresholds are set in the [Technical data \[17\]](#). The thresholds can be customized via the VictronConnect app.

Alternatively, a dynamic low battery shutdown can be configured. For more information, see [Dynamic shutdown \[9\]](#) chapter.

#### High battery voltage

The inverter will shut down if the DC input voltage is too high. The LEDs will indicate a shutdown due to high battery voltage. The inverter will first wait for 30 seconds and will only resume operation when the battery voltage drops to an acceptable level.

Check for a faulty battery charger, generator, or solar charger connected to the battery.

#### High temperature

The inverter will shut down if it detects an internal temperature that is too high. The LEDs will indicate a high temperature shutdown. The inverter will wait 30 seconds and will only resume operation when the temperature drops to an acceptable level.

High temperature alarms are usually caused by excessively high ambient temperatures, often combined with high inverter loads. Check that the location where the inverter is used is well ventilated and possibly air-conditioned.

#### High DC ripple

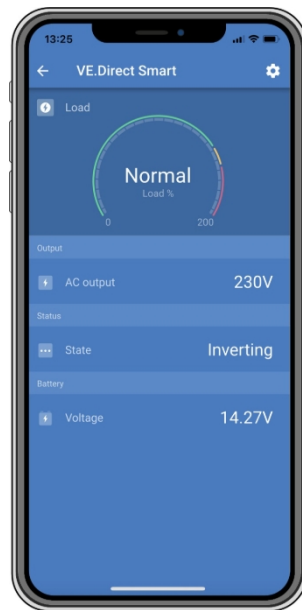
The inverter will shut down if it detects high DC ripple. The LEDs will indicate a high DC ripple shutdown. The inverter will wait 30 seconds before restarting. If the DC ripple voltage is still too high after 3 restarts, the inverter will shut down and will not attempt to restart. To restart the inverter, turn the inverter off and then on again.

High DC ripple is usually caused by loose DC cable connections and/or DC wires that are too thin. To eliminate or prevent ripple alarms, check the wires between the battery and the inverter. Check that the wire gauge is as recommended, that all connections are properly tightened, and that fuses and battery isolators are working properly. For more information on DC ripple, see [In the book Wiring Unlimited](#) find.

Continuous, high DC ripple reduces the lifespan of the inverter.

## 6.4. Monitoring via VictronConnect app

The VictronConnect app allows you to monitor the operation of the inverter.



*VictronConnect app.*

For information about joining [the VictronConnect app \[5\]](#) and/or the VictronConnect manual, which is available in the [VictronConnect app information page](#) is available.

The VictronConnect app displays the following information:

- Inverter load expressed as a percentage of the inverter's rated power.
- AC output voltage.
- Battery voltage.

- Operational status.
- Warning or alarm messages \*.

\* ) Please note that the app does not run in the background. This means that the app will not send alerts or warnings to your phone unless the app is running in the foreground.

## 6.5. Monitoring using GX device, GlobalLink and VRM portal

The inverter can be connected to a GX device, such as a [For Cerbo GX](#) or one [For Ekrano GX](#). Once connected, the GX device will display the inverter on the system overview screen and in the device list. The GX device will also display a message if the inverter has a warning or alarm.



Example of GX screens from left to right: system screen, inverter device screen, and alarm message.

If the GX device is connected to the Internet, remote monitoring of the inverter is possible via the VRM portal. For more information about the VRM portal, see [VRM – Remote Monitoring](#) information page.

Alternatively, the switch can be connected to a [GlobalLink 520](#) and can then be monitored remotely via the VRM portal.

## 7. Technical data

### 7.1. Technical data VE.Direct 230 V inverter

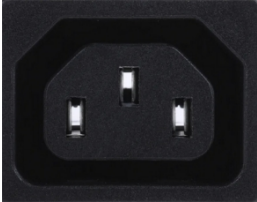
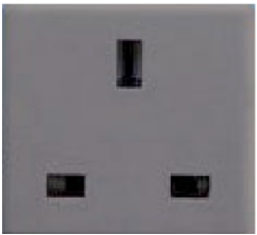
| VE.Direct 230V inverter                                                         | 12/250<br>24/250<br>48/250                                   | 12/375<br>24/375<br>48/375 | 12/500<br>24/500<br>48/500 | 12/800<br>24/800<br>48/800 | 12/1200<br>24/1200<br>48/1200 | 12/1600<br>24/1600<br>48/1600 |
|---------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------|----------------------------|----------------------------|-------------------------------|-------------------------------|
| Article number <sup>(1)</sup>                                                   | PINxx1251X10                                                 | PINxx1371X10               | PINxx1501X10               | PINxx1801X10               | PINxx2121X10                  | PINxx2161X00                  |
| Continuous performance at 25 °C                                                 | 250W                                                         | 375W                       | 450W                       | 800W                       | 1150W                         | 1450W                         |
| Continuous performance at 40 °C                                                 | 200W                                                         | 300W                       | 380W                       | 650W                       | 1000W                         | 1300W                         |
| Time-limited power (cold start)                                                 | 300W/15s                                                     | 450W/10s                   | 500W/1 hour                | 900 W/1 hour               | 1200 W/1 hour                 | 1600 W/1 hour                 |
| Peak performance                                                                | 400W/2s                                                      | 600W/2s                    | 750W/3s                    | 1200W/15s                  | 1600W/15s                     | 2100W/15s                     |
| Output AC voltage                                                               | 230V +/- 3%                                                  |                            |                            |                            |                               |                               |
| Output AC frequency (adjustable)                                                | 50 or 60 Hz +/- 0.1%                                         |                            |                            |                            |                               |                               |
| Input DC voltage range                                                          | 9.2-17V<br>18.4-34V<br>36.8-62V                              |                            |                            |                            |                               |                               |
| Low battery shutdown DC voltage (adjustable)                                    | 9.3V<br>18.6V<br>37.2V                                       |                            |                            |                            |                               |                               |
| Dynamic (load dependent) DC undervoltage shutdown (fully configurable)          | Yes, see the <a href="#">"Dynamic shutdown"</a> [9] chapter. |                            |                            |                            |                               |                               |
| Low battery voltage restart and alarm DC voltage (adjustable)                   | 10.9V<br>21.8V<br>43.6V                                      |                            |                            |                            |                               |                               |
| Battery charging detection DC voltage (adjustable)                              | 14.0V<br>28 V<br>56 V                                        |                            |                            |                            |                               |                               |
| Max. efficiency                                                                 | 84%<br>86%<br>86%                                            | 86%<br>88%<br>88%          | 86%<br>88%<br>88%          | 90%<br>90%<br>91%          | 91%<br>91%<br>92%             | 91%<br>91%<br>92%             |
| Idle power                                                                      | 5W<br>6W<br>8W                                               | 6W<br>7W<br>9W             | 7W<br>8W<br>10W            | 8W<br>8W<br>9W             | 11W<br>11W<br>12W             | 14W<br>14W<br>15W             |
| Default loaded performance in mode (default search interval: 2.5 s, adjustable) | 1W<br>1W<br>2W                                               | 1W<br>1W<br>2W             | 1W<br>1W<br>2W             | 1W<br>2W<br>2W             | 1W<br>2W<br>3W                | 1W<br>2W<br>3W                |
| ECO mode stop and start power setting                                           | Adjustable                                                   |                            |                            |                            |                               |                               |
| Protection <sup>(2)</sup>                                                       | a-g                                                          |                            |                            |                            |                               |                               |
| Operating temperature province                                                  | -40 to +65 °C (fan cooling)                                  |                            |                            |                            |                               |                               |
| Performance degradation                                                         | 1.25% for every °C above 40 °C                               |                            |                            |                            |                               |                               |
| Humidity (non-condensing)                                                       | up to 95%                                                    |                            |                            |                            |                               |                               |

| Inverter VE.Direct 230 V                                                                                                                                                                                           | 12/250<br>24/250<br>48/250                                                                                         | 12/375<br>24/375<br>48/375                                     | 12/500<br>24/500<br>48/500                                     | 12/800<br>24/800<br>48/800                                     | 12/1200<br>24/1200<br>48/1200                                  | 12/1600<br>24/1600<br>48/1600                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------|
| HOUSE                                                                                                                                                                                                              |                                                                                                                    |                                                                |                                                                |                                                                |                                                                |                                                                |
| Material and color                                                                                                                                                                                                 | Steel frame and plastic cover (blue Ral 5012)                                                                      |                                                                |                                                                |                                                                |                                                                |                                                                |
| Battery connectors                                                                                                                                                                                                 | Screw terminals                                                                                                    |                                                                |                                                                |                                                                |                                                                |                                                                |
| Maximum battery cable cross-section                                                                                                                                                                                | 10 mm <sup>2</sup><br>10 mm <sup>2</sup><br>10 mm <sup>2</sup>                                                     | 10 mm <sup>2</sup><br>10 mm <sup>2</sup><br>10 mm <sup>2</sup> | 10 mm <sup>2</sup><br>10 mm <sup>2</sup><br>10 mm <sup>2</sup> | 25 mm <sup>2</sup><br>16 mm <sup>2</sup><br>16 mm <sup>2</sup> | 35 mm <sup>2</sup><br>25 mm <sup>2</sup><br>25 mm <sup>2</sup> | 50 mm <sup>2</sup><br>25 mm <sup>2</sup><br>25 mm <sup>2</sup> |
| Standard AC outlets                                                                                                                                                                                                | SCHUKO model: CEE 7/4<br>IEC model: IEC-320 (with male connector) UK<br>model: BS 1363<br>AU/NZ model: AS/NZS 3112 |                                                                |                                                                |                                                                |                                                                |                                                                |
| Protection class                                                                                                                                                                                                   | IP 21                                                                                                              |                                                                |                                                                |                                                                |                                                                |                                                                |
| Weight                                                                                                                                                                                                             | 2.7 kg                                                                                                             | 3 kg                                                           | 3.5 kg                                                         | 5.5 kg                                                         | 7.2 kg                                                         | 8.9 kg                                                         |
| Dimensions (l x w x h, mm)                                                                                                                                                                                         | 86x165x260<br>86x165x260<br>86x165x260                                                                             | 86x165x260<br>86x165x260<br>86x165x260                         | 86x172x275<br>86x172x275<br>86x172x275                         | 95x231x334<br>105x216x310<br>105x216x310                       | 117x231x374<br>117x231x333<br>117x231x333                      | 117x231x395<br>117x231x365<br>117x231x365                      |
| ACCESSORIES                                                                                                                                                                                                        |                                                                                                                    |                                                                |                                                                |                                                                |                                                                |                                                                |
| Remote control on/off connector                                                                                                                                                                                    | Yes                                                                                                                |                                                                |                                                                |                                                                |                                                                |                                                                |
| Automatic transfer switch                                                                                                                                                                                          | Not built in. Add one <a href="#">Filax2</a> switch, or use it instead <a href="#">inverter/charger</a> .          |                                                                |                                                                |                                                                |                                                                |                                                                |
| STANDARDS                                                                                                                                                                                                          |                                                                                                                    |                                                                |                                                                |                                                                |                                                                |                                                                |
| Security                                                                                                                                                                                                           | EN/IEC 60335-1, EN/IEC 62109-1                                                                                     |                                                                |                                                                |                                                                |                                                                |                                                                |
| EMC                                                                                                                                                                                                                | EN 55014-1, EN 55014-2<br>IEC 61000-6-1, IEC 61000-6-2, IEC 61000-6-3                                              |                                                                |                                                                |                                                                |                                                                |                                                                |
| Motor Vehicle Directive                                                                                                                                                                                            | ECE R10-4 in progress                                                                                              |                                                                |                                                                |                                                                |                                                                |                                                                |
| 1. Output socket:<br>X=1: IEC<br>X=2: Schuko<br>X=3: AU/NZ<br>X=4: UK                                                                                                                                              |                                                                                                                    |                                                                |                                                                |                                                                |                                                                |                                                                |
| 2. Protection key:<br>a. Output short circuit<br>b. Overload<br>c. Battery voltage too high<br>d. Battery voltage too low<br>e. Temperature too high<br>f. 230 VAC at the inverter output<br>g. DC ripple too high |                                                                                                                    |                                                                |                                                                |                                                                |                                                                |                                                                |

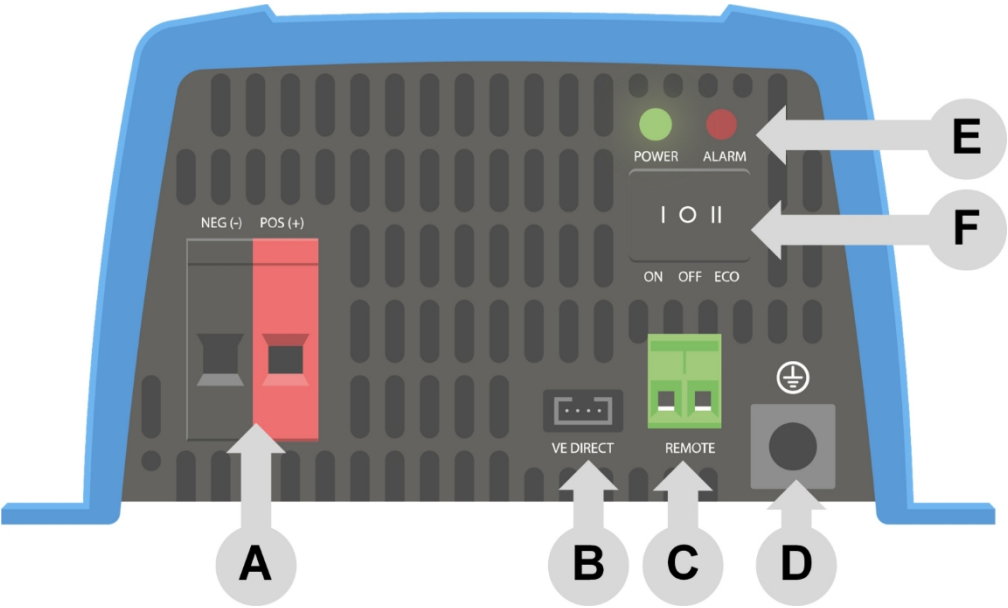
## 8. Appendix

### 8.1. AC outlet

Depending on the model, the inverter is equipped with one of the following AC sockets:

| AC outlet                    | Alternating voltage | Image                                                                                |
|------------------------------|---------------------|--------------------------------------------------------------------------------------|
| IEC-320 (with plug together) | 230V                |    |
| Schuko (CEE 7/4)             | 230V                |    |
| UK (BS 1363)                 | 230V                |  |
| AU/NZ (AS/NZS 3112)          | 230V                |  |

8.2. Connection overview



| # | Description                        |
|---|------------------------------------|
| A | Battery connections                |
| B | VE.Direct connection               |
| C | Connecting remote on/off terminals |
| D | Chassis ground connection          |
| E | LEDs                               |
| F | ON/OFF/ECO switch                  |

8.3. Installation information: neutral-earth connection

Connecting the inverter neutral output to chassis/ground

The AC output is isolated from the DC input and the enclosures. Local regulations may require the use of a true neutral conductor. In this case, one of the AC output conductors must be connected to the enclosure and the enclosure must be connected to a reliable earth ground. It is possible to connect the neutral conductor to the enclosure inside the converter; the method for doing so is described below.

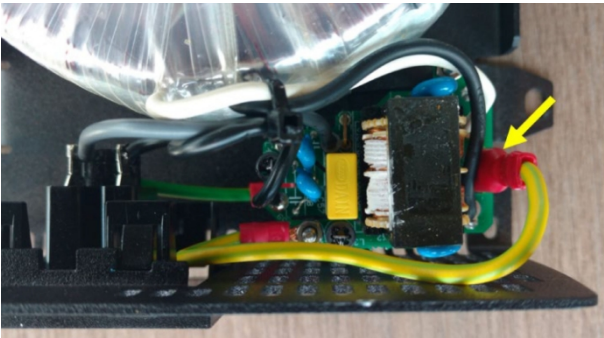
Please be sure to disconnect the battery when connecting the neutral wire to the protective earth (PE).

After removing the plastic cover, the internal PE conductor connecting the neutral conductor to the housing becomes accessible. A Torx T10 screwdriver is required to loosen the four screws securing the plastic cover.

For inverters with a power of 250 VA, 375 VA and 500 VA:

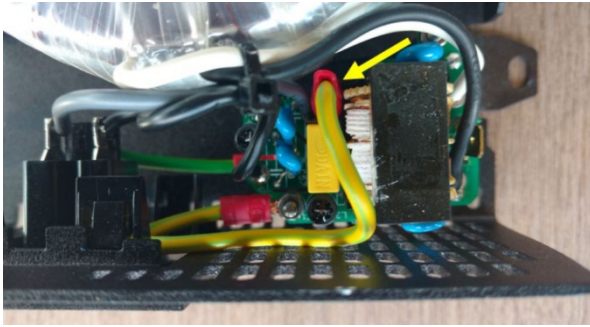
1. Personal grounding

Position of the PE conductor (indicated by the arrow):

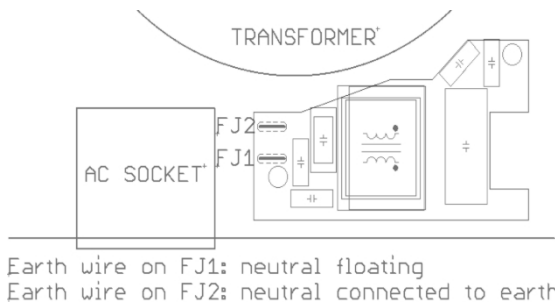


2. The neutral wire is connected to the protective earth

Position of the PE conductor (indicated by the arrow):



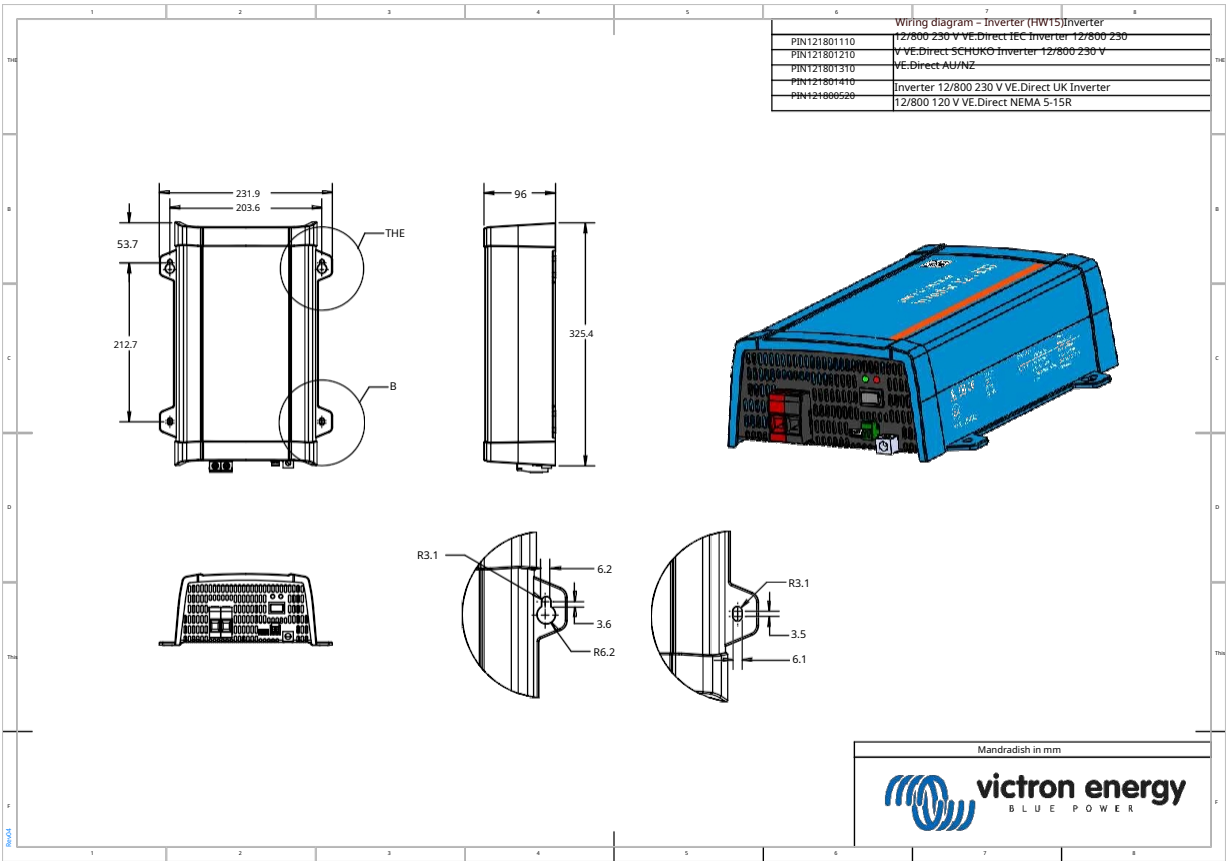
The housing ground wire can be connected to either FJ1 (free floating neutral) or FJ2 (neutral connected to ground/housing). The labels FJ1 and FJ2 are printed on the circuit board. The default setting is FJ1, which means the neutral is free floating.



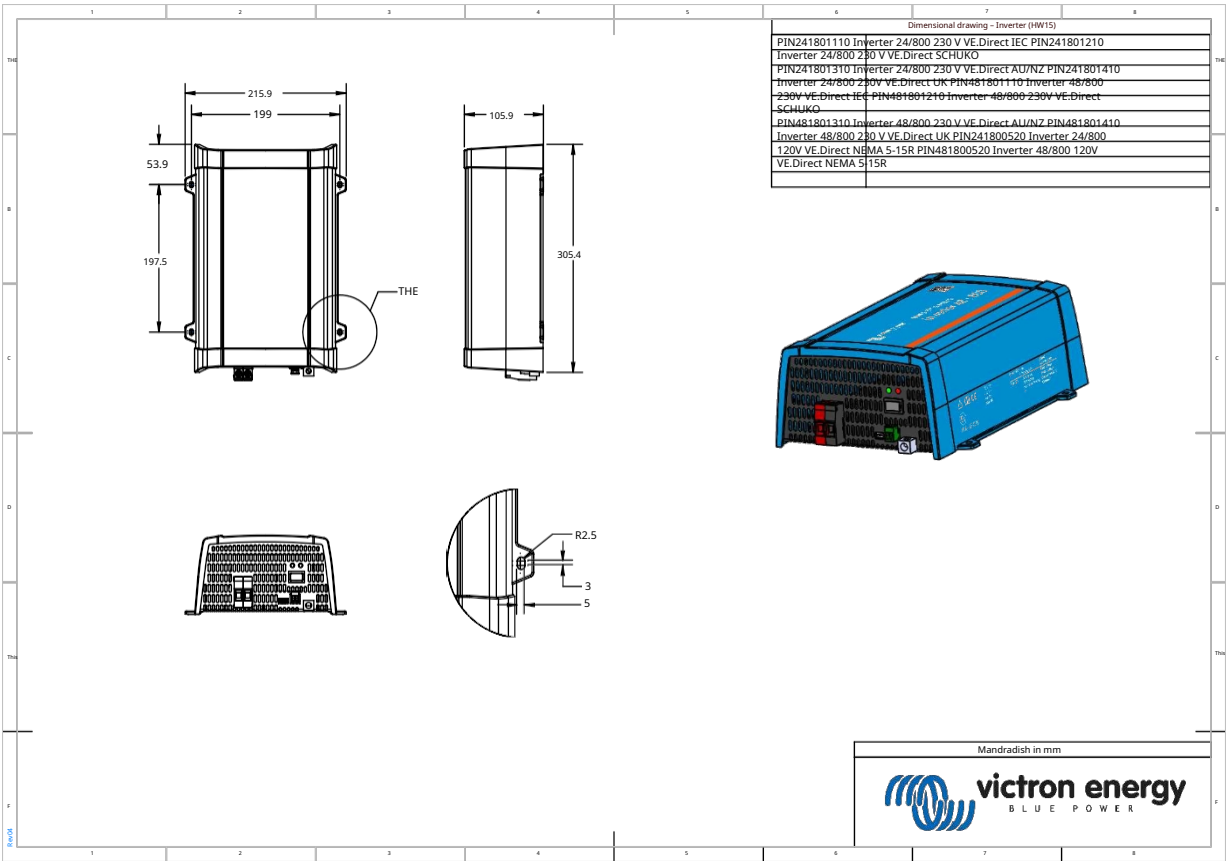




8.6. Dimensions of the 12/800 model

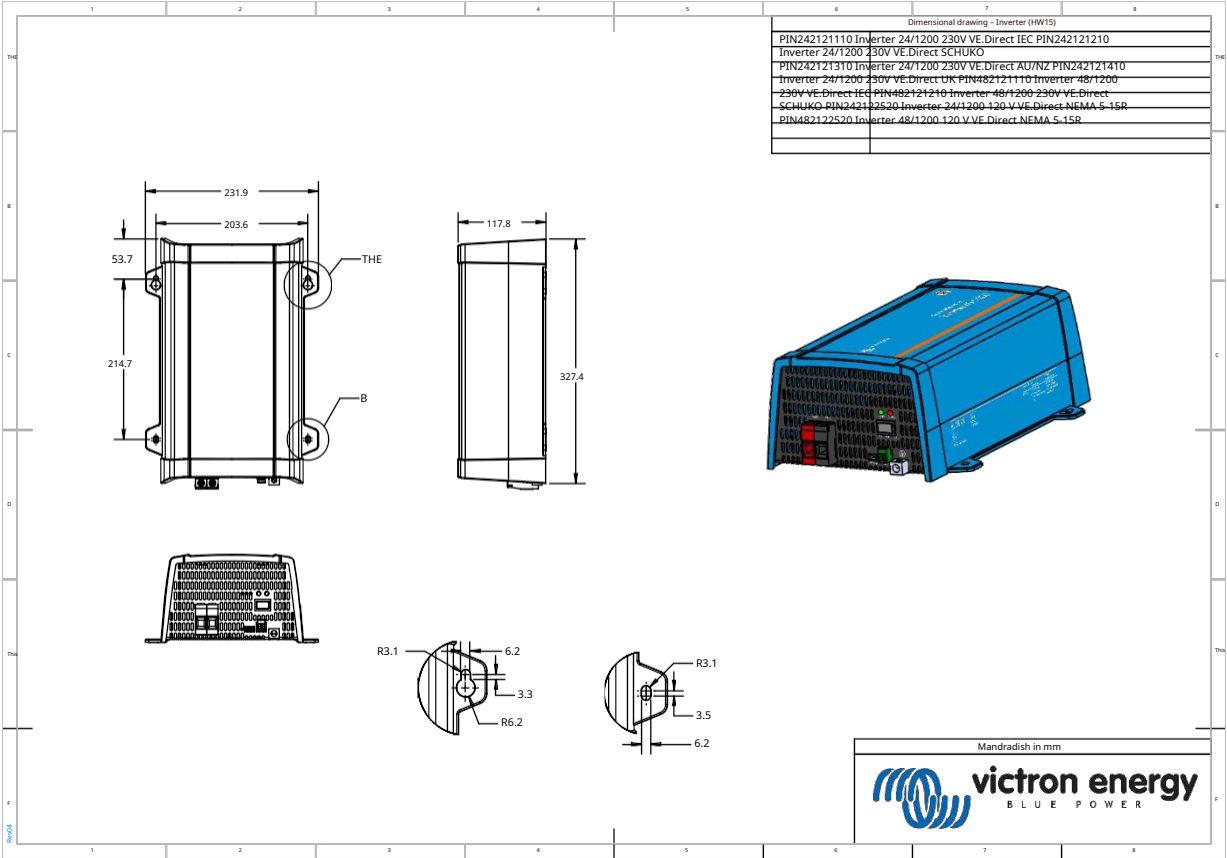


8.7. Dimensions 24/800 and 48/800 models





8.9. Dimensions 24/1200 and 48/1200 models



8.10. Dimensions 12/1600 model

