

Phoenix Inverter VE.Direct

12 250	12 375	12 500	12 800	12 1200
24 250	24 375	24 500	24 800	24 1200
48 250	48 375	48 500	48 800	48 1200

1. Safety instructions

WARNING: ELECTRIC SHOCK HAZARD

The product is used in conjunction with a permanent energy source (battery). Input and/or output terminals may still be dangerously energized, even when the equipment is switched off. Always disconnect the battery before carrying out maintenance or servicing the product.

The product has no internal user-serviceable components. Do not remove the front plate or operate the product if any panels have been removed. All servicing must be undertaken by qualified personnel.

Please read the installation instructions in the installation manual before installing the equipment.

This is a Safety Class I product (supplied with a protective grounding terminal). The chassis must be grounded. A grounding point is located on the outside of the product. Whenever it is likely that the grounding protection has been damaged, the product must be turned off and secured against unintended operation; please contact qualified service staff.

The AC output is isolated from the DC input and the chassis. Local regulations may require a true neutral. In this case one of the AC output wires must be connected to the chassis, **and the chassis must be connected to a reliable ground**. Please note that a true neutral is needed to ensure correct operation of an earth leakage circuit breaker.

Ensure that the equipment is used under the correct ambient conditions.

Never operate the product in a wet or dusty environment.

Never use the product where there is a risk of gas or dust explosions.

Ensure there is adequate free space (10 cm) for ventilation around the product and check that the ventilation vents 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.

2. Description

VE.Direct communication port

The VE.Direct port can be connected to:

- A computer (VE.Direct to USB interface cable needed)
- Apple and Android smartphones, tablets and other devices (VE.Direct to Bluetooth Smart dongle needed)

Fully configurable

- Low battery voltage alarm trip and reset levels
- Low battery voltage cut-off and restart levels, or Dynamic Cut-off
- Output voltage 210 - 245 V
- Frequency 50 Hz or 60 Hz
- ECO mode on/off and ECO mode sense level

Monitoring

Battery voltage, AC Output voltage, load indicator, alarms

Proven reliability

The full bridge with toroidal transformer topology has proven its reliability over many years. The inverters are short circuit proof and protected against overheating, whether due to overload or high ambient temperature.

High start-up power

Needed to start loads such as power converters for LED lamps, filament lamps or electric tools.

ECO mode

When in ECO mode, the inverter will switch to standby when the load decreases below a preset value. It will switch on and check every few seconds, adjustable, if the load has increased again.

Remote on/off connector

A remote on/off switch can be connected to a two-pole connector or between battery plus and the left hand contact of the two pole connector.

LED diagnosis

A red and a green LED indicate inverter operation and status of the different protections.

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

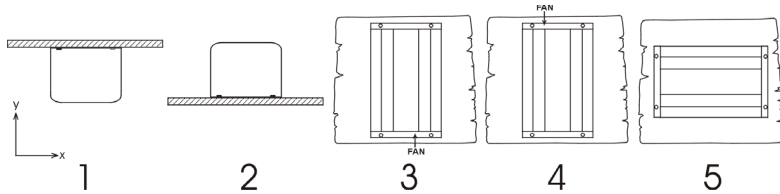
For our low power inverters we recommend our Filax Automatic Transfer Switch. The Filax features a very short switchover time (less than 20 milliseconds) so that computers and other electronic equipment will continue to operate without disruption.

Available with different output sockets

Schuko, UK (BS-1363), AU/NZ (3112) or IEC-320 (male plug included)

3. Installation

3.1 Location of the inverter



- | | | |
|---|--|--|
| 1 | Ceiling mounting (inverted). | <u>Not recommended</u> |
| 2 | Base mounting. | OK |
| 3 | Vertical wall mounting, fan at bottom. | OK (beware of small objects falling through the ventilation openings on top). |
| 4 | Vertical wall mounting, fan on top. | <u>Not recommended</u> |
| 5 | Horizontal wall mounting. | OK |

For best operating results, the inverter should be placed on a flat surface. To ensure a trouble free operation of the inverter, it must be used in locations that meet the following requirements:

- Avoid any contact with water. Do not expose the inverter to rain or moisture.
- Do not place the unit in direct sunlight. Ambient air temperature should be between $-20\text{ }^{\circ}\text{C}$ and $40\text{ }^{\circ}\text{C}$ (humidity $< 95\%$ non condensing). Note that in extreme situations the inverter's case temperature can exceed $70\text{ }^{\circ}\text{C}$.
- Do not obstruct the airflow around the inverter. Leave at least 10 centimetres clearance around the inverter. When the inverter is running too hot, it will shut down. When the inverter has reached a safe temperature level the unit will automatically restart again.

3.2 Connection to the battery

In order to utilize the full capacity of the product, batteries with sufficient capacity and battery cables with sufficient cross section should be used. See table:

	12/250	24/250	48/250	12/375	24/375	48/375
Minimum battery cap.	30 Ah	20 Ah	10 Ah	40 Ah	30 Ah	15 Ah
Internal DC fuse	2 x 30 A	30 A	25 A	2 x 40 A	40 A	25 A
Fuse type (Mfr.: Littelfuse)	ATOF 32 V	ATOF 32 V	FKS 80 V	ATOF 32 V	ATOF 32 V	FKS 80 V
Fuse replaceable	no	no	no	no	no	no
Recommended DC cable cross-section (mm ²)						
0 – 1,5 m	4 mm ²	2,5 mm ²	1,5 mm ²	6 mm ²	4 mm ²	2,5 mm ²
1,5 – 3 m	6 mm ²	4 mm ²	2,5 mm ²	10 mm ²	6 mm ²	4 mm ²

	12/500	24/500	48/500	12/800	24/800	48/800
Minimum battery cap.	60 Ah	40 Ah	20 Ah	100 Ah	50 Ah	30 Ah
Internal DC fuse	3 x 35 A	2 x 25 A	30 A	125 A	2 x 40 A	2 x 20 A
Fuse type (Mfr.: Littelfuse)	ATOF 32 V	ATOF 32 V	FKS 80 V	MIDI 32 V	ATOF 32 V	FKS 80 V
Fuse replaceable	no	no	no	yes	no	no
Recommended DC cable cross-section (mm ²)						
0 – 1,5 m	6 mm ²	6 mm ²	4 mm ²	16 mm ²	6 mm ²	4 mm ²
1,5 -3 m	10 mm ²	10 mm ²	6 mm ²	25 mm ²	10 mm ²	6 mm ²

	12/1200	24/1200	48/1200
Minimum battery cap.	150 Ah	60 Ah	30 Ah
Internal DC fuse	200 A	100 A	50 A
Fuse type (Mfr.: Littelfuse)	MIDI 32 V	MIDI 32 V	MIDI 58 V
Fuse replaceable	yes	yes	yes
0 – 1,5 m	25 mm ²	10 mm ²	6 mm ²
1,5 -3 m	35 mm ²	16 mm ²	10 mm ²

The inverters are fitted with an internal DC fuse (see table above for rating). If the DC cable length is increased to more than 1,5m, an additional fuse or DC circuit breaker must be inserted close to the battery.

Reverse polarity connection of the battery wires will blow the internal fuse and can damage the inverter. The internal fuse is not always replaceable (see table above).

3.3 Wire size for connecting the inverter chassis to ground

The earth conductor from the earth lug on the chassis to ground should have at least half the cross-section of the conductors used for the battery connection: see Appendix B.

3.4 Connection to the load

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

3.5 Connecting the inverter neutral output to the chassis/ground

The AC output is isolated from the DC input and the chassis. Local regulations may require a true neutral. In this case one of the AC output wires must be connected to the chassis, and the chassis must be connected to a reliable ground: see appendix A.

3.6 Remote on/off connector

A remote on/off switch can be connected to the two-pole connector. Alternatively, the left-hand contact of the connector can be switched to battery positive: useful in automotive applications, wire it to the ignition contact.

Note that also the front switch needs to set to either On or ECO for the inverter to start.

3.7 Configuration

The inverter is ready for use with the factory settings (see specifications), and can be configured with a computer (VE.Direct to USB interface cable needed), Apple and Android smartphones, tablets and other devices (VE.Direct to Bluetooth Smart dongle needed).

4. Operation

4.1 LED definitions

Green LED	Status	Trouble shooting
●●●●●●●● Solid on	Inverter on	Red LED Off status OK Red LED On or blinking: The Inverter is still on, but will shut down when the condition gets worse. See red LED table for warning reason
●●----- Slow single pulse	ECO mode	If the inverter keeps switching on and off while there is a load connected, the load may be too small compared to the actual ECO mode settings. Increase the load or change ECO mode settings. (minimum ECO mode setting: 15 W)
●●●----- Fast double pulse	Off and waiting	Inverter did shut down because of a protection. The inverter will restart automatically as soon as all alarm conditions are cleared. See red LED state for the shutdown reason.
----- Off	Inverter off	Red LED Off Check the On/Off/ECO switch: it should be in On position or in ECO position. Check Remote on/off connector. Check DC cable connections and fuses. Inverter fuse blown: the inverter has to be returned for service. Red LED On or blinking The inverter did shut down because of a protection. It will no longer automatically restart. The red LED indicates the reason for shutdown. Remove the cause and then restart the inverter by switching it Off, and then back On.

Red LED	Definition	Trouble shooting
●●●●●●●● Solid on	Overload	Reduce load
●●●●----- Slow blink	Low batt.	Recharge or replace battery Check DC cable connections Check cable cross section as it may be insufficient. See section 4.3 Protections and automatic restarts for manual and automatic restart behavior.
●-●-●-●- Fast blink	High batt.	Reduce DC input voltage, check for faulty charger
●-●----- Double pulse	High temp.	Reduce load and/or move inverter to better ventilated area
●----- Fast single pulse	High DC ripple	Check DC cable connections and cable cross section.

4.2 ECO Mode

Set the front switch to ECO mode to reduce the power consumption in no-load operation. The inverter will automatically switch off as soon as it detects that there is no load connected. It then switches on, briefly, every 2.5 seconds to detect a load. If the output power exceeds the set level, the inverter will continue to operate.

The default ECO mode wake-up minimum power is 15 Watt.
The default ECO mode search interval is 2.5 seconds

Note that the required ECO mode settings are heavily dependent on the type of load: inductive, capacitive, non-linear. Adjustment may be needed.

4.3 Protections and automatic restarts

Overload

Some loads like motors or pumps draw large inrush currents in a start-up situation. In such circumstances, it is possible that the start-up current exceeds the over current trip level of the inverter. In this case the output voltage will quickly decrease to limit the output current of the inverter. If the over current trip level is continuously exceeded, the inverter will shut down: wait 30 seconds and then restart.

After three restarts followed by another overload within 30 seconds of restarting, the inverter will shutdown and remain off. The LEDs will signal shutdown due to overload. To restart the inverter, switch it Off, then On.

Low battery voltage (adjustable)

The inverter will shut down when the DC input voltage drops below the low battery shutdown level. After a minimum delay of 30 seconds, the inverter will restart if the voltages rise above the low battery restart level.

After three restarts followed by a low battery shutdown within 30 seconds of restarting, the inverter will shutdown and stop retrying. The LEDs will signal low battery shutdown. To restart the inverter, switch it Off, and then On, or recharge the battery: as soon as the battery has risen and then stays above the Charge detect level for 30 seconds, it will switch on.

See the Technical Data table for default low battery shutdown and restart levels. They can be changed with VictronConnect (computer or app).

Alternatively Dynamic Cut-off can be implemented, see https://www.victronenergy.com/live/ve_direct:phoenix-inverters-dynamic-cutoff

High battery voltage

Reduce DC input voltage and/or check for a faulty battery- or solar-charger in the system. After shutting down due to a high battery voltage, the inverter will first wait 30 seconds and then retry operation as soon as the battery voltage has dropped to acceptable level. The inverter will not stay off after multiple retries.

High temperature

A high ambient temperature or enduring high load may result in shut down to over temperature. The inverter will restart after 30 seconds. The inverter will not stay off after multiple retries. Reduce load and/or move inverter to better ventilated area.

High DC ripple

High DC ripple is usually caused by loose DC cable connections and/or too thin DC wiring. After the inverter has switched off due to high DC ripple voltage, it waits 30 seconds and then restarts.

After three restarts followed by a shutdown due to high DC ripple within 30 seconds of restarting, the inverter will shutdown and stops retrying. To restart the inverter, switch it Off and then On.

Continuous high DC ripple reduces life expectancy of the inverter.

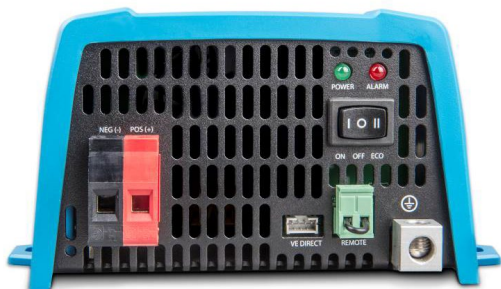
5. Technical data

Phoenix Inverter	12 Volt	12/250	12/375	12/500	12/800
	24 Volt	24/250	24/375	24/500	24/800
	48 Volt	48/250	48/375	48/500	48/800
Cont. power at 25 °C (1)	250 VA		375 VA	500 VA	800 VA
Cont. power at 25 °C / 40 °C	200 / 175 W		300 / 260 W	400 / 350 W	650 / 560 W
Peak power	400 W		700 W	900 W	1500 W
Output AC voltage / frequency (adjustable)	230 VAC or 120 VAC +/- 3 % 50 Hz or 60 Hz +/- 0,1 %				
Input voltage range	9,2 - 17 / 18,4 - 34,0 / 36,8 - 62,0 VDC				
Low battery shut down (adjustable)	9,3 / 18,6 / 37,2 VDC				
Low battery restart & alarm (adjustable)	10,9 / 21,8 / 43,6 VDC				
Battery charged detect (adjustable)	14,0 / 28,0 / 56,0 VDC				
Max. efficiency	87/88/88 %	89/89/90 %	90/90/91 %	90/90/91 %	
Zero-load power	4,2/5,2/7,9 W	5,6/6,1/8,5 W	6/6,5/9 W	6,5/7/9,5 W	
Default zero-load power in ECO mode (default search interval: 2,5 s, adjustable)	0,8/1,3/2,5 W	0,9/1,4/2,6 W	1 / 1,5 / 3 W	1 / 1,5 / 3 W	
ECO mode stop and start power setting	Adjustable				
Protection (2)	a – f				
Operating temperature range	-40 to +60 °C (fan assisted cooling) (derate 1,25 % per °C above 40 °C)				
Humidity (non-condensing)	max 95 %				
ENCLOSURE					
Material & Colour	Steel chassis and plastic cover (blue Ral 5012)				
Battery-connection	Screw terminals				
Maximum cable cross-section	10 mm ² / AWG8				25/10/10 mm ² / AWG4/8/8
Standard AC outlets	230 V: Schuko (CEE 7/4), IEC-320 (male plug included) UK (BS 1363), AU/NZ (AS/NZS 3112) 120 V: Nema5-15R				
Protection category	IP 21				
Weight	2,4 kg/5,3 lbs	3,0 kg/6,6 lbs	3,9 kg/8,5 lbs	5,5 kg/12 lbs	
Dimensions (h _x w _x d, mm) (h _x w _x d, inch)	86x165x260 3,4x6,5x10,2	86x165x260 3,4x6,5x10,2	86x172x275 3,4x6,8x10,8	105x216x305 4,1x8,5x12,1 (12 V model: 105x230x325)	
ACCESSORIES					
Remote on-off	Yes				
Automatic transfer switch	Filax or Multi				
STANDARDS					
Safety	EN/IEC 60335-1 / EN/IEC 62109-1				
EMC	EN 55014-1 / EN 55014-2 IEC 61000-6-1 / IEC 61000-6-3				
Automotive Directive	ECE R10-4 EN 50498				
1) Nonlinear load, crest factor 3:1					
2) Protection key:					
a) output short circuit					
b) overload					
c) battery voltage too high					
d) battery voltage too low					
e) temperature too high					
f) DC ripple too high					

5. Technical data, continued

Phoenix Inverter	12 Volt	12/1200
	24 Volt	24/1200
	48 Volt	48/1200
Cont. power at 25 °C (1)	1200 VA	
Cont. power at 25 °C / 40 °C	1000 / 900 W	
Peak power	2400 W	
Output AC voltage / frequency (adjustable)	230 VAC or 120 VAC +/- 3 % 50 Hz or 60 Hz +/- 0,1 %	
Input voltage range	9,2 - 17 / 18,4 - 34,0 / 36,8 - 62,0 VDC	
Low battery shut down (adjustable)	9,3 / 18,6 / 37,2 VDC	
Low battery restart & alarm (adjustable)	10,9 / 21,8 / 43,6 VDC	
Battery charged detect (adjustable)	14,0 / 28,0 / 56,0 VDC	
Max. efficiency	92 / 94 / 94 %	
Zero-load power	8 / 9,5 / 10 W	
Default zero-load power in ECO mode (default search interval: 2,5 s, adjustable)	1 / 1,7 / 2,7 W	
ECO mode stop and start power setting	Adjustable	
Protection (2)	a – f	
Operating temperature range	-40 to +60 °C (fan assisted cooling) (derate 1,25 % per °C above 40 °C)	
Humidity (non-condensing)	max 95 %	
ENCLOSURE		
Material & Colour	Steel chassis and plastic cover (blue Ral 5012)	
Battery-connection	Screw terminals	
Maximum cable cross-section	35/25/25 mm ² / AWG2/4/4	
Standard AC outlets	230 V: Schuko (CEE 7/4), IEC-320 (male plug included) UK (BS 1363), AU/NZ (AS/NZS 3112) 120 V: Nema5-15R	
Protection category	IP 21	
Weight	7,7 kg/17 lbs	
Dimensions (hxwx d, mm) (hxwx d, inch)	117x232x327 4,6x9,1x12,9 (12 V model: 117x232x367)	
ACCESSORIES		
Remote on-off	Yes	
Automatic transfer switch	Filax or Multi	
STANDARDS		
Safety	EN/IEC 60335-1 / EN/IEC 62109-1	
EMC	EN 55014-1 / EN 55014-2 IEC 61000-6-1 / IEC 61000-6-3	
Automotive Directive	ECE R10-4 EN 50498	
1) Nonlinear load, crest factor 3:1 2) Protection key: a) output short circuit b) overload c) battery voltage too high d) battery voltage too low e) temperature too high f) DC ripple too high		

Fig 1: Front and rear view



Mounting instructions

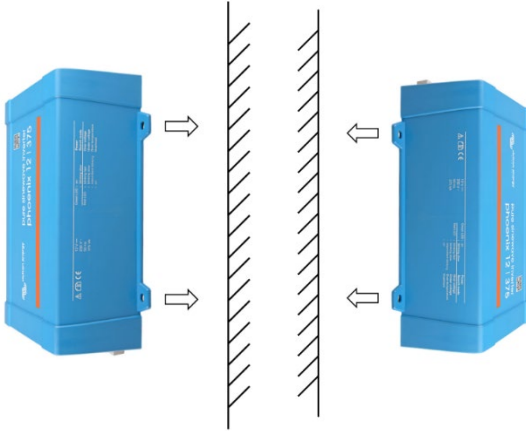


Figure 1



Figure 2

Mount the inverter with four screws vertically up- or downwards or horizontally up- or downwards (as indicated in Figure 1) against a sturdy wall or horizontally up- or downwards (as indicated in Figure 2) on a suitable ground surface (as indicated in Figure 2). Keep at least 4 inches (10 cm) clearance with respect to other apparatus/objects. Beware that IP21 only applies to the lower mounting method depicted in Figure 2; otherwise IP20 is applies. **Do not mount the inverter upside down to a surface.**

Appendix A

Connecting the inverter neutral output to the chassis/ground

The AC output is isolated from the DC input and the chassis. Local regulations may require a true neutral. In this case one of the AC output wires must be connected to the chassis, and the chassis must be connected to a reliable ground. Inside the inverter a provision has been made to be able to connect the neutral and the chassis; the way to do this is explained below.

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

An internal PE wire, which is used to connect the neutral and the chassis, is accessible after removing the plastic cover. A Torx T10 screwdriver is needed to loosen the four screws which hold the plastic cover.

In the pictures below the two possible connections of the PE wire are shown:

For the 250 VA, 375 VA and 500 VA inverters:

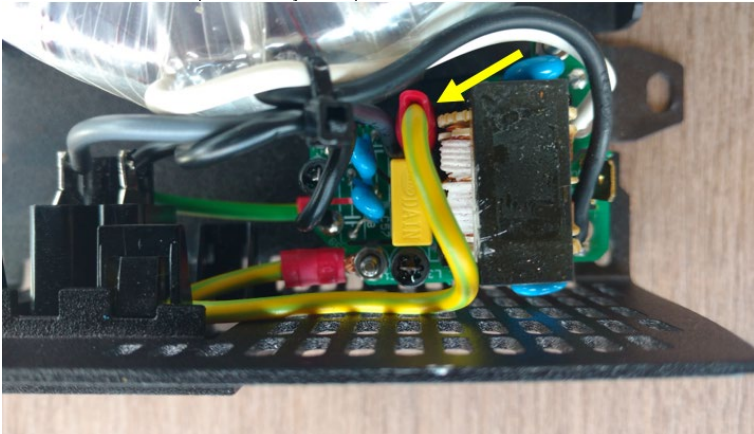
1. Neutral floating

Position of the PE wire (indicated by arrow):



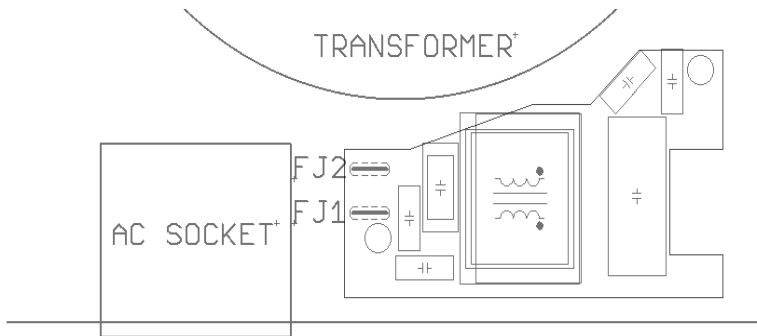
2. Neutral connected to protective earth

Position of the PE wire (indicated by arrow):



For the 800 VA and 1200 VA inverters:

For these inverters the earth wire from the chassis can be either connected to FJ1 (neutral floating) or to FJ2 (neutral connected to earth/chassis). The labels FJ1 and FJ2 are printed on the circuit board. The default position is FJ1, i.e. neutral is floating.



Earth wire on FJ1: neutral floating
 Earth wire on FJ2: neutral connected to earth

Appendix B**Wire size for connecting the inverter chassis to ground**

The earth conductor from the earth lug on the chassis to ground should have at least half the cross-section of the conductors used for the battery connection. The maximum conductor size that fits the earth lug is 25 mm². Use the table below to find the correct cross-section for the earth conductor.

Cable cross-section	
to battery	to protective earth
1.5 mm ²	≥ 0.75 mm ²
2.5 mm ²	≥ 1.5 mm ²
4 mm ²	≥ 2.5 mm ²
6 mm ²	≥ 4 mm ²
10 mm ²	≥ 6 mm ²
16 mm ²	≥ 10 mm ²
25 mm ²	≥ 16 mm ²
35 mm ²	25 mm ²

Victron Energy Blue Power

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