

FemtoGrid Controller Box (Vestas VTC 25-002)

Installation Manual

Application:

FemtoGrid Solar and/or Wind Optimizers in combination with DC Grid
or AC Grid combined with non-FemtoGrid inverter(s)

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1. Explanation of the used symbols

For optimal use of this document we will start with the explanation of the symbols appearing in this User Manual of the Vestas VTC 25-002.



This symbol indicates a symbol.



This symbol indicates a remark that if ignored makes commissioning more difficult.



This symbol indicates a warning that if ignored may result in damage to components or possible danger for persons. Read these passages carefully.

2. Introduction

General

Thank you for purchasing this FemtoGrid product and by doing so helping to make this earth greener by adding a solar and/or wind installation to our planet. Your solar or wind installation supplies energy directly suitable for a DC or an AC grid which in turn helps reducing CO₂ emission and stimulates us in our quest to switch from conventional fossil energy sources to renewable energy sources.

User group for this document



This product has to be installed by authorized installers. It is also necessary that the installer complies with the rules of the local grid administrator. It is strongly recommended that the installer reads this user manual carefully and keeps in mind all the safety measures, the technical connecting rules of the local grid administrator, and every other applicable rule.

FemtoGrid's solution for solar or wind installations (when using a stand-alone application of a DC grid or a stand-alone application of an AC grid together with a non-FemtoGrid inverter):

FemtoGrid's smart solution enhances performance, safety, reliability and utilization of solar and wind installations and is based on 4 (DC grid) or 5 (AC grid) component groups:

- PO310 Solar Optimizer (for each solar panel) or PO2500-UW002 Wind Optimizer (together with Safety Box) for a wind turbine (for example Anakata A018)
- Non-FemtoGrid Inverter(s) when connecting to an AC grid
- VTC 25-002 Vestas Controller Box
- DC cables
- (Optional) Monitoring (wireless monitoring system) which consists of a Monitoring Box and a Monitoring Portal

Together with the solar panels (and/or the wind turbine), the fastening material, and the installation itself our system is a turnkey solution that through its innovative features has important benefits in comparison to traditionally built solar installations with the use of string architecture.

An example of an implementation on site is shown here.



3. Safety instructions

Installing Femtogrid systems



The installation of the 5 component groups (PO310 Solar Power Optimizers and/or PO2500-UW002 Wind Optimizer(s), non-Femtogrid inverter(s), VTC 25-002 Controller Box, DC cables and Monitoring Box) have to be done by authorized installers in agreement with the local and national rules (the regulations applying in the Netherlands are stated in NEN1010).

Switching on of the Controller Box



Do not connect the VTC 25-002 Vestas Controller Box to the power (230V AC or 400V DC) before all PO310 Power Optimizers (along with their solar panels) are connected in parallel and/or the PO2500-UW002 Wind Optimizer (together with the Safety Box) is connected. Voltages up to 400V can be present on the DC Grid. Do not touch the inside of the connectors.

High voltages inside the system components



Do not open the PO310 Solar Power Optimizers, the PO2500-UW002 Wind Optimizer(s), the non-Femtogrid inverter(s) or the VTC 25-002 Controller Box. This is not necessary for the installation. In case of necessity it may only be done by authorized engineers. In some installations it is necessary to configure beforehand the VTC 25-002 Vestas Controller Box in Slave mode (at switched off local supply) by placement of the supplied jumpers. Only in that exceptional case it is necessary to open the Controller Box.

Femtogrid DC bus safety warnings



If the Safety connection of the VTC 25-002 Vestas Controller Box(s) is disconnected all the power of the connected devices to the DC bus is switched off. In case the cables or the connectors are damaged there is a possibility to get an electrical shock.

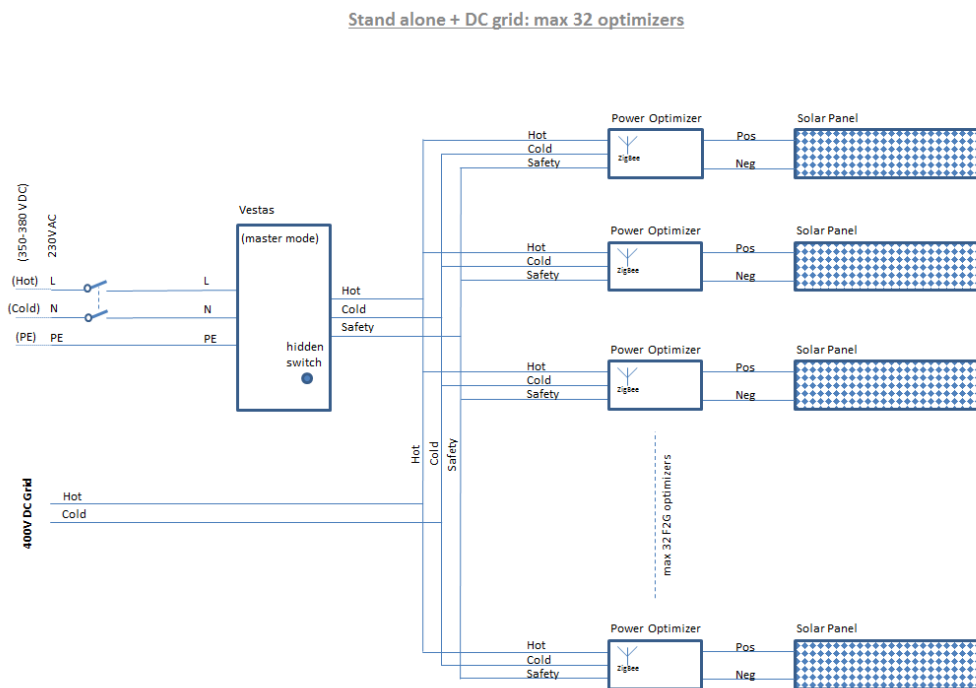


Place an endcap(s) on the non-used T-connector(s) of the DC bus cable. Otherwise penetrating water can cause your solar and/or wind installation to malfunction.

4. Application schematics

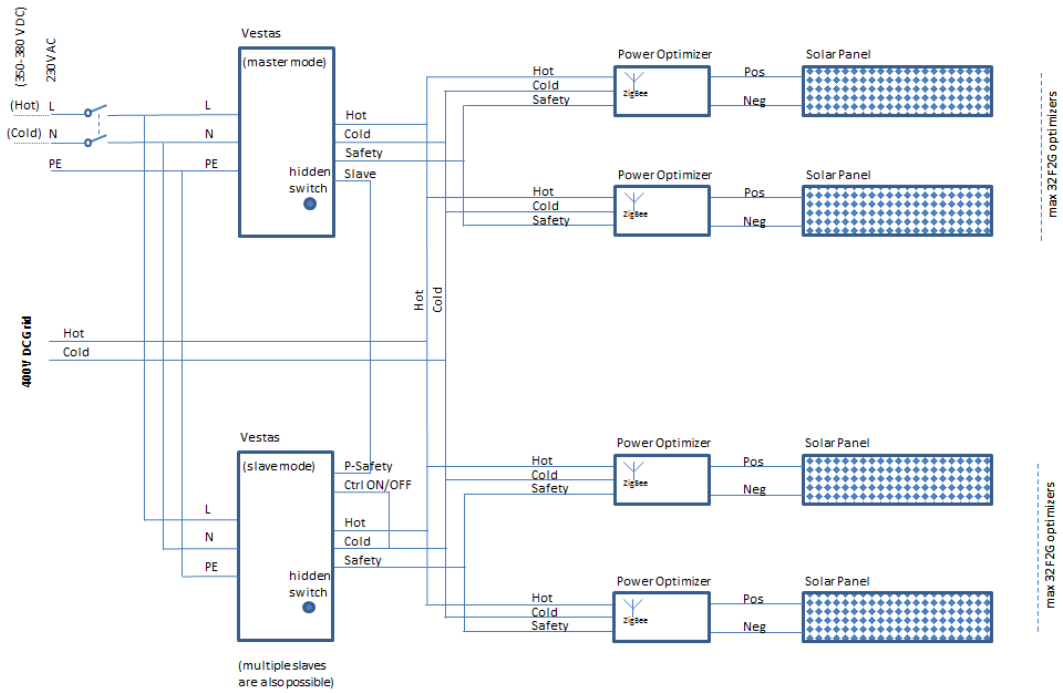
Femtogrid systems use in the special case a Vestas Controller Box is needed (as in the case of an AC grid combined with non-Femtogrid inverters or in the case of a DC grid without the use of inverters) 5 component groups to enhance performance, safety, reliability and utilization of solar and wind installations: PO310 Solar Optimizer (for each solar panel) and/or PO2500-UW002 Wind Optimizer (combined with Safety Box) for a wind turbine, non-Femtogrid inverter(s) if connected to an AC grid, VTC 25-002 Vestas Controller Box, DC cables and (optional) Monitoring.

Examples of some possible installations are shown here:



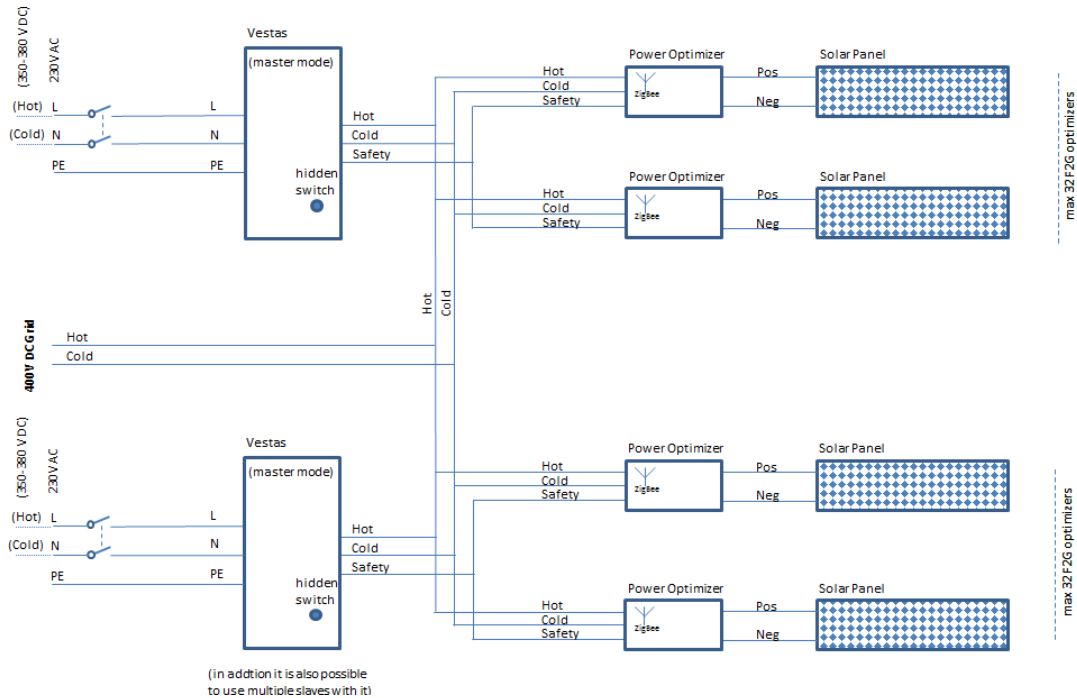
Connecting example 1: Stand alone + DC grid (max 32 optimizers)

Master / Slave + DC grid: max 64 optimizers



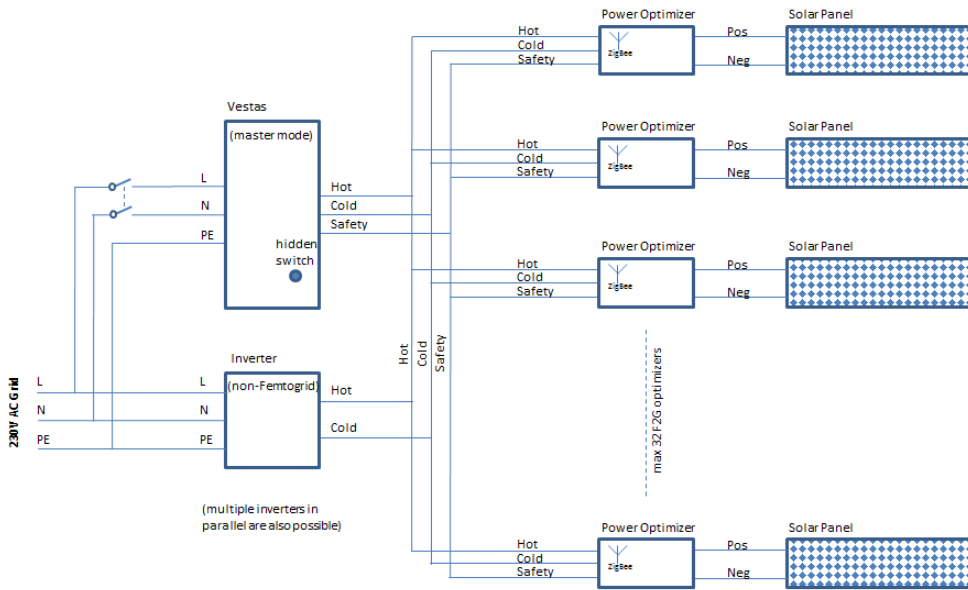
Connecting example 2: Master / Slave + DC grid (max 64 optimizers)

Master / Master + DC grid: max 2 x 32 optimizers



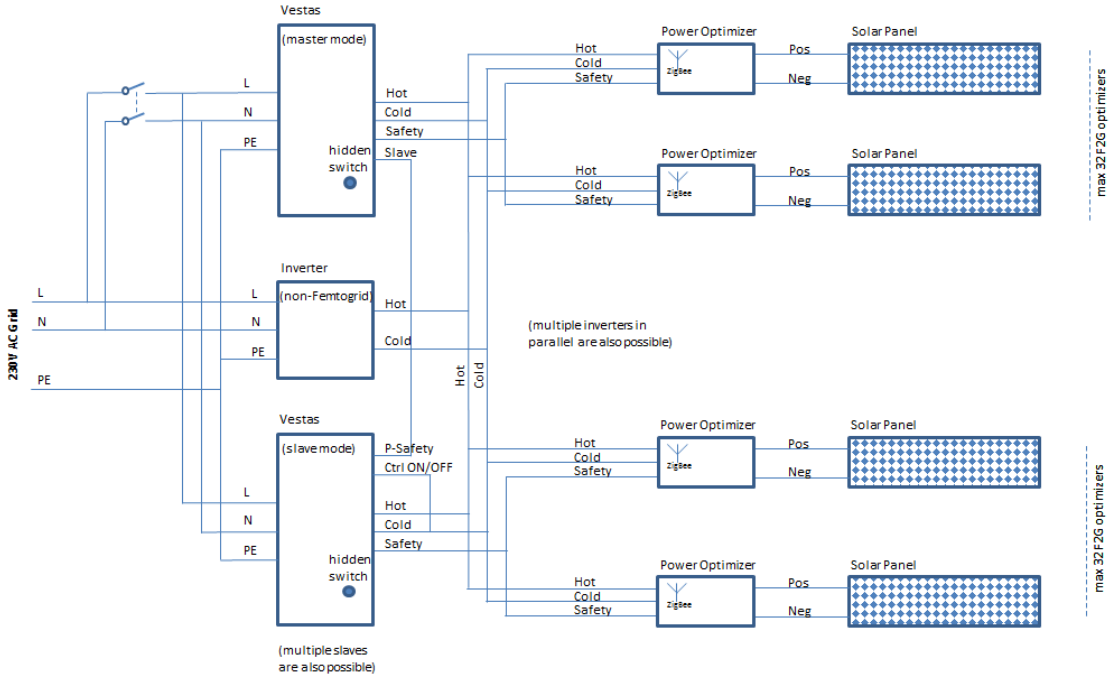
Connecting example 3: Master / Master + DC grid (max 2 x 32 optimizers)

Stand alone + AC grid: max 32 optimizers



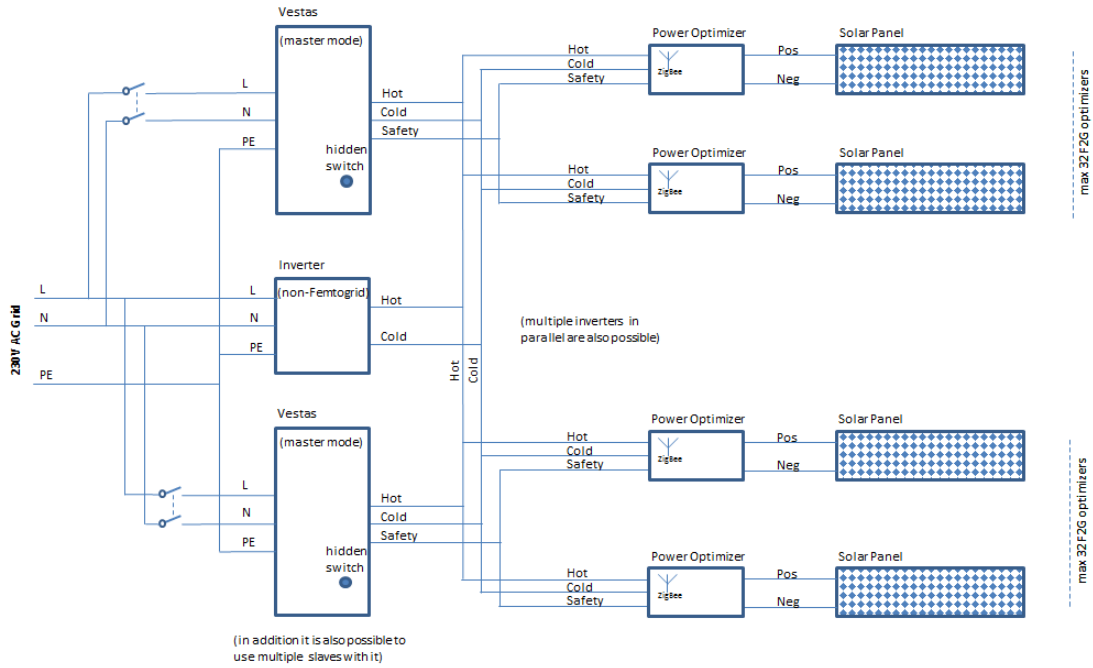
Connecting example 4: Stand alone + AC grid (max 32 optimizers)

Master / Slave + AC grid: max 64 optimizers



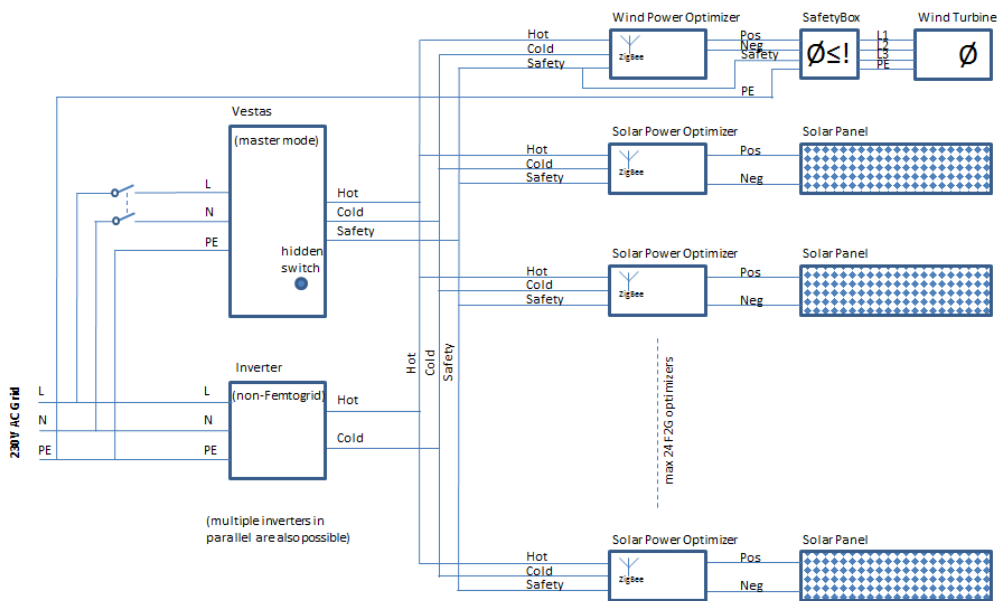
Connecting example 5: Master / Slave + AC grid (max 64 optimizers)

Master / Master + AC grid: max 2 x 32 optimizers



Connecting example 6: Master / Master + AC grid (max 2 x 32 optimizers)

Stand alone + AC grid: 1 wind optimizer en max 24 solar optimizers



Connecting example 7: Stand alone + AC grid (1 wind and max 24 solar optimizers)

All PO310 Power Optimizers are connected in parallel by using the special Femtograd DC cables in order to build our unique and patented 400 V DC parallel bus system. The cables have the appearance of standard solar cables but have some extra features in addition to a larger copper area. For starters the Femtograd DC cable has 3 wires: in addition to the '+' (red) and the '-' (blue) there is an integrated '0' (black) safety wire that supplies the Safety (48 V DC) output of the Vestas Controller Box (Master) to all the Solar and Wind Optimizers. Disconnecting this supply which is coming out of the Controller Box ensures that the DC side of your solar and/or wind installation (the DC bus) is being switched off. Any additional Vestas Controller Boxes (Slaves) are supplied with the Slave signal (which is also 48 V DC but controlled by the Master Vestas) via separate cables.

The Femtograd DC cables constitute the parallel network, which is one of the distinguishing features of the Femtograd system. This parallel network eliminates the negative effect of partial shade, the differences between modules and suboptimal orientation which can generate up to 30% more solar energy. It also ensures a higher level of security and reliability and makes it possible to easily replace those parts of the solar installation that do not work properly and finally makes the total installation easily expandable.

All PO310 Solar Power Optimizers, Wind Power Optimizers and the Monitoring Box made by Femtograd have ZigBee low power wireless communication possibilities. After the first commissioning of a solar and/or wind installation a wireless ZigBee network is being set up that makes it possible to pass through production data to the My Femtograd portal. This monitoring of the installation enables the end user, the installer and Femtograd to maximize both the uptime and the lifetime of the complete installation. The passing through of production data will have no influence on the electrical power generation of the solar or wind installation. For further details on how to set up a ZigBee network see the installation manual of the Monitoring Box or the manual of the Power Optimizers.

5. Main features of the installation process

This Vestas Controller Box is used only as a (necessary) complement for systems using Femtograd solar and/or wind optimizers in case Femtograd inverter(s) are not being used. These Femtograd inverters normally supply the Safety power for the other (Femtograd) components which now has to be supplied by the Controller Box (see also the application schematics in chapter 4 for examples).

Before connecting the total system all the recommendations that are given in the installation manuals of these basic system components have to be implemented (placing and connection of the optimizers , inverter(s), cabling, etc). The Vestas Controller Box has no ZigBee functionality built in and therefore there is no need or possibility to log into a network. An example of the layout of an enclosure which holds several Vestas Controller Boxes intended for a large system is depicted in the following chapter 6.

6. Mechanical installation of the Controller Box

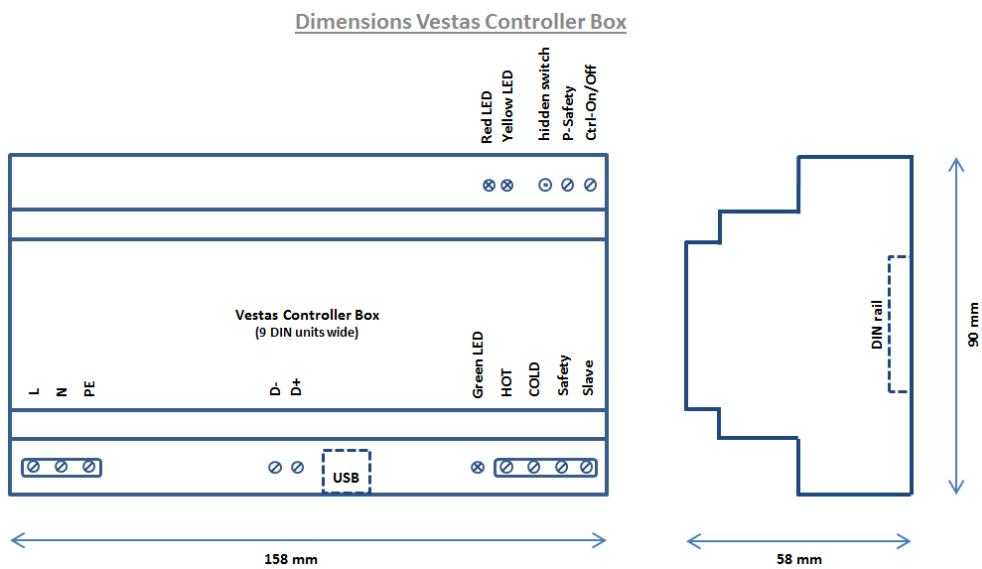
Check the product for damage



Check if your Vestas Controller Box is undamaged. In case of damage contact your distributor.

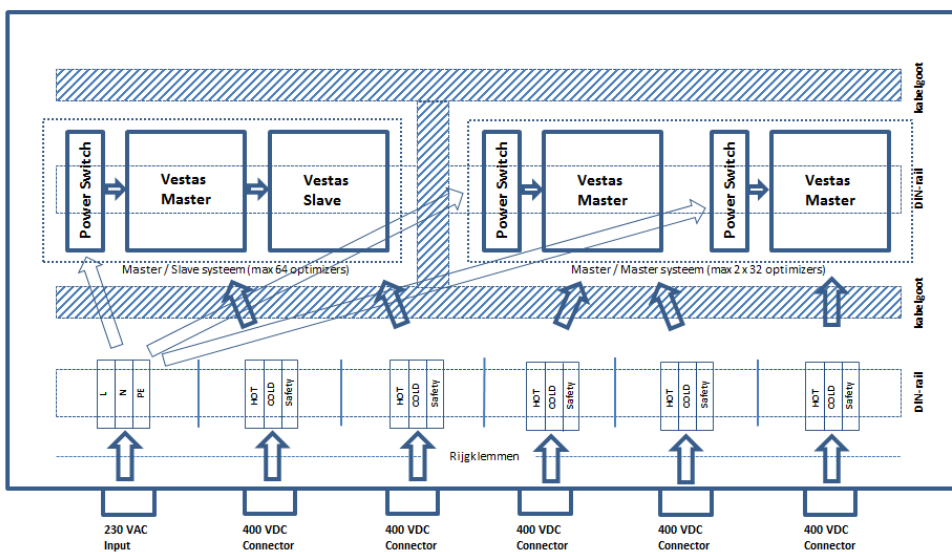
Dimensions

The length, width and height of the Box are 157 x 90 x 58 mm, see following figure.



The Vestas is intended to be placed on a DIN-rail in a closed housing. A configuration example of such an enclosure with indication of the needed connecting material is shown here.

Configuration example of a DIN-rail enclosure for a larger Vestas system



7. LED indication and hidden switch

Here we only briefly discuss normal operation mode as is visible directly after powering on the Controller Box (configured as Master = default, meaning that both internal jumpers are not placed). Initially the 48V Safety output voltage is being switched on and if after a short period of time the expected sensor input signals have become available (among others from the 400V DC bus but also from internal signals of the Vestas itself) and have the right values than this output voltage remains present, which is visible from the green output LED that switches on (the yellow processor LED switches on simultaneously with the green one). The red indication LED stays off during default mode of operation. See for the other functions of the Vestas and the indications of the LED's and the use of the hidden switch and the jumpers the separate user manual of the Vestas Controller Box VTC 25-002.

8. Technical specifications

The technical specifications of the Vestas Controller Box are stated in the accompanying Vestas VTC 25-002 Datasheet.

9. Practical hints

To be added later.

10. Company information

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