

# Grid Connection

Influence of the grid conditions in terms of connected power  
of PV inverters



## Content

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Some properties of a PV inverter grid connection can cause the grid voltage at the inverter to increase and exceed the permissible operating range if the feed power is high. If this occurs, SMA grid guard, an independent disconnection device integrated into the inverter, will safely disconnect the inverter from the grid. The switch-off limits for this are determined by the technical connection requirements in the country of installation.

The technical information provided below explains what requirements must be met to prevent the device from switching off due to a voltage overshoot at the AC connection.

# 1 Estimating the maximum possible feed power

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For the initial estimate of how much power can be fed to a phase conductor of the main power grid, the following information is needed:

- Grid voltage at the grid connection point (without feed power),
- Grid impedance at the terminal of the inverter,
- Applicable conditions regarding inverter-based grid monitoring in the country of installation.

The grid voltage and grid impedance must be determined through measurements performed at the installation site.

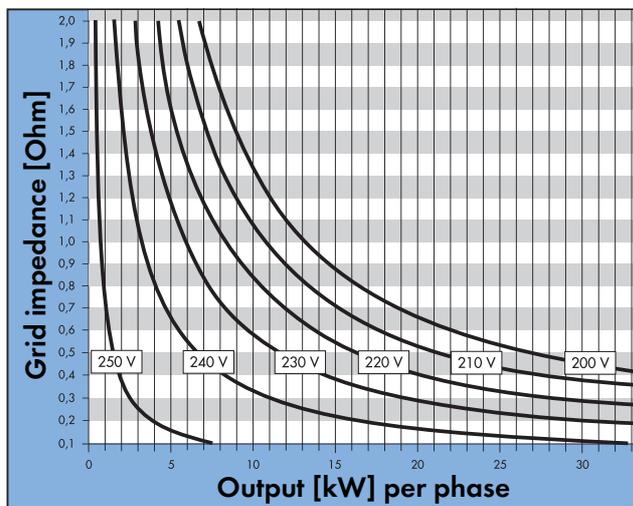
Note that a measurement of the grid impedance will only represent a spot value. Under real-world conditions, grid impedance is not static, but subject to constant changes (e.g., connection of loads, grid expansion, etc.).

## **Switch-off condition in German grids (DIN VDE 0126-1-1)**

The average grid voltage ( $U_{AC}$ ) at the inverter as measured over a period of 10 minutes is limited to a maximum of 253 V in Germany according to DIN VDE 0126-1-1. If the inverter records that the 10-minute average exceeds this voltage limit, or if the 260 V limit is temporarily exceeded, it will switch off immediately. The inverter will display a grid error message if this occurs.

## **Estimating a general switch-off condition at 253 V**

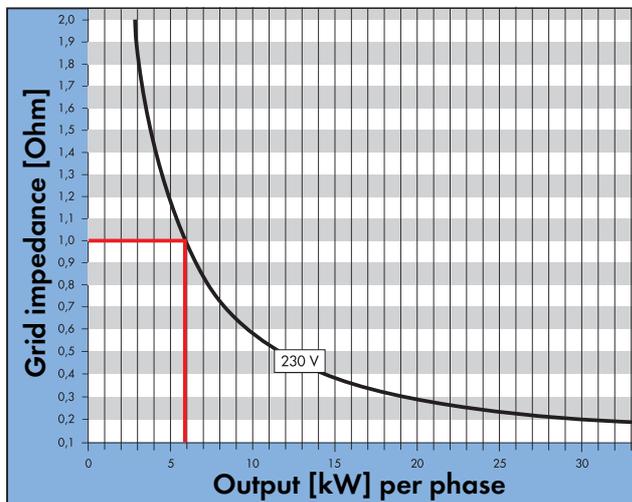
The following diagram shows the feed power situations based on the grid voltage as measured without feed power. A maximum possible feed power per phase (x axis) is obtained for the respective curves depending on the grid impedance (y axis). The switch-off condition in this case is 253 V. (The diagram does not include the 10-minute average value combined with a fast cut-off at 260 V that is required in Germany. The result is therefore somewhat lower than the output that is actually possible.)



**Example:**

Possible feed power per phase depending on grid impedance at  $U_{ACmax} = 253 \text{ V}$ .

- The grid voltage without mains supply is 230 V
- The grid impedance at the terminal is 0.7 Ohms
- Switch-off criterium at  $U_{ACmax} = 253 \text{ V}$



The power as read on the x axis is approximately 8.3 kW per phase. To install a higher output per phase without causing disconnections due to excessive AC voltage, the connection requirements must be optimized for the inverter, e.g., by:

- Using cables with larger conductor cross-sections,
- Using shorter cable routes,
- Modifying the switch-off criteria of the inverter.

## 2 Switch-off criteria for countries other than Germany

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The switch-off criteria for the target country of the inverter are pre-stored in a parameter set. These criteria are based on knowledge of the target land of your supplier or the deployment location as indicated during order placement.

You can change the switch-off parameters using a personal access code. The access code can be requested from the SMA Service Line after having obtained the express consent of the local grid operator.