



Power Limitation

Protection of the Inverter by Input Power Limitation or de-rating

What is De-rating?

De-rating mode is a functioning state that protects the inverter against stress and destruction. In this mode the DC/DC module limits the input power below the maximum limit, when an overloading condition occurs. For example, if the inverter gets too warm, the de-rating function reduces the input power, in order to lower the internal temperature. In this way damage to the inverter components is avoided and the life increased.

The de-rating mode works by continuously monitoring the inverter through various control algorithms. The inverter does not shut down when de-rating. The inverter continues to operate at the limit values, which ensures maximum production even in overload conditions.

When is the De-rating Mode Activated?

The de-rating mode can be activated by one of the following factors:

- PV power is above the maximum input power
- PV current is above the maximum current
- Temperature in the DC/AC board power module is above the threshold level
- Temperature on the DC/DC board is above the threshold level

De-rating with PV Power

PV power is limited to a safe value (usually the maximum power according to the technical specifications):

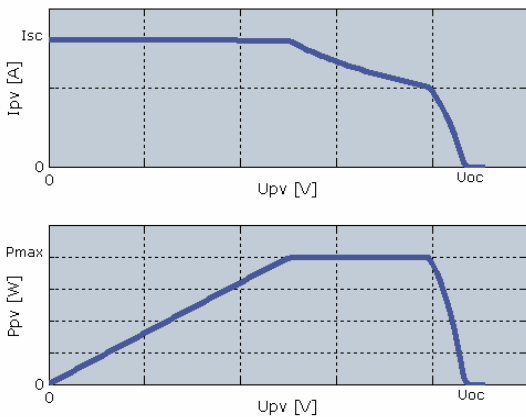


Figure 1 Array I-U curve and P-U curve when de-rating with PV power

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De-rating with PV Current

PV current is limited to the maximum value according to the technical specifications:

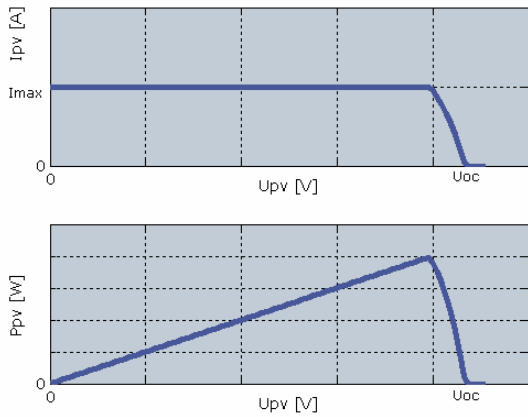


Figure 2 Array I-U curve and P-U curve when de-rating with PV current

De-rating with too high PV voltage

At high PV voltages, the current ripple in the AC filter increases. Therefore, when running at high PV voltage, the DC power is de-rated in order to lower the output current ripple:

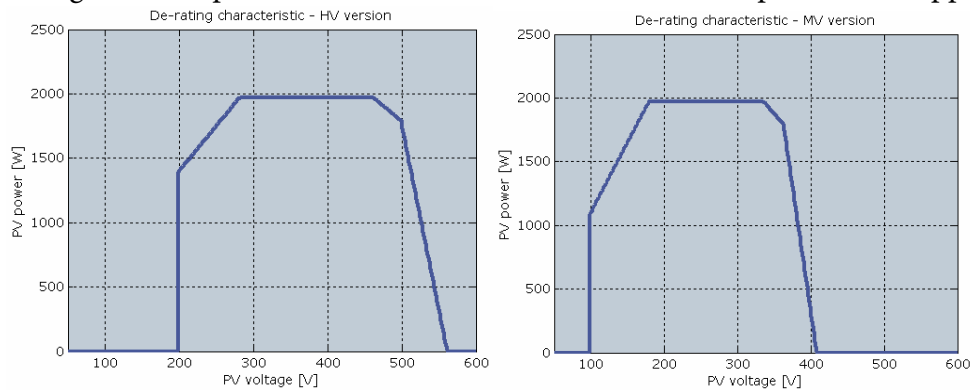


Figure 3 De-rating with too high PV voltage. The PV current limitation can be seen



De-rating with power module temperature

To protect the DC modules and the whole inverter from high temperatures, the temperatures on DC/DC boards and inside the DC/AC power module are measured and used to limit the power in case of high temperature:

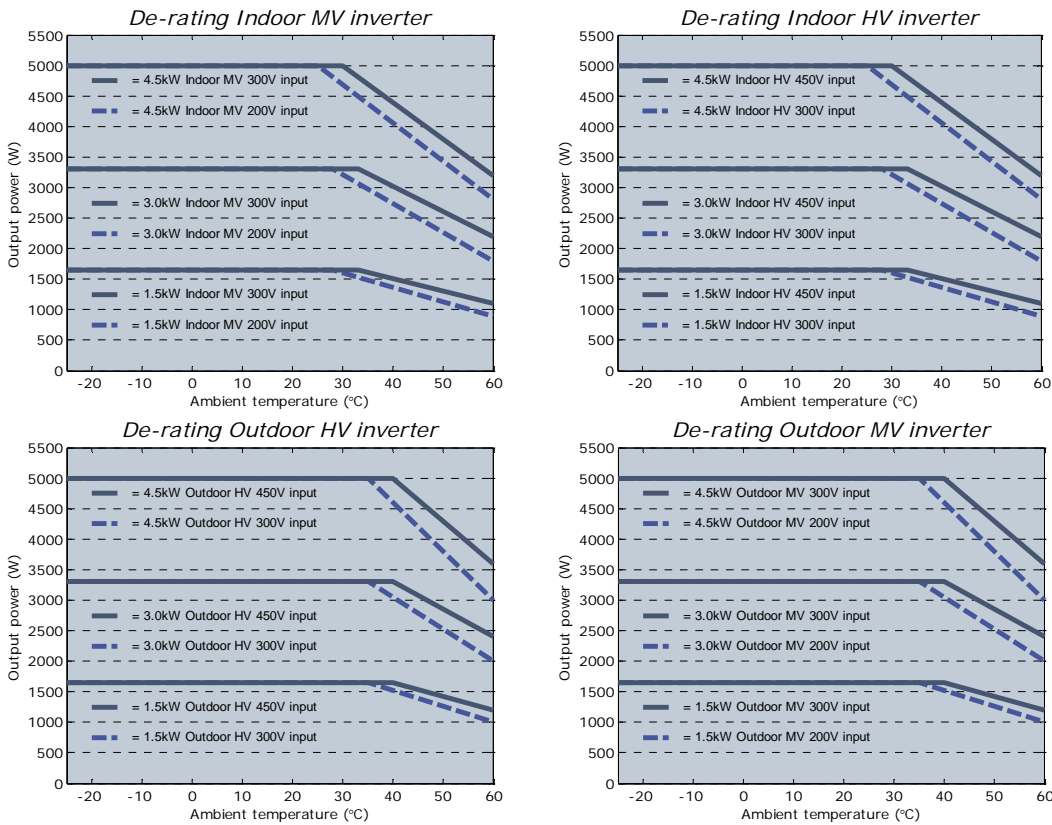


Figure 4 De-rating with power module temperature



De-rating with high and low grid voltage

At high grid voltages the maximum AC power is slightly reduced (by reducing the PV power)
 At low grid voltage the output power is limited by the maximum current rating of the inverter.

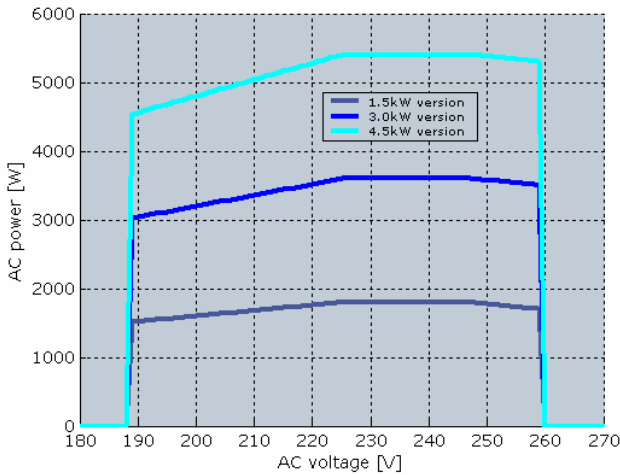


Figure 5 De-rating with too high grid voltage. The AC current limitation can be seen

If one of the above incidents occurs, the DC/DC module goes into the de-rating state. The lowest maximum power limit value determined by these factors will be the limit at which the PV power will be reduced and controlled.

Temperature detection

The temperatures in the DC/AC power module and on the DC/DC module are detected with a temperature sensor, which is built into the power module on the DC/AC module or is mounted on the PCB of the DC/DC module. At high ambient temperatures the de-rating is more significant, as increase of ambient temperature proportionally increase the internal temperature of the inverter. Therefore it is important that free air circulation to the heat-sink is ensured.

Doubling of life

Because the power limitation ensures that components do not overheat, the overall reliability of the inverter increases. The life of the inverter also increases, as a rule of thumb says that ambient temperature reductions of 10°C will double the life. As the de-rating causes the internal temperature to stay at limited levels, the inverter will thus have an increased life span