NEOVOLTA

Technical Product Notes

NV16KAC MPPT Input Voltage and Current Limits and String Design Requirements

DATE CREATED:	TN NUMBER:	PREPARED BY:
11/25/2025	TN-NV16KAC-001	Patrick Honegger

1. MPPT Input with Self-Limiting Capability

The NV16KAC MPPTs include a built-in self-limiting function that restricts the incoming string current (Imp) to a maximum of 24 A. This feature provides installers and system designers with some flexibility when using PV modules that may produce slightly higher currents—up to +5% above 24 A. In such cases, the inverter will automatically limit the current to 24 A, resulting in power clipping.

Important Considerations:

- The self-limiting function does not permit oversizing of the PV system beyond the inverter's specifications.
- The maximum allowable total DC input power remains 24,000 W.
- Exceeding the total DC power limit or connecting strings with significantly higher current can cause equipment damage and will void the warranty.

2. Maximum PV Open-Circuit Voltage (Voc)

Each MPPT input on the NeoVolta 16kAC hybrid inverter is limited to a maximum allowable Voc of 500 VDC per MPPT.

This voltage must never be exceeded, including during the coldest expected temperature at the installation location. Exceeding this 500 VDC limit can result in immediate inverter damage.

Technical Product Notes

3. Why Voc Changes with Temperature (Simple Explanation)

Solar panel voltage behaves in the opposite way to what people expect:

- Cold temperatures increase Voc.
  - When panels get colder, electrons move more freely and voltage rises.
- Hot temperatures decrease Voc.
  - When panels get hot, the materials inside them resist the flow of electrons, lowering voltage.

Although a panel may be listed with a Voc = 50 V at STC, that value is measured at 25°C/77°F cell temperature.
If the panel is installed where winter temperatures reach 0°C or lower, its Voc may increase significantly, sometimes 5–10% or more.

Note: This is why string sizing must be based on the coldest temperatures of the panels, not warm weather temperatures.

4. Recommended Operating Voltage Range

To achieve the best performance from the MPPT:

- Optimal MPPT operating range: 120–430 VDC
- Start-up (wake-up) voltage: 120 VDC

Design your strings so that under most daylight conditions the voltage stays within the 120–430V range.

Technical Product Notes

5. Sample String Sizing Calculation

Goal: Check if a string exceeds the 500 V limit at the site's coldest temperature.
Example Module:

- STC Voc = 49.2 V
- Temperature coefficient Voc = –0.29% / °C, –0.161% per °F
- Installed where coldest cell temperature estimate is –5°C or 23°F

Step 1: Calculate the temperature delta
STC is measured at 25°C, so:
25 – (–5) = 30°C difference

Step 2: Calculate the Voc increase
Increase = 0.29% × 30 = 8.7% increase

Step 3: Adjust panel Voc for cold
Voc_cold = 49.2 V × 1.087 = 53.5 V (cold)

Step 4: Determine maximum safe number of panels
500 V / 53.5 V = 9.34 → Maximum = 9 panels in series per MPPT

Final Check:
9 panels × 53.5 V = 481.5 V → SAFE
10 panels × 53.5 V = 535 V → NOT SAFE (would damage inverter)

**See below for the same calculations in Fahrenheit:

Step 1: Calculate the temperature delta (°F)
STC (25°C) = 77°F
Cold condition (–5°C) = 23°F
ΔT = 77°F – 23°F = 54°F difference

Step 2: Calculate the Voc increase using °F-based coefficient
Temperature coefficient = 0.16% per °F
Increase = 0.16% × 54°F
= 0.0016 × 54
= 0.0864 → 8.64% increase (≈ 8.7%, same result as Celsius)

Step 3: Adjust panel Voc for cold temperature
Panel Voc (STC) = 49.2 V

Voc_cold = 49.2 × 1.0864
≈ 53.5 V

Step 4: Determine maximum safe number of panels
500 V inverter limit:
500 V ÷ 53.5 V = 9.34 → Max = 9 panels

Final Check
9 panels × 53.5 V = 481.5 V → SAFE
10 panels × 53.5 V = 535 V → NOT SAFE

6. Design Summary

- ✓ Max Voc per MPPT: 500 VDC
- ✓ Never exceed 500 VDC at coldest expected temperature
- ✓ Optimal MPPT range: 130–430 VDC
- ✓ Minimum start-up: 120 VDC
- ✓ Always calculate cold Voc using module datasheet and local temperature data

Version	Revision Date	Brief Description of Change
V1.0	12/8/2025	Document Published
V1.1	12/12/2025	MPPT Input with Self limiting capability information added