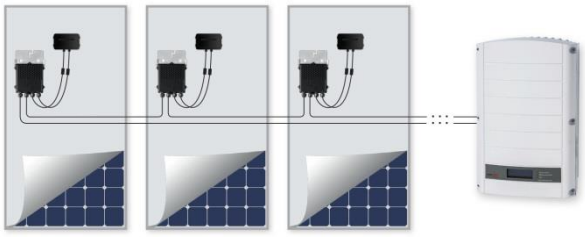
Declaration Regarding Compliance of SolarEdge Architecture to AS5033

To whom it may concern,

The purpose of this document is to provide a brief overview of the operation principles of photovoltaic installations containing SolarEdge power optimizers and inverters, and explain their compliance with the AS5033 Australian installation standard.

In the SolarEdge architecture, the basic unit is a photovoltaic module connected to a DC/DC power optimizer (whether by connecting a standard PV module to an add-on power optimizer, or by use of a "smart module" containing a PV module with integrated power optimizer). A group of power optimizers is then connected in series in a string which is then connected to the input of a SolarEdge inverter. The inverter output is then connected to the grid.



Though the installation of a SolarEdge system is very similar to that of standard PV systems, there are some significant advantages to the system:

- **Module-level MPPT**: A highly-optimized algorithm ensures that each module is constantly kept at maximum power point (MPP), preventing energy losses due to module mismatch or partial shading conditions.
- **SafeDC™**: The power optimizers only output high voltage and power when connected to a functional SolarEdge inverter connected to an AC grid. Under all other conditions (e.g during installation, maintenance, grid outage, or inverter malfunction), each power optimizer reverts to safety mode, in which it outputs only 1 volt.
- **Fixed String Voltage**: Since the power optimizers could vary their output voltage without loss of power, the string's voltage is maintained at a fixed optimal point for DC to AC inversion regardless of a string's length or environmental conditions.

  The SolarEdge single phase inverters (SExx00, with power ratings from 2.2kW to 6kW) have a fixed DC voltage of $350V_{DC}$ nominal ($500V_{DC}$ maximum).

  The SolarEdge three phase inverters (SExxK, with power ratings from 5kW to 17kW) have a Neutral-clamped topology, which causes the DC+ and DC- to have potential relative to ground. The DC+ is $375V_{DC}$ nominal ($475V_{DC}$ maximum) relative to ground, and the DC- is $-375V_{DC}$ nominal ($-475V_{DC}$ maximum) relative to ground.

Most aspects of AS5033 apply similarly to standard PV installations and to SolarEdge systems. However, there are some differences – which are described below.

Connection of Modules in Different Orientations

Clause 2.1.5 of AS5033 contains the following requirements:

> To reduce mismatch and improve PV array yield, **all PV modules connected to the same PCE MPPT input** should be of the same technology, and have the same number of series connected PV modules (see Figures 2.2 to 2.4). In addition, **all PV modules connected to the same PCE MPPT input** should have similar rated electrical characteristics including short circuit current, open circuit voltage, maximum power current, maximum power voltage and rated power and temperature coefficients.
>
> NOTE: This is a design issue which needs to be considered by designer/installer, particularly when replacing modules or modifying an existing system.
>
> Modules that are electrically in the same string shall be all in the same orientation within ±5° (azimuth and tilt angle).

AS5033 clause 2.1.5 states that each group of modules connected to a Power Conversion Equipment (PCE) with Maximum Power Point Tracking (MPPT) should have the same characteristics. Since a SolarEdge power optimizer is a PCE with MPPT, each module can be considered individually, and it is acceptable to connect modules of different technology, electrical characteristics, and orientations in the same string of a SolarEdge system.

V_{OC} Calculation in SolarEdge Systems

According to AS5033 clause 4.2(b) the PV array maximum voltage is calculated according to manufacturer instructions. In SolarEdge systems the V_{OC} of each module and power optimizer is 1V (as described above), so for example if there are 12 power optimizers connected in series, the string V_{OC} is 12V. After the power optimizers are connected to an inverter and the inverter is turned on, the string voltage rises to a fixed working voltage regardless of the number of serially connected power optimizers.

It is important to note that string V_{OC} is not dependent on the open circuit voltage of the stand-alone module – since each module is connected to a power optimizer – but rather on the power optimizer outputs – since those are the devices connected in series to form strings.

Yours faithfully,

Meir Adest

VP of Core Technologies