

RCD Selection for SolarEdge Inverters - Application Note

PV System Residual Current Factors

In every PV installation, several elements contribute to the current leakage to protective earth (PE). These elements can be divided into two main types:

- **Capacitive discharge current** - Discharge current is generated mainly by the parasitic capacitance of the PV modules to PE. The module type, the environmental conditions (rain, humidity) and even the distance of the modules from the roof can affect the discharge current. Other factors that may contribute to the parasitic capacitance are the inverter's internal capacitance to PE and external protection elements such as lightning protection. During operation, the DC bus is connected to the alternating current grid via the inverter. Thus, a portion of the alternating voltage amplitude arrives at the DC bus. The fluctuating voltage constantly changes the charge state of the parasitic PV capacitor (i.e. capacitance to PE). This is associated with a displacement current, which is proportional to the capacitance and the applied voltage amplitude.
- **Residual current** - if there is a fault, such as defective insulation, where an energized cable comes into contact with a grounded person, an additional current flows, known as a residual current.

Residual Current Device (RCD)

All SolarEdge inverters incorporate a certified internal RCD (Residual Current Device) to protect against possible electrocution in case of a malfunction of the PV array, cables or inverter (DC). The RCD in the SolarEdge inverter can detect leakage on the DC side. There are 2 trip thresholds for the RCD as required by the DIN VDE 0126-1-1 standard. A low threshold is used to protect against rapid changes in leakage typical of direct contact by people. A higher threshold is used for slowly rising leakage currents, to limit the current in grounding conductors for fire safety. The default value for higher speed personnel protection is 30mA, and 300mA per unit for lower speed fire safety.

Installation and Selection of an External RCD device

An external RCD is required in some countries. The installer must check which type of RCD is required by the specific local electric codes. Installation of an RCD must always be conducted in accordance with local codes and standards. SolarEdge recommends the use of a type-A RCD. Unless a lower value is required by the specific local electric codes, SolarEdge suggests an RCD value between 100mA and 300mA. For the three phase inverters stated in the table below, use the following RCD values:

Three Phase Inverter	Minimum RCD value
SE25K, SE27.6K, SE33.3K	300mA
SE50K, SE55K, SE66.6K	600mA
SE82.8K, SE100K	900mA

Where required by local regulations the use of an RCD type-B is permitted.

In installations where the local electric code requires an RCD with a lower leakage setting, the discharge current might result in nuisance tripping of the external RCD. The following steps are recommended to avoid nuisance tripping of the external RCD:

1. Selecting the appropriate RCD is important for correct operation of the installation. An RCD with a rating of 30mA may actually trip at a leakage as low as 15mA (according to IEC 61008). High quality RCDs will typically trip at a value closer to their rating.
2. Configure the trip voltage of the inverter' internal RCD to a lower value than the trip current of the external RCD. The internal RCD will trip if the current is higher than the allowed current, but because the internal inverter RCD automatically resets when the residual currents are low it saves the manual reset.