

PV Fact Sheet

03 | DC fuses in PV installations

When are DC fuses mandatory to install?

This fact sheet focuses on photovoltaic installations on top of buildings within the European Union. One essential part of such an installation is the PV combiner box. These boxes are used to combine several strings and to protect against overvoltage and feature many more functions.

How do I find out if fuses are required?

Depending on the kind of photovoltaic installation, a combiner box with fuses is required. According to the IEC 62548:2016 the following formula must be applied:

$$I_{SC} \times 1.25 \times (\text{number of strings} - 1) = I_{R \max}$$

If $I_{R \max} > I_R$ then fuses are mandatory

If $I_{R \max} < I_R$ then fuses are not required

I_{SC} = short circuit current of the module

$I_{R \max}$ = max. return current

I_R = return current of the module

Example:

The solar panel in this example has an I_{SC} of 6.07A and an I_R of 15A. The first calculation in the graphic below shows first an installation with only one string. Applying the formula from IEC 62548:2016, it shows that no fuse is required.

The same applies for the calculation with two strings. In both cases, it does not make sense to install a fuse because the fuse will never blow and these currents are too low to damage the PV module.

For the last calculation, a setup with three strings is taken into consideration. Here the $I_{R \max}$ is higher than I_R , which leads to the conclusion that fuses are required.

All installations with more than three strings always require DC fuses.

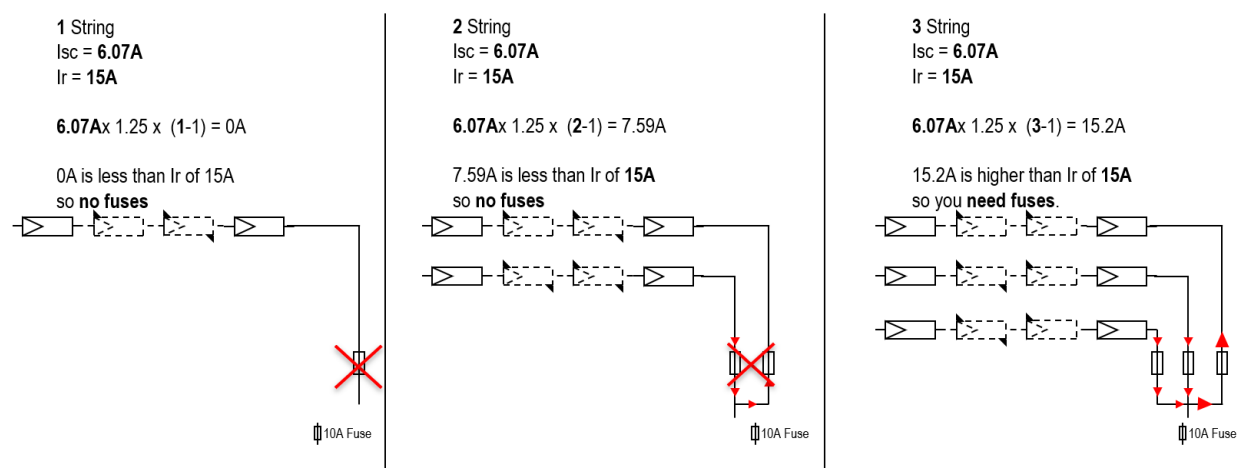


Figure 1: Three example calculations to find out if a fuse is needed or not

PV Fact Sheet

03 | DC fuses in PV installations

Benefits of fuses in PV installations

The physical function of the fuse is to protect the modules against damage caused by a return current higher than the specified I_R of the modules. If the rules above are not applied and fuses are installed although they were not required, this will not create more safety. Instead, it will lead to more safety rules to be considered such as not removing fuses under load and not touching the fuse holders. So, it is recommended to follow the rules as defined in IEC 62548:2016.

How do I find out the fuse size?

IEC 62548:2016 defines the dimensioning of the fuse. The formula to be applied is the following:

Short circuit current of the module $I_{SC} \times 1.5 = \text{current of the fuse}$

Weidmüller PV Next

PV Next is a global combiner box portfolio made by Weidmüller. These products based on a modular concept. The aim is to cover as many variants as possible with the lowest number of final products. These products are available with and without fuse clips, so you can choose always the right solution for your installation.



Figure 2: PV Next combiner box



Pascal Niggemann

Head of PV Systems Home & Business,
Weidmüller Interface GmbH & Co. KG, Germany

Pascal.Niggemann@weidmueller.com | www.weidmueller.com/pv-rooftop