

# Application of string fuses

of Sunny Mini Central 9000TL / 10000TL / 11000TL



## Content

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In the course of standardizing technical documents, module manufacturers are increasingly being asked to specify reverse current ratings in the technical data sheets of PV modules.

In taking into account guaranteed properties, system planners are faced with the question of whether and what kind of protection can be offered for strings.

The technical information provided below explains:

- how reverse currents can occur,
- whether fuse protection is even required and
- how the new Sunny Mini Central 9000TL / 10000TL / 11000TL are prepared for fuse protection.

# 1 Introduction

The new Sunny Mini Central 9000TL / 10000TL / 11000TL allow the direct connection of up to five parallel strings. If three or more strings are to be connected directly to the Sunny Mini Central, the so-called reverse current rating (specified by manufacturer) of the modules being used must be noted. Hence, it may be necessary to protect the individual strings from excessive reverse currents by using "string fuses".

The DC inputs of the Sunny Mini Central can be retrofitted with special string fuses (thermal fuses). A monitoring function is also integrated.

Since the necessity of the fuse and its value depend on the generator configuration and the integrated module type, the Sunny Mini Centrals are supplied ex-works with short-circuit pins instead of fuses.

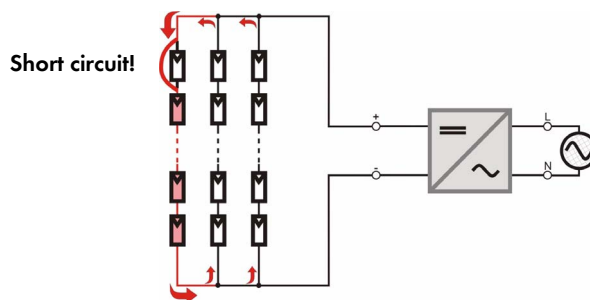
Fuse protection is only a precautionary measure designed to minimize risks such as fire in the event a fault occurs.

Fuse protection is not a guarantee that the PV generator will be protected from consequential damage.

# 2 How can a reverse current occur?

A reverse current can occur through a short circuit in one or more of the modules in a string of the PV generator (e.g., due to insulation damage, short circuit in the module, short circuit in the DC cabling). In extreme cases the sum of the short-circuit currents of all unaffected strings flow into the defective string instead of the Sunny Mini Central. The current flowing through the defective string is called a "reverse current" and can damage other modules in the string (consequential damage) or lead to excessive heating.

Reverse current into the defective string = total current of the remaining strings



## 3 Does my system need fuses?

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Three different cases must be considered depending on the data sheet specifications of the module manufacturers.

### Case A

If the module manufacturer's data sheet specifies a concrete fuse value, then you can retrofit the Sunny Mini Central 9000TL/10000TL/11000TL with the appropriate fuses.

In this case only use the add-on kits offered by SMA as they contain fuses specifically tested for use in PV systems.

### Case B

If the data sheet specifies the "reverse current rating" of the module rather than a fuse value, then the correct fuse value can be determined as follows:

#### 1. Calculate the maximum possible reverse current in the system

The maximum possible reverse current is calculated as:

the short-circuit current of integrated module x (number of connected strings - 1).

#### 2. Check whether string fuses are required

If the maximum possible reverse current exceeds the reverse current rating of the integrated module (specified by manufacturer), then you should install string fuses in the Sunny Mini Centrals.

#### 3. Determine the fuse value

To calculate the fuse value, you must have the following information:

- Number of parallel strings per Sunny Mini Central (Sunny Design system design tool)
- Reverse current rating of the module (specified by module manufacturer)
- MPP-current of the module under STC [Standard Test Conditions] (specified by module manufacturer)

To ensure long service life and reliable operation, the fuse value has to satisfy two conditions:

- a) It should be 1.7 times greater than the MPP-current of the module under STC.
- b) It should be less than the reverse current rating of the module.

Add-on kits for protecting DC inputs with 8 A, 10 A, 12 A, 16 A or 20 A are currently offered (additional types available by request):

Order number: FUSEKIT8A-NR (8 A)

Order number: FUSEKIT10A-NR (10 A)

Order number: FUSEKIT12A-NR (12 A)

Order number: FUSEKIT16A-NR (16 A)

Order number: FUSEKIT20A-NR (20 A)

Use the fuse value that satisfies conditions a) and b).

**Case C**

If no information on fuse protection or the reverse current rating is provided or the calculation in Case B does not yield a feasible result, contact your module manufacturer and ask whether fuse protection is necessary.

## 4 Which fuse types can be used in the Sunny Mini Central 9000TL / 10000TL / 11000TL?

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You may only use fuses that are included in the specified add-on kits or approved by SMA.

Each add-on kit includes five fuses and five fuse holders for easy and secure installation and replacement.

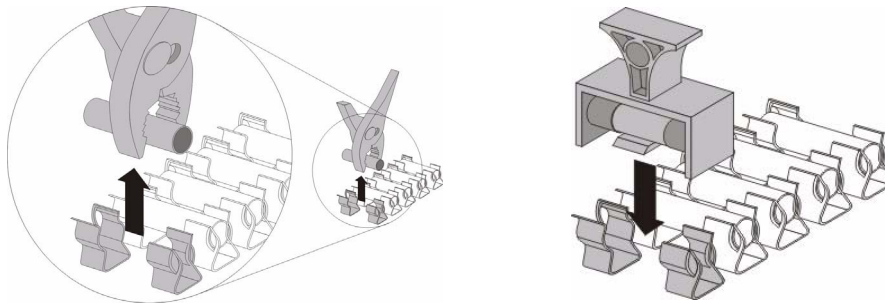
The add-on kits contain the following approved fuse types (additional types available by request):

- 8 A: SIBA URDC PV-Fuse DC 900 V, 8 A, ItemNo. 50 215 06.8
- 10 A: SIBA URDC PV-Fuse DC 900 V, 10 A, ItemNo. 50 215 06.10
- 12 A: SIBA URDC PV-Fuse DC 900 V, 12 A, ItemNo. 50 215 06.12
- 16 A: SIBA URDC PV-Fuse DC 900 V, 16 A, ItemNo. 50 215 06.16
- 20 A: SIBA URDC PV-Fuse DC 900 V, 20 A, ItemNo. 50 215 06.20

## 5 Installing the fuses

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1. Remove the jumpers (delivery state) as depicted in the lower left.
2. Install the string fuses with the fuse holder as depicted in the lower right.



## 6 How do I know if a fuse is blown?

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If installed, the fuses in the Sunny Mini Central will be monitored automatically.

A defective fuse will be indicated by an error message in the Sunny Mini Central's display and reported to any system monitoring devices that are connected. Although the Sunny Mini Central will continue to feed power, it cannot use the power from the affected string.

To ensure that the fuse monitoring function is working properly, all five slots must be equipped with the appropriate fuses at all times. This also applies if only some of the DC inputs contain strings.

More information is available in the installation guide of the Sunny Mini Central 9000TL / 10000TL / 11000TL.