

Solar Power: 100% Self-Consumption Solution with the SMA Power Control Module **SUNNY BOY / SUNNY TRIPOWER**



Contents

In some countries or regions, the network operator specifies that power produced by PV plants must not be fed into the electricity grid. The PV power generated must only be used for self-consumption. The aim is that the PV plant only generates as much energy as can be consumed at the same time at the grid connection point. There are two possible solutions here: on the one hand via the installation of a complete control circuit, on the other hand through the controlling of the maximum active power generated by the inverter.

This technical information describes how you can use the generated PV energy for self-consumption with the help of dynamic active power limitation and, amongst other things, through the use of the SMA Power Control Module without feeding into the electricity grid. In addition to the SMA products, however, further products are necessary for this solution.

The following details the products sold by SMA Solar Technology AG and describes their use for self-consumption.

SMA Solar Technology AG expressly recommends that you contact the local network operator before you install a PV plant based on this concept.

Necessary Products

The following products and functions are necessary in order to install a PV plant for complete self-consumption.

- SMA inverters that are compatible with the SMA Power Control Module (see below)
- SMA Power Control Module
- Current or power measuring device to be selected by the installer
- Programmable logic controller (PLC) that is to be selected and programmed by the installer

Solution 1: Installation of a Control Circuit

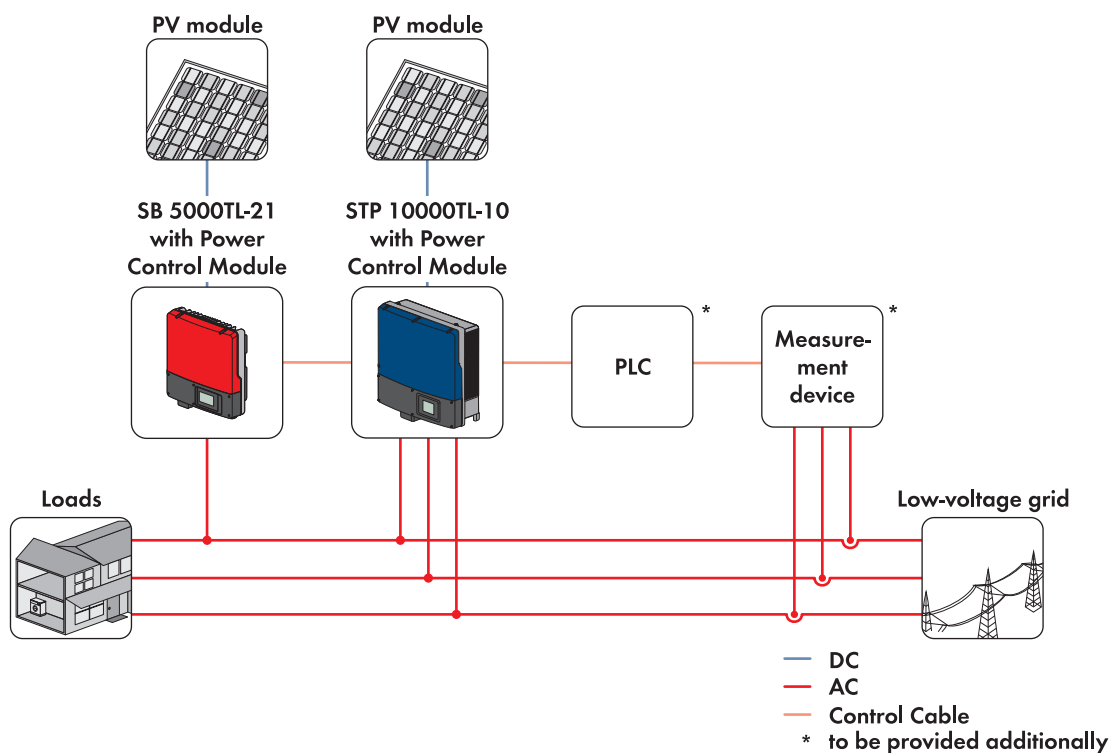


Figure 1: Example of a PV plant for complete self-consumption (control circuit)

The aim is to reduce the active power of the inverter as soon as feed-in of the generated PV power into the electricity grid is registered. The measuring device measures the size and direction of the flow of current at the feed-in point continuously, and transmits the information to the PLC which in turn controls all SMA Power Control Modules of the inverters present in the PV plant in small power increments.

Solution 2: Control of the Maximum Active Power Generated by the Inverter

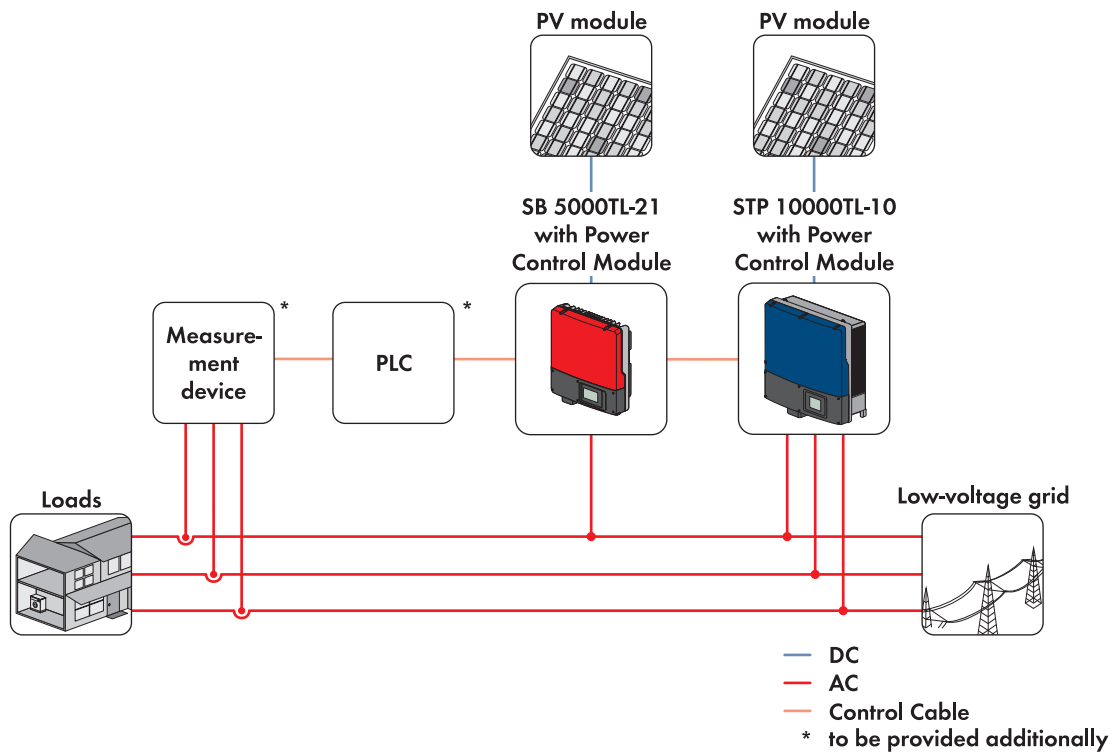


Figure 2: Example of a PV plant for complete self-consumption (control)

The measuring device continuously measures the power consumed by the loads and transmits this to the PLC. The PLC converts this value into the next smallest power reduction step and controls the inputs of the SMA Power Control Modules with this. As a result, it is not possible that more power is fed in than consumed.

SMA Power Control Module

Based on the nominal power of the inverter, the SMA Power Control Module can reduce the active power between 100% and 0%. In PV plants with several inverters, each inverter has to be equipped with an SMA Power Control Module. A maximum of five inverters can be controlled with an SMA Power Control Module in parallel operation.

The digital inputs of the SMA Power Control Module are programmable. There are a total of 16 setting possibilities or entry combinations. The option "No active power limitation: 100%" must be assigned to a combination that has at least one active pin. For the option "Active power limitation: 0%" it must be configured that all pins are open. In the event of a PLC disturbance, no signal will be sent and as a result the PV system stops feeding in. The PLC must here also be configured in such a way that a signal is only transmitted if data is being received from the measuring device.

In order to block an entry combination, the value -1% must be entered in the communication product. This allows that unassigned entry combinations can be blocked.

The following table shows how the SMA Power Control Module influences the active power of the inverter via four digital inputs.

Digital input D1	Digital input D2	Digital input D3	Digital input D4	Display in the communication product Sunny Explorer	Value (example)
Open	Open	Open	Open	D1: 0 D2: 0 D3: 0 D4: 0	0%
Closed	Open	Open	Open	D1: 1 D2: 0 D3: 0 D4: 0	5%
Open	Closed	Open	Open	D1: 0 D2: 1 D3: 0 D4: 0	10%
Closed	Closed	Open	Open	D1: 1 D2: 1 D3: 0 D4: 0	16%
Open	Open	Closed	Open	D1: 0 D2: 0 D3: 1 D4: 0	23%
Closed	Open	Closed	Open	D1: 1 D2: 0 D3: 1 D4: 0	30%
Open	Closed	Closed	Open	D1: 0 D2: 1 D3: 1 D4: 0	36%
Closed	Closed	Closed	Open	D1: 1 D2: 1 D3: 1 D4: 0	42%
Open	Open	Open	Closed	D1: 0 D2: 0 D3: 0 D4: 1	50%
Closed	Open	Open	Closed	D1: 1 D2: 0 D3: 0 D4: 1	57%
Open	Closed	Open	Closed	D1: 0 D2: 1 D3: 0 D4: 1	65%
Closed	Closed	Open	Closed	D1: 1 D2: 1 D3: 0 D4: 1	72%
Open	Open	Closed	Closed	D1: 0 D2: 0 D3: 1 D4: 1	80%
Closed	Open	Closed	Closed	D1: 1 D2: 0 D3: 1 D4: 1	86%
Open	Closed	Closed	Closed	D1: 0 D2: 1 D3: 1 D4: 1	93%
Closed	Closed	Closed	Closed	D1: 1 D2: 1 D3: 1 D4: 1	100%

Table 1

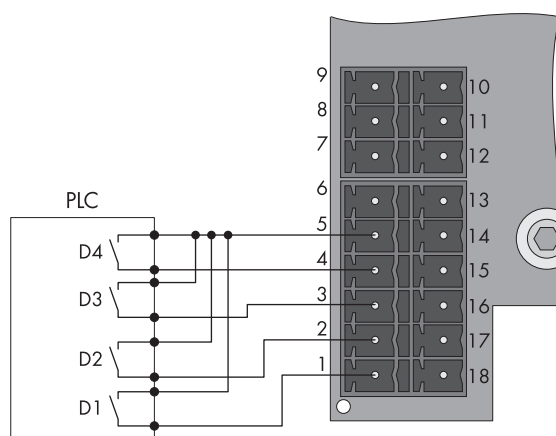


Figure 3: SMA Power Control Module - pin assignment

If the network operator does not allow that the inverter still feeds in a low amount of active power when limited to 0%, the following parameter for grid disconnection should be set. Setting this parameter opens the grid relays at a command of 0%, whereby the inverter disconnects from the electricity grid and no power can be fed in. Depending on the type of communication and the communication product used, the parameter name may vary.

Type of communication	Parameter name	Setting
Bluetooth® Wireless Technology	Plant and device control	Yes
	> Configuration of the feed-in management > Grid disconnection at setpoint of 0% or 0 W, Configuration of feed-in management	No
RS485	P-GriSwOpnZerW	Yes
		No

Table 2

When the parameter is activated (**Yes/Ja**), the inverter disconnects from the electricity grid when the signal "0%" is issued. When the parameter is deactivated (**No/Nein**), the inverter continues to feed in with minimum power at a command of "0%".

The reduction of the active power to the 16 set values can be realised within five seconds, grid disconnection is possible within two seconds.

The following SMA inverters can be equipped with the SMA Power Control Module ex works or retrofitted:

Sunny Boy	From firmware version	Sunny Tripower	From firmware version
• SB 2500TLST-21	V 2.50*	• STP 5000TL-20	V 2.02*
• SB 3000TLST-21	V 2.55**	• STP 6000TL-20	V 2.51**
• SB 3000TL-21		• STP 7000TL-20	
• SB 3600TL-21		• STP 8000TL-20	
• SB 4000TL-21		• STP 9000TL-20	
• SB 5000TL-21		• STP 8000TL-10	V 2.50*
		• STP 10000TL-10	V 2.55**
		• STP 12000TL-10	
		• STP 15000TL-10	
		• STP 17000TL-10	
		• STP 15000TLEE-10	V 2.51*
		• STP 20000TLEE-10	V 2.54**

* for simplified active power limitation

** for finely graded active power limitation

You will find additional information in the SMA Power Control Module installation manual and in the technical information "SMA Power Control Module - Multi-function Interface for PV Inverters" (see www.SMA-Solar.com).

The ideal configuration of the PLC logic and the communication structure depends on several factors; for example type, size and number of loads and possible specifications of the network operator. Therefore, SMA Solar Technology AG is not able to supply a complete manual. However, the following considerations serve as an aid to the configuration of an efficient system.

If the PV plant is made up of more than five inverters, the PV plant must be sub-divided into several groups. Each group must consist of a maximum of five inverters. Each inverter in a group must be equipped with an SMA Power Control Module and the inverters must be connected in order that the SMA Power Control Modules can transmit the signal within a group.

A further possibility is the direct communication with each SMA Power Control Module. This allows more flexibility, but can result in a significant number of digital outputs of the PLC. If the active power has to be reduced to a value other than 0% (e.g. 60% and 30%), the installation can be configured in such a way that one or more inverters disconnect(s) from the electricity grid instead of limiting the active power of all inverters to 60% or 30%. The necessary active power limitation is therefore effective after two seconds.

Ensuring Self-Consumption in the Event of a Fault in the Measuring Device or the PLC

In the event of a disturbance, the SMA Power Control Module does not receive a signal, all digital inputs are open and the inverter limits the active power to 0% (see table) and no longer feeds into the electricity grid.

In some cases network operators specify the non-feed-in of 0 watts under fault conditions (e.g. in the event of a fault in the PLC or the measuring device). In these cases the parameters **Grid disconnection at setpoint of 0% or 0 W, Configuration of feed-in management** or **P-GriSwOpnZerW** must be set (see table 2).