Planning Guidelines



PV Systems with Zero Export

Table of Contents

1 Content and Structure of this Document 3

2 Solution 1: Direct Self-consumption with Zero Export 5

2.1 System overview 5

2.2 System Requirements for Zero Export 5

3 Solution 2: Self-consumption with a battery-storage system and zero export 7

3.1 System overview 7

3.2 System Requirements for Zero Export 8

4 Solution 3: Retrofit a Battery-storage System for Self-consumption with Zero Export in Existing PV Systems 10

4.1 System overview 10

4.2 System Requirements for Zero Export 11

5 Setting Measured Values at the Point of Interconnection 14

6 Setting Zero Export 16

1 Content and Structure of this Document

Zero-export systems are systems that consist of power generation units and, if applicable, battery-storage systems, in which feeding electricity into the utility grid is not intended and is actively prevented by the system. The zero-export system from SMA maximizes self-consumption and uses 100% of the self-generated solar power. Our system lets customers expand the solar energy without high additional investments in the utility grids. This is necessary if the grid operator does not allow grid feed-in because of a weak infrastructure and possible overload, for example.

SMA Solar Technology AG offers a variety of solutions especially for PV systems that are no longer allowed or intended to feed solar power into the grid due to restrictions imposed by the grid operator.

The scope of this document is limited to PV systems in the residential and commercial segments.

Solution 1: Direct Self-Consumption with Zero Export

An intelligent PV inverter is installed in the system. This inverter is configured for zero export and dynamically limits the power if it cannot be consumed in the household at the same time it is generated. The proportion of self-generated energy in the power consumption is 50% to 70%.

PV inverter	Storage system	Additional components
The inverter must be able to regulate the power.	-	Components for intelligent energy management: • SMA Energy Meter (EMETER-20) • SMA Energy Meter CT (EM-1CT63A-21, EM-3CT63A-21) • Sunny Home Manager 2.0 • Optional upgrade by adding components for charging electric vehicles

Solution 2: Self-consumption with a battery-storage system and zero export

This system is equipped with a storage system so that a larger proportion of the consumed power can be covered by electric current from the customer's own PV system. It also requires an intelligent battery or hybrid inverter that can regulate the power. 1 Sunny Island 6.0H or 8.0H can be installed as the battery inverter.
Information: The Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0 and the Sunny Tripower Smart Energy 5.0 / 6.0 / 8.0 / 10.0 can also be operated as a battery inverter.

As an alternative to an intelligent PV inverter and an additional battery inverter, an intelligent hybrid inverter such as Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0 or Sunny Tripower Smart Energy 5.0 / 6.0 / 8.0 / 10.0 may be used.

In a typical household, the proportion of self-generated solar power in total consumption after installing such a battery system ranges from 50% to 100%.

PV inverter	Storage system	Additional components
The inverter must be able to regulate the power.	• 1x Sunny Island 6.0H / 8.0H with a compatible battery. • 1x Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0 • 1x Sunny Tripower 5.0 / 6.0 / 8.0 / 10.0 Smart Energy • 1x compatible battery **Information:** If you have a Sunny Boy Smart Energy 3.6 / 4.0 / 5.0 / 6.0 or a Sunny Tripower 5.0 / 6.0 / 8.0 / 10.0 Smart Energy, a separate PV inverter is no longer required.	Components for intelligent energy management: • SMA Energy Meter (EMETER-20) • SMA Energy Meter CT (EM-1CT63A-21, EM-3CT63A-21) • Sunny Home Manager 2.0 • Optional upgrade by adding components for charging electric vehicles • Optional system upgrade by adding a battery-backup system

Solution 3: Retrofit a Battery-Storage System for Self-consumption with Zero Export in Existing PV Systems

If a PV inverter from another manufacturer (a feed-in system whose feed-in tariff has expired) is installed in the existing system, or if the existing inverter cannot be regulated, the system can be upgraded to a zero-export system by adding a battery system. Any PV inverter can be used in the system in combination with a compatible battery. 1 Sunny Island 6.0H or 8.0H must be installed as the battery inverter. The proportion of self-generated energy in the power consumption is 50% to 100%.

PV inverter	Storage system	Additional components
Any inverter can be used. Make sure that the AC power of the PV inverter is not greater than the rated power of the battery inverter.	Upgrade of the existing PV system: • 1x Sunny Island 6.0H / 8.0H • 1x compatible battery	Components for intelligent energy management: • SMA Energy Meter (EMETER-20) • SMA Energy Meter CT (EM-1CT63A-21, EM-3CT63A-21) • Sunny Home Manager 2.0 • Optional upgrade by adding components for charging electric vehicles • Additional contactor for disconnecting the PV inverter

2 Solution 1: Direct Self-consumption with Zero Export

2.1 System overview

A zero export system is connected to the utility grid but is designed to ensure that no surplus energy is fed into it. All the energy generated is consumed on-site. Here, it is important that the PV inverter can regulate the generated power so that only so much energy is generated as is currently consumed and in total no energy is fed into the grid. Adding additional electrical loads (e.g., an electric vehicle) can increase the usable power of the PV system.

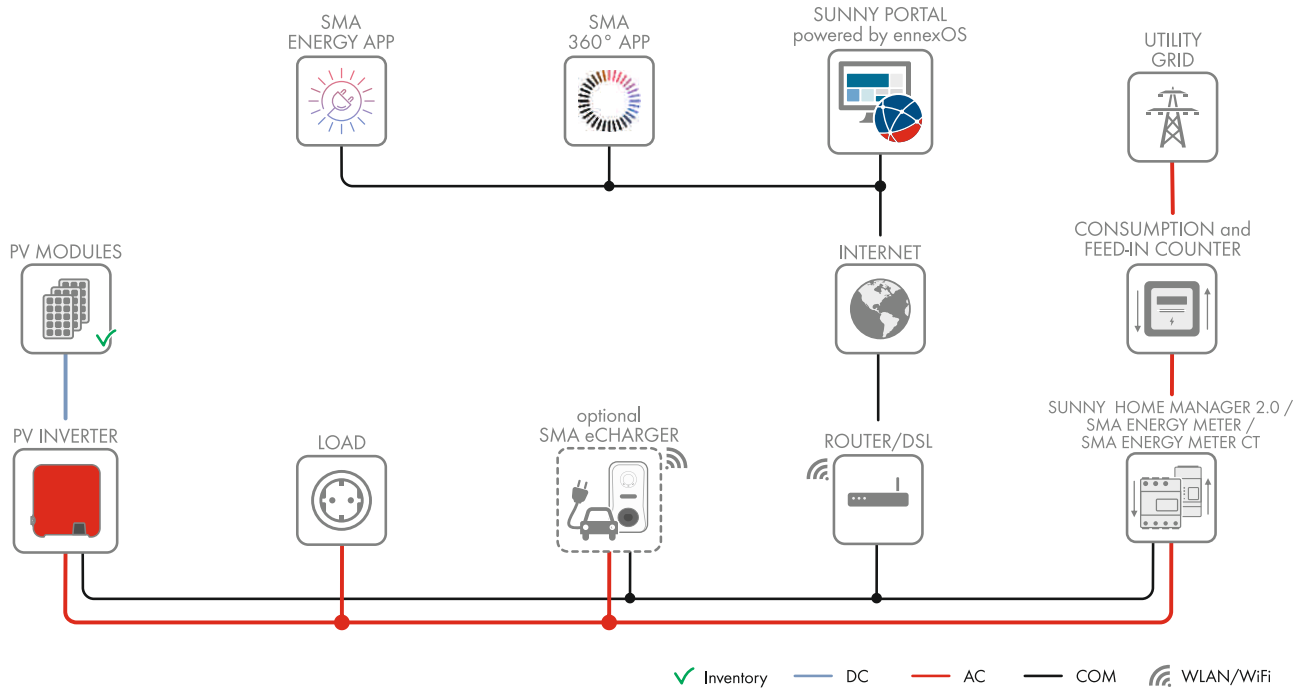


Figure 1: System configuration: Solution 1

If the inverter of your PV system cannot regulate the power, it must be replaced with a new inverter. Alternatively, you can upgrade your PV system by adding a Sunny Island (see Section 4, page 10).

The PV inverters listed below can regulate the power within the allowed time:

Product	Type
Sunny Boy	SB3.0-1AV-41 / SB3.6-1AV-41 / SB4.0-1AV-41 / SB5.0-1AV-41 / SB6.0-1AV-41
Sunny Tripower	STP3.0-3AV-40 / STP4.0-3AV-40 / STP5.0-3AV-40 / STP6.0-3AV-40 / STP8.0-3AV-40 / STP10.0-3AV-40
Sunny Tripower X	STP12-50 / STP15-50 / STP20-50 / STP25-50

2.2 System Requirements for Zero Export

If your PV system is equipped with more than one inverter that can regulate power, you can generally operate your system as a zero-export system without any upgrades.

For zero export, the hardware components listed below must be included in the PV system:

- ☐ Controllable PV or hybrid inverter
- ☐ SMA Energy Meter (EMETER-20) / SMA Energy Meter CT (EM-1CT63A-21, EM-3CT63A-21) or Sunny Home Manager 2.0 (from firmware version 2.6.6.R)
- ☐ Additional components to increase the self-sufficiency quota, e.g., radio-controlled sockets or a controllable heating rod. See the "SMA SMART HOME - Compatibility list for the Sunny Home Manager 2.0".

To charge an electric vehicle with solar power, you need to upgrade the system by adding the SMA eCharger (see product manual).

Information: Optional loads cannot be used with zero export and must be configured accordingly.

With this solution, you can always install a storage system at a later time.

Configure the parameter settings according to the components in use (see Section 5, page 14).

3 Solution 2: Self-consumption with a battery-storage system and zero export

3.1 System overview

In the case of systems where grid feed-in is not possible or desired, but you want to increase the proportion of self-generated energy in the consumed power, we advise installing a storage system in addition to the smart PV inverter. This reduces grid purchase costs to a minimum. To ensure that the system does not feed into the utility grid, an SMA Home Manager 2.0 or Energy Meter can be installed. It measures the power at the point of interconnection, limits the PV inverter as soon as the battery-storage system is fully charged, and prevents the electric current from flowing into the utility grid.

Here, it is important that the PV inverter can regulate the generated power so that only so much energy is generated as is currently consumed and stored. The storage system, consisting of a battery inverter and battery, supplements the power generators. Alternatively, the system can be designed with a hybrid inverter to which further PV inverters may be added. The storage system lets you shift the time of consumption so that your own solar power can be used at night, for example. For instance, the generated energy can be used to charge an electric vehicle. In addition, installing a battery-backup system can provide security if the utility power grid fails.

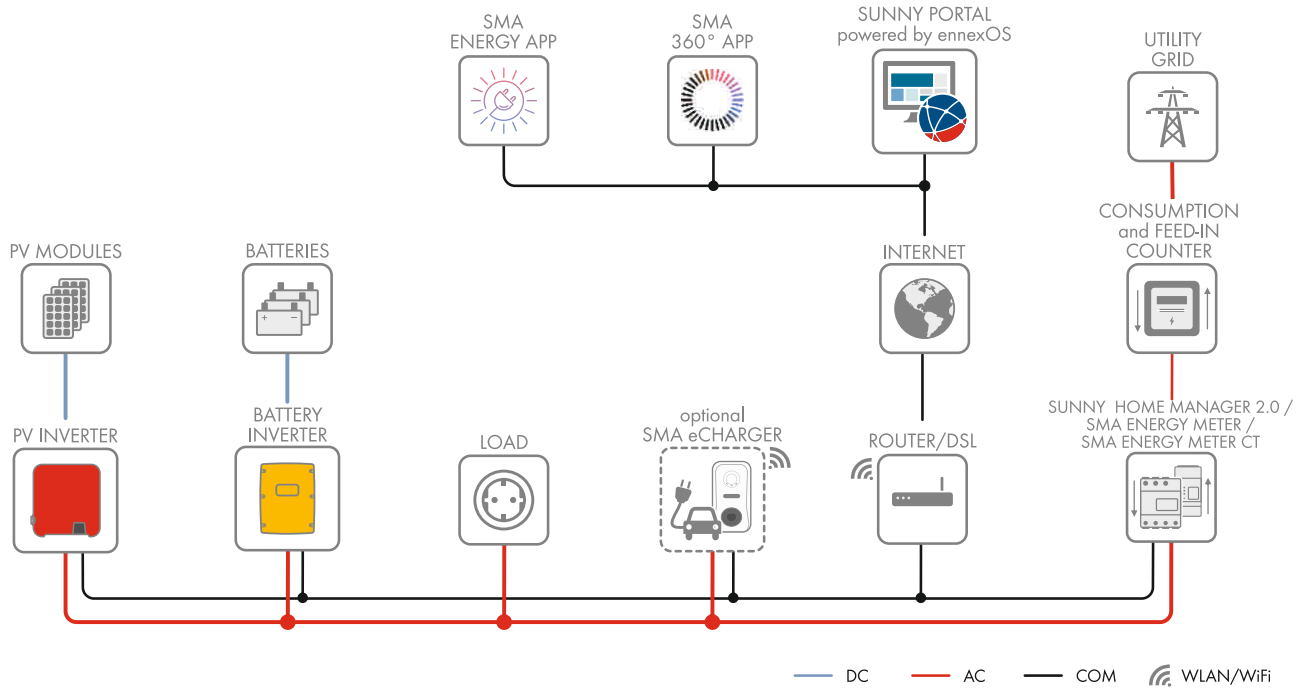


Figure 2: Design of the PV system: solution 2 with PV and battery inverters.

Information: The SMA eCharger can currently only be controlled by the Sunny Home Manager 2.0.

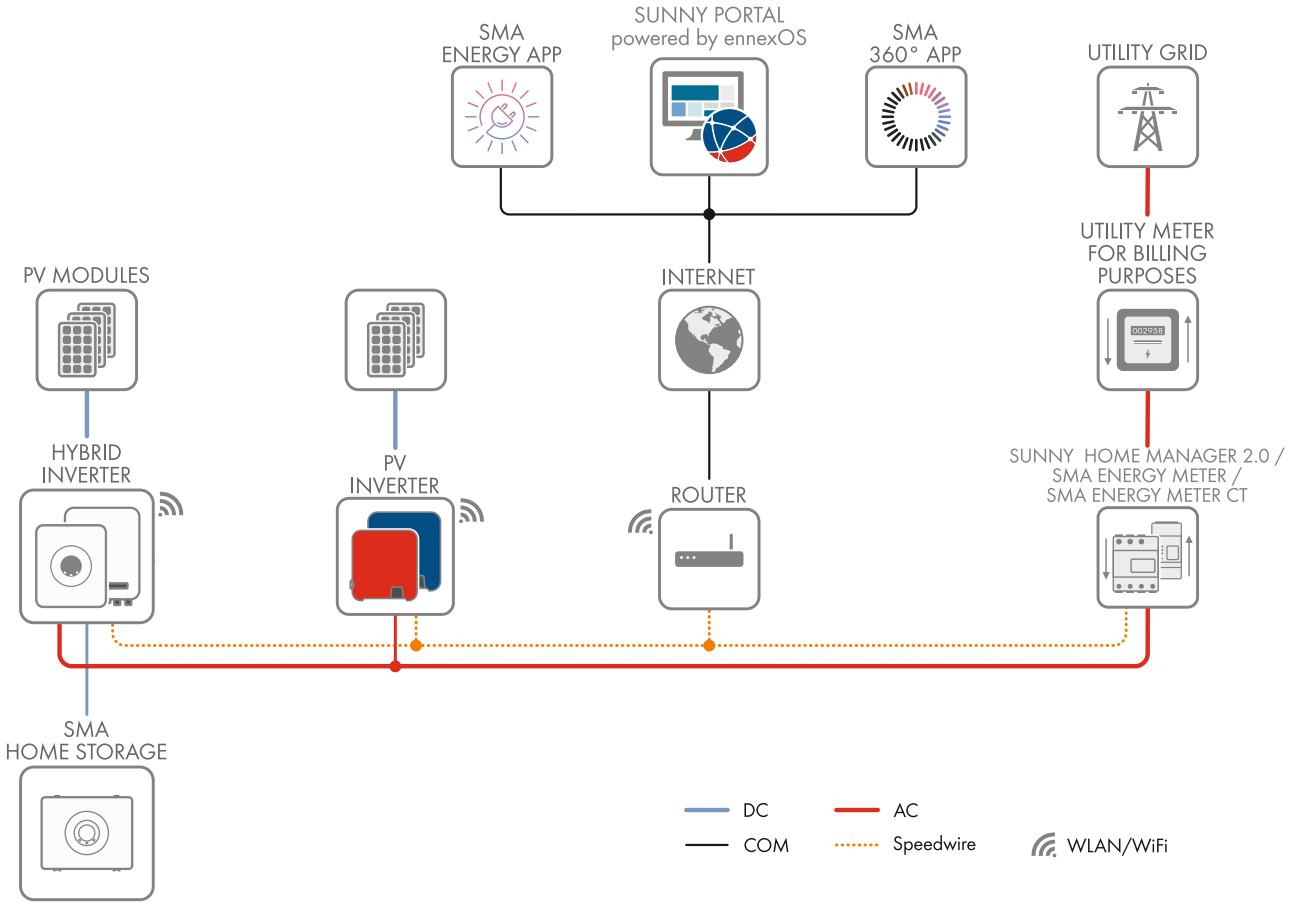


Figure 3: Design of the PV system: solution 2 with hybrid inverter and optional PV inverters

Information: In PV systems equipped with the Sunny Home Manager 2.0, the use of two battery or hybrid inverters is not supported.

The SMA inverters listed below meet the requirements of Solution 2 and do not need to be replaced:

Product	Type
Sunny Boy	SB3.0-1AV-40 / SB3.6-1AV-40 / SB4.0-1AV-40 /SB5.0-1AV-40 SB3.0-1AV-41 / SB3.6-1AV-41 / SB4.0-1AV-41 / SB5.0-1AV-41 / SB6.0-1AV-41
Sunny Boy Smart Energy	SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50
Sunny Tripower	STP3.0-3AV-40 / STP4.0-3AV-40 / STP5.0-3AV-40 / STP6.0-3AV-40 / STP8.0-3AV-40 / STP10.0-3AV-40
	STP12-50 / STP15-50 / STP20-50 / STP25-50
Sunny Tripower Smart Energy	STP5.0-3SE-40 / STP6.0-3SE-40 / STP8.0-3SE-40 / STP10.0-3SE-40
Sunny Island	SI6.0H-13 / SI8.0H-13

3.2 System Requirements for Zero Export

For zero export, the hardware components listed below must be included in a PV system equipped with a battery-storage system:

☐ Controllable PV or hybrid inverter

- ☐ Sunny Island x.0H
- ☐ Compatible battery-storage system
- ☐ SMA Energy Meter (EMETER-20) / SMA Energy Meter CT (EM-1CT63A-21, EM-3CT63A-21) or Sunny Home Manager 2.0 (from firmware version 2.6.6.R)

To charge an electric vehicle with solar power, you need to upgrade the system by adding the SMA eCharger. Configuration for charging only with PV current is not permitted. Configure the SMA eCharger so that only a limited amount of grid power may be used (see product manual).

Configure the parameter settings according to the components in use (see Section 5, page 14).

4 Solution 3: Retrofit a Battery-storage System for Self-consumption with Zero Export in Existing PV Systems

4.1 System overview

Solution 3 is a zero-export system with a battery-storage system. The system is operated with 1 PV inverter and 1 Sunny Island. This solution is especially useful for PV systems in which the PV inverter is not an SMA product, cannot regulate the energy, and should not be replaced by another product.

In this system, the generated energy is regulated by the battery inverter. If the PV inverter cannot be controlled by communication, an additional contactor controlled by the multifunction relay of the battery inverter must be installed. As soon as a defined state of charge is reached in the battery, the battery inverter opens the contactor and this temporarily disconnects the PV inverter from the system. When the battery falls below a defined state of charge, the battery inverter closes the contactor so that the PV inverter can generate energy again.

The state of charge at which the Sunny Island is set to stop the PV inverter must be below the threshold where the battery's charging power begins to decrease. SMA Solar Technology AG recommends setting the adjustable state of charge to a value below 85% (see product manual).

When using lithium-ion batteries, the **automatic equalization charge** for lithium-ion batteries should be enabled (see product manual). The Sunny Island regularly charges the battery from the utility grid to full capacity to recalibrate the state of charge.

Here, it is important that the charging power of the battery inverter is at least equal to the maximum AC power of the PV inverter. This ensures that the energy from the PV system is not fed into the utility grid but is received by the battery-storage system, or the PV system is disconnected by the contactor.

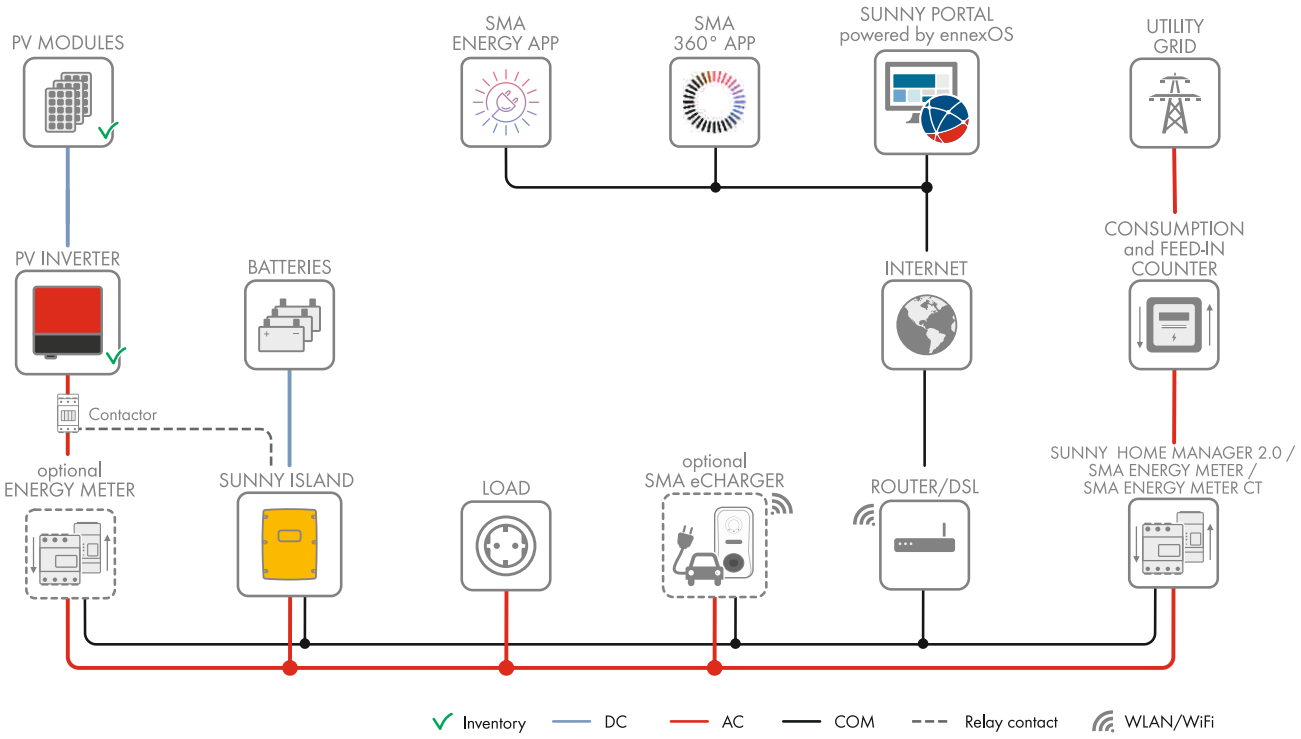


Figure 4: System configuration: Solution 3

The SMA battery inverters listed below can be used in a battery system:

Product	Type
Sunny Island	SI6.0H-13 / SI8.0H-13

Only compatible batteries are suitable for this use case (see "Approved Batteries and Information on Batteries in Sunny Island Systems").

4.2 System Requirements for Zero Export

For zero export, the hardware components listed below must be included in an existing PV system equipped with a battery-storage system:

- ☐ The existing PV inverter is used. Any PV inverter can be used for this.
- ☐ Additional contactor for closed-loop control of the PV inverter
- ☐ Sunny Island x.0H (from firmware version 3.30.12.R). Make sure that the maximum AC power of the PV inverter is less than or at most equal to the rated power of the battery inverter being used.
- ☐ Compatible battery-storage system
- ☐ SMA Energy Meter (EMETER-20) / SMA Energy Meter CT (EM-1CT63A-21, EM-3CT63A-21) or Sunny Home Manager 2.0 (from firmware version 2.6.6.R)
  Information: The SMA Energy Meter is used for visualizing system data with third-party PV inverters.

To charge an electric vehicle with solar power, you need to upgrade the system by adding the SMA eCharger (see product manual).

Configure the parameter settings according to the components in use (see Section 5, page 14).

Installing a Contactor for Closed-Loop Control of the PV Inverter

The Sunny Island features an integrated multifunction relay that uses a contactor to switch the PV inverter on and off. The contactor must be installed additionally.

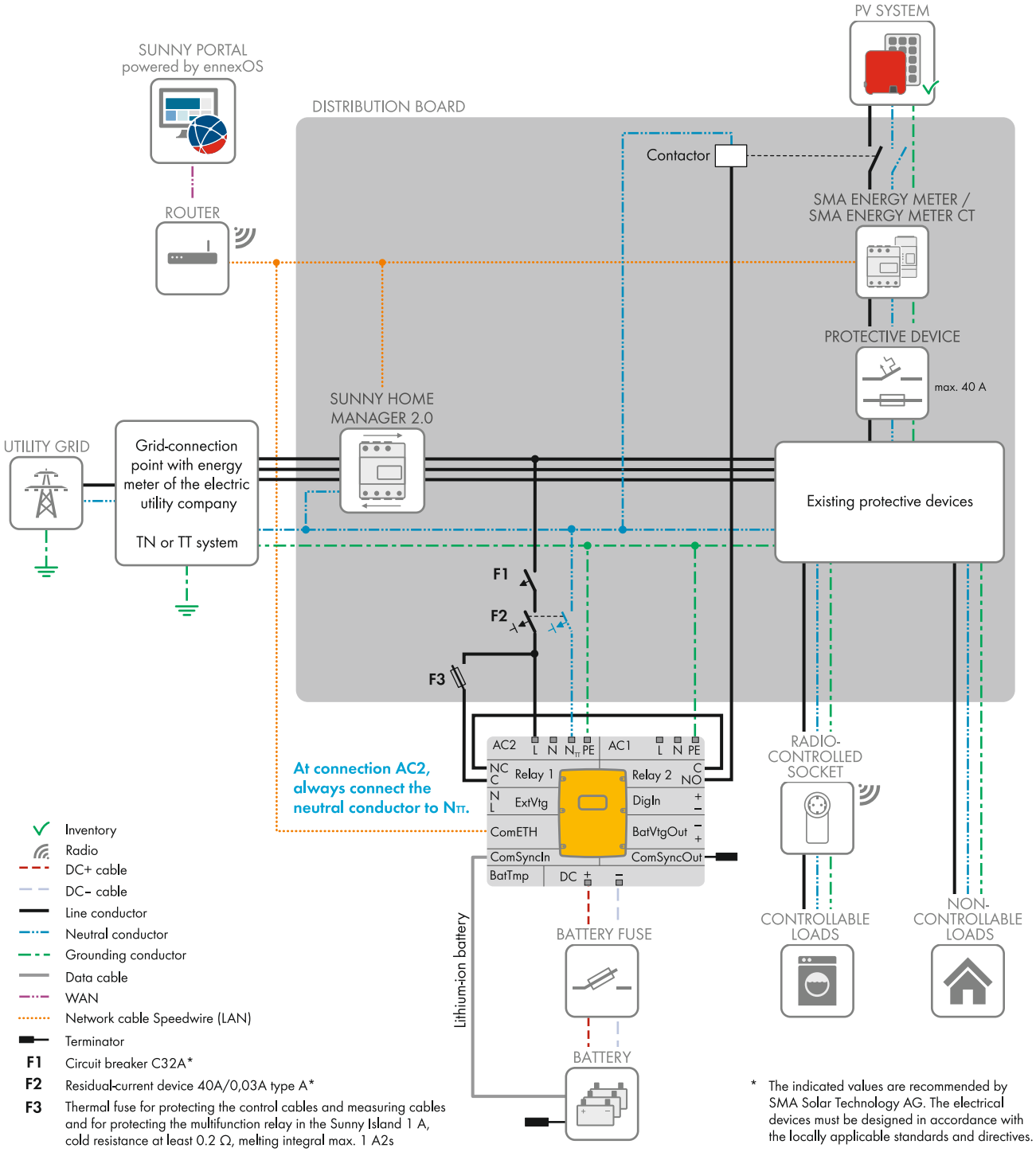


Figure 5: Circuitry overview for a system with Solution 3

Requirements for the Additional Installations:

- ☐ Contactor with 2 make contacts: 230 VAC, 32 A, 2 x S
- ☐ The contactor must be connected to the **relay 1** and **relay 2** connections in Sunny Island. The contacts **C** and **NC** as well as **C** and **NO** are used in series connection. For information on cable requirements and the installation procedure, refer to the product manual.

Requirements for a single-phase system with Sunny Island:

- A single-phase system with a Sunny Island is only used for increased self-consumption, not as a battery-backup system.

Adjusting the Parameters via the User Interface of the Battery Inverter

Adjusting the Parameters of the Switching Limits

The following parameters in the parameter group **Device > Load shedding 1** in the Sunny Island must be adjusted via the user interface so that the Sunny Island can control the PV inverter reliably.

- Disconnection of the PV inverter: For relay 1 **Battery state of charge threshold for stop load shedding 1**: 85% of the SOC
- Connection of the PV inverter: For relay 1 **Battery state of charge threshold for start load shedding 1**: 75% of the SOC
- Relay 2 is closed when Sunny Island is in operation.
- Relay 2 is opened when the Sunny Island is switched off, set to stop, or displays a fault.

Adjusting the Country Data Set

The current country data set must be selected for the system. To do this, the system must be configured as an on-grid system with self-consumption.

For information on the procedure for changing the settings on the Sunny Island user interface, refer to the product manual.

Communication failure between Sunny Island and energy meter or Sunny Home Manager 2.0

If communication between the Sunny Island and the SMA Energy Meter or the Sunny Home Manager 2.0 is interrupted, the Sunny Island stops after a certain time and both multifunction relays switch to the idle state. As a consequence, the PV inverter operation is also stopped.

- The time to detect an interruption in the communication can be set in the parameter group **System and device control** via the device parameter **Communication timeout data logging energy meter at the point of interconnection** (1 to 30 seconds; default setting: 2 seconds).

5 Setting Measured Values at the Point of Interconnection

To ensure measurement values from the point of interconnection are available every 200 ms, device-specific parameter settings must be configured.

If the system has a System Manager, no additional settings are required. In connection with an energy meter, an SMA System Manager takes over closed-loop control at the point of interconnection and can control or regulate subordinate inverters. The System Manager also takes over system monitoring and communication to the Sunny Portal powered by ennexOS. The Sunny Home Manager can be used as a superordinate device but is not able to fully perform the functions of the System Manager. For example, the Sunny Home Manager cannot be used for reactive power control.

Product	Type	User interface powered by ennexOS
Sunny Boy	SB3.0-1AV-40 / SB3.6-1AV-40 / SB4.0-1AV-40 / SB5.0-1AV-40	-
	SB3.0-1AV-41 / SB3.6-1AV-41 / SB4.0-1AV-41 / SB5.0-1AV-41 / SB6.0-1AV-41	-
Sunny Boy Smart Energy	SBSE3.6-50 / SBSE4.0-50 / SBSE5.0-50 / SBSE6.0-50	✓
Sunny Tripower	STP3.0-3AV-40 / STP4.0-3AV-40 / STP5.0-3AV-40 / STP6.0-3AV-40 / STP8.0-3AV-40 / STP10.0-3AV-40	-
	STP12-50 / STP15-50 / STP20-50 / STP25-50	✓
Sunny Tripower Smart Energy	STP5.0-3SE-40 / STP6.0-3SE-40 / STP8.0-3SE-40 / STP10.0-3SE-40	-
Sunny Island	SI6.0H-13 / SI8.0H-13 from firmware version 3.30.37	-

In systems with devices that **do not** feature a user interface powered by ennexOS, and where multiple devices are installed, parameter settings must be configured on one of the following devices:

Devices	Procedure
The **SMA Energy Meter (EMETER-20)** must provide the measured values from the point of interconnection every 200 ms so that the required control dynamics can be reached.	1. Select **Device parameters** > **Device** > **Interface** directly on the device. 2. Click on [**Edit parameters**]. 3. Set the value of the **Measurement interval** parameter to 200 ms. 4. Confirm with [**Save all**].

Devices	Procedure
The **Sunny Home Manager 2.0** must provide the measured values from the point of interconnection every 200 ms so that the required control dynamics can be reached. Therefore, the setting in Sunny Portal must be changed after registering the system:	1. Go to **Device management** via the side menu **Configuration**. 2. Open the context menu of the Sunny Home Manager via the button •••. 3. Select **Display device properties**. 4. Start the edit via the button ✎ in the area **Advanced configurations**. 5. Configure the settings in the area **Direct meter communication**. 6. In the **Counter Configuration** field, set the measuring interval to **200 ms**. 7. Confirm with [**Save**].
Alternatively, you can configure the parameters directly on the **PV or hybrid inverter**.	1. Select **Device parameters** > **System communication** > **Meter on Speedwire** directly on the device. 2. Click on [**Edit parameters**]. 3. Set the value of the **Measurement interval of the energy meter** parameter to 200 ms. 4. Confirm with [**Save all**].

6 Setting Zero Export

To adjust the parameter settings, follow the instructions in the operating manual of your device.

If multiple devices are installed in systems with devices that have a user interface powered by ennexOS, you can configure the settings via the System Manager's user interface. The System Manager applies the settings to all subordinated devices.

Requirements:

- ☐ When setting parameters via a communication product: The inverter must be registered in a communication product.
- ☐ Depending on the type of communication, a computer with a Wi-Fi or Ethernet interface must be available.
- ☐ Depending on the country data set, an SMA Grid Guard Code might be required. You can request the SMA Grid Guard code for devices without a user interface powered by ennexOS via the Online Service Center. It is not required for devices with a user interface powered by ennexOS.
  Information: Although the Sunny Tripower Smart Energy does not have a user interface powered by ennexOS, an SMA Grid Guard code is not required.

Procedure:

1. Activate the inverter's user interface or, if using a Sunny Home Manager, open the Sunny Portal.
2. Log in using your email address, user name, or user group.
3. Call up the parameter settings (see operating manual of the device).
4. If necessary, enter the SMA Grid Guard code.
5. Check the parameters according to the specified overview and adjust them if necessary.
6. Save the parameter setting.
7. Document all changes (e.g., on the supplementary sheet with the default settings). The changes are saved and the data is transferred to the inverter. The saving process can take several hours if the inverter is in night mode. The data is saved in the inverter's memory when the inverter starts.

To guarantee zero export, the following parameters must be set:

Parameter	Value to be set
External active power setting, limitation of change rate	**Off**
External active power setting 2, limitation of change rate	**off**
External active power setting, nominal value filter	**off**
External active power setting 2, nominal value filter	**Off**
Activation of plant control based on maximum of active power phase measured value	**On**
Operating mode active power setting	**External active power specification**

ENERGY
THAT
CHANGES

SMA

www.SMA-Solar.com