



SolarEdge Export Limitation Application Note

**North America
Version 2.3**

Disclaimers

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- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate the equipment.

Revision History

Version 2.3 (December 2017)

- Removed clustering support.

Version 2.2 (November 2017)

- ZigBee support for communications between inverters discontinued.

Version 2.1 (September 2017)

- Added clustering support.
- Information on export limitation response times.
- Updated meter definitions: Production, inverter production, site production.

Version 1.0 (February 2016)

- Initial version.

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Chapter 1: Introducing Export Limitation

The SolarEdge Smart Energy Management solutions allow increasing the self-consumption of a site. One method used for this purpose is export limitation, which allows installing a larger PV system or a larger inverter without violating grid export (feed-in) limitations.

For export limitation, a SolarEdge device - an inverter or a Control and Communication Gateway (CCG) - dynamically adjusts the PV power production in order to ensure that exported power does not exceed a preconfigured limit. To enable this functionality, an energy meter that measures export or consumption must be installed at the site.

To use export limitation, the inverter/CCG communication board firmware (CPU) version must be 2.8xx/3.8xx or higher. If the CPU version is lower, contact SolarEdge support for an upgrade file and instructions (support@solaredge.com).

This document describes system setup considerations and how to configure the system for export limitation.

Terminology

The following terms are used in this document:

- **Export:** The power injected to the grid.
- **Import:** The power purchased from the grid.
- **Export/Import meter:** A meter that is installed at the grid connection point and reads the energy/power exported/imported to/from the grid.
- **Consumption:** The power consumed by the site.
- **Consumption meter:** A meter that is installed at the load consumption point and reads the energy/power consumed by the site.
- **Self-consumption:** The PV power consumed by the site and not fed into the grid.
- **Production:** The power produced by the PV system.
- **Production meter:** A meter that is installed at the inverter output or site AC connection, or in the inverter (a built-in revenue grade meter), and reads the energy/power produced by the PV system or site.

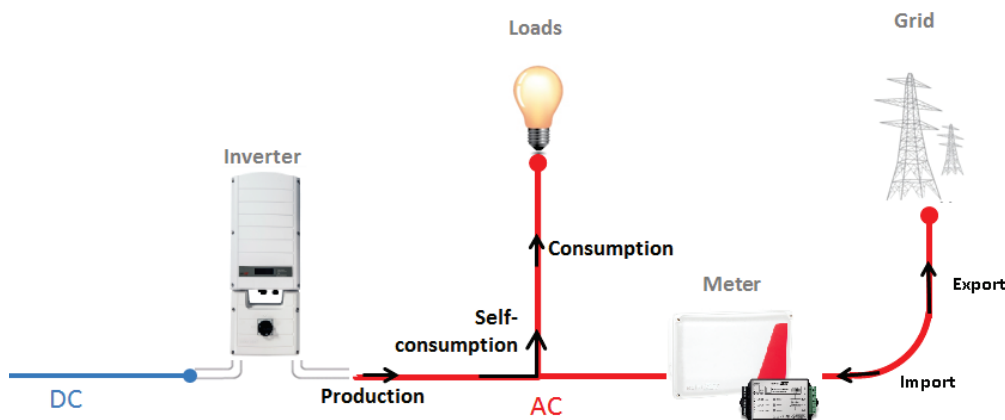


Figure 1: Terminology

Chapter 2: Connection Options

Export Limitation is managed either by an inverter or by a CCG, which is the site's smart energy manager. The inverter/CCG reads the exported power from a meter installed at the grid connection point or reads the consumption from a meter installed at the load consumption point, and adjusts PV power production according to the preconfigured limit.

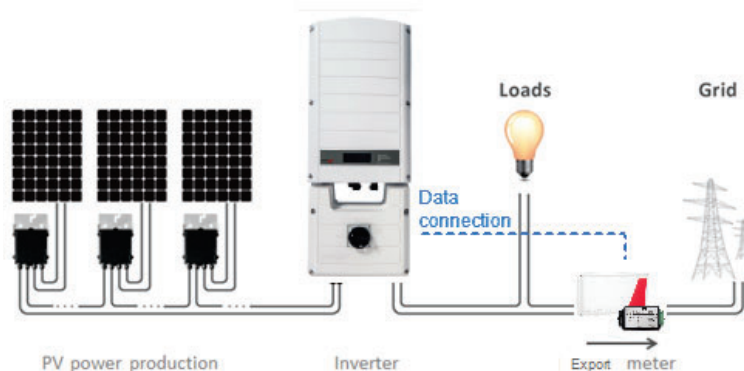


Figure 2: Typical installation with export meter

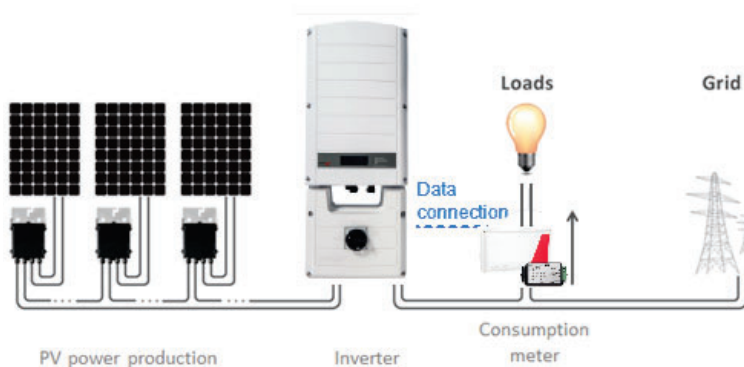


Figure 3: Typical installation with consumption meter

The following sections describe meter types, location considerations, meter data displayed in the SolarEdge monitoring platform, and the most common connection scenarios for export limitation.

For SolarEdge meter installation, refer to the meter installation guide, available on the SolarEdge website at <http://www.solaredge.com/files/pdfs/solaredge-meter-installation-guide-na.pdf>.

The system Export Limitation response time depends on the meter location and on the communication method between the inverters:

- If the meter is installed at the grid connection point: 2 seconds
- If the meter is installed at the load consumption point: approximately 10 seconds.

Single Inverter System

In a single inverter system, the meter is connected directly to the RS485 port of the inverter, which serves as the smart energy manager.

If your inverter has a built-in RGM (Revenue Grade inverter), connecting an external meter for export limitation requires an RS485 Expansion Kit (available from SolarEdge).

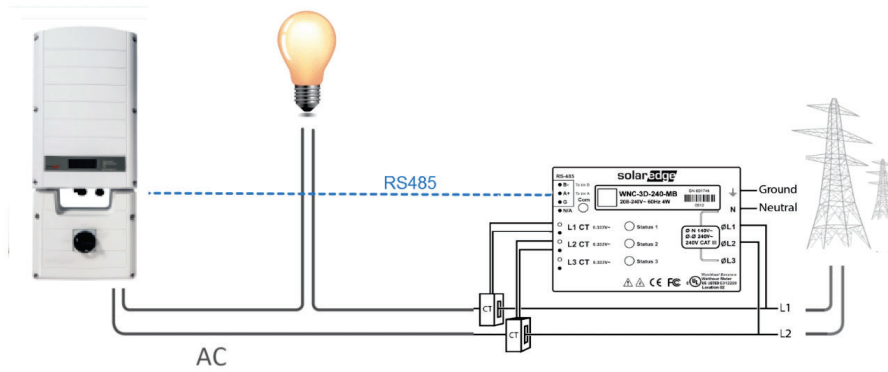


Figure 4: Single-inverter connection

Multiple Inverter System

Multiple Inverter System with RS485 Meter

When using an RS485 meter for multiple inverter export limitation, two options are available:

- The meter is connected to the RS485 port of one of the inverters. This inverter serves as the smart energy manager. In this case, as the inverter's RS485 port is occupied by the meter, use the RS485 Expansion Kit (available from SolarEdge).
- The meter is connected to one of the RS485 ports of a CCG. The CCG is the smart energy manager. The CCG's second RS485 port can be used to create an RS485 bus for communication between the inverters. This option is illustrated in [Figure 5](#).

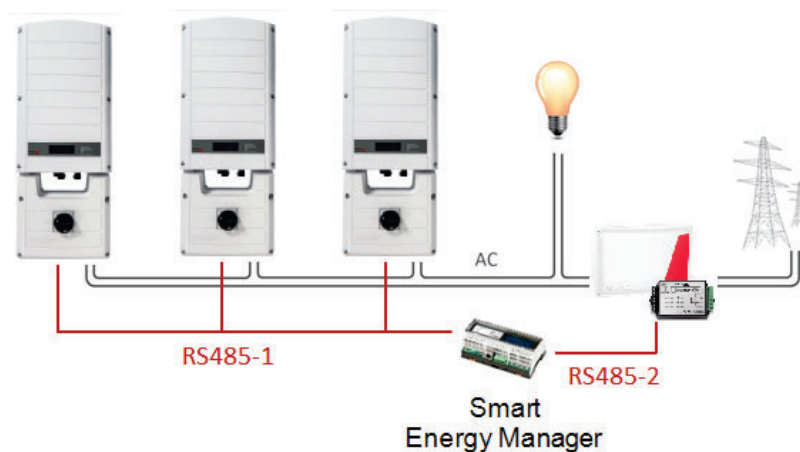


Figure 5: Multi-inverter connection with CCG

Chapter 3: Export Limitation Configuration

This step should be done after installing and configuring a meter.

In a multi-inverter system, the limit is configured in the smart energy manager (the inverter or CCG that is connected directly to the meter).



NOTE

The smart energy manager is the device connected to the meter. The manager does not necessarily have to be the communication master.



NOTE

Calculated meter readings (also referred to as "virtual meters"), such as self-consumption, are calculated using the data measured by the meter and the inverters. Virtual meters are only sent when Energy Manager is enabled. If virtual meter information is required, but export limitation is not, the Energy Manager should be enabled without any site limit setting (default).

► To configure export limitation in the SolarEdge device:

1. Enter Setup mode, scroll down to the **Power Control** menu and select it. A menu similar to the following is displayed:

```
Grid Control <En>
Energy Manager
RRCR Conf.
Reactive Pwr Conf.
Active Pwr Conf.
Phase Balance <Dis>
Wakeup Conf.
P(f)
Advanced
Load Defaults
```

2. Select **Energy Manager**. The available Smart Energy Management options are displayed:

```
Limit Control <Dis>
Energy Ctrl <Dis>
Advanced
```

3. Select **Limit Control**. The following screen is displayed:

```
Control Mode <Dis>
Site Limit <->
Advanced
```

4. Select **Control Mode**. the following screen is displayed:

```
Disable
Export Ctrl.
Production Ctrl.
Min Import Ctrl.
```

5. Select **Export Ctrl.**¹

6. Select **Site Limit** and enter the limit value at the connection point, in kW. The default value is none (-), which means that the system is not limited.

```
Site Limit [kW]
[kWh]
xxxxxxxx.xxx
```



NOTE

The value you enter here is the overall limit to which the site export will be restricted, whether you use the Total or Per Phase limit control modes (as explained in the next step).

¹Production Control, which limits the system production, may also be selected. For more information, refer to the Production Limitation Application Note.

7. In the **Limit Control** menu, select **Limit Mode**. The following is displayed:

```
Total
Per Phase
```

8. Select the **Total** option. The Total site limit is the total export power, that is, the combined production minus the combined consumption.

For three phase inverter connections, you can select the Per Phase option. The inverter sets the limit on each phase to 1/3 of the total site limit. Use this mode if there is a limit on each individual phase.

► **To verify export limitation operation:**

1. Press the Enter button or the LCD external button until reaching the Smart Energy Manager status screen, showing the site level data:

```
Site Limit:      7.0 kW
Site Prod:       10.0 kW
Site Export:     4.0 kW
Self-consume:   6.0 kW
```

Site Limit: The limit that was defined for the site

Site Prod: The power produced by the site

Site Export: The power that is fed into the grid. This line is displayed only if the control mode is Export

Self-consume: The PV power consumed by the site. This line is displayed only if the control mode is Export

2. Check the Power Control status screen of any inverter:

```
PWR CTRL: REMOTE
PWR Limit: 10.04 kW
Cos Phi: 0.9
Power Prod: 7000W
```

PWR CTRL: The power control status:

- **REMOTE** - Communication with the smart energy manager is confirmed/validated. This status should appear in all inverters.
- **LOCAL** - The power is controlled locally (e.g. by a fixed limit), or this inverter limits the PV power production to its relative portion of the export power limit, as a result of disconnected communication with the smart energy manager. If this status appears, check the communication to the smart energy manager or the communication to the meter.

Cos Phi: The ratio between active to reactive power

Power Prod: The power produced by the inverter

PWR Limit: The inverter maximum output power set by the smart energy manager

Appendix A: Meter Information Displayed in the Monitoring Platform

If your device is connected to the SolarEdge server, you can view the meter’s readings in the monitoring platform. Verify that the meter type is set correctly in the Admin page > Logical Layout > Meter details:

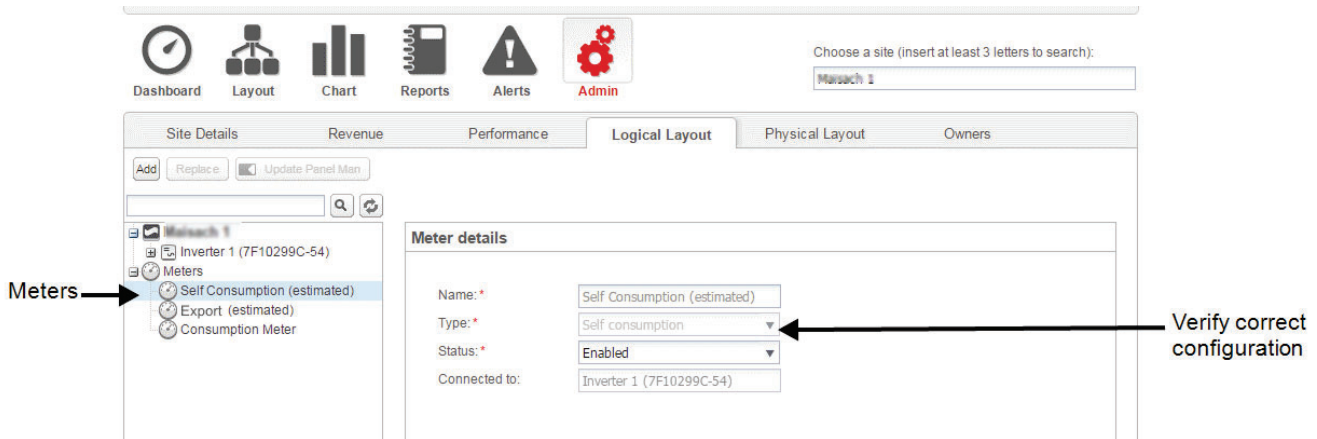


Figure 6: Setting the Meter details in the monitoring platform

Calculated meter readings (also referred to as "virtual meters"), such as self-consumption, are calculated using the data measured by the meter and the inverters.

The data from the inverters and from installed meters is displayed in the Dashboard and Charts tabs of the monitoring platform. The displayed data depends on the meter(s) location: grid connection point (export), or load consumption point (consumption). The following tables detail the displayed information per meter location.

Export meter:

Data	Displayed in Monitoring Dashboard	Displayed in Monitoring Charts
Production (inverter/site)	✓	✓
Consumption	✓ (calculated)	✓ (calculated)
Self-consumption	✓ (calculated)	✓ (calculated)
Export	X	✓
Import	X	✓

Consumption meter:

Data	Displayed in Monitoring Dashboard	Displayed in Monitoring Charts
Production (inverter/site)	✓	✓
Consumption	✓	✓
Self-consumption	✓ (calculated)	✓ (calculated)
Export	X	✓ (calculated)
Import	X	✓ (calculated)

Appendix B: Examples of Total Export Limitation

The following examples illustrate the behavior of a system with export limitation when using the **Total** Limit Mode options described in [Export Limitation Configuration](#) on page 7, step 7.

- **Total:** The Total site limit is the total export power on all the phases combined, that is, the combined production minus the combined consumption, as represented in the formula below. Reverse current on one phase will count as negative power and can compensate for another phase.

$$Export_{Total} = \sum_{x=1}^3 Production_{phase(x)} - \sum_{x=1}^3 Consumption_{phase(x)}$$

- **Per Phase (for three phase inverters):** Each phase will be limited to 1/3 of the configured site limit, that is, the export power is the sum of the production minus the consumption of each phase, as represented in the formula below. The division of the limit into the three phases is performed internally; the user enters the total site limit.

$$Export_{PerPhase} = \sum_{x=1}^3 (Production_{phase(x)} - Consumption_{phase(x)})$$

The example system has a single-phase inverter with a maximum AC power of 7.6 kW.

In the example, the Site Limit and Limit Mode configuration is detailed. The example includes production and consumption scenarios and details how the export, consumption and import power values are influenced by the conditions. The tables in each scenario detail the following values:

- Potential PV Production
- Consumption (load)
- Production
- Export power
- Self-consumption
- Import power

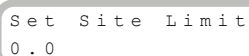
In addition, the Smart Energy Management status screen is presented with the values applicable to each scenario.

Example - 0% Export Limit, Total Limit Mode

In this example, the system export power limit is set to 0% of max DC power, that is, no power is fed into the grid, and the **Total** Limit Mode is used.

► To configure this setting:

1. Enter 0.0 in the **Set Site Limit** screen (refer to [Export Limitation Configuration](#) on page 7):



Set Site Limit
0.0

2. Select **Limit Control** → **Limit Mode** → **Total**.

Scenario A

PV potential is greater than the loads.

The loads are powered from the PV.

PV production is not limited, because there is no export power.

	Total power [kW]	Total [kW]
Potential PV Production	7	7
Consumption (load)	4	4
Production	4	4
Export	$\text{Max}(\sum \text{Production} - \sum \text{Consumption}, 0) = \text{Max}(0, 0)$	0
Self-consumption	$\text{Min}(\sum \text{Production}, \sum \text{Consumption}) = \text{Min}(4, 4)$	4
Import	$\sum \text{Consumption} - \sum \text{Self consumption} = 4 - 4$	0

The Smart Energy Manager status screen displays the following:

```

Site Limit:      0.0 kW
Site Prod:       4.0 kW
Site Export:     0.0 kW
Self-consume:   4.0 kW
    
```

Scenario B

PV potential is lower than the loads.

The loads are powered from the PV and from the grid.

PV production is not limited, because there is no export power.

	Total power [kW]	Total [kW]
Potential PV Production	4	4
Consumption (load)	7	7
Production	4	4
Export	$\text{Max}(\sum \text{Production} - \sum \text{Consumption}, 0) = \text{Max}(-3, 0)$	0
Self-consumption	$\text{Min}(\sum \text{Production}, \sum \text{Consumption}) = \text{Min}(4, 7)$	4
Import	$\sum \text{Consumption} - \sum \text{Self consumption} = 7 - 4$	3

The Smart Energy Manager status screen displays the following:

```

Site Limit:      0.0 kW
Site Prod:       4.0 kW
Site Export:     0.0 kW
Self-consume:   4.0 kW
    
```