

StorEdge™ Solution Applications with the StorEdge Interface and LG Chem Batteries – Connection and Configuration (Europe, APAC, South Africa)

Revision History

- Version 2.0 – removed Tesla batteries, added LG batteries
- Version 1.0 – initial version, using Tesla batteries

Introduction

SolarEdge's StorEdge Solution with the StorEdge Interface can be used for various applications that enable energy independence for system owners, by utilizing a battery to store power and supply power as needed. The StorEdge Solution is based on and managed by the SolarEdge inverter for both PV and battery management, and is compatible with LG Chem High Voltage Batteries.

This document describes two of the main StorEdge Solution applications¹:

- Maximize self-consumption – the battery is automatically charged and discharged to meet consumption needs and reduce the amount of electricity purchased from the grid
- Charge/discharge profile programming – the system operates according to a configurable charge/discharge profile, for example for time of use arbitrage (charge the battery from PV/grid when tariffs are low and discharge it when tariffs are high)

These applications can be used together with the export limitation application. For details on export limitation, refer to https://www.solaredge.com/sites/default/files/feed-in_limitation_application_note.pdf.

Contents

Introduction	1
Overview	2
System Components	2
System Configurations	2
Compatibility Information.....	3
Related Documentation.....	3
System Connection	4
System Configuration Options and Setup	7
Basic Configuration	7
Large Residential PV Systems.....	9
AC Coupling using a SolarEdge Three Phase Inverter	10
AC Coupling using a non-SolarEdge Inverter	11
Appendix A – Creating a Charge/Discharge Profile.....	14
Charge/Discharge Modes.....	14
Creating a Profile	14
Appendix B – Verifying StorEdge Functionality.....	15
SolarEdge Support Contact Information	16

¹ The system applications and configurations described in this document do not provide backup power.

Overview

System Components

The StorEdge Solution is comprised of the following components:

- **Single Phase SolarEdge Inverter** – the SolarEdge single phase inverter manages battery and system energy in addition to its traditional functionality as a DC-optimized PV inverter; in some configurations, an AC-coupled SolarEdge inverter is used instead. The StorEdge solution is supported by the following SolarEdge single phase inverters:
 - HD-Wave inverters
 - Non-HD-Wave inverters



NOTE

Any single phase inverter manufactured from week 40 2014 and with CPU version 3.xxxx or higher and DSP1 version 1.210.7xx or higher may be used; inverter firmware upgrade is required, and can be downloaded at: <https://www.solaredge.com/storedge/firmware>

- **StorEdge Interface** – the StorEdge Interface provides safe and reliable connectivity between the battery and the inverter. The StorEdge solution is supported by the following StorEdge Interface units:
 - SESTI-S4: StorEdge Interface for HD-Wave inverters
 - SESTI-S1 and SESTI-S2: StorEdge Interface for single phase non-HD-Wave inverters
- **SolarEdge Modbus Meter** – the meter is used by the inverter for import/export or consumption readings, and manages the battery charge/discharge accordingly; the meter readings are displayed in the SolarEdge monitoring platform.



NOTE

System management for maximize self-consumption or charge/discharge profile programming is determined by the number of phases read by the inverter, combined, i.e. if there is a CT (current transformer) on one phase, management will be done for that phase only. If there are CTs on all three phases, the three phases will all be managed together, for example import on one phase can be cancelled out by export on another phase.

- **LG Chem RESU7H/RESU10H Battery** – a DC-coupled battery designed to work with the StorEdge solution.

System Configurations

The configurations described in the application note are the following:

Use Case	Description	Page
Basic Configuration	This configuration is based on one of each of the StorEdge components and is suitable for most residential systems.	7
Large Residential PV Systems	For residential sites with large PV systems, two single phase inverters may be installed. One inverter manages the battery and functions as a PV inverter, and the second inverter is used for production of the additional PV power.	9
AC Coupling using a SolarEdge Three Phase Inverter	For sites that require a three phase inverter, or already have a three phase SolarEdge inverter installed, the StorEdge single phase system can be AC-coupled to the three phase SolarEdge inverter, i.e. the single phase inverter used to manage the battery is connected to the AC output of the three phase inverter.	10
AC Coupling using a non-SolarEdge Inverter	For sites with an already installed PV system with a non-SolarEdge single phase or three phase inverter, the StorEdge system can be AC-coupled to the existing inverter, i.e. the SolarEdge inverter used to manage the battery is connected to the AC output of the existing inverter.	11

For configurations with more than one SolarEdge inverter, the inverters are connected to each other with RS485, with one inverter configured as the master and connected to the SolarEdge monitoring server.

Compatibility Information

The following table lists the StorEdge applications that can be used for each system configuration:

System Configuration	Mode of Operation			
	Maximize Self-consumption	Charge/Discharge Profile Programming	Zero Export Limitation	Non-Zero Export Limitation
Basic Configuration	✓	✓	✓	✓
Large Residential PV Systems	✓	✓	✓	✓
AC coupling using a SolarEdge Three Phase Inverter	✓			✓
AC coupling using a non-SolarEdge Inverter	✓			✓

Related Documentation

For detailed installation and configuration instructions of the system components refer to the following installation guides:

StorEdge Interface installation:

- https://www.solaredge.com/sites/default/files/storedge_interface_installation_with_LG_and_HD_wave.pdf

Inverter installation:

- HD-Wave Inverters Installation Guide:
https://www.solaredge.com/sites/default/files/se_hd_wave_inverter_installation_guide.pdf
- Single Phase Non-HD-Wave Inverters Installation Guide:
<https://www.solaredge.com/sites/default/files/se-inverter-installation-guide.pdf>

Modbus meter installation:

- <https://www.solaredge.com/sites/default/files/solaredge-meter-installation-guide.pdf>

Wiring guide and onsite checklist:

- https://www.solaredge.com/sites/default/files/storedge_interface_wiring_quick_guide_and_on_site_checklist_for_lg_batteries.pdf

Charge/discharge profile programming:

- https://www.solaredge.com/sites/default/files/storedge_charge_discharge_profile_programming.pdf

Export limitation:

- https://www.solaredge.com/sites/default/files/feed-in_limitation_application_note.pdf

System Connection

The following diagrams illustrate the connection of the system components when using the basic configuration: one battery and one StorEdge Interface. The following diagrams contain enlarged segments of this diagram. For further information see the *StorEdge Interface Wiring Guide & On Site Checklist*:

https://www.solaredge.com/sites/default/files/storedge_interface_wiring_quick_guide_and_on_site_checklist_for_lg_batteries.pdf

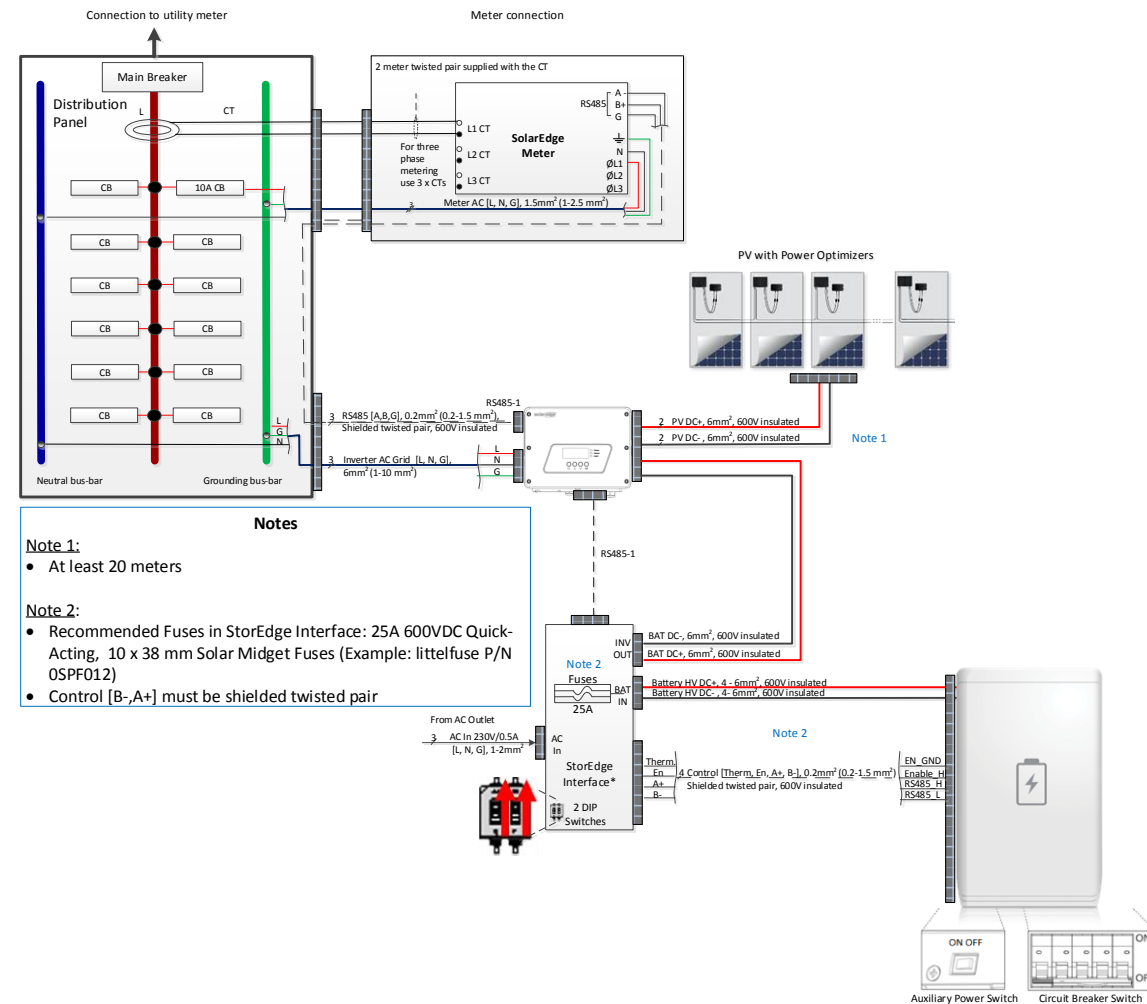


Figure 1: Basic Configuration

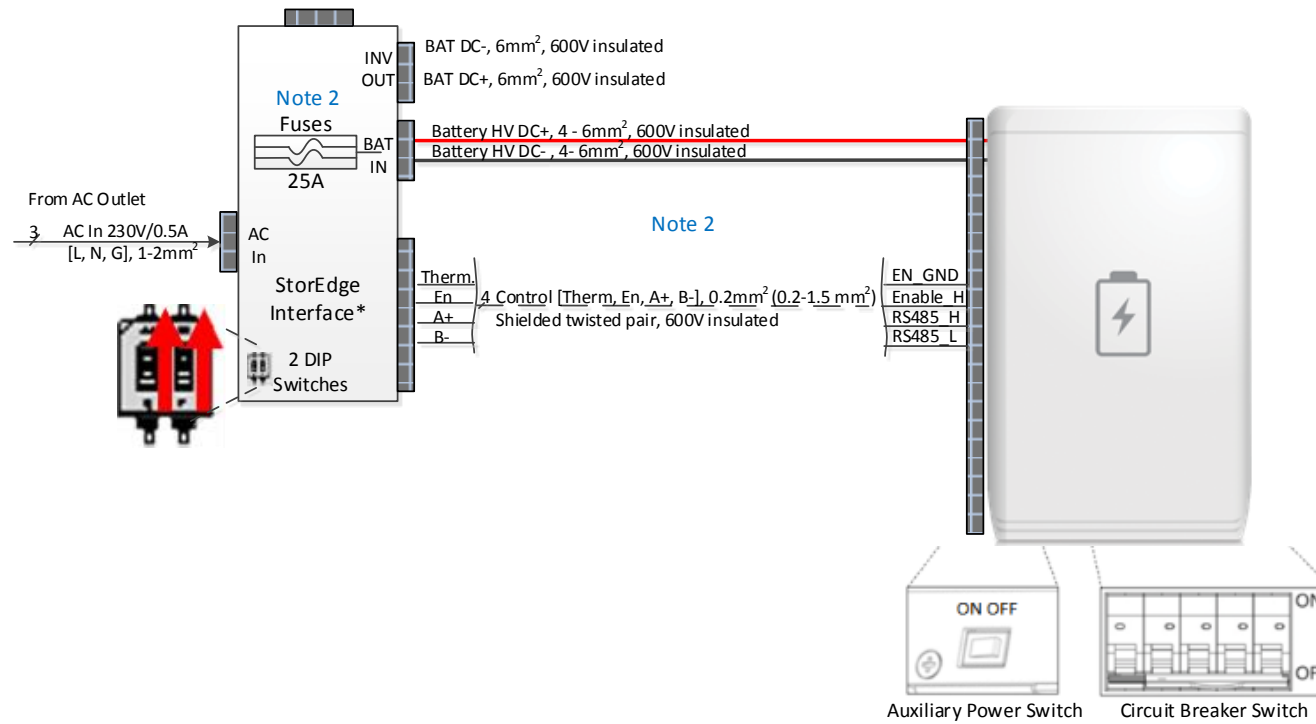


Figure 2: Basic Configuration, Battery - StorEdge Interface Connection

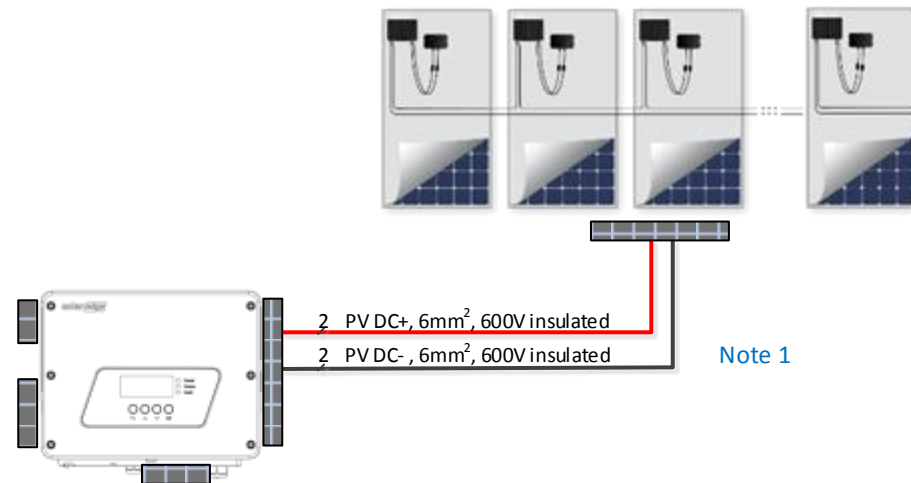


Figure 3: Basic Configuration, Inverter - Power Optimizer Connection

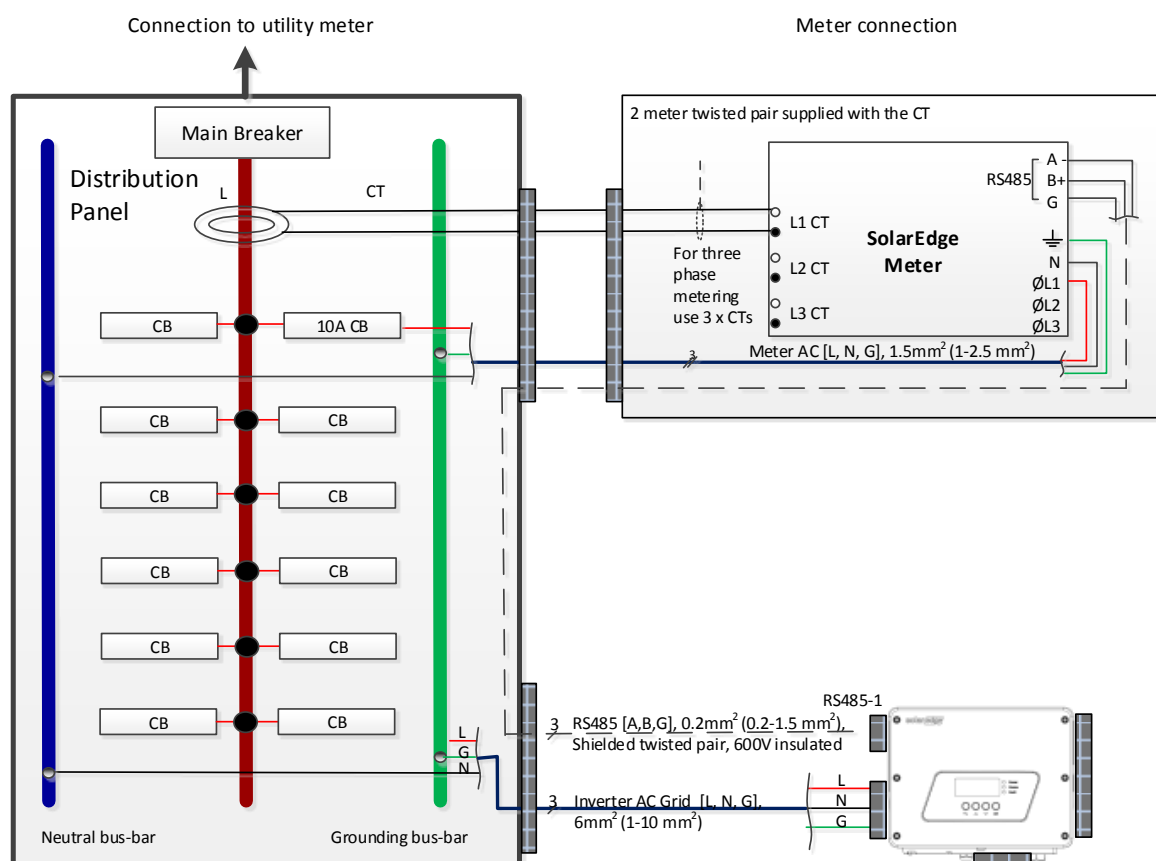


Figure 4: Basic Configuration, Inverter - Main Breaker and Meter Connection

Table 1: Notes for Basic Configuration Diagram

Note	Description
Note 1	<ul style="list-style-type: none"> Maximum 20 meters
Note 2	<ul style="list-style-type: none"> Recommended StorEdge Interface fuses: 25A 600VDC Quick-Acting, 10 x 38 mm Solar Midget Fuses (Example: Littelfuse P/N OSPF012) Control [B-, A+] must be shielded twisted pair

System Configuration Options and Setup

There are various StorEdge system configurations, suitable for different PV systems user needs.

Some system configurations have multiple SolarEdge inverters. The inverters are connected to each other with RS485 and appear under a single site in the monitoring platform.

This section describes each of these configurations, and the required system setup via the inverter LCD and internal buttons and via the monitoring platform (where applicable).

Basic Configuration

This configuration is based on one of each of the StorEdge components and is suitable for most residential systems.

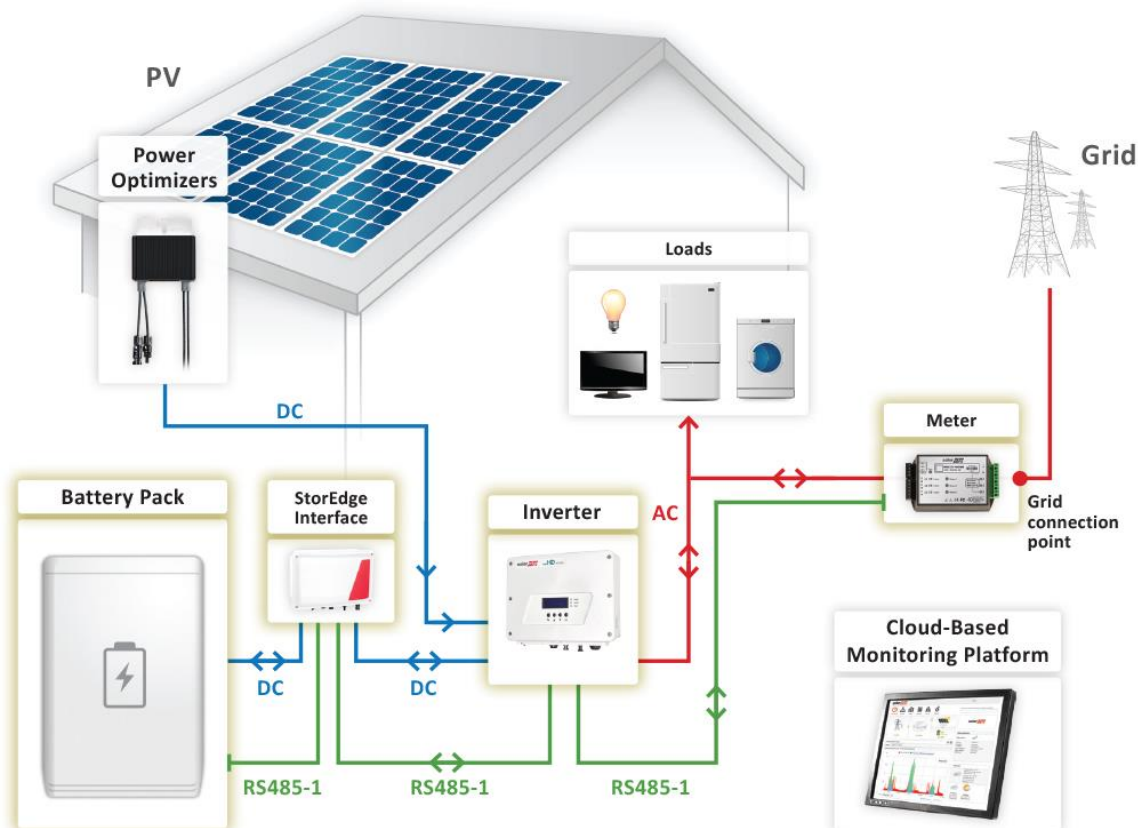


Figure 5: Basic Configuration

► To connect and configure the meter and the battery:

- 2 Turn the battery Auxiliary switch and Circuit Breakers ON
- 3 Turn the AC Breaker of the inverter and interface ON.
- 4 Make sure the wiring is connected according to the diagram above
- 5 If a firmware upgrade is required, see the *StorEdge Interface Wiring Guide & On Site Checklist*:
https://www.solaredge.com/sites/default/files/storedge_interface_wiring_quick_guide_and_on_site_checklist_for_lg_batteries.pdf
- 6 Check the Communication status screen and verify that the battery and the meter are properly connected and configured

```

Dev  Prot  ##
RS485-1<MLT><02><02>
ZigBee <---><---><--->

```

- If Dev is not "MLT", the system is not pre-configured and requires full configuration. Proceed with step 8 below.
- If ## < 02, the meter and/or the battery are not configured correctly. Check the configuration. Proceed with step 7 below.
- If Prot < 02, the meter and/or the battery is not communicating correctly. Check the configuration and wiring connection.

- If Prot = 02 – the battery and meter are configured and communicating properly. Proceed with step 7 below.
- 7** Check that the meter CT rating is set to the correct value as appears on the CT label in order to complete the meter setting. To check, select **Communication → RS485-1 Conf → Device type → Multi Devices → Meter 2 → Device Type → Revenue Meter**. The meter configuration screen is displayed. Configure the meter:
 - a. Check that the CT value is set as it appears on the CT label. If it is not configured correctly, check the communication as described in section below: *To verify communication*.

If communication is verified, skip steps 8 to 10 and proceed with system application configuration for maximize self-consumption or for charge/discharge profile programming as described below.
- 8** Select **Communication → RS485-1 Conf → Device Type → Multi-devices**. A list of devices is displayed.
- 9** Select **Meter 2**. The meter configuration screen is displayed. Configure the meter:
 - a. Select **Device Type → Revenue Meter**
 - b. Check that the CT value is set as it appears on the CT label. To check, select **CT Rating → <xxxxA>**. If it is not configured correctly, use the up/down arrows to set each character, press <Enter> to set the character and move to the next one, then long press on <Enter> to set the value.
 - c. Select **Meter Func.** and select the function according to the meter CT(s) location:
 - i. **Export + Import**: meter CT(s) at grid connection point (as shown in the diagram above)
 - ii. **Consumption**: meter CT(s) at load consumption point
- 10** Select **Battery 1**. The battery configuration screen is displayed. Configure the battery:
 - a. Select **Device Type → Battery Pack**
 - b. Select the battery protocol: **LG Battery**, and **ID: 15**
- 11** After configuring the meter and the battery proceed with system application configuration for maximizing self-consumption or for charge/discharge profile programming.

► **To maximize self-consumption:**

- 1** Select **Power Control → Energy Manager → Energy Ctrl → Max Self-Consume**.

► **To set up Charge/Discharge Profile Programming:**

- 1** Select **Power Control → Energy Manager → Energy Ctrl → Time of Use**.
- 2** Select **Storage Ctrl → AC Charge Lim → Limit Type**, and set one of the following limits:
 - a. Set %PV to enter a limit as a percentage of year-to-date energy production.
 - b. Set kWh to enter a fixed annual energy limit.
 - c. Set None to unlimit the charging.
- 3** Profile loading can be done remotely from the monitoring platform. Refer to *Appendix A – Creating a Charge/Discharge Profile* on page 14 for information on creating a charge/discharge profile.
 - a. In the monitoring platform, click the Admin icon and select the Energy Manager tab.
 - b. Select **Set profile from server** check box.
 - c. Select **Apply this profile** and select the profile name from the drop-down list. The profile is applied to all inverters in the site.
 - d. Click **Save**. The Energy Manager window displays:
 - i. In the Storage mode column: "Storage Profile" (if you applied a profile)
 - ii. In the Storage profile name column: The specific profile that was applied to the site, as reported by each inverter.

► **To verify communication:**

After connecting and configuring a communication option, perform the following steps to check that the connection to the monitoring server has been successfully established.

- 1** Turn on the AC to the inverter by turning ON the circuit breaker on the main distribution panel.
- 2** Wait for the inverter to connect to the SolarEdge monitoring platform. This may take up to two minutes.
- 3** Push the OK / LCD button several times, until you see the communication screen on the LCD panel:

V _{ac} [V]	V _{dc} [V]	P _{ac} [W]
230.2	18.4	0
P_OK: 000/000		<S_OK>
		OFF

S_OK: Indicates that the connection to the SolarEdge monitoring platform is successful.

- 4 For additional verification, refer to Appendix B – Verifying StorEdge Functionality on page 15.

Large Residential PV Systems

For residential sites with large PV systems, two single phase inverters may be installed. One inverter manages the battery and functions as a PV inverter, and another inverter is used for production of the additional PV power.

The two inverters can optionally be connected to different phases.

For StorEdge interface installations with two HD-Wave inverters, both inverters require CPU version 3.2186 and above. If an upgrade is needed, refer to the StorEdge and Device Control Firmware Updates page at:

<https://www.solaredge.com/storedge/firmware>

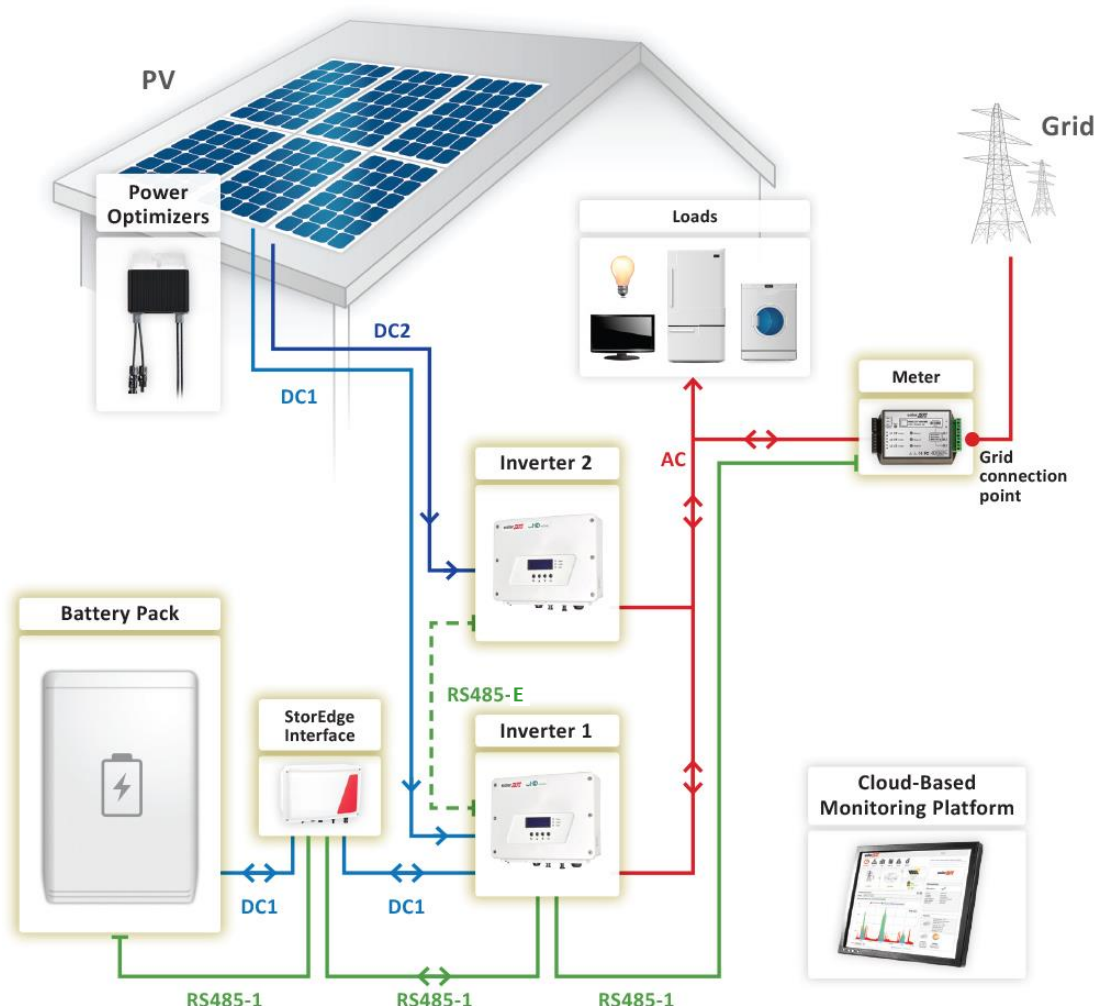


Figure 6: Large residential PV systems

► Configure the system:

- 1 Configure inverter 1, meter and battery as described in the *Basic Configuration*.
- 2 After configuring the meter and the batteries proceed with system application configuration for inverter 1:
 - a. For charge/discharge profile programming, as described in the basic configuration, or
 - b. To maximize self-consumption:

Select **Power Control** → **Energy Manager** → **Energy Ctrl** → **Max Self-Consume**
- 3 Inverter 2 requires the same CPU version as inverter 1.

► Configure Inverter Master-Slave Communication:

- 1 Connect inverter 1 RS485 Expansion port to inverter 2 RS485-1 port using an RS485 twisted pair cable. Terminate both sides.
- 2 In Inverter 1, select **Communication** → **RS485-E Conf** → **Enable**. Press Enter to continue.
- 3 Select **Protocol** → **Master**
- 4 Select **Slave Detect**. Verify that the inverter reports the correct number of slaves.
- 5 Inverter 2 does not require communication configuration.

► Verifying Communication:

Verify communication as described in the Basic Configuration section.

AC Coupling using a SolarEdge Three Phase Inverter

For sites that require a three phase inverter, or already have a three phase SolarEdge inverter installed, the StorEdge single phase system can be AC-coupled to the three phase SolarEdge inverter. The StorEdge AC Coupled inverter is used to manage the battery and is connected to the AC output of the three phase inverter.

For StorEdge interface installation with an HD-Wave inverter, both inverters require CPU version 3.2186 and above. If an upgrade is needed, refer to the StorEdge and Device Control Firmware Updates page at:

<https://www.solaredge.com/storedge/firmware>



NOTE

The StorEdge AC Coupled inverter does not work with power optimizers or as a standard solar PV inverter.



NOTE

Charge/discharge profile programming is not applicable to StorEdge AC coupled systems.

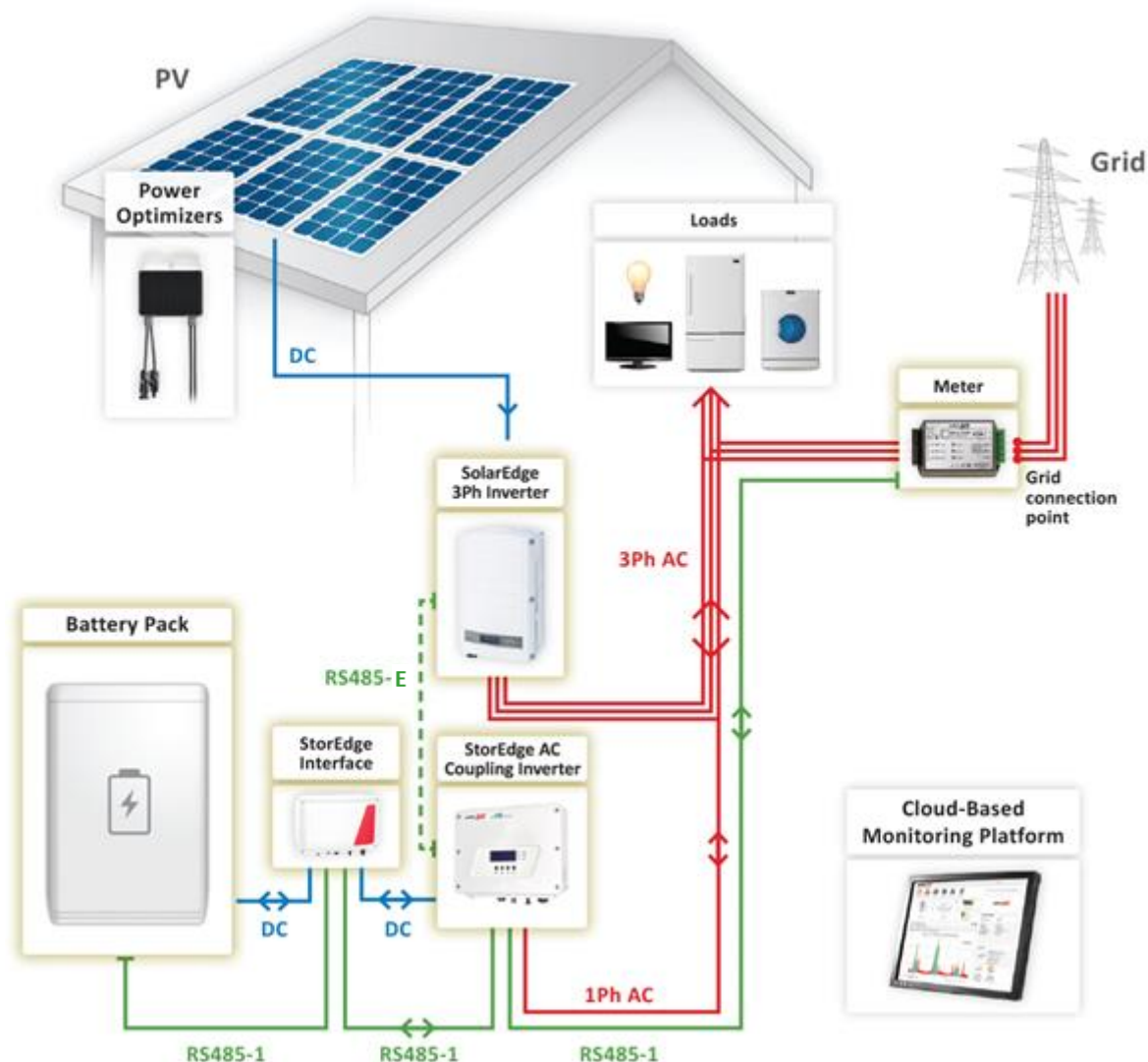


Figure 7: Three Phase PV Systems

► **Configure the Meter and the Battery:**

- 1 Configure the meter and battery from the single phase inverter as described in the Basic Configuration section.

► **To set up Maximize Self-consumption:**

- 1 Select **Power Control** → **Energy Manager** → **Energy Ctrl** → **Max Self-Consume**
- 2 Continue setup as described in the basic configuration.

► **Configure Inverter RS485 Communication:**

- 1 Install an RS485 Expansion Kit in the three phase inverter.
- 2 Connect the single phase inverter's RS485 Expansion port to the three phase inverter's RS485 port using an RS485 twisted pair cable. Make sure to terminate both sides.
- 3 The three phase inverter does not require communication configuration.
- 4 Configure the single phase inverter with the RS485 Expansion port:
 - a. Select **Communication** → **RS485-E Conf** → **Enable**. Press <Enter> to continue.
 - b. Select **Protocol** → **Master**.
 - c. Select **Slave Detect**. Verify that the inverter reports the correct number of slaves.

► **Verifying Communication:**

Verify communication as described in the Basic Configuration section.

AC Coupling using a non-SolarEdge Inverter

For sites with an already installed PV system with a non-SolarEdge single phase or three phase inverter, the StorEdge system can be AC-coupled to the existing inverter. The StorEdge AC Coupled inverter is used to manage the battery and is connected to the AC output of the three phase inverter.

**NOTE**

The StorEdge AC Coupled inverter does not work with power optimizers or as a standard solar PV inverter.

**NOTE**

Charge/discharge profile programming is not applicable to StorEdge AC coupled systems.

In this configuration, an additional meter is connected. The additional meter is used to measure PV production of the existing inverter and to enable monitoring of system production, consumption and self-consumption; the meter is not required for system operation, only for full system monitoring.

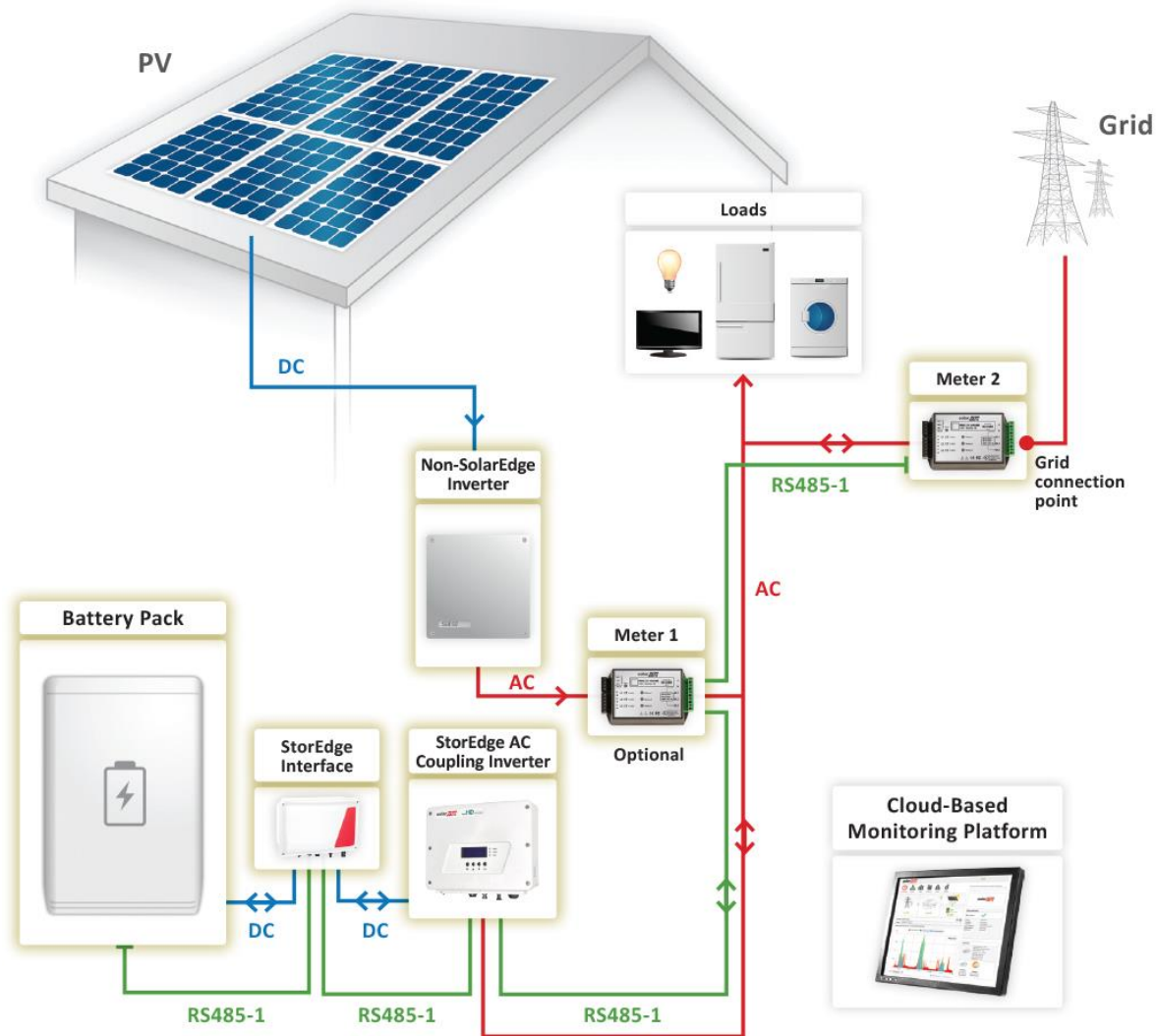


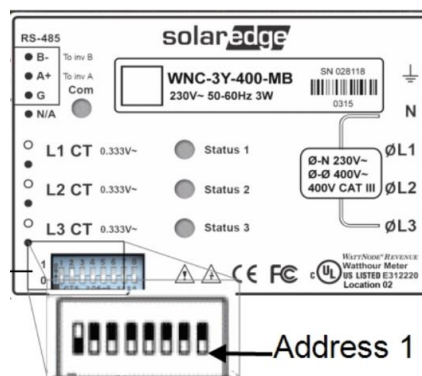
Figure 8: Non-SolarEdge PV systems

► **Configure Meter 2 and the Battery:**

- 1 Connect the two meters to the same RS485 communication bus as described in Appendix B of the Meter Installation Guide <https://www.solaredge.com/sites/default/files/solaredge-meter-installation-guide.pdf>
- 2 Configure the meter and battery as described in the Basic Configuration section.

► **Configure Meter 1 (Non-SolarEdge Inverter Production Meter)²:**

- 1 The meter is pre-configured to address 2. Using the DIP switches, configure the meter to address 1: Set DIP switch 1 (the leftmost switch) to 1, and all other switches to 0.



- 2 Select **Communication** → **RS485-1 Conf** → **Device Type** → **Multi-devices**. A list of devices is displayed.
- 3 Select **Meter 1**. The meter configuration screen is displayed. Configure the meter:

² The meter is required to measure maximum self-consumption power on loads, derived from production of grid, inverter and Non-StorEdge inverter,

- a. Select **Device Type** → **Revenue Meter**
- b. Set the CT value that appears on the CT label: **CT Rating** → **<xxxxA>** (use the up/down arrows to set each character, press Enter to set the character and move to the next one, long press on Enter to set the value)
- c. Select **Meter Func** → **Non-SE Production**

After configuring the meters and the battery, proceed with system application configuration:

- For charge/discharge profile programming, as described in the Basic Configuration section, or
- To maximize self-consumption:
Select **Power Control** → **Energy Manager** → **Energy Ctrl** → **Max Self-Consume**

► **Verifying Communication:**

Verify communication as described in the Basic Configuration section.

Appendix A – Creating a Charge/Discharge Profile

A charge/discharge profile is created from a yearly calendar, repeated for 20 years as long as no profile changes are made. The yearly calendar is divided into segments, with one of seven charge/discharge modes assigned to each segment.

A profile comprises three components:

- 1** A daily profile type: defines the charge/discharge modes throughout a day. Different day types may be defined, for example, winter weekday, spring weekday, weekend, holiday, etc.
- 2** A seasonal profile: defines weekly profiles to use during specified periods of the year. These periods must cover the entire year. A typical use case is creating seasonal profiles corresponding to the seasonal changes of electricity rates.
- 3** Special day type: defines dates that should have a specific daily profile instead of the profile defined for the relevant period. For example, if you defined a seasonal profile from Dec. 15 to Jan. 15 but want the system to have a different daily profile for New Years, define a special day. Special days can be set as one-time events or as recurring events.



NOTE

Charge/discharge profile programming is not applicable to StorEdge AC coupled systems.

Charge/Discharge Modes

Table 2: Charge/Discharge Modes

Mode	Description
OFF	No battery charging/discharging; can be used to extend battery lifetime by minimizing the number of shallow discharges (for example at nighttime or during the winter).
CHARGE_EXCESS_PV	Charge battery with PV power, which is not self-consumed.
CHARGE_FULL_PV	Charge battery with all available PV power until it is full, and only then use PV power for self-consumption; useful when import rate is low.
CHARGE_FULL_PV_AC	Charge battery with all available PV power and with grid power until it is full, and only then use PV power for self-consumption; useful when import rate is very low.
DISCHARGE_MAXIMIZE_FEED_IN	Discharge battery until the inverter reaches its AC limit; useful when export rate is high.
DISCHARGE_MINIMIZE_PURCHASED	Discharge battery only for self-consumption, not for export to the grid.
MAXIMIZE_SELF_CONSUMPTION	Charge/discharge battery as needed to maximize self-consumption.

Creating a Profile

This procedure can be completed before the system is installed or connected to the monitoring platform, that is, the site was defined in the monitoring platform but not connected.

► To create a profile:

- 1** Perform steps 1-9 in the procedure, “To create a storage profile” in the application note: *Charge/Discharge Profile Programming through the Monitoring platform – Application Note*, at:
https://www.solaredge.com/sites/default/files/storedge_charge_discharge_profile_programming.pdf

Appendix B – Verifying StorEdge Functionality

After system installation and configuration is completed, verify that the system is properly operating:

► Verify the meter function:

- 1 Make sure other power sources (e.g. non-SolarEdge PV inverter) are not producing power.
- 2 Verify the AC is ON.
- 3 When using StorEdge interface SESTI-S1, turn the StorEdge Interface ON/OFF switch to ON.
- 4 Check the meter installed at the grid connection point:
 - a. Turn the inverter ON/OFF switch to OFF.
 - b. Connect loads on one of the measured phases.
 - c. Press the external LCD light button to display the Import or Export meter status screen, and check that the import or export power is greater than zero:

```
Import Meter
Status:      <OK/Error>
Power [W]:   xxxxx.x
Energy [Wh]: xxxxx.x
```

- d. Press the LCD light button to display the Export meter status screen, and check that the Export power is equal to zero. If it is not equal to zero check the CT direction on all connected phases.

► Verify maximized self-consumption:

- 1 Verify the inverter ON/OFF switch is ON.
- 2 Turn on as many loads as needed so that consumption will be greater than the inverter's maximum AC power. In the inverter LCD check that the Meter status screen is displaying import power greater than zero.
- 3 Press the inverter LCD light button to display the Smart Energy Management and the Battery status screens, and check that:
 - a. **State** = Discharging (assuming consumption > PV production, inverter maximum AC power > PV production)
 - b. **PWR** > 0

```
BSN: XXXXXXXXXX ID:24
SOE: 89%         PWR: 2W
Total: <x>Wh
State: Discharging
```

- 4 While the PV modules are exposed to sunlight, verify that the battery is charging properly:
 - a. Minimize consumption by turning off all the load circuit breakers, except for the inverter.
 - b. In the inverter LCD check that the Meter status screen is displaying import power close to zero.
 - c. Press the external LCD light button to display the Battery status screen, and check that:
 - i. **State** = Charging
 - ii. **SOE** percentage is increasing
 - iii. **PWR** > 0

```
BSN: XXXXXXXXXX ID:24
SOE: 89%         PWR: 2W
Total: <x>Wh
State: Charging
```

SolarEdge Support Contact Information

If you have technical queries concerning our products, please contact us:

Australia (+61)	1800 465 567	support@solaredge.net.au
APAC (Asia Pacific)		support-asia@solaredge.com
Belgium (+32)	080073041	support@solaredge.be
France (+33)	0800917410	support@solaredge.fr
Germany (+49)	089-45459730	support@solaredge.de
Italy (+39)	800 784 824	support@solaredge.it
United Kingdom (+44)	0800 028 1183	support@solaredge.uk
Greece (+30)	00800125574	
Netherlands (+31)	0800-0221089	
New Zealand (+064)	0800 144 875	
Worldwide (+972)	073-2403118	
Fax (+972)	+972 73 240-3117	