Technical Note – Retrofit Application, SigenStors Integrated with Installed Inverters

The historical version

Version 1.0, March, 2024 – Initial release

Version 2.0, April, 2024 - Second release: Added zero export function instruction

Version 3.0 July, 2024- Third release: Added the instruction of third party inverters connected to Gateway Smart Port

Version 4.0, August, 2024- Revise the Diagram of adding third party inverters

Version 5.0, October, 2024- Revise the Diagram of adding third party inverters for On-grid Retrofit Solution

Background

For existing on-grid solar PV projects which are already in operation (using inverters from other brands), it is hoped that by adding a battery energy storage system (BESS) the entire installation can achieve maximum self-consumption, while keeping a centralized monitoring, management, and zero-injection requirements between the newly added BESS and the existing on-grid solar system. The retrofit solution proposed via SigenStors provided by Sigenergy can meet the requirements in this scenario.

Introduction of the existing on-grid system

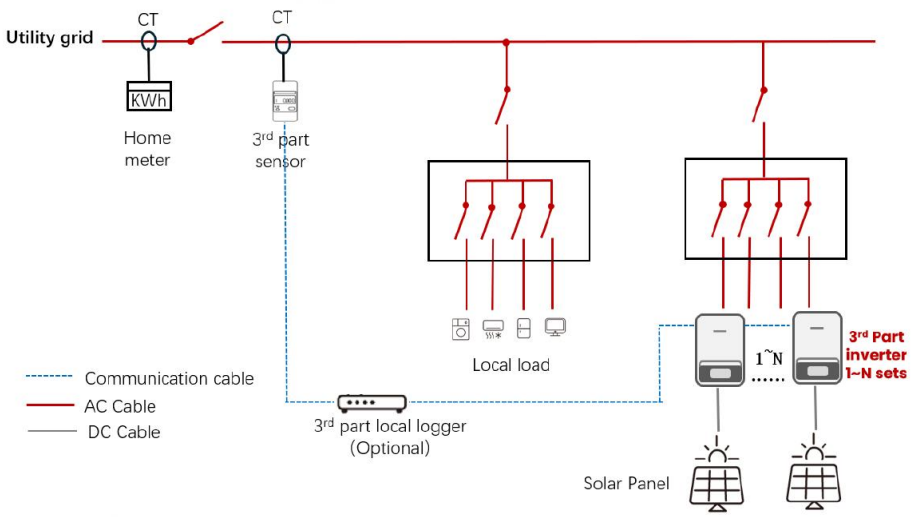


Figure 1: Single line diagram of the existing on-grid system

The existing on-grid system description:

1. Pure on-grid scenario, power outage scenario will not occur (There is no backup).
2. One or several 3rd-party PV on-grid inverters have been installed.
3. No existing battery system.
4. A CT or power sensor has been installed to meet zero-injection requirement: the inverter(s) communicates with the power sensor (or through a local logger) to detect the power at the grid connection point in real time. When the inverter detects power injection into the grid at the power sensor point, it will limit its AC output power to ensure that the solar system has no power injection into the grid.
5. The existing inverters system is unable to communicate with a potential newly solar and ESS system.

Requirements for retrofit:

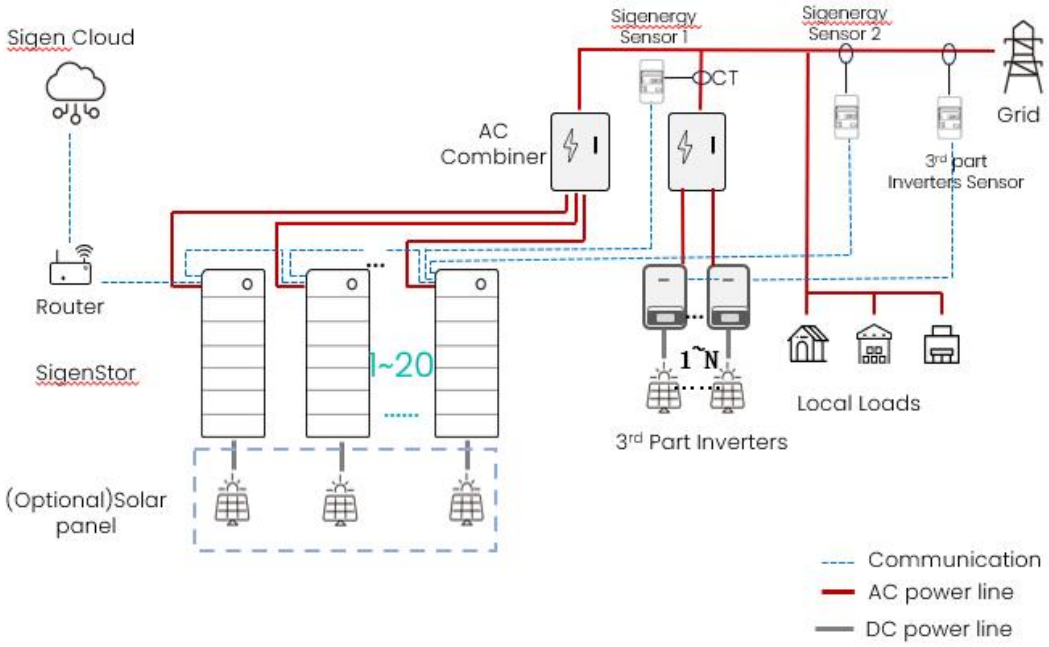
1. By adding a Sigenergy battery system (DC or AC coupled), the new system can support centralized management, maximum consumption, and zero injection requirements.
2. The excess solar power from existing PV inverters can be captured by the newly added batteries.

3. When the solar power of existing inverters is insufficient, Sigenergy's energy storage system supplements power to the loads.
4. Support monitoring of the newly added system information and existing inverters system information at the same time.

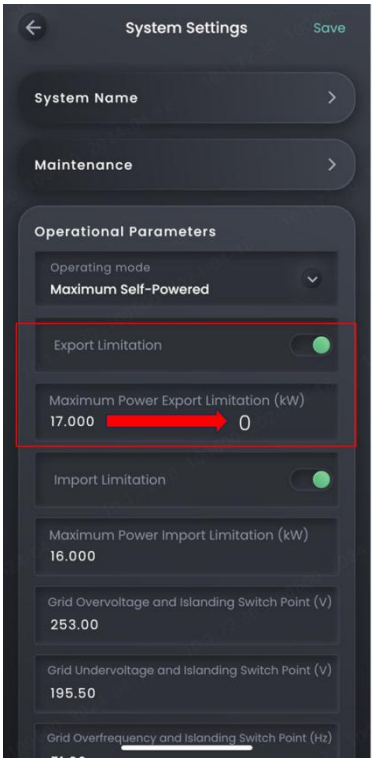
Sigenergy On-grid Retrofit Solution

In response to the existing system and retrofit requirements, Sigenergy can provide the solution with all-in-one Sigenstor and two power sensors, which can achieve the retrofit requirements mentioned above without communication with existing 3rd-party inverters.

The single line diagram of the retrofit solution is shown below:



- **Sigenergy Sensor 1** is used to get the power generation data (such as AC active power, AC current, voltage and yield) of the existing solar system and display it on the mySigen APP.
- **Sigenergy Sensor 2** is mainly used for power control at the grid connection point, to realize the maximum consumption and zero-injection functions for the entire system. To achieve zero injection functions, please refer to the image below which indicates the two steps to enable zero injection functions from mySigen APP.



Step 1: Enable the Export Limitation

Step 2: Set Maximum Export Limitation to "0"

Control strategy for maximum consumption and zero-injection

1. **When the output power of the 3rd-party inverters is less than the Local Load power**: the newly added SigenStors will supplement the power supply to the load. When both the newly added SigenStors and the 3rd-party inverters cannot support the load, the remaining power supply demand is supplemented by importing power from the utility grid.
2. **When the power of the 3rd-party inverters exceeds the load power:** the newly added SigenStor will detect the injection current at the point of **Sienergy Sensor 2** and control the SigenStor to charge the battery to ensure zero injection at the point of **Sienergy sensor 2**. In this way, the excess power of the 3rd-party inverter will charge Sienergy's battery and will not be wasted.
3. **When the output power of the 3rd-party inverters is larger than the load power, and the remaining power is larger than the chargeable power of the newly added SigenStors**: the SigenStors will charge the battery at its maximum chargeable power. Meanwhile, 3rd-party inverters can detect the injection current at the point of the 3rd party sensor and limit their output power to ensure zero-injection at the point of the 3rd party sensor.

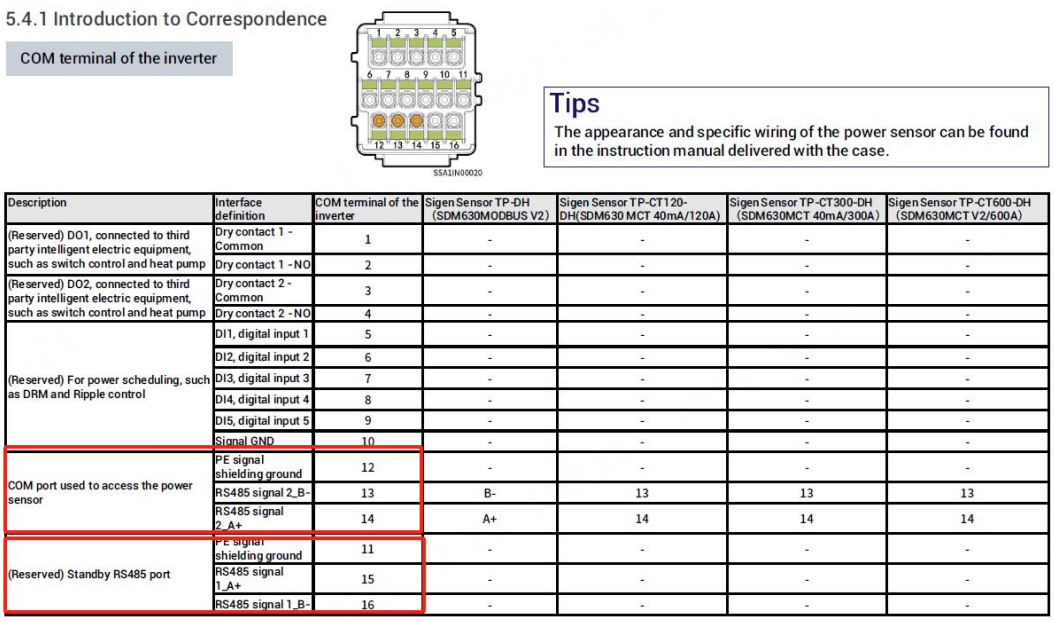
Important Note:

From the above control strategy, Sienergy' s SigenStors will prioritize controlling zero-injection at the point of **Sigenergy Sensor 2**, and then the 3rd-party inverters will control zero-injection at the point of 3rd party sensor. To keep a stable control, the zero-injection parameter at the point of **Sigenergy Sensor 2** is generally set to be slightly **smaller** than that at the point of 3rd party sensor. In this way, Sienergy's SigenStors will prioritize the implementation of the zero-injection strategy. If it exceeds the control range of SigenStors, the 3rd-party inverters will do the zero-injection function and limit its output power.

- For example: Setting the zero-injection parameter of the 3rd-party sensor to 0W, and setting that of the **Sigenergy Sensor 2** to (-100)W. In this way, the Sigenstors system will constantly control the power at the point of **Sigenery Sensor 2** ≤ (-100)W, and the 3rd-party inverters will control the power at the point of 3rd-party sensor ≤ 0W, ensuring that the SigenStors prioritizes zero-injection control.

Important Note:

Sigenergy Sensor 1 in **Figure 2** can only be connected to the RS485-1 port of SigenStor **(Pin 15 and Pin 16 shown as below)**. **Sigenergy Sensor 2** in **Figure 2** can only be connected to the RS485-2 port of the SigenStor (**Pin 13 and Pin 14 shown as below)**. The order of the two ports cannot be exchanged.



Description	Interface definition	COM terminal of the inverter	Sigen Sensor TP-DH (SDM630MODBUS V2)	Sigen Sensor TP-CT120-DH(SDM630 MCT 40mA/120A)	Sigen Sensor TP-CT300-DH (SDM630MCT 40mA/300A)	Sigen Sensor TP-CT600-DH (SDM630MCT V2/600A)
(Reserved) DO1, connected to third party intelligent electric equipment, such as switch control and heat pump	Dry contact 1 - Common	1	-	-	-	-
	Dry contact 1 - NO	2	-	-	-	-
(Reserved) DO2, connected to third party intelligent electric equipment, such as switch control and heat pump	Dry contact 2 - Common	3	-	-	-	-
	Dry contact 2 - NO	4	-	-	-	-
(Reserved) For power scheduling, such as DRM and Ripple control	DI1, digital input 1	5	-	-	-	-
	DI2, digital input 2	6	-	-	-	-
	DI3, digital input 3	7	-	-	-	-
	DI4, digital input 4	8	-	-	-	-
	DI5, digital input 5	9	-	-	-	-
	Signal GND	10	-	-	-	-
COM port used to access the power sensor	PE signal shielding ground	12	-	-	-	-
	RS485 signal 2_B-	13	B-	13	13	13
	RS485 signal 2_A+	14	A+	14	14	14
(Reserved) Standby RS485 port	PE signal shielding ground	11	-	-	-	-
	RS485 signal 1_A+	15	-	-	-	-
	RS485 signal 1_B-	16	-	-	-	-

Figure 3: Inverter RS485 Wiring Diagram

Adding an existing third-party installed inverter in the mySigen APP:

Please log in with an end-user account:

1. Select “Add System Device”
2. Select ” Inverter”
3. Fill in the brand and model of the installed inverters
4. Select the power sensor model
5. Finish adding installed inverters

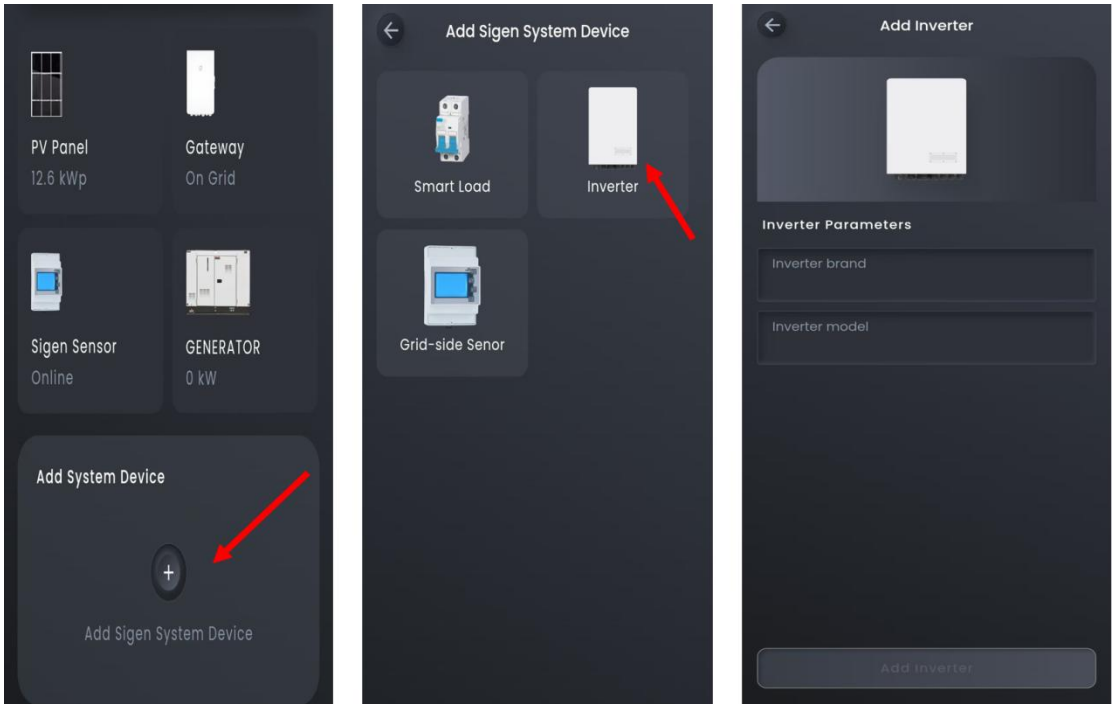


Figure 4: Interface of adding 3rd party inverter system

Query the 3rd-party inverters system information on the mySigen App:

After adding the existing inverter, you can query the following 3rd-party inverters system information on the mySigen App:

1. Real time information of installed inverters, including voltage, current, active power and energy.
2. The installed inverters can be displayed on the homepage with energy and power.

*Additional display information will be added in the next version of the mySigen APP

Backup retrofit solution:

If the newly added system also needs backup capabilities where it is required to

supply power when power outage occurs, Sigenergy can provide a solution for this scenario through its Sigen Gateway in combination with the SigenStor solution.

Important Note:

- 3rd party inverters can be connected to the Sigen Gateway **Grid Port (with grid) or Smart Port**.
- If the 3rd party inverters are connected to the **Smart Port**, please contact our engineer for separate verification for the compatibility of the 3rd party inverters. Please check the list in the following for the inverter brands which have been verified. After verification, the 3rd party inverters can operate in back-up situations. In off-grid situation, if the power sent from the 3rd party inverters is less than the load power plus the charging power of Sigen inverters, the 3rd party inverters can operate normally; however, if the power sent from the 3rd party inverters is greater than the load power plus the charging power of Sigen inverters, the 3rd party inverters will stop operating because of startup of the protective measure from SigenStor system.

  *Note: In some cases, the load power might be zero. Thus, it is suggested that the power of the 3rd party inverters should be less than the charging power of the connected Sigen systems.

- Local load is connected to the Sigen Gateway grid **Backup Port**.
- The SigenStors are connected to the Sigen Gateway **Inverters Port**, only supporting a maximum of 12 SigenStors in parallel connection.
- If the 3rd party inverters are connected to grid port, when a power outage occurs, the SigenStors and the gateway will switch to off grid mode, and only the SigenStors will supply the load. The 3rd party inverters will shut down.
- When there is utility grid, the same control strategy as with the on-gird retrofit solution introduced above will apply.
- The Sigen Gateway does not support the 3rd-party inverters being connected to the **Backup Port.**

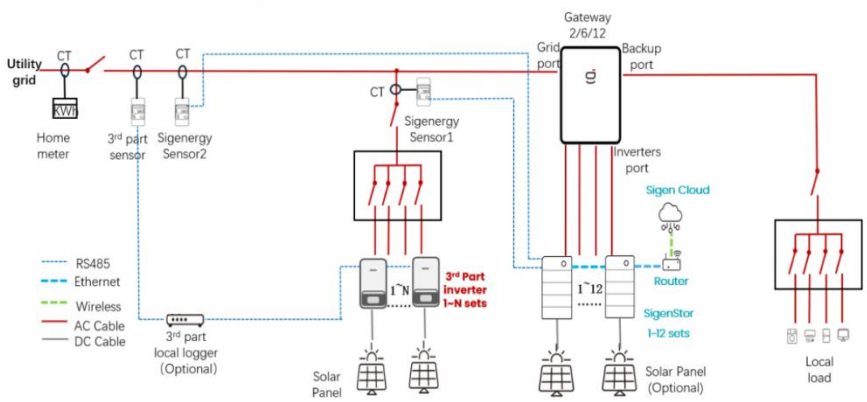


Figure 5: Single line diagram of the retrofit solution (Backup scenario): 3rd party inverters are connected to **Grid Port**

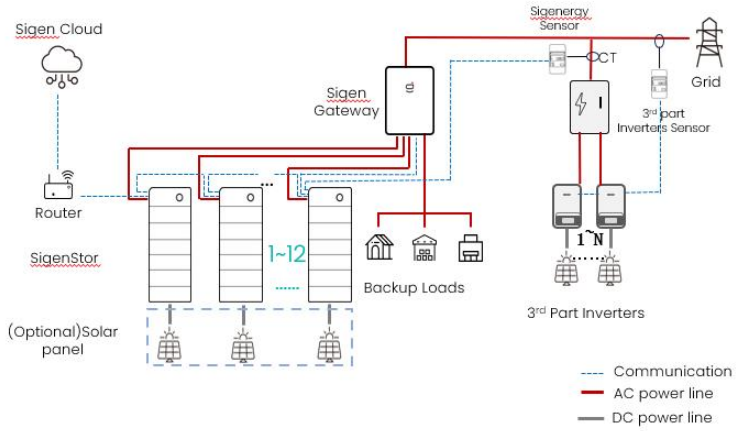


Figure 6: Single line diagram of the retrofit solution (backup scenario): 3rd party inverters are connected to **Smart Port**