

Understanding Sunlight Backup system for installers and system designers

This document describes the Sunlight Backup configuration using IQ8 Series Microinverters. The following sections are included in this document:

[Introduction](#)

[System components](#)

[Essential load solution](#)

[Essential load selection](#)

[Configuring a Sunlight Backup system](#)

[System behavior](#)

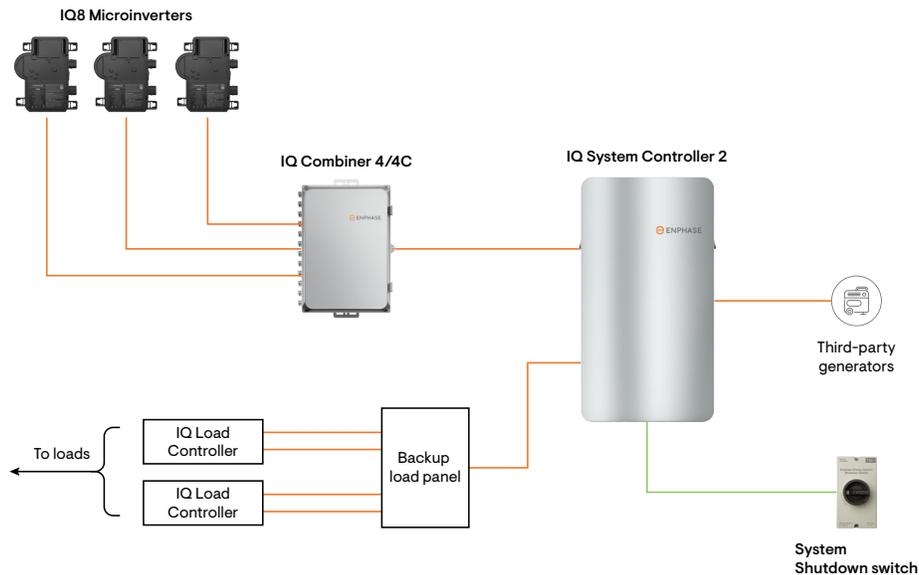
Introduction

An Enphase Sunlight Backup system provides backup power when the sun is shining. The system provides backup for up to four 240 V or eight 120 V pre-selected, essential load circuits. The system consists of IQ8 Series Microinverters, IQ System Controller 2, IQ Combiner 4C, up to two IQ Load Controllers and other accessories as needed. The Sunlight Backup system needs at least one IQ Load Controller installed on site.

NOTE: Sunlight Backup should only be used for the essential loads in the home. Using the solution to back up the entire home will lead to a poor experience and is not supported by Enphase.

System components for Sunlight Backup

The system consists of IQ8 Series Microinverters, IQ System Controller 2, IQ Combiner 4/4C, either one or two IQ Load Controllers, and other accessories as needed.



- **IQ8 Series Microinverters** are the industry’s first split-phase, grid-forming solar microinverters, capable of converting DC power to AC power efficiently. They are essential for a Sunlight Backup system. The Sunlight Backup system supports up to 64 A continuous AC output i.e., 15.4 kW AC nameplate aggregate from the IQ8 Microinverters.
- **IQ Combiner 4/4C** consolidates the interconnection of PV equipment into a single enclosure and streamlines installations by providing a consistent, pre-wired solution for residential applications. The IQ Combiner 4/4C includes an Enphase IQ Gateway with the latest software needed to support IQ8 Microinverters. Install the communication kit, COMMS-CELLMODEM-M1-06 or COMMS-KIT-01, with IQ Combiner 4 or 4C respectively, to enable wireless communication with IQ Battery and IQ System Controller 2.
- **IQ System Controller 2** automatically detects utility power outages and seamlessly transitions to backup power. It enables grid-forming IQ8 Series Microinverters and compatible third-party AC standby generators to be connected to the home. IQ System Controller 2 is a certified rapid shutdown device for IQ8 Microinverters operating in backup configurations.

NOTE: IQ System Controller 1 will not work and is not safe to use with IQ8 Series Microinverters.

- **Enphase Energy System Shutdown Switch** must be used in an Enphase Energy system with grid-forming IQ8 PV Microinverters when used with IQ System Controller 2 to comply with 2017 NEC 690.12. It functions as the rapid shutdown initiator for the system.
- **IQ Load Controller** Each IQ Load Controller unit can be used to control two 240 V loads or four 120 V loads. Dedicated loads up to 36 A resistive/25 A inductive or branch circuits with multiple loads up to 32 A resistive/25 A inductive are supported. A Sunlight Backup system needs at least one IQ Load Controller installed on site.

Refer to the “[System use cases for IQ8 Microinverters](#)” technical brief for more details on single line diagram and bill of materials for a Sunlight Backup system.

NOTE: Compatible third-party backup generators can be added to a Sunlight Backup system. Refer to the “[Generator integration technical brief](#)” to know details about adding a generator to the system. Only use utility sense generators with Sunlight Backup systems. A generator in a Sunlight Backup system must be configured to operate in **Automatic** mode using the Enphase App. The system starts the generator and connects it to the home loads whenever there is a grid outage. However, power from the generator is used only if the power produced by microinverters is insufficient to support the home loads.

Essential load solution

The power produced by IQ Microinverters depends on the solar irradiance at the site location, which can vary depending on cloud cover, shading on the PV panels, time of the day, seasons, and other factors. The system may collapse if the power produced is less than what is needed to power the loads.

Load control is a mandatory component in any IQ8 Sunlight Backup system. This ensures that one or more of the essential loads can be shed, if required, to successfully form a microgrid when limited power is available. An Essential Loads solution consists of:

- An off-the-shelf panel with up to four 240 V or eight 120 V essential load circuits that are backed up by the system.
- Up to two IQ Load Controllers - Each IQ Load Controller can be used to perform circuit-level control for two 240 V loads or four 120 V loads. Each 240 V load can be controlled independently, but the 120 V loads can be controlled in groups of up to two loads. The product is rated for dedicated loads up to 36 A resistive/25 A inductive or branch circuits with multiple loads up to 32 A resistive/25 A inductive.

Note: a) At least one IQ Load Controller is necessary for this solution. b) Each IQ Load Controller must be installed as per instructions in its [Quick Install Guide](#). Each IQ Load Controller contains two contactors and a power supply. The input of the power supply must be drawn from a dedicated breaker in the backup loads panels and the output must be connected to the coils of both contactors via auxiliary contacts in the IQ System Controller 2. This enables the IQ System Controller to control the loads connected to the IQ Load Controllers.

Essential load selection

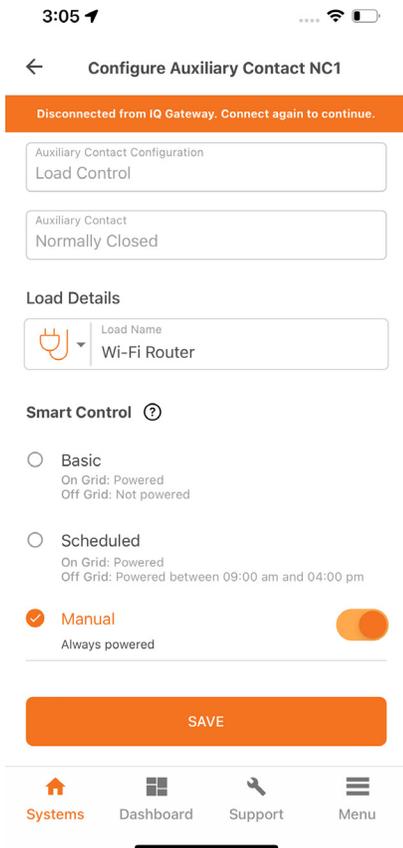
Work with the homeowner to select the essential loads. Keep the following points in mind while selecting the essential loads.

1. Enphase recommends that the backup loads should not exceed 30% of the power of the IQ8 Microinverters. For example, the rated power output for a system with 24 IQ8 Microinverters is 5.7 kW AC. The backup loads should not exceed 1.7 kW AC (30% of 5.7 kW AC).
2. The system can back up four 240 V or eight 120 V circuits. While backing up four 240 V circuits, it controls each of the backed-up circuits individually. While backing up eight 120 V circuits, the backed-up circuits are divided into four groups with two circuits each, and the system can control each group (of two circuits). In case a single Load Controller is used, the 120 V loads are grouped into two groups.
3. Ensure that each auxiliary contact is named in a way that reflects the loads controlled by that contact. These names are shown to the homeowner in the Enphase App and proper naming ensures the homeowner understands the priority of loads and the system behavior.
4. Ensure that the branch circuit with the Wi-Fi router and modem is always an essential load and has the highest priority among the essential load circuits.
5. If another load is added to the auxiliary contact that controls the branch circuit for Wi-Fi, ensure that it is a light load. Overloading this auxiliary contact results in a poor homeowner experience as they will lose their internet connectivity and consequently lose the ability to control loads in their system.

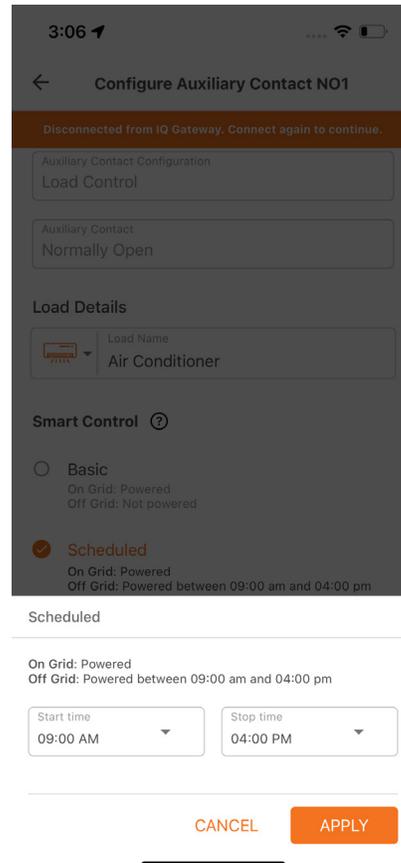
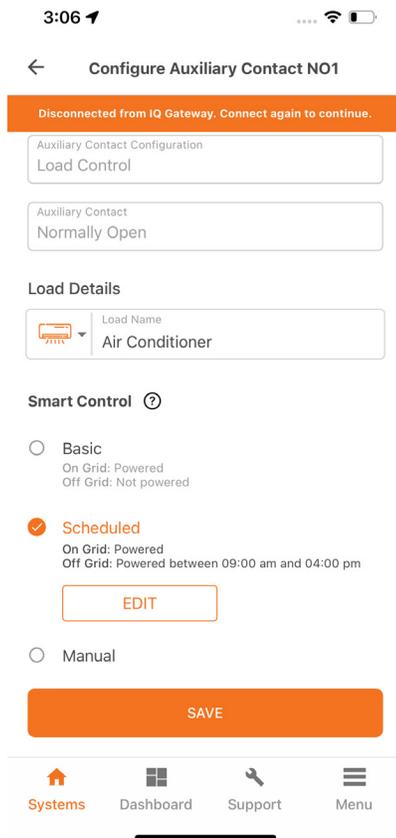
Configuring a Sunlight Backup system

When commissioning a gateway, ensure to use the latest Enphase Installer App version.

- The Enphase Installer App automatically detects a Sunlight Backup use case by the presence of grid forming IQ8 Series Microinverters and the IQ System Controller 2, and when there are no IQ Batteries.
- Once the Enphase Installer App has detected a Sunlight Backup use case, it is required to scan up to two IQ Load Controller(s) and configure the auxiliary contacts in the IQ System Controller to proceed with commissioning.
- Connect the homeowner's internet modem and router branch circuit to the NC1 auxiliary contact to ensure it has the highest priority. Set the operating mode of this circuit to **Manual** using the Enphase Installer App. This ensures that the circuit is powered on as soon as power is available when running off-grid.
- If a second 120 V load is added to the same contactor, ensure it is a low-power load such as lights.



- For a Sunlight Backup system, the Enphase Installer App automatically sets all controlled loads to the **Scheduled** mode with a default time window of 9 a.m. to 4 p.m. local time. This means all essential loads (controlled by NC1, NC2, NO1, and NO2) are available only between 9 a.m. to 4 p.m. local time if the system is running off-grid i.e., during a grid outage. This ensures that the system provides backup to loads only during periods where there is typically adequate sunlight and avoids multiple system restarts. A homeowner can change the time window to any time between 7 a.m. to 8 p.m. to match local sunrise/sunset conditions and available irradiance depending on the season. As instructed previously, NC1 must be used for the Wi-Fi modem and router, and the circuit configuration must be changed to **Manual** mode.



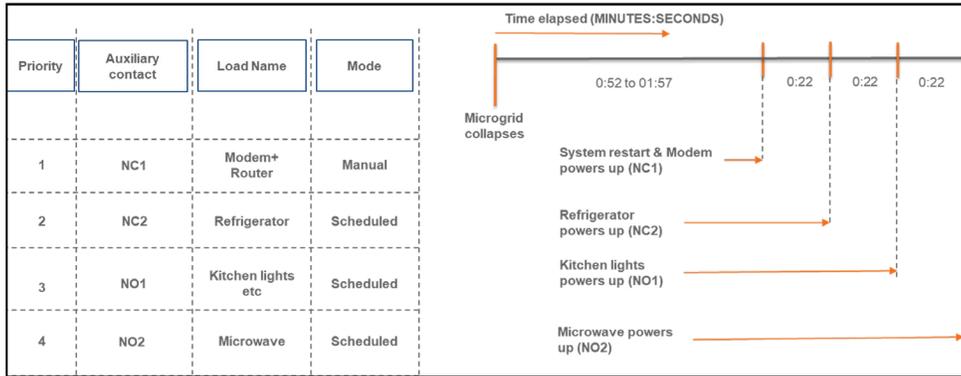
- Enphase recommends staggering the “turn on” and “turn off” times of various loads so that the heaviest loads are set to operate during maximum solar power production, typically between 11 a.m. and 3 p.m. A homeowner can always change the operating schedule of a load using the Enphase App. For more details, refer to [“Understanding Sunlight Backup system for homeowners”](#).

System behavior

This section provides timing details and priorities of controlled loads for system designers.

- When the system shuts down that is, the microgrid collapses, and all the essential loads are powered off.
- If sunlight is available, the system can take up to two minutes to restart (also referred to as a black start) after a microgrid collapse event. At this point, loads configured to operate in **Manual** mode will turn on. The next steps followed by the system are outlined below:
 - The IQ System Controller 2 will power the remaining loads in a pre-determined order. Loads controlled by the remaining auxiliary contacts (NC2, NO1, NO2 – in that order) are powered on, with a 22-second gap. If a load is in **Scheduled** mode, it will turn on only if the current time falls within the scheduled time window.
 - If there is a system shutdown within 22 seconds of a load being powered on, then the system considers that load to be responsible for the collapse.
 - If a load causes five system shutdowns, the system disables that load i.e., the load is deprioritized and powered off. It will not be automatically powered on while the system is off-grid. The homeowner can use the Enphase App to turn the load on when irradiance increases. For more details, refer to “[Understanding Sunlight Backup system for homeowners](#)”.
 - If the load is successfully powered for more than five minutes, the system will reset the system shutdown counter for that load. This means if a load is added to the microgrid and does not cause a collapse for at least five minutes, its system shutdown counter is reset.
 - If all the loads are deprioritized, the system will retry the above sequence after one hour.
- All loads will be powered on automatically when the system reconnects to the grid or connects to a generator.
- If a system restarts due to Sunlight Jump Start in the morning, the system will reset the shutdown counters of all loads from the previous day.

The illustration below shows a timeline from system shutdown until the point when all loads are connected back to the system. This illustration assumes all loads are powered on during the first system restart. The sequence below will repeat if there are successive failures.



EVENT	TIME TAKEN (MINUTES: SECONDS)	TIME ELAPSED SINCE SYSTEM SHUTDOWN (MINUTES: SECONDS)
System shutdown/microgrid collapse	N/A	00:00
System restart IQ8 Microinverters restart and provide 240 V output load, controlled by NC1 when it is powered on (if in Manual mode)	00:52 to 01:57	00:52 to 01:57
Load controlled by NC2 is powered on	00:22	01:14 to 02:19
Load controlled by NO1 is powered on	00:22	01:36 to 02:41
Load controlled by NO2 is powered on	00:22	01:58 to 03:03

The system takes up to 117 seconds to power up after a microgrid collapse. Loads in Scheduled mode are powered on only if the current time falls in the scheduled time window.

Revision history

REVISION	DATE	DESCRIPTION
ING-00001-2.0	April 2023	Editorial updates
ING-00001-1.0	April 2023	Internal release
Previous releases		