

Enphase Energy System planning guide

Applicable regions: North America

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1. About this guide

This document contains information for site surveyors and design engineers to analyze a site and plan the design, installation, and support of home energy backup systems using the Enphase Energy System. This is not a guide for installation and operation. This paper supplements the information in the data sheets, quick install guides, and product manuals. This document's diagrams and information are demonstrative of system configurations and installations. They may not, however, include all additional state and local codes, standards, and other Authorities Having Jurisdiction (AHJs) applicable to a site.

2. Enphase Energy System overview

All Enphase Energy Systems fall into one of the following groups depending on the energy sources used in a system.

- Solar Only
- Battery
- Solar + Battery

The system can also be divided into grid-tied and grid-forming systems based on its ability to form a microgrid. An IQ System Controller will be installed in a grid-forming system.

Grid-forming systems can be categorized as whole home or partial home backup systems.

Whole home backup: When the power grid fails, the Enphase Energy System will switch all electrical circuits to backup power. The system must have sufficient backup power and energy capacity to support all the loads in a home.

Partial home backup: The home loads are segregated into backed-up and non-backed-up loads. The backup load panel is set up to power essential loads. When the power goes out, the Enphase Energy System powers the backup electrical panel while leaving the main load panel unpowered.

The Enphase Energy System supports four use cases that are described in the following table.

Table 1: EES use cases

Energy sources at the site	Configuration	Description
Solar Only, Solar + Battery, or Battery Only	Grid-tied	<ul style="list-style-type: none">• The system does not provide any backup. It saves money by supplying power to home loads, storing energy generated for later use, or exporting excess energy back to the grid when permitted.¹
Solar Only	Partial home backup (Sunlight Backup)	<ul style="list-style-type: none">• When the sun shines, the system offers backup for up to four 240 V loads or eight 120 V vital loads.

¹ Export from Enphase IQ Battery is generally not permitted, except when requested by utilities via grid services programs.

Energy sources at the site	Configuration	Description
		<ul style="list-style-type: none"> Only IQ8 Series Microinverters support this configuration.
Solar + Battery or Battery Only	Partial home backup	<ul style="list-style-type: none"> The system provides essential load backup during the day or night. Load control is advised for any backup load that exceeds storage power capacity.
Solar + Battery or Battery Only	Whole home backup	<ul style="list-style-type: none"> The system provides backup for the whole home during the day or night. Storage capacity is chosen to be sufficient to meet NEC 710.15(a) on its own. Load control is advised for better energy management and resilience.

2.1 Product overview

- IQ8 Series Microinverters and accessories:** The Enphase Energy System is fully compatible with IQ8 Series Microinverters.
- IQ6/IQ7 Series Microinverters and accessories:** Enphase Energy System technology is fully compatible with IQ7 and IQ6 Series Microinverters and makes retrofit upgrades as simple as new installations.
- M Series Microinverters and accessories:** Enphase Energy System technology is compatible with Enphase M215 and M250 Microinverters, making retrofit upgrades simple.



WARNING: IQ8 Series Microinverters are not backward compatible with IQ6 or M Series Microinverters. Enphase Energy System does not support mixing IQ6 Series Microinverters with IQ8 Series Microinverters or M Series Microinverters.



WARNING: IQ8 Series Microinverters are not backward compatible with IQ6 or M Series Microinverters. Enphase Energy System does not support mixing IQ6 Series Microinverters with IQ8 Series Microinverters or M Series Microinverters.



IMPORTANT: IQ8 Series Microinverters can be added to existing IQ7 systems on the same IQ Gateway in the following grid-tied configurations only: Solar Only and Solar + Battery (IQ Battery 3T/10T or IQ Battery 5P) without backup.



IMPORTANT: IQ7 Series Microinverters cannot be added to a site with existing IQ8 Series Microinverters on the same gateway, as a mixed system of IQ7 and IQ8 will not support IQ8-specific PCS features and grid-forming capabilities. If IQ7 Microinverters need to be added to a site on the same gateway where IQ8 Microinverters are present, the IQ8 Microinverters must be retired and recommissioned after commissioning the IQ7 Microinverters.



NOTE: M215 and M250 Series Microinverters are the only legacy microinverters compatible with the Enphase Energy System. Other legacy M Series and S Series Microinverters are

incompatible. The M Series Microinverters are incompatible with IQ System Controller 3M and IQ Meter Collar.



WARNING: The Enphase Energy System does not support mixing M Series Microinverters with IQ8 Series Microinverters or IQ6/IQ7 Series Microinverters. Use an Envoy S Metered for M Series Microinverters.



WARNING: The Enphase Energy System supports only grid-tied configurations with third-party PV inverters. Grid-forming configurations with third-party PV inverters are not supported.



NOTE: IQ System Controller 3M and IQ Meter Collar do not support third-party PV inverters.

- IQ Gateway is a communications gateway that can communicate with IQ Series Microinverters, IQ Batteries, and the IQ System Controller 2/3/3G/3M. It collects system performance information and transmits it over the internet to Enphase Cloud. An IQ Gateway is required for Enphase Energy Systems with IQ Series Microinverters. Note that the IQ Gateway is included in an Enphase IQ Combiner. For retrofit sites, an IQ Gateway may already be present.



NOTE: A stand-alone IQ Gateway (without the IQ Combiner 5/5C) would need a COMMS-KIT-02 installed for wired communication with the IQ System Controller 3/3G/3M and/or the IQ Battery 5P.



WARNING: IQ Gateway will not communicate with M Series Microinverters. Use an Envoy S Metered for M Series Microinverters.



WARNING: M Series Microinverters require Envoy S Metered gateway to work with IQ Batteries. Envoy S Metered is not IEEE 1547:2018 compliant. If the utility insists on IEEE 1547:2018 compliance, microinverter replacement with IQ7 or IQ8 Series will be required.

- Envoy S Metered is a communications gateway with M Series Microinverters, IQ Batteries, and the IQ System Controller 2/3/3G. It collects system performance information and transmits it over the internet to Enphase Cloud. An Envoy S Metered is required for every Enphase Energy System with M Series Microinverters.



NOTE: An Envoy S Metered would need a COMMS-KIT-02 installed for wired communication with the IQ System Controller 3/3G and/or the IQ Battery 5P.



WARNING: Legacy Gateway/EMU SKUs (ENV-120-01, ENV-120-02, IEMU-03, IEMU-01, or IEMU02) will not work with an Enphase Energy System. You must replace these legacy SKUs with an Envoy S Metered during the Enphase Energy System installation.

- System Shutdown Switch is the only Rapid shutdown switch per 2020 NEC 690.12 for an IQ8 grid-agnostic system. This switch is bundled together with the IQ System Controller 2/3/3G/3M.



NOTE: System Shutdown Switch is not needed in an Enphase Energy System with IQ6/IQ7 Series or M Series Microinverters. Enphase System Shutdown Switch is only NEC and UL 1741 PV RSE compliant for IQ8 grid-forming systems. It must not be installed or placarded as the Rapid shutdown initiator for IQ6/IQ7 or M Series Microinverters.



WARNING: System Shutdown Switch is not listed as the rapid shutdown initiator for systems using IQ6, IQ7, or M Series Microinverters. The installers need to connect the RSD auxiliary contacts of IQ System Controller 3/3G/3M using jumper wires to make the system operational. Refer to Installer memo – [Wiring the Rapid shutdown switch with IQ System Controller 2.](#)

- IQ Combiner 4/4C consolidates interconnection equipment into a single enclosure and streamlines PV and storage installations by providing a consistent, pre-wired solution for residential applications. IQ Combiner 4/4C includes Enphase IQ Gateway with the latest software to support IQ8 Microinverters. Install the Communications Kit COMMS-KIT-01 with IQ Combiner 4/4C to enable wireless communication with IQ System Controller 2 and IQ Battery 3/3T/10/10T. IQ Combiner 4/4C also supports hold-down kits on all four PV circuits. IQ Combiner 4C ships with Enphase Mobile Connect, cellular modem CELLMODEM-07-NA-05, pre-installed, while IQ Combiner 4 ships without the cell modem.

 **NOTE:** A stand-alone IQ Gateway or IQ Combiners other than IQ Combiner5/5C require a COMMS-KIT-02 installed for wired communication with the IQ System Controller 3/3G/3M and/or the IQ Battery 5P.

- IQ Combiner 5/5C consolidates interconnection equipment into a single enclosure and streamlines PV and storage installations by providing a consistent, pre-wired solution for residential applications. It offers up to four 2-pole 20 A input circuits and an Eaton BR series busbar assembly. IQ Combiner 5/5C supports wired communication with the IQ System Controller 3/3G/3M and/or the IQ Battery 5P for Enphase Storage System sites. IQ Combiner 5/5C also supports hold-down kits on all four PV circuits. IQ Combiner 5C ships with Enphase Mobile Connect, cellular modem CELLMODEM-07-NA-05, pre-installed, while IQ Combiner 5 ships without the cell modem.

 **NOTE:** IQ Combiner 5/5C has wired control communication integrated into it and can operate with IQ System Controller 3/3G/3M and IQ Battery 5P out of the box.

 **NOTE:** Install the COMMS-KIT-01 with IQ Combiner 5/5C to enable wireless communication with IQ System Controller 2 and IQ Battery 3/3T/10/10T.

- IQ Load Controller: Each IQ Load Controller unit can enable fine-grained, circuit-level control for 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 by the IQ Load Controller.
- An Enphase Mobile Connect cellular modem is always required in an IQ Battery system or Sunlight Backup system to ensure the best performance of your system. The cellular modem connects to a USB port on the IQ Gateway.

 **NOTE:** Enphase Mobile Connect cellular modem CELLMODEM-07-NA-05 is preinstalled in IQ Combiner 4C/5C.

- Current transformers are required for the Enphase Energy System to operate correctly.
 - Enphase Production CT enables PV production monitoring. This is shipped as part of the IQ Combiner 4/4C/5/5C.
 - Enphase Consumption CTs enable home energy consumption monitoring.
 - Enphase Storage CT enables battery charging/discharging monitoring.
 - Enphase Generator CTs are needed in systems that have a generator integrated. This CT pair is connected in parallel with the Enphase Consumption CTs.
- IQ Battery 5P is an all-in-one AC-coupled IQ Battery system. It has a total usable energy capacity of 5 kWh and includes six embedded grid-forming microinverters with a 3.84 kW power rating. It provides scalable backup capability, so customers can start with 5 kWh and add IQ Batteries up to 80 kWh depending on the system design and configuration.

 **NOTE:** IQ Battery 5P is incompatible with IQ System Controller 2 and IQ Battery 3/3T/10/10T.

- IQ System Controller 3/3M connects the home to grid power, the IQ Battery, and PV. It provides microgrid interconnect device (MID) functionality by automatically detecting and seamlessly transitioning the system from grid power to backup power in the event of a grid failure. It allows an IQ Battery and/or an IQ6/IQ7/IQ8 Series Microinverter array to form an intentional island (per IEEE 1547.4 definition). It contains a neutral-forming transformer (NFT) to enable 120/240 V operation in backup mode.



IMPORTANT: IQ System Controller 3 is available in three SKUs. The SKUs have one PV distributed energy resource (DER) port and one IQ Battery DER port available. Depending on the SKU, the third DER port supports an additional 80 A storage/solar/generator.

Table 2: IQ System Controller and SKU

Product name	SKU	3 rd DER port configuration
IQ System Controller 3	SC200D111C240US01	80 A (64 A continuous) IQ Battery or 80 A (64 A continuous) Enphase PV microinverters
IQ System Controller 3G	SC200G111C240US01	80 A (64 A continuous) generator
IQ System Controller 3M	SC200D111CMC1US01	80 A (64 A continuous) IQ Battery or 80 A (64 A continuous) Enphase PV microinverters

- Communications Kit 2 enables the IQ Gateway or Envoy S Metered to communicate with IQ Battery 5P and IQ System Controller 3/3G/3M using the Enphase CTRL cable. The kit is connected to one of the USB ports on the IQ Gateway. This product is not needed for systems using IQ Combiner 5/5C.



NOTE: Communications Kit 2 needs to be used only at sites that have standalone IQ Gateway or Envoy S Metered.



NOTE: Communications Kit 2 will not work with IQ System Controller 2 and IQ Battery 3/3T/10/10T.

- IQ Battery 3/3T/10/10T is an all-in-one AC-coupled storage system with embedded grid-forming multi-mode microinverters. You can connect multiple IQ Battery 3/3T/10/10T storage systems to maximize potential backup for homes.
- IQ Meter Collar ensures that every home can use whole-home backup while eliminating the need for load relocation and the labor cost of load rewiring. IQ Meter Collar provides microgrid interconnect device (MID) functionality by automatically detecting and seamlessly transitioning the system from grid power to backup power in the event of a grid failure. It integrates the consumption meter, eliminating the need to install external Consumption CTs. Every IQ System Controller 3M needs an IQ Meter Collar to function.
- IQ System Controller 2 connects the home to grid power, the IQ Battery storage system, and PV. It provides microgrid interconnect device (MID) functionality by automatically detecting and seamlessly transitioning the system from grid power to backup power in the event of a grid failure. It allows Enphase Energy Systems to form an intentional island (per IEEE 1547.4 definition) and contains a neutral-forming transformer (NFT) to enable 120/240 V operation in backup mode.
- Communications Kit 1 enables direct communication between IQ Battery 3/3T/10/10T, IQ System Controller 2, and the IQ Gateway or Envoy S Metered using 2.4 GHz frequency. The kit is connected to one of the USB ports on the Envoy.

2.2 Product generation and interoperability

The Enphase Energy System is made up of three product generations. Generations 1 and 2 products use wireless communication, while Generation 3 products use wired communication. The system design and installation instructions differ depending on the product generation. In all three generations, microinverters connect with the IQ Gateway/IQ Combiner 5/5C via power line communication (PLC).

Different components may not work together or support certain system features. Check the following table to see if the various system components are interoperable.

Table 3: Product generation and interoperability

	Solar only	Solar + Battery without backup		Sunlight Backup		Solar + Battery with backup	
	Produce solar energy only when the grid is up	Produce and save energy only when the grid is up		Produce solar energy even when the grid is down		Produce and save energy even when the grid is down	
		With IQ Battery 3T/10T	With IQ Battery 5P	With future IQ Battery 3T/10T	With future IQ Battery 5P	With IQ Battery 3T/10T	With IQ Battery 5P
Microinverters							
IQ8 Microinverter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IQ6/IQ7 Microinverter	Yes	Yes	Yes	No	No	Yes	Yes
M Series Microinverter ²	Yes	Yes (With Envoy S Metered)	Yes (With Envoy S Metered)	No	No	Yes (With Envoy S Metered)	Yes (With Envoy S Metered)
IQ Combiner							
IQ Combiner 5/5C	Yes	No	Yes	No	Yes	No	Yes
IQ Combiner 4/4C	Yes	Yes With COMMS-KIT-01	Yes With COMMS-KIT-02	Yes With COMMS-KIT-01	Yes With COMMS-KIT-02	Yes With COMMS-KIT-01	Yes With COMMS-KIT-02
IQ System Controller							
IQ System Controller 3/3G	N/A	N/A	N/A	No	Yes	No	Yes

² M Series Microinverters are not IEEE 1547:2018 compliant. If the site is in an area that requires IEEE 1547:2018, then upgrade to IQ8 Series Microinverters.

	Solar only	Solar + Battery without backup		Sunlight Backup		Solar + Battery with backup	
IQ System Controller 3M	N/A	N/A	N/A	No	N/A	No	Yes (with IQ Meter Collar)
IQ System Controller 2	N/A	N/A	N/A	Yes	No	Yes	No
Accessories							
IQ Load Controller	N/A	N/A	N/A	Yes Essential loads panel required	Yes Essential loads panel required	Yes	Yes
Generator Support	N/A	N/A	N/A	Yes	Yes With IQ System Controller 3G	Yes	Yes With IQ System Controller 3G

3. Design an Enphase Energy System

To learn about designing an Enphase Energy System, see the following topics.

3.1 National Electrical Code

The National Electric Code Article 705 Part II allows a microgrid system to disconnect from the utility grid and operate in island mode, forming an intentional island or microgrid that supplies backup power. The ability of an inverter to transition between interactive and island modes is called multi-mode. A system requires a microgrid interconnect device (MID) to disengage and reconnect to the primary power source or grid to prevent a multi-mode inverter from islanding while connected to the utility grid.

The IQ System Controller 3/3G and IQ System Controller 3M with IQ Meter Collar include a MID that allows the IQ8 Series Microinverters and IQ Batteries to establish an intentional island or operate in island mode when disconnected from the area's electric power system. It also includes distributed energy resource (DER) relays for disconnecting and reconnecting the microinverter and battery storage array from both loads and the utility grid in the event of a fault condition.

The following figure shows a drawing of an AC-coupled multi-mode system based on 2020 NEC sections 690 and 705.

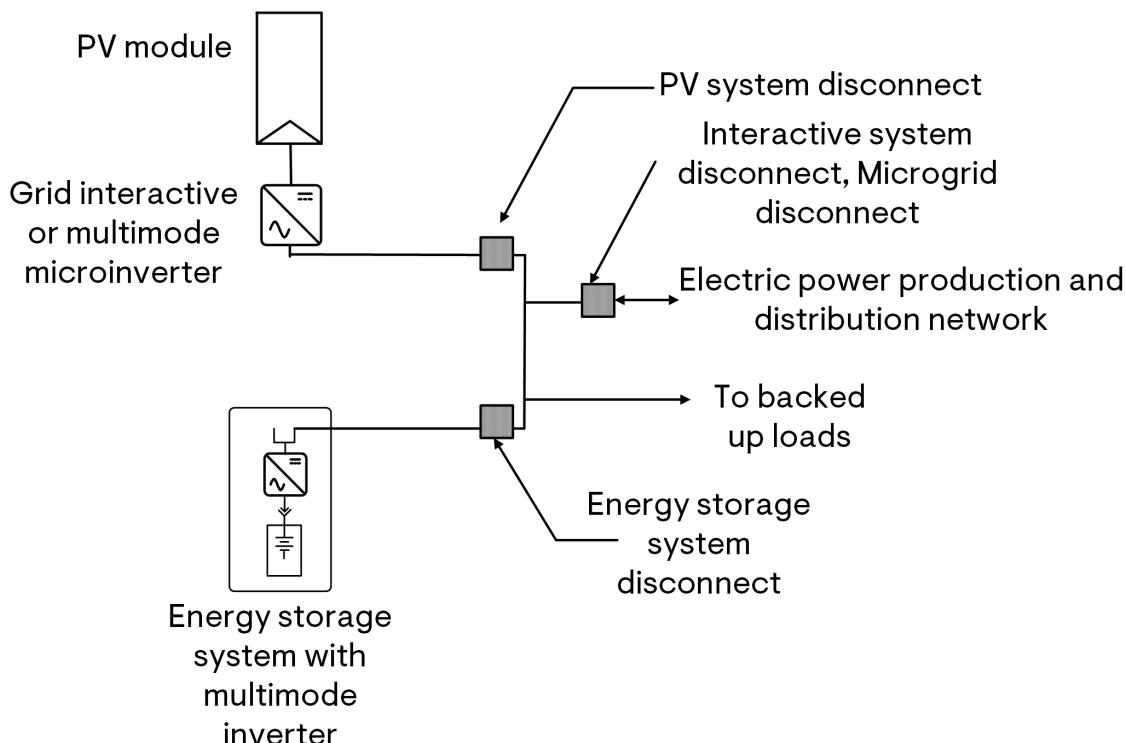


Figure 1: AC-coupled multi-mode system

3.2 Features to improve design and installation flexibility

To learn more about the features, see the following topics.

3.2.1 Rapid shutdown initiator for PV

In an Enphase system that operates only in grid-interactive mode, the PV system disconnect will initiate the PV system rapid shutdown, as specified in 2020 NEC 690.12.

The Rapid shutdown initiator differs for systems that can operate in grid-forming mode, depending on the microinverter product family.

M Series, IQ6, or IQ7 Series Microinverters cannot form an intentional microgrid. The PV system disconnects, or aggregate PV breaker can accomplish this disconnect. An Enphase System Shutdown Switch is not needed in this configuration. If the jurisdiction follows NEC 2020, the IQ Combiner breaker inside the IQ System Controller can act as the Rapid shutdown initiator if the IQ System Controller is installed in a readily accessible location. Otherwise, a fused disconnect must be installed as the Rapid shutdown initiator. For jurisdictions that follow NEC 2017, the PV branch circuit breakers inside the IQ Combiner (or PV combiner box) can also act as the Rapid shutdown initiator if the combiner is readily accessible.

For IQ8 Series Microinverters, the System Shutdown Switch must be installed, and it is the only method available to initiate rapid shutdown effectively, irrespective of whether the jurisdiction follows NEC 2017 or 2020.

3.2.2 ESS disconnect for IQ Battery

Enphase Energy System requires an ESS disconnecting means that can be used to disconnect the battery from other parts of the system, thereby enabling emergency shutdown of the system. Enphase System Shutdown Switch can be used as the ESS disconnecting means per 2023 NEC 706.15.

3.2.3 Power Control Systems (PCS)

Power Control Systems (PCS), as defined in NFPA 70, NEC 2020 705.13, control the output of one or more power production sources, Energy Storage Systems (ESS), and other equipment. Power Control Systems can be used in a variety of use cases, for example, to limit current and loading on the busbars and conductors supplied by the power production sources and/or Energy Storage Systems. Enphase Power Control implements power control that complies with the UL 1741 Certification Requirement Decision (CRD) and UL 3141 Outline of Investigation for Power Control Systems.

Enphase Energy Systems have interconnected electric power production sources such as microinverters and/or IQ Battery. The amount of power production sources that can be connected to a system is generally governed by various sections of the NEC.

Power Control System integration allows flexible installation of Enphase systems with minimal additional homeowners costs (for example, install more PV or batteries) or comply with special requirements in certain jurisdictions. This technical brief describes the benefits and implementation details of Power Control System integration for real-time current monitoring and export limits.

PCS enables the following features in the Enphase Energy System:

- IQ Battery oversubscription mode: This feature is available on systems that use IQ Battery 5P. It increases the energy storage capacity that can be installed against a given battery breaker by reducing the maximum continuous current rating of the battery to comply with NEC rating requirements such as 2020 NEC 705.28. Battery oversubscription can increase the energy capacity of the battery array by up to 200%.
- For grid-tied systems, IQ Battery oversubscription is supported on one breaker on IQ Combiner and up to two breakers on off-the-shelf combiners. The ampacity of the storage breaker on the IQ Combiner can be up to 60 A (48 A continuous) while that on the off-the-shelf combiner can be up to 80 A (64 A continuous).
- For grid-forming systems, IQ Battery oversubscription is supported on the storage port in IQ System Controller 3G, and the storage port and additional DER port on IQ System Controller 3/3M. The ampacity of the breaker on each port can be up to 80 A (64 A continuous).

Battery oversubscription increases overload capacity relative to the new continuous current rating and is coordinated with circuit breaker trip curves.

- Battery import-only mode: This PCS feature ensures the Enphase IQ Battery never exports power to the grid. This is the default mode for all IQ Batteries (IQ Battery 3T/10T, IQ Battery 5P). This feature allows the homeowner to avoid the installation of an additional Net Generation output meter (NGOM).
- Battery export-only mode: The export-only mode (also called charge from PV-only) ensures that the Enphase IQ Battery never imports any power from the grid but can export to the grid.



NOTE: Enphase IQ Battery can operate either in battery import-only mode or battery export-only mode (not both).

- Main panel upgrade avoidance (MPUA) mode with

- Busbar overload control: This feature reduces the system payback period by allowing maximum renewable energy generation and helps avoid the cost of panel upgrades for large PV and battery systems.
- Feeder control: This feature enables avoiding the cost of a panel upgrade for a large PV and battery system.
- Main panel upgrade avoidance mode: This PCS feature limits the back feed current of the Enphase Energy System back to the main panel to avoid having to upgrade the main panel. Only IQ8 Series Microinverters support the feature; IQ6/IQ7 and M Series Microinverters do not support this feature.
- Aggregate power export limit (PEL) mode: This PCS feature ensures that the aggregate PV power exported to the grid is limited to the aggregate power export limit (PEL) value set by the installer. This ensures the aggregate power export is below the level defined, as measured at the Consumption CTs. The batteries do not export to the grid because they support Energy Storage System (ESS) import only mode today.
- IQ EVSE main breaker trip avoidance (MBTA): This feature enables the installation of a more powerful IQ EVSE to charge the electric vehicle (EV) by avoiding service upgrades and Main service breaker trips when home loads are extremely high.
- NEM integrity mode: This feature allows for expanding legacy net energy metering (NEM) 1.0/2.0 systems in California with additional PV and battery capacity without losing the NEM 1.0/2.0 tariff. This is achieved by making the new system export no more than what the existing legacy system is producing.

For further information, refer to the [Power Control Systems \(PCS\) integration tech brief](#).

For comprehensive CT placement guidelines, refer to the [Guidelines for current transformer \(CT\) installation](#).

4. Economic use cases

There are many economic goals that the Enphase Energy System supports. These include reducing the utility bill by charging during low tariff periods and saving energy to ensure that loads can be served through the battery(ies) during the peak tariff period. Power from PV can be exported to the grid, especially during peak tariff periods.

The system also supports the special case of *power export limiting*, where the utility does not allow a homeowner to export power from the PV system to the grid. Examples are the Hawaii self-supply and NEM+ programs, where no export is allowed, which is called *zero export*.

Optimizing energy storage capacity sizing for economic use cases is beyond the scope of this document.

5. System profiles

The Enphase Energy System supports three smart profiles for the batteries to implement the Backup, Self-Consumption, and economic use cases.

- Full Backup: 100% of the battery capacity is reserved for backup, and the battery does not discharge while on-grid. This profile is not available in grid-tied configurations.
- Self-Consumption: The battery discharges till reserved capacity to ensure the home loads are served with PV and storage as far as possible. Effectively the system tries to reduce imports from the grid whenever possible. Note the Battery Only discharges till the reserve charge limit while

on-grid. The battery discharges below the reserve charge limit only when the grid is down. This profile is not available in battery-only systems.

- **Savings:** This profile is for the economic use case wherein the battery discharges when the rates are at the peak and charges using PV before peak tariff periods.

 **NOTE:** When the Savings profile is selected with the NEM 3.0 tariff structure, IQ Battery may export to the grid or import from the grid to provide economic benefit to the homeowner based on the AI-optimization profile and battery mode selected during system commissioning. Outside the NEM 3.0 tariff structure, IQ Battery does not export to the grid. During the peak tariff period, PV is exported to the grid and the battery is discharged to serve loads.

 **NOTE:** The Battery Only discharges till the reserve charge limit while on-grid. The battery discharges below the reserve charge limit only when the grid is down.

A description of these modes with screenshots of how homeowners can select the same is available in the [Enphase storage system owner's guide](#).

 **NOTE:** In all modes, the battery will charge from the grid till the reserve charge limit to ensure that the desired amount of battery charge for backup is guaranteed to be available.

6. System sizing

This section is relevant for grid-forming systems only.

6.1 Grid-tied systems

Optimal system sizing for a grid-tied system depends on multiple factors, such as solar irradiance at the location, energy usage patterns, and energy tariffs. Enphase recommends using the Solargraf tool to size the system.

6.2 Grid-forming systems

To learn about system sizing for grid-forming systems, see the following topics.

6.2.1 Load analysis

A proper load study is the first step in effectively sizing a system. If an IQ Gateway with properly configured Consumption CTs is already installed at a site, Enphase Cloud data can be used to size the system properly. Load data for system size can also be obtained through a site survey, utility bills, and third-party consumption meters.

6.2.2 Microinverter array and IQ Battery sizing

A backup system can power loads when the grid is down.

It is important to differentiate the terms power and energy. Power is a measure of the instantaneous electricity used and is expressed in units of watts (W) or kilowatts (kW). Battery power rating indicates how much power can flow out of the battery at any instant. Energy is the integrated power used over time and is expressed in units of watt-hours (Wh) or kilowatt-hours (kWh). When running in the

backup operation, any power capacity or energy capacity shortages will result in a loss of power to the loads and should be avoided. Therefore, it is essential to size the system for both power and energy capacities in each installation.

Sufficiently size the IQ Battery power rating to power loads and charge from PV power generation. You can increase the power rating by adding additional IQ Battery units, which also provide additional backup, improving the customer user experience.

The stand-alone or microgrid power sources must be sufficient to meet the 2020 NEC 710.15(A) requirements.

- 2020 NEC 710.15 (A) supply output. Power supply to premises wiring systems shall be permitted to have less capacity than the calculated load. The ability of the stand-alone supply shall be equal to or greater than the load posed by the largest single-utilization equipment connected to the system. Calculated general lighting loads shall not be considered as a single load.
- Power (kW) capacity from the IQ Battery system must exceed the largest single load.
- Energy storage (kWh) capacity should be sized to supply the estimated backup loads for a user-defined period.

An additional factor to consider is the inrush current for the device if a large appliance, like an air conditioner or a pool pump, needs to be powered back up. See the product nameplate or the manufacturer's literature to determine the inrush current requirement. To meet this need, the battery array must be of an appropriate size.

6.2.2.1 Systems using IQ8 Series Microinverters with IQ Battery 5P systems

The number of IQ8 Series Microinverters is limited by the continuous current rating of the PV port in IQ System Controller 3G (64 A). In IQ System Controller 3/3M, if the DER port is not being used for additional IQ Battery 5P, the number of IQ8 Series Microinverters is limited by the continuous current rating of the PV port and DER port together (64 A + 64 A).

 **NOTE:** Additional IQ8 Microinverters must be segregated into a separate grid-tied system with a different IQ Gateway/IQ Combiner 5/5C/4/4C.

6.2.2.2 Systems using IQ8 Series Microinverters with IQ Battery 3T/10T system

The number of IQ8 Series Microinverters in a microgrid with a single IQ Battery 3T is limited to 48. For systems with more than one IQ Battery 3T, the number of IQ8 Series Microinverters is limited only by the continuous current rating of the PV port in IQ System Controller 2 (64 A).

 **NOTE:** Additional IQ8 Microinverters must be segregated into a separate grid-tied system with a different IQ Gateway/IQ Combiner 5/5C/4/4C.

Table 4: Number of IQ8 Series Microinverters supported by grid-forming IQ Battery 3T/10T systems

No. of IQ Battery 3T units	Equivalent 10T units	IQ Battery energy capacity (kWh)	IQ Battery rated continuous output power (kVA)	PV array-rated continuous output power (kVA)	IQ8	IQ8+	IQ8M	IQ8A	IQ8H	IQ8MC	IQ8AC	IQ8HC
1	-	3.36	1.28	1.92	48	48	44	44	40	48	44	40
2	-	6.72	2.56	3.84	64	52	44	44	40	48	44	40
3	1	10.08	3.84	5.76	64	52	44	44	40	48	44	40
4	-	13.44	5.12	7.68	64	52	44	44	40	48	44	40
5	-	16.8	6.40	9.60	64	52	44	44	40	48	44	40
6	2	20.16	7.68	11.52	64	52	44	44	40	48	44	40
7	-	23.52	8.96	13.44	64	52	44	44	40	48	44	40
8	-	26.88	10.24	15.36	64	52	44	44	40	48	44	40
9	3	30.24	11.52	17.28	64	52	44	44	40	48	44	40
10	-	33.6	12.80	19.20	64	52	44	44	40	48	44	40
11	-	36.96	14.08	21.12	64	52	44	44	40	48	44	40
12	4	40.32	15.36	23.04	64	52	44	44	40	48	44	40

6.2.2.3 Systems using IQ6, IQ7, or M Series Microinverters with IQ Battery 5P systems

To maintain system stability while operating in off-grid mode, the microinverter array-rated continuous output power shall not exceed 150% of the IQ Battery array-rated continuous output power.

In the IQ System Controller 3/3M configuration, additional microinverters can be connected to the DER port (if the DER port is not being used for additional IQ Battery 5P) until the microinverter to IQ Battery 5P ratio in the following table is adhered to. Additional PV can be connected to the backup subpanel and mapped to the same IQ Gateway/IQ Combiner in the microgrid.

 **NOTE:** If the installed PV power exceeds the allowed limit, use the PV shedding feature to drop excess PV when the system transitions to off-grid mode.

Table 5: Microinverter to IQ Battery 5P ratio for sites with IQ6, IQ7, or M Series

Select	IQ Battery energy capacity (kWh)		IQ Battery rated continuous output power (kVA)		Microinverter array rated continuous output power (kVA)		IQ6		IQ6+		IQ7		IQ7+		IQ7X		IQ7A		M215		M250	
1	5	3.84	5.76	25	20	24	19	18	16	26	24											
2	10	7.68	11.52	50	41	48	39	36	33	53	48											
3	15	11.52	17.28	75	61	72	59	54	49	80	72											
4	20	15.36	23.04	100	82	96	79	73	66	106	96											
5	25	19.20	28.80	125	102	120	99	91	82	133	120											
6	30	23.04	34.56	150	123	144	119	109	99	160	144											
7	35	26.88	40.32	175	143	168	138	128	115	186	168											
8	40	30.72	46.08	200	164	192	158	146	132	213	192											



NOTE: If the system has IQ Battery oversubscription enabled, use the IQ Battery array's revised nameplate power rating to calculate the microinverter array size.

6.2.2.4 Systems using IQ6, IQ7, or M Series Microinverters with IQ Battery 3T/10T systems

Table 6: Number of IQ6, IQ7, or M Series Microinverters supported by grid-forming IQ Battery 3T/10T systems

No. of IQ Battery 3T units	Equivalent 10T units	IQ Battery energy capacity (kWh)		PV array-rated continuous output power (kVA)		IQ6	IQ6+	IQ7	IQ7+	IQ7X	IQ7A	M215	M250
1	-	3.36	1.28	1.92		8	6	8	6	6	5	8	8
2	-	6.72	2.56	3.84		16	13	16	13	12	11	17	16
3	1	10.08	3.84	5.76		25	20	24	19	18	16	26	24
4	-	13.44	5.12	7.68		33	27	32	26	24	22	35	32
5	-	16.8	6.40	9.60		41	34	40	33	30	27	44	40
6	2	20.16	7.68	11.52		50	41	48	39	36	33	53	48
7	-	23.52	8.96	13.44		58	47	56	46	42	38	62	56
8	-	26.88	10.24	15.36		66	54	64	52	48	44	71	64
9	3	30.24	11.52	17.28		75	61	72	59	54	49	80	72
10	-	33.6	12.80	19.20		83	68	80	66	61	55	88	80
11	-	36.96	14.08	21.12		91	75	88	72	67	60	97	88
12	4	40.32	15.36	23.04		100	82	96	79	73	66	106	96

6.2.2.5 Generator sizing

The system architecture restricts the minimum generator nameplate for pairing with a certain number of IQ Battery units to ensure that the generator can be operated safely and not harmed by unintended back-feed from the PV and/or storage. This limit varies according to the microinverter family installed on the roof.



NOTE: Size the generator power rating appropriately to power loads while charging the IQ Batteries. The minimum generator size should be used as a starting point in the design.

- ✓ **NOTE:** The battery array in the system must be sized appropriately to support the backed-up loads before the generator connects to the microgrid. Load control must be used to shed any loads the battery cannot support until the generator is connected.
- ✓ **NOTE:** The Enphase Installer App allows you to connect a lower or higher nameplate-rated generator to the system than the recommended generator capacity. However, using smaller generators than stated herein may compromise microgrid stability and can damage the generator due to inadvertent back-feed.
- ✓ **NOTE:** If the system has 15 kWh energy storage or more, the generator nameplate rating required exceeds the usable power from the generator port (that is, 15.36 kW or 64 A at 240 V) from the generator. Generator sizes beyond the values mentioned above will not result in any improvement in terms of current or battery charging speed.
- ✓ **NOTE:** The nameplate value and maximum continuous generator current can be set in the Enphase Installer App while commissioning the generator. The IQ Gateway will ensure that the system does not draw more than the generator nameplate rating and keeps generator usage below the maximum continuous generator current.
- ✓ **NOTE:** If the system has IQ Battery oversubscription enabled, use the IQ Battery array's revised nameplate power rating to calculate the generator size.

6.2.2.5.1 Solar-only grid-forming system (Sunlight Backup)

The minimum generator nameplate rating must be at least 100% of the microinverter array's rated AC power output. The following table shows some examples of this pairing.

Table 7: Examples of minimum generator nameplate rating calculation for a Sunlight Backup system

Microinverter type	Rated output (W) of one microinverter	No. of microinverters	Minimum generator nameplate (kW)
IQ8	240	16 (one branch circuit)	3.84
IQ8	240	32 (two branch circuits)	7.68
IQ8PLUS	290	13 (one branch circuit)	3.77
IQ8PLUS	290	20 (two branch circuits)	5.8
IQ8H-240	380	15 (two branch circuits)	5.7

6.2.2.5.2 Battery-only systems

The minimum generator nameplate rating must be 143% of the IQ Battery array.

6.2.2.5.2.1 IQ Battery 5P

Table 8: Minimum generator nameplate rating for a system with IQ Battery 5P

IQ Battery 5P units	IQ Battery power (kW)	Minimum generator nameplate (kW)
1	3.84	5.49

IQ Battery 5P units	IQ Battery power (kW)	Minimum generator nameplate (kW)
2	7.68	10.98
3	11.52	16.47
4	15.36	21.96
5	15.36	21.96
6	15.36	21.96
7	15.36	21.96
8	15.36	21.96

6.2.2.5.2.2 IQ Battery 3T/10T systems

Table 9: Minimum generator nameplate rating for a system with IQ Battery 5P

No. of IQ Battery 3T units	No. of IQ Battery 3T units	IQ Battery rated continuous output power (kVA)	Minimum generator nameplate (kW)
1	-	1.28	1.83
2	-	2.56	3.66
3	1	3.84	5.49
4	-	5.12	7.32
5	-	6.40	9.15
6	2	7.68	10.98
7	-	8.96	12.81
8	-	10.24	14.64
9	3	11.52	16.47
10	-	12.80	18.30
11	-	14.08	20.13
12	4	15.36	21.96

6.2.2.5.3 Solar + Battery grid-forming systems

6.2.2.5.3.1 Systems with IQ8 Series Microinverters with IQ Battery 5P or IQ Battery 3T/10T

The minimum generator nameplate rating must be a) 100% of the microinverter array-rated AC power output or b) 143% of the IQ Battery array, whichever is higher. The following table shows some examples of generator pairing with an Enphase Energy System with IQ8 Series Microinverters and IQ Battery.

Table 10: Examples of minimum generator nameplate rating for a system with IQ8 Series Microinverters and IQ Battery 5P

Microinverter type	Rated output (W) of one microinverter	No. of microinverters	Rated power output of the microinverter array (kW)	IQ Battery 5P units	IQ Battery power (kW)	Min. generator nameplate (kW)
IQ8	240	16 (one branch circuit)	3.84	1	3.84	5.49
IQ8	240	32 (two branch circuits)	7.68	1	3.84	7.68
IQ8PLUS	290	13 (one branch circuit)	3.77	2	7.68	10.98
IQ8PLUS	290	20 (two branch circuits)	5.8	3	11.52	16.47
IQ8H-240	380	15 (two branch circuits)	5.7	4	15.36	21.94
IQ8H-240	380	40 (four branch circuits)	15.2	4	15.36	21.94

Table 11: Examples of minimum generator nameplate rating for a system with IQ8 Series Microinverters and IQ Battery 3T/10T

Microinverter type	Rated output (W) of one microinverter	No. of microinverters	Rated output power output of the microinverter array (kW)	IQ Battery 3/3T units	IQ Battery 10/10T units	IQ Battery power (kW)	Min. generator nameplate (kW)
IQ8	240	16 (one branch circuit)	3.84	1	—	1.28	3.84
IQ8	240	32 (two branch circuits)	7.68	2	—	2.56	7.68
IQ8PLUS	290	13 (one branch circuit)	3.77	3	(One IQ Battery 10/10T)	3.84	5.49
IQ8PLUS	290	20 (two branch circuits)	5.8	4	—	5.12	7.31
IQ8H-240	380	15 (two branch circuits)	5.7	5	—	6.4	9.14
IQ8H-240	380	40 (four branch circuits)	15.2	6	(Two IQ Battery 10/10T)	7.68	15.2
IQ8H-240	380	40 (four branch circuits)	15.2	12	(Two IQ Battery 10/10T)	15.36	21.94

6.2.2.5.3.2 Systems with IQ6, IQ7 Series Microinverters with IQ Battery 5P or IQ Battery 3T/10T

The minimum generator nameplate rating must be 143% of the IQ Battery array.

Table 12: Minimum generator nameplate rating for a system with IQ Battery 5P

IQ Battery 5P units	IQ Battery power (kW)	Minimum generator nameplate (kW)
1	3.84	5.49
2	7.68	10.98
3	11.52	16.47
4	15.36	21.96
5	15.36	21.96
6	15.36	21.96
7	15.36	21.96
8	15.36	21.96

Table 13: Minimum generator nameplate rating for a system with IQ Battery 5P

No.of IQ Battery 3T units	Equivalent 10T units	IQ Battery rated continuous output power (kVA)	Minimum generator nameplate (kW)
1	—	1.28	1.83
2	—	2.56	3.66
3	1	3.84	5.49
4	—	5.12	7.32
5	—	6.40	9.15
6	2	7.68	10.98
7	—	8.96	12.81
8	—	10.24	14.64
9	3	11.52	16.47
10	—	12.80	18.30
11	—	14.08	20.13
12	4	15.36	21.96

6.2.2.5.3.3 Systems with M Series Microinverters with IQ Battery 5P or IQ Battery 3T/10T

For M Series systems, there is no PV-to-generator power ratio because the microinverter array needs to be disconnected from the microgrid when the generator is connected and generating power.

6.2.2.6 Storage system sizing

To learn about storage system sizing, see the following topics.

6.2.2.6.1 Solar-Only grid-forming (Sunlight Backup) configuration

- Select the absolute minimum number of IQ8 Series Microinverters required to meet the 2020 NEC 710.15 (A) requirements based on the largest maximum single load power rating (kW) that must be backed up. In an IQ8 PV backup system, the IQ8 PV capacity can be added to the system's stand-alone supply to meet the 2020 NEC 710.15 standard (A). However, because solar resources are highly variable, Enphase suggests a safety margin to improve customer experience. As a starting point for the design, 30% of the PV AC apparent power is suggested. For example, Enphase recommends that the greatest single load on a 6 kVA AC PV system not exceed 1.8 kVA.
- If the system has a generator, PV shedding may need to be implemented to maintain system stability as described in the section [Generator sizing](#) on page 19.
- Only up to four 240 V or up to eight 120 V pre-selected essential load circuits can be backed up in this configuration. All these loads must be controlled using the IQ Load Controller. Each 240 V load can be regulated independently; however, 120 V loads can only be handled in groups of up to two. Refer to [Load and solar circuit control using IQ System Controller auxiliary contacts](#) for more details.

6.2.2.6.2 Battery-Only backup configurations: IQ Battery 3T/10T systems

1. Identify the largest single load power rating (kW) you want to back up and select the minimum IQ Battery 3T/10T units required to meet the 2020 NEC 710.15(A) requirements.
2. If the system has a generator, additional units may be needed to maintain system stability as described in [Generator sizing](#) on page 19.
3. Based on the estimated backup loads for the user-defined period, calculate the required energy storage (kWh) capacity and the minimum IQ Battery 3T/10T units needed.
4. Based on a site's load analysis of both power (kW) and energy capacity (kWh) needed, determine the total number of IQ Battery 3T/10T units required for the storage system.
5. The minimum IQ Battery 3T/10T units required is calculated as the largest of steps 1 and 2.
6. The desired number of IQ Battery 3T/10T units is the value calculated in step 2.

 **NOTE:** Up to 40 kWh of IQ Battery 3T/10T can be connected to a single IQ System Controller 2.

 **NOTE:** IQ Load Controller is recommended for all backup load circuits that exceed the storage power capacity. Refer to [Load and solar circuit control using IQ System Controller auxiliary contacts](#) for more details.

6.2.2.6.3 Battery-Only backup configurations: IQ Battery 5P systems

1. Identify the largest single load power rating (kW) you want to back up and select the minimum IQ Battery 5P units required to meet the 2020 NEC 710.15(A) requirements.
2. If the system has a generator, additional units may be needed to maintain system stability as described in [Generator sizing](#) on page 19.
3. Based on the estimated backup loads for the user-defined period, calculate the required energy storage (kWh) capacity and the minimum IQ Battery 5P units required.
4. Based on a site's load analysis of both power (kW) and energy capacity (kWh), determine the total number of IQ Battery 5P units required for the storage system.
5. The minimum IQ Battery 5P units required is calculated as the largest of steps 1 and 2.
6. The desired number of IQ Battery 5P units is the value calculated in step 3.

 **NOTE:** Using the IQ Battery oversubscription feature, up to 40 kWh of IQ Battery 5P can be connected to each IQ System Controller 3/3G/3M battery port with a rated power output of 15.36 kW. As a result, the IQ System Controller 3G can support up to 40 kWh of IQ Battery 5P, while the IQ System Controller 3/3M can support up to 80 kWh of IQ Battery 5P.

 **NOTE:** IQ Battery oversubscription maintains the overload capability of IQ Battery 5P at 200% of the original nameplate rating for 1.5 seconds.

 **NOTE:** IQ Load Controller is recommended for all backup load circuits that exceed the storage power capacity. Refer to [Load and solar circuit control using IQ System Controller auxiliary contacts](#) for more details.

6.2.2.6.4 Solar + Battery backup configurations: IQ Battery 3T/10T systems

1. Identify the largest single load power rating (kW) you want to back up and select the minimum IQ Battery 3T/10T units required to meet the 2020 NEC 710.15(A) requirements.
2. Additional battery units may be required to maintain system stability depending on the microinverter used in the system, as described in the section [Microinverter array and IQ Battery sizing](#) on page 15.
3. If the system has a generator, additional units may be needed to maintain system stability as described in the section [Generator sizing](#) on page 19.
4. Based on the estimated backup loads for the user-defined period, calculate the required energy storage (kWh) capacity and the minimum number of IQ Battery 3T/10T units needed.
5. Based on a site's load analysis of both power (kW) and energy capacity (kWh) needed, determine the total number of IQ Battery 3T/10T units required for the storage system.
 - The minimum number of IQ Battery 3T/10T units required is calculated as the largest of step 1, step 2, and step 3.
 - The desired number of IQ Battery 3T/10T units is the value calculated in step 2.

 **NOTE:** Up to 40 kWh of IQ Battery 3T/10T can be connected to a single IQ System Controller 2.

 **NOTE:** IQ Load Controller is recommended for all backup load circuits that exceed the storage power capacity. Refer to [Load and solar circuit control using IQ System Controller auxiliary contacts](#) for more details.

6.2.2.6.5 Solar + Battery backup configurations: IQ Battery 5P systems

1. Identify the largest single load power rating (kW) you want to back up and select the minimum IQ Battery 5P units required to meet the 2020 NEC 710.15(A) requirements.
2. Additional battery units may be required to maintain system stability depending on the microinverter used in the system, as described in the section [Microinverter array and IQ Battery sizing](#) on page 15.
3. If the system has a generator, additional units may be needed to maintain system stability as described in the section [Generator sizing](#) on page 19.
4. Based on the estimated backup loads for the user-defined period, calculate the required energy storage (kWh) capacity and the minimum IQ Battery 5P units required.
5. Based on a site's load analysis of both power (kW) and energy capacity (kWh), determine the total number of IQ Battery 5P units required for the storage system.
 - The minimum number of IQ Battery 5P units required is calculated as the largest of step 1, step 2, and step 3.
 - The desired number of IQ Battery 5P units is the value calculated in step 3.

 **NOTE:** Using the IQ Battery oversubscription feature, up to 40 kWh of IQ Battery 5P can be connected to each IQ System Controller 3/3G/3M battery port with a rated power output of 15.36 kW. As a result, the IQ System Controller 3G can support up to 40 kWh of IQ Battery 5P, while the IQ System Controller 3/3M can support up to 80 kWh of IQ Battery 5P.

 **NOTE:** IQ Battery oversubscription maintains the overload capability of IQ Battery 5P at 200% of the original nameplate rating for 1.5 seconds.



NOTE: IQ Load Controller is recommended for all backup load circuits that exceed the storage power capacity. Refer to [Load and solar circuit control using IQ System Controller auxiliary contacts](#) for more details.

6.2.3 Optimal placement of IQ Battery 5P(s) on two ports in IQ System Controller 3/3M

The IQ System Controller 3/3M has a storage port and an additional DER port to which IQ Battery 5P(s) can be connected. The placement of the IQ Batteries on each port determines the maximum aggregate continuous power available from the battery system. Note that when utilizing the additional DER port for adding IQ Battery 5P the DER port cannot be used to connect additional microinverters. The optimal placement of the IQ Batteries maximizes the aggregate continuous power (kW) and aggregate overload current available from the chosen battery system with the given aggregate storage energy (kWh).

The optimal placement of IQ Battery 5P(s) on two ports per a given number of IQ Battery 5P(s) in IQ System Controller 3/3M is shown in the following table, assuming that the breaker rating on each port is 80 A.

Table 14: Optimal placement of the IQ Battery 5P(s) on two ports in IQ System Controller 3/3M

Ideal battery placement			At storage port (DER 2)			At additional port (DER 3)			Aggregate			
$N = N_1 + N_2$	Total no. of batteries	No. of batteries on storage (DER 2) port	No. of batteries on additional (DER 3) port	IQ Battery oversubscription			IQ Battery oversubscription			IQ Battery oversubscription		
$N = N_1 + N_2$	N_1	N_2		I_1	$I_{\text{overload1}}$	I_2	$I_{\text{overload2}}$	$I_A = I_1 + I_2$	$I_{\text{Aggregate overload}} = I_{\text{overload1}} + I_{\text{overload2}}$	$E_A = (N_1 + N_2) \times E_{\text{battery}}$		
1	1	0	Disabled	16	32	Disabled	0	0	16	32	5	
2	2	0	Disabled	32	64	Disabled	0	0	32	64	10	
3	3	0	Disabled	48	96	Disabled	0	0	48	96	15	

Ideal battery placement				At storage port (DER 2)			At additional port (DER 3)			Aggregate	
$N = N_1 + N_2$	N_1	N_2		Enabled if $N_1 > 4$ batteries			Enabled if $N_2 > 4$ batteries				
				I_1	$I_{\text{overload1}}$	I_2	$I_{\text{overload2}}$	$I_A = I_1 + I_2$	$I_{\text{Aggregate overload}} = I_{\text{overload1}} + I_{\text{overload2}}$	$E_A = (N_1 + N_2) \times E_{\text{battery}}$	
4	4	0	Disabled	64	128	Disabled	0	0	64	128	20
5	4	1	Disabled	64	128	Disabled	16	32	80	160	25
6	4	2	Disabled	64	128	Disabled	32	64	96	192	30
7	4	3	Disabled	64	128	Disabled	48	96	112	224	35
8	4	4	Disabled	64	128	Disabled	64	128	128	256	40
9	5	4	Enabled	64	160	Disabled	64	128	128	288	45
10	6	4	Enabled	64	192	Disabled	64	128	128	320	50
11	7	4	Enabled	64	224	Disabled	64	128	128	352	55
12	8	4	Enabled	64	256	Disabled	64	128	128	384	60
13	8	5	Enabled	64	256	Enabled	64	160	128	416	65
14	8	6	Enabled	64	256	Enabled	64	192	128	448	70
15	8	7	Enabled	64	256	Enabled	64	224	128	480	75
16	8	8	Enabled	64	256	Enabled	64	256	128	512	80

7. Component list for solar-only or battery-only system configurations

To learn about various component lists for solar-only or battery-only system configurations, see the following topics.

7.1 With IQ Battery 5P and/or IQ System Controller 3/3G/3M

Table 15: Component list for Solar Only or Battery Only system configurations

Component type	Product name and model number	Solar Only	Sunlight Backup	Battery Only grid-tied	Battery Only grid-forming
Microinverters	IQ8 Series <ul style="list-style-type: none"> IQ8-60-2-US IQ8PLUS-72-2-US IQ8M-72-2-US IQ8A-72-2-US IQ8H-240-72-2-US IQ8MC-72-M-US IQ8AC-72-M-US IQ8HC-72-M-US 	As needed per system design	As needed per system design	0	0
	IQ8 Series <ul style="list-style-type: none"> IQ8H-208-72-2-US 	As needed per system design (IQ Battery integration not supported)	Not supported	0	0
	IQ7 Series <ul style="list-style-type: none"> IQ7-60-2-US IQ7PLUS-72-2-US IQ7X-96-2-US IQ7A-72-2-US 	As needed per system design	Not supported	0	0
	IQ6 Series <ul style="list-style-type: none"> IQ6-60-2-US IQ6PLUS-72-2-US 	As needed per system design	Not supported	0	0

Component type	Product name and model number	Solar Only	Sunlight Backup	Battery Only grid-tied	Battery Only grid-forming
	M Series <ul style="list-style-type: none"> • M215-60-2LL-S22-IG • M215-60-2LL-S25-IG • M250-60-2LL-S22 • M250-60-2LL-S25 • M250-72-2LL-S22 • M250-72-2LL-S25 	As needed per system design	Not supported	0	0
Battery	IQ Battery 5P <ul style="list-style-type: none"> • IQ Battery-5P-1P-NA 	—	—	As needed per system design, up to 16 units maximum (does not support 208 V operation)	As needed per system design, up to 16 units maximum (does not support 208 V operation)
	IQ Battery 5P Pedestal Mount for NA <ul style="list-style-type: none"> • B05-PI-0550-O 	0	0	Optional (1 per IQ Battery 5P)	Optional (1 per IQ Battery 5P)
	IQ Battery 5P Lifting Handle <ul style="list-style-type: none"> • IQ Battery-HNDL-5 	0	0	1	1
AC combiner	IQ Combiner 5/5C <ul style="list-style-type: none"> • X-IQ-AM1-240-5 • X-IQ-AM1-240-5C (includes IQ Gateway, two Consumption CTs, and one battery CT) • X-IQ-AM1-240-5-HDK (includes IQ Gateway, two Consumption CTs, one battery CT, and one hold down kit) • X-IQ-AM1-240-5C-HDK (includes one IQ Gateway, two Consumption CTs, one battery CT, and one hold down kit) 	1 (not for M Series)	1	1	1
Gateway	IQ Gateway for IQ Series	1 (if not using	0	1 (if not using IQ Combiner)	1 (if not using IQ Combiner)

Component type	Product name and model number	Solar Only	Sunlight Backup	Battery Only grid-tied	Battery Only grid-forming
	<ul style="list-style-type: none"> ENV-IQ-AM1-240 ENV2-IQ-AM1-240³ 	IQ Combiner; not for M Series)			
	ENV-S-AM1-120	1 (only for M Series)	Not supported	Not supported	Not supported
Load control	IQ Load Controller <ul style="list-style-type: none"> EP-NA-LK02-040 	0	1 or 2	0	1 or 2
Enphase Energy System communications	Communications Kit <ul style="list-style-type: none"> COMMS-KIT-02 (Includes 1 Battery CT, Power Jumper for IQ Gateway, and NEMA 4X enclosure) 	0	0	1 (If not using IQ Combiner)	1 (If not using IQ Combiner)
Cellular modem	Enphase Mobile Connect <ul style="list-style-type: none"> CELLMODEM-07-NA-05 	0 or 1 (if not using IQ Combiner 5C)	0 or 1 (if not using IQ Combiner 5C)	0 or 1 (if not using IQ Combiner 5C)	0 or 1 (if not using IQ Combiner 5C)
Current transformers	Consumption CTs <ul style="list-style-type: none"> CT-200-SPLIT or CT-200-CLAMP 	2 (if not using IQ Combiner 5/5C)	2 (if not using IQ Combiner 5/5C)	0	0
	Battery CT <ul style="list-style-type: none"> CT-200-CLAMP (Included with IQ Combiner 5/5C as well as with COMMS-KIT-02) 	0	0	0	0
	Generator CT <ul style="list-style-type: none"> CT-200-CLAMP 	0	2 (if using a generator, it must be purchased separately)	0	2 (if using a generator, it must be purchased separately)
IQ Combiner 5/5C Hold-Down Kit	Hold-down kit for IQ Combiner 5/5C	0	1 or 2 (only for IQ8)	0	0

³ Use this SKU in jurisdictions that mandate IEEE 1547:2018 compliance.

Component type	Product name and model number	Solar Only	Sunlight Backup	Battery Only grid-tied	Battery Only grid-forming
	<ul style="list-style-type: none"> X-IQ-NA-HD-125A 		Series systems)		
IQ Combiner 5/5C breakers	PV branch circuit breakers <ul style="list-style-type: none"> BRK-20A-2P-240V BRK-20A-2P-240V-B (for grid-forming IQ8) 	1,2,3 or 4 (if using IQ Combiner 5/5C)	1,2,3 or 4 (if using IQ Combiner 5/5C)	0	0
	Storage branch circuit breakers ⁴ <ul style="list-style-type: none"> BRK-20A-2P-240V BRK-40A-2P-240V BRK-60A-2P-240V 	0	0	1,2,3 or 4 (if using IQ Combiner 5/5C)	1,2,3 or 4 (if using IQ Combiner 5/5C)
IQ System Controller	For systems without generators <ul style="list-style-type: none"> IQ System Controller 3 SC200D111C240US01⁵ 	0	1	0	1
	For systems without generators and with IQ Meter Collar <ul style="list-style-type: none"> IQ System Controller 3M SC200D111CMC1US01⁵ 	0	0	0	1 (with IQ Meter Collar)
	For systems with generator <ul style="list-style-type: none"> IQ System Controller 3G SC200G111C240US01⁵ 	0	1	0	1
	Main breaker and/or load breaker for IQ System Controller 3/3G <ul style="list-style-type: none"> BRK-200A-2P-240V (Eaton SKU: CSR2200N) BRK-175A-2P-240V (Eaton SKU: CSR2175N) BRK-150A-2P-240V 	0	0, 1, or 2	0	0, 1, or 2

⁴ Sum of ratings of the storage branch circuit breakers shall not exceed 80 A if using IQ Combiner 5/5C.

⁵ IQ System Controller 3/3G/3M ships with Enphase System Shutdown Switch (Rapid shutdown switch) and pre-installed hold-down kit on all 3 DER circuits. Separate hold-down kits are not needed.

Component type	Product name and model number	Solar Only	Sunlight Backup	Battery Only grid-tied	Battery Only grid-forming
	<ul style="list-style-type: none"> • (Eaton SKU: CSR2150N) • BRK-125A-2P-240V • (Eaton SKU: CSR2125N) • BRK-100A-2P-240V • (Eaton SKU: CSR2100) 				
	IQ System Controller 3/3G/ 3M circuit breakers ⁶ <ul style="list-style-type: none"> • BRK-40A-2P-240V • (Eaton SKU: BR240) • BRK-40A-2P-240V-B (Eaton SKU: BR240B) • BRK-60A-2P-240V (Eaton SKU: BR260) • BRK-80A-2P-240V (Eaton SKU: BR280) • BRK-20A-2P-240V-B (Eaton SKU: BR220B) • BRK-30A-2P-240V (Eaton SKU: BR230B) 	0	0, 1, or 2	0	0, 1, or 2
IQ Meter Collar	MC-200-011-V01	0	0	0	1 (with IQ System Controller 3M)
Control cable	CTRL-SC3-NA-01	—	As needed	As needed	As needed

7.2 With IQ Battery 3T/10T and/or IQ System Controller 2

Table 16: Component list for with IQ Battery 3T/10T and/or IQ System Controller 2

Component type	Product name and model number	Solar Only grid-tied	Sunlight Backup	The battery grid-tied	Battery-only grid-forming
Microinverters	IQ8 Series <ul style="list-style-type: none"> • IQ8-60-2-US • IQ8PLUS-72-2-US 	As needed per system design	As needed per system design (up to 64 A continuous)	0	0

⁶ IQ System Controller 3/3G/3M is compatible with ABB/GE and Siemens breakers for DERs.

Component type	Product name and model number	Solar Only grid-tied	Sunlight Backup	The battery grid-tied	Battery-only grid-forming
	<ul style="list-style-type: none"> IQ8M-72-2-US IQ8A-72-2-US IQ8H-240-72-2-US IQ8MC-72-M-US IQ8AC-72-M-US IQ8HC-72-M-US 				
	IQ8 Series <ul style="list-style-type: none"> IQ8H-208-72-2-US 	As needed per system design	Not supported	0	0
	IQ7 Series <ul style="list-style-type: none"> IQ7-60-2-US IQ7PLUS-72-2-US IQ7X-96-2-US IQ7A-72-2-US 	As needed per system design	Not supported	0	0
	IQ6 Series <ul style="list-style-type: none"> IQ6-60-2-US IQ6PLUS-72-2-US 	As needed per system design	Not supported	0	0
	M Series <ul style="list-style-type: none"> M215-60-2LL-S22-IG M215-60-2LL-S25-IG M250-60-2LL-S22 M250-60-2LL-S25 M250-72-2LL-S22 M250-72-2LL-S25 	As needed per system design	Not supported	0	0
	IQ Battery	IQ Battery 3T/10T	0	0	As needed per system design (does not support 208 V operation)
	IQ Battery Lifting Handle	0	0	1	1

Component type	Product name and model number	Solar Only grid-tied	Sunlight Backup	The battery grid-tied	Battery-only grid-forming
	<ul style="list-style-type: none"> ENCHARGE-HNDL-R1 				
AC combiner	IQ Combiner 4/4C <ul style="list-style-type: none"> X-IQ-AM1-240-4 X-IQ-AM1-240-4C X2-IQ-AM1-240-4⁷ X2-IQ-AM1-240-4C Includes IQ Gateway and 2 Consumption CTs 	1(not for M Series)	1	1	1
Gateway	IQ Gateway for IQ Series <ul style="list-style-type: none"> ENV-IQ-AM1-240 ENV2-IQ-AM1-2407 	1(if not using IQ Combiner; not for M Series)	0	1(if not using IQ Combiner)	1(if not using IQ Combiner)
	ENV-S-AM1-120	1(only for M Series)	Not supported	0	0
Load control	IQ Load Controller <ul style="list-style-type: none"> EP-NA-LK02-040 	0	1 or 2	0	1 or 2
Enphase Energy System communications	Communications Kit <ul style="list-style-type: none"> COMMS-KIT-01 	0	1	1	1
Cellular modem	Enphase Mobile Connect <ul style="list-style-type: none"> CELLMODEM-07-NA-05 	0 or 1 (if not using IQ Combiner 4C)	0 or 1 (if not using IQ Combiner 4C)	0 or 1 (if not using IQ Combiner 4C)	0 or 1 (if not using IQ Combiner 4C)
Current transformers	Consumption CTs <ul style="list-style-type: none"> CT-200-SPLIT or CT-200-CLAMP 	2(if not using IQ Combiner 4/4C)	2(if not using IQ Combiner 4/4C)	2(if not using IQ Combiner 4/4C)	2(if not using IQ Combiner 4/4C)
	Generator CT <ul style="list-style-type: none"> CT-200-CLAMP 	0	2(if using a generator, it must be	0	2(if using generator, it must be

⁷ Use this SKU in jurisdictions that mandate IEEE 1547:2018 compliance.

Component type	Product name and model number	Solar Only grid-tied	Sunlight Backup	The battery grid-tied	Battery-only grid-forming
			purchased separately)		purchased separately)
IQ Combiner 4/4C Hold-Down Kit	Hold-down kit for IQ Combiner 4/4C X-IQ-NA-HD-125A	0	1 or 2 (only for IQ8 Series systems)	0	0
IQ Combiner 4/4C breakers	PV branch circuit breakers <ul style="list-style-type: none"> BRK-20A-2P-240V BRK-20A-2P-240V-B (for grid-forming IQ8) 	1,2,3 or 4 (if using IQ Combiner 4/4C)	1,2,3 or 4 (if using IQ Combiner 4/4C)	0	0
	Storage branch circuit breaker ⁸ <ul style="list-style-type: none"> BRK-20A-2P-240V BRK-40A-2P-240V BRK-60A-2P-240V 	0	0	1,2,3 or 4 (if using IQ Combiner 4/4C)	1,2,3 or 4 (if using IQ Combiner 4/4C)
System controller	IQ System Controller 2 <ul style="list-style-type: none"> EP200G-SC2-RSD-KIT 	0	1	0	1
	Hold-down kit for IQ System Controller 2 <ul style="list-style-type: none"> EP200G-NA-HD-200A 	0	1	0	1
	Main breaker and/or load breaker for IQ System Controller 2 <ul style="list-style-type: none"> BRK-200A-2P-240V (Eaton SKU: CSR2200N) BRK-175A-2P-240V (Eaton SKU: CSR2175N) BRK-150A-2P-240V 	0	0, 1, or 2	0	0, 1, or 2

⁸ Sum of ratings of the Storage branch circuit breakers shall not exceed 80 A if using IQ Combiner 4/4C.

Component type	Product name and model number	Solar Only grid-tied	Sunlight Backup	The battery grid-tied	Battery-only grid-forming
	<ul style="list-style-type: none"> • (Eaton SKU: CSR2150N) • BRK-125A-2P-240V • (Eaton SKU: CSR2125N) • BRK-100A-2P-240V • (Eaton SKU: CSR2100) 				
	IQ System Controller 2 circuit breakers <ul style="list-style-type: none"> • BRK-40A-2P-240V-B (Eaton SKU: BR240B) • BRK-60A-2P-240V (Eaton SKU: BR260) • BRK-80A-2P-240V (Eaton SKU: BR280) • BRK-20A-2P-240V-B (Eaton SKU: BR220B) • BRK-30A-2P-240V (Eaton SKU: BR230B) 	0	0, 1, or 2	0	0, 1, or 2

8. Component list for Solar + Battery system configurations

To learn about various component lists for Solar + Battery system configurations, see the following topics.

8.1 With IQ Battery 5P and/or IQ System Controller 3/3G/3M

Table 17: Component list for with IQ Battery 5P and/or IQ System Controller 3/3G/3M

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
Microinverters	IQ8 Series <ul style="list-style-type: none"> IQ8-60-2-US IQ8PLUS-72-2-US IQ8M-72-2-US IQ8A-72-2-US IQ8H-240-72-2-US IQ8MC-72-M-US IQ8AC-72-M-US IQ8HC-72-M-US 	As needed per system design	As needed per system design (up to 64 A continuous) In IQ System Controller 3, up to 128 A continuous if DER port is used for additional microinverters	As needed per system design (up to 64 A continuous) In IQ System Controller 3, up to 128 A continuous if DER port is used for additional microinverters
	IQ8 Series <ul style="list-style-type: none"> IQ8H-208-72-2-US 	As needed per system design (IQ Battery integration not supported)	Not supported	Not supported
	IQ7 Series <ul style="list-style-type: none"> IQ7-60-2-US IQ7PLUS-72-2-US IQ7X-96-2-US IQ7A-72-2-US 	As needed per system design	As needed per system design	As needed per system design
	IQ6 Series <ul style="list-style-type: none"> IQ6-60-2-US IQ6PLUS-72-2-US 	As needed per system design	As needed per system design	As needed per system design
	M Series <ul style="list-style-type: none"> M215-60-2LL-S22-IG 	As needed per system design	As needed per system design	As needed per system design

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
	<ul style="list-style-type: none"> • M215-60-2LL-S25-IG • M250-60-2LL-S22 • M250-60-2LL-S25 • M250-72-2LL-S22 • M250-72-2LL-S25 			
Batteries	IQ Batteries <ul style="list-style-type: none"> • IQ Battery-5P-1P-NA 	As needed per system design (does not support 208 V operation)	As needed per system design, up to 16 units maximum (does not support 208 V operation)	As needed per system design, up to 16 units maximum (does not support 208 V operation)
	IQ Battery 5P Pedestal Mount for NA <ul style="list-style-type: none"> • B05-PI-0550-O 	Optional (1 per IQ Battery 5P)	Optional (1 per IQ Battery 5P)	Optional (1 per IQ Battery 5P)
	IQ Battery 5P Lifting Handle <ul style="list-style-type: none"> • IQ Battery-HNDL-5 	1	1	1
AC combiner	IQ Combiner 5/5C <ul style="list-style-type: none"> • X-IQ-AM1-240-5 • X-IQ-AM1-240-5C (includes IQ Gateway, two Consumption CTs, and one battery CT) • X-IQ-AM1-240-5-HDK (includes one IQ Gateway, two Consumption CTs, one battery CT, and one hold down kit) • X-IQ-AM1-240-5C-HDK (includes one IQ Gateway, two Consumption CTs, one battery CT, and one hold down kit) 	1(not for M Series Microinverters)	1(not for M Series Microinverters)	1(not for M Series Microinverters)
Gateway	IQ Gateway for IQ Series <ul style="list-style-type: none"> • ENV-IQ-AM1-240 • ENV2-IQ-AM1-2409F9F⁹ 	1(if not using IQ Combiner 5/5C; not for	1(if not using IQ Combiner 5/5C; not for	1(if not using IQ Combiner 5/5C; not for M Series Microinverters)

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
		M Series Microinverters)	M Series Microinverters)	
	Envoy S Metered <ul style="list-style-type: none"> ENV-S-AM1-120 	1(for M Series Microinverters)	1(for M Series Microinverters)	1(for M Series Microinverters)
Load control	IQ Load Controller <ul style="list-style-type: none"> EP-NA-LK02-040 	0	0, 1, or 2	0, 1, or 2
Enphase Energy System communications (between IQ Batteries, IQ System Controller 3/3G/3M, and IQ Gateway)	Communications Kit <ul style="list-style-type: none"> COMMS-KIT-02 (Includes 1 Battery CT, Power Jumper for IQ Gateway, and NEMA 4X enclosure) 	1(if not using IQ Combiner 5/5C)	1(if not using IQ Combiner 5/5C)	1(if not using IQ Combiner 5/5C)
Cellular modem	Enphase Mobile Connect <ul style="list-style-type: none"> CELLMODEM-07-NA-05 	0 or 1 (if not using IQ Combiner 5C)	0 or 1 (if not using IQ Combiner 5C)	0 or 1 (if not using IQ Combiner 5C)
Current transformers	Consumption CTs <ul style="list-style-type: none"> CT-200-SPLIT or CT-200-CLAMP 	2(if not using IQ Combiner 5C)	2(if not using IQ Combiner 5C)	2(if not using IQ Combiner 5C)
	Battery CT <ul style="list-style-type: none"> CT-200-SPLIT or CT-200-CLAMP (Included with IQ Combiner 5/5C as well as with COMMS-KIT-02) 	0	0	0
	Generator CTs <ul style="list-style-type: none"> CT-200-CLAMP 	0	2(if using a generator, it must be purchased separately)	2(if using a generator, it must be purchased separately)

⁹ Use this SKU in jurisdictions that mandate IEEE 1547:2018 compliance.

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
IQ Combiner 5/5C hold-down kit	Hold-down kit for IQ Combiner 5/5C X-IQ-NA-HD-125A (for grid-forming IQ8)	0	1 for PV branch circuits ≤ 2 ; 2 for PV branch circuits > 2 and ≤ 4 (if using IQ Combiner 5/5C)	1 for PV branch circuits ≤ 2 ; 2 for PV branch circuits > 2 and ≤ 4 (if using IQ Combiner 5/5C)
IQ Combiner 5/5C breakers	PV branch circuit breakers <ul style="list-style-type: none"> BRK-20A-2P-240V BRK-20A-2P-240V-B (for grid-forming IQ8) 	1,2,3 or 4 (if using IQ Combiner 5/5C)	1,2,3 or 4 (if using IQ Combiner 5/5C)	1,2,3 or 4 (if using IQ Combiner 5/5C)
	Storage branch circuit breakers ¹⁰ <ul style="list-style-type: none"> BRK-20A-2P-240V BRK-40A-2P-240V BRK-60A-2P-240V 	1,2,3 or 4 (if using IQ Combiner 5/5C)	0	0
IQ System Controller	For systems without generators <ul style="list-style-type: none"> IQ System Controller 3 SC200D111C240US01¹¹ 	0	1	1
	For systems without generators and with IQ Meter Collar <ul style="list-style-type: none"> IQ System Controller 3M SC200D111CMC1US01¹¹ 	0	1 (with IQ Meter Collar)	0
	For systems with a generator <ul style="list-style-type: none"> IQ System Controller 3G SC200G111C240US01¹¹ 	0	1	1

¹⁰ Sum of ratings of the storage branch circuit breakers shall not exceed 80 A when using IQ Combiner 5/5C.

¹¹ IQ System Controller 3/3G/3M ships with Enphase System Shutdown Switch (Rapid shutdown switch) and pre-installed hold-down kit on all 3 DER circuits. Separate hold-down kits are not needed.

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
	Main breaker and/or load breaker for IQ System Controller 3/3G <ul style="list-style-type: none"> • BRK-200A-2P-240V • (Eaton SKU: CSR2200N) • BRK-175A-2P-240V • (Eaton SKU: CSR2175N) • BRK-150A-2P-240V • (Eaton SKU: CSR2150N) • BRK-125A-2P-240V • (Eaton SKU: CSR2125N) • BRK-100A-2P-240V • (Eaton SKU: CSR2100) 	1	0, 1, or 2	0, 1, or 2
	IQ System Controller 3/3G/3M circuit breakers ¹² <ul style="list-style-type: none"> • BRK-40A-2P-240V • (Eaton SKU: BR240) • BRK-40A-2P-240V-B (Eaton SKU: BR240B) • BRK-60A-2P-240V (Eaton SKU: BR260) • BRK-80A-2P-240V (Eaton SKU: BR280) • BRK-20A-2P-240V-B (Eaton SKU: BR220B) • BRK-30A-2P-240V (Eaton SKU: BR230B) 		0, 1, or 2	0, 1, or 2
IQ Meter Collar	MC-200-011-V01	0	1 (with IQ System Controller 3M)	0
Control cable	CTRL-SC3-NA-01	—	As needed	As needed

¹² IQ System Controller 3/3G/3M is compatible with ABB/GE and Siemens breakers for DERs.

8.2 With IQ Battery 3T/10T and/or IQ System Controller 2

Table 18: Component list for with IQ Battery 3T/10T and/or IQ System Controller 2

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
Microinverters	IQ8 Series <ul style="list-style-type: none"> IQ8-60-2-US IQ8PLUS-72-2-US IQ8M-72-2-US IQ8A-72-2-US IQ8H-240-72-2-US IQ8MC-72-M-US IQ8AC-72-M-US IQ8HC-72-M-US 	As needed per system design	As needed per system design (up to 64 A continuous)	0
	IQ8 Series <ul style="list-style-type: none"> IQ8H-208-72-2-US 	As needed per system design	Not supported	0
	IQ7 Series <ul style="list-style-type: none"> IQ7-60-2-US IQ7PLUS-72-2-US IQ7X-96-2-US IQ7A-72-2-US 	As needed per system design	Not supported	0
	IQ6 Series <ul style="list-style-type: none"> IQ6-60-2-US IQ6PLUS-72-2-US 	As needed per system design	Not supported	0
	M Series <ul style="list-style-type: none"> M215-60-2LL-S22-IG M215-60-2LL-S25-IG M250-60-2LL-S22 M250-60-2LL-S25 M250-72-2LL-S22 M250-72-2LL-S25 	As needed per system design	Not supported	0
IQ Battery	IQ Battery 3T/10T	As needed per system design (does not	0	As needed per system design (does

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
		support 208 V operation)		not support 208 V operation)
	IQ Battery Lifting Handle • ENCHARGE-HNDL-R1	0	0	1
AC combiner	IQ Combiner 4/4C • X-IQ-AM1-240-4 • X-IQ-AM1-240-4C • X2-IQ-AM1-240-4C ¹³ • X2-IQ-AM1-240-4C (includes IQ Gateway and 2 Consumption CTs)	1(not for M Series)	1	1
Gateway	IQ Gateway for IQ Series • ENV-IQ-AM1-240 • ENV2-IQ-AM1-2407	1(if not using IQ Combiner; not for M Series)	0	1(if not using IQ Combiner)
	ENV-S-AM1-120	1(only for M Series)	Not supported	0
Load control	IQ Load Controller • EP-NA-LK02-040	0	1 or 2	0
Enphase Energy System communications	Communications Kit • COMMS-KIT-01	1	1	1
Cellular modem	Enphase Mobile Connect • CELLMODEM-07-NA-05	0 or 1 (if not using IQ Combiner 4C)	0 or 1 (if not using IQ Combiner 4C)	0 or 1 (if not using IQ Combiner 4C)
Current transformers	Consumption CTs • CT-200-SPLIT or CT-200-CLAMP	2(if not using IQ Combiner 4/4C)	2(if not using IQ Combiner 4/4C)	2(if not using IQ Combiner 4/4C)

¹³ Use this SKU in jurisdictions that mandate IEEE 1547:2018 compliance.

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
	Generator CTs • CT-200-CLAMP	0	2 (if using a generator, it must be purchased separately)	2 (if using a generator, it must be purchased separately)
IQ Combiner 4/4C Hold-Down Kit	Hold-down Kit for IQ Combiner 4/4C X-IQ-NA-HD-125A (for grid-forming IQ8)	0	1 for PV branch circuits ≤2. 2 for PV branch circuits >2 and ≤4 (if using IQ Combiner 4/4C)	1 for PV branch circuits ≤2. 2 for PV branch circuits >2 and ≤4 (if using IQ Combiner 4/4C)
IQ Combiner 4/4C breakers	PV branch circuit breakers • BRK-20A-2P-240V • BRK-20A-2P-240V -B (for grid-forming IQ8)	1,2,3 or 4 (if using IQ Combiner 4/4C)	1,2,3 or 4 (if using IQ Combiner 4/4C)	1,2,3 or 4 (if using IQ Combiner 4/4C)
	Storage branch circuit breaker ¹⁴ • BRK-20A-2P-240V • BRK-40A-2P-240V • BRK-60A-2P-240V	1,2,3 or 4 (if using IQ Combiner 4/4C)	0	0
	IQ System Controller 2 • EP200G-SC2-RSD-KIT	0	1	1
	Hold-down Kit for IQ System Controller 2 • EP200G-NA-HD-200A	0	2 for IQ8 Series systems; 1 otherwise	2 for IQ8 Series systems; 1 otherwise
	Main breaker and/or load breaker for IQ System Controller 2 • BRK-200A-2P-240 V • (Eaton SKU: CSR2200N)	0	0, 1, or 2	0

¹⁴ Sum of ratings of the Storage branch circuit breakers shall not exceed 80 A when using IQ Combiner 4/4C.

Component type	Product name and model number	Grid-tied system	Whole home backup	Partial home backup
	<ul style="list-style-type: none"> • BRK-175A-2P-240V (Eaton SKU: CSR2175N) • BRK-150A-2P-240V (Eaton SKU: CSR2150N) • BRK-125A-2P-240V (Eaton SKU: CSR2125N) • BRK-100A-2P-240V (Eaton SKU: CSR2100) 			
	IQ System Controller 2 circuit breakers <ul style="list-style-type: none"> • BRK-40A-2P-240V -B (Eaton SKU: BR240B) • BRK-60A-2P-240V (Eaton SKU: BR260) • BRK-80A-2P-240V (Eaton SKU: BR280) • BRK-20A-2P-240V -B (Eaton SKU: BR220B) • BRK-30A-2P-240V (Eaton SKU: BR230B) 	0	0, 1, or 2	0

9. Grid-tied (without backup) system configurations

Grid-connected systems can generate energy, supply it to home loads, and store it for later use - but only when the grid is available.

9.1 Solar Only

During the day, microinverters generate energy and supply loads. If permitted, excess energy is exported to the grid.

9.1.1 With IQ Combiner 5/5C

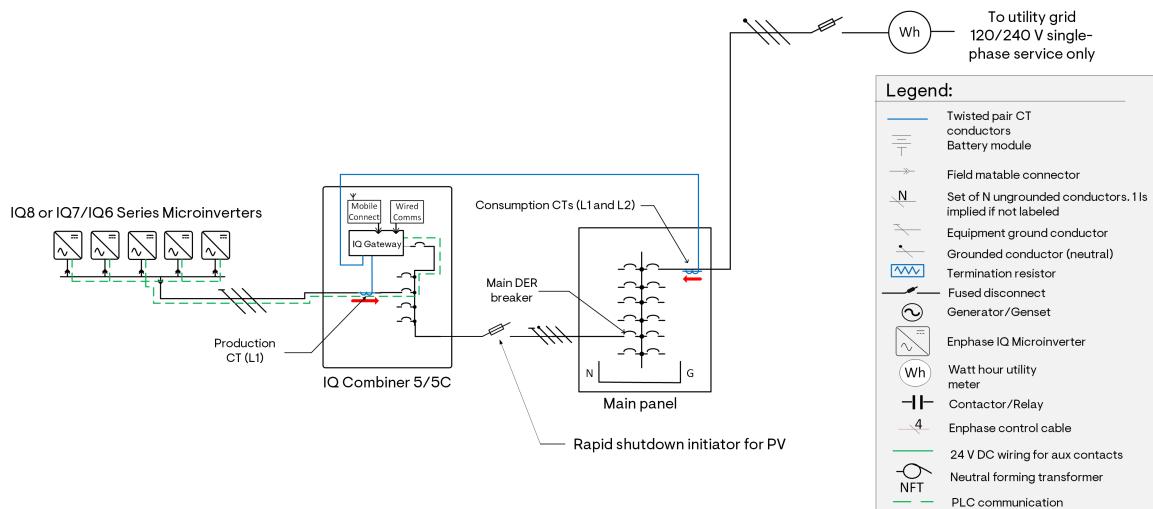


Figure 2: Solar Only grid-tied configuration with IQ8 or IQ7/IQ6 Series Microinverters and IQ Combiner 5/5C

- IQ Combiner 5/5C can support DER breakers totaling up to 80 A.
- The main DER breaker (aggregate DER breaker on the main panel) can act as the Rapid shutdown initiator for PV in grid-tied configuration if readily accessible.
- To make it easier to add battery backup functionality in the future, design the system with enough space in the installation area for an IQ System Controller 3/3G/3M and an IQ Battery 5P.



WARNING: IQ8 Series Microinverters are not backward compatible with IQ6 or M Series Microinverters. Enphase Energy System does not support mixing IQ6 Series Microinverters with IQ8 Series Microinverters or M Series Microinverters.



IMPORTANT: IQ8 Series Microinverters can be added to existing IQ7 systems on the same IQ Gateway in the following grid-tied configurations only: Solar Only and Solar + Battery (IQ Battery 3T/10T or IQ Battery 5P) without backup.



IMPORTANT: IQ7 Series Microinverters cannot be added to a site with existing IQ8 Series Microinverters on the same gateway, as a mixed system of IQ7 and IQ8 will not support IQ8-specific PCS features and grid-forming capabilities. If IQ7 Microinverters need to be added to a site on the same gateway where IQ8 Microinverters are present, the IQ8 Microinverters must be retired and recommissioned after commissioning the IQ7 Microinverters.



NOTE: If the rated continuous current of an IQ8 or IQ7/IQ6 Microinverter array is greater than 64 A, an IQ Combiner 5/5C cannot be used to aggregate all PV branch circuits. An appropriately sized, off-the-shelf PV subpanel and a standalone IQ Gateway in a NEMA 3R or higher-rated box can be used for such systems. See [Solar-only grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Gateway, and off-the-shelf combiner box](#) on page 108 for details on the configuration and wiring diagram.

9.1.2 With IQ Combiner 4/4C

Solar Only grid-tied configuration can also utilize IQ Combiner 4/4C to support a continuous PV current of up to 64 A.

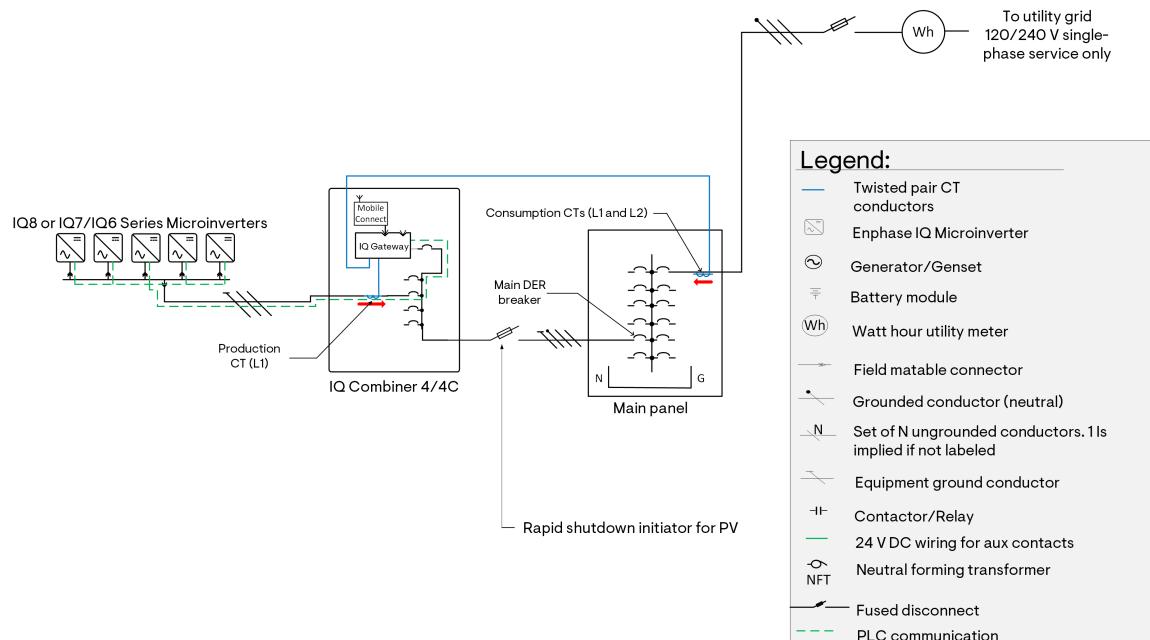


Figure 3: Solar Only grid-tied configuration with IQ8 or IQ7/IQ6 Series Microinverters and IQ Combiner 4/4C

- IQ Combiner 4/4C can support DER breakers totaling up to 80 A.
- Systems with IQ8 Series Microinverters require an IQ Gateway (formerly Envoy) with software version 7. X or higher. The IQ Combiner 4/4C ships preprogrammed with software version 7. X or higher.
- The main DER breaker (aggregate DER breaker on the main panel) can act as the Rapid shutdown initiator for PV in grid-tied configuration if it is readily accessible.



WARNING: IQ8 Series Microinverters are not backward compatible with IQ6 or M Series Microinverters. Enphase Energy System does not support mixing IQ6 Series Microinverters with IQ8 Series Microinverters or M Series Microinverters.



IMPORTANT: IQ8 Series Microinverters can be added to existing IQ7 systems on the same IQ Gateway in the following grid-tied configurations only: Solar Only and Solar + Battery (IQ Battery 3T/10T or IQ Battery 5P) without backup.



IMPORTANT: IQ7 Series Microinverters cannot be added to a site with existing IQ8 Series Microinverters on the same gateway, as a mixed system of IQ7 and IQ8 will not support IQ8-specific PCS features and grid-forming capabilities. If IQ7 Microinverters need to be added to a site on the same gateway where IQ8 Microinverters are present, the IQ8 Microinverters must be retired and recommissioned after commissioning the IQ7 Microinverters.



NOTE: If the rated continuous current of an IQ8 or IQ7/IQ6 Microinverter array is greater than 64 A, an IQ Combiner 4/4C cannot be used to aggregate all PV branch circuits. An appropriately sized, off-the-shelf PV subpanel and a standalone IQ Gateway in a NEMA 3R or higher-rated box can be used for such systems. See [Solar-only grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Gateway, and off-the-shelf combiner box on page 108](#) for details on the configuration and wiring diagram.

9.2 Battery Only

To learn about grid-forming battery-only systems, see the following topics.

9.2.1 With IQ Battery 5P

The IQ Battery will store energy from the grid at lower rates and deliver it to loads when grid tariffs are higher. IQ Battery cannot export energy back to the grid.

9.2.1.1 With IQ Combiner 5/5C

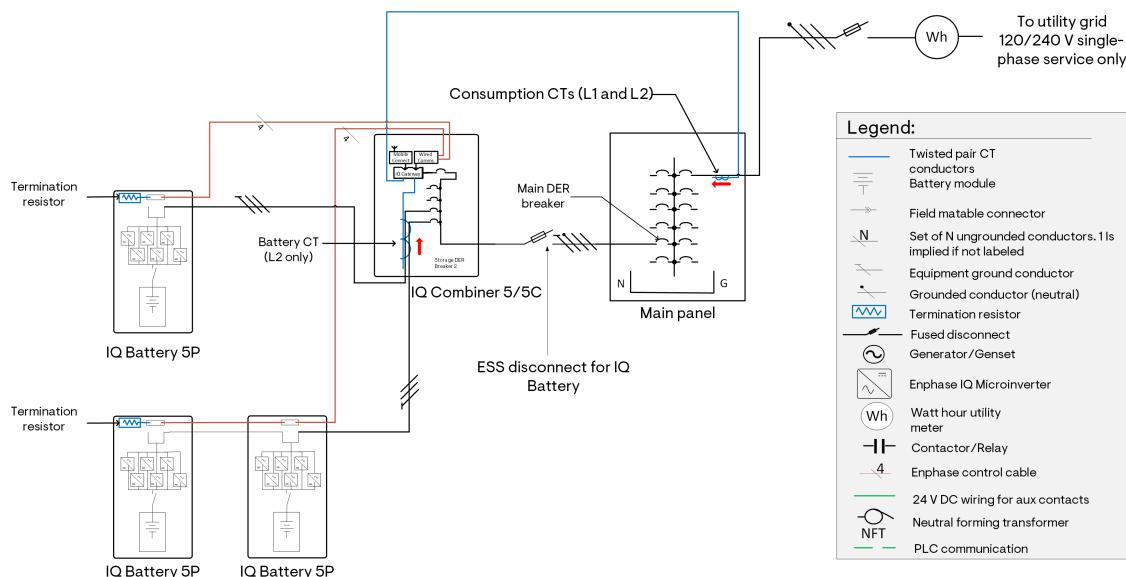


Figure 4: Battery Only grid-tied configuration with IQ Battery 5P and IQ Combiner 5C

- IQ Combiner 5/5C can support DER breakers totaling up to 80 A. Each breaker slot on the combiner can accommodate a breaker rating of up to 60 A.
- On the IQ Combiner 5/5C, the system supports Power Control Systems (PCS) for battery oversubscription on one breaker. By limiting the continuous current from the battery branch, battery oversubscription can double the battery storage capacity that can be connected to that breaker.
- Instead of IQ Combiner 5/5C, an off-the-shelf subpanel can be used for higher storage capacity. Refer to [Battery Only grid-tied configuration with IQ Battery 5P, IQ Gateway, Communications Kit 2, off-the-shelf subpanel, and two battery circuits](#) on page 110.
- The battery current transformer (CT) must clamp L2 conductors on both IQ Battery 5P branches if there are two or more battery circuits landing in the combiner.
- To make it easier to add battery backup functionality in the future, design the system with enough space in the installation area for an IQ System Controller 3/3G/3M and an IQ Battery 5P.
- The main DER breaker (aggregate DER breaker on the main panel) can act as the ESS disconnecting means in grid-tied configuration if readily accessible.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

9.2.1.2 With IQ Gateway and Communications Kit 2

IQ Battery 5P can also be paired with an off-the-shelf subpanel, Enphase IQ Gateway, Communications Kit 2 (COMMS-KIT-02), and Enphase Mobile Connect.

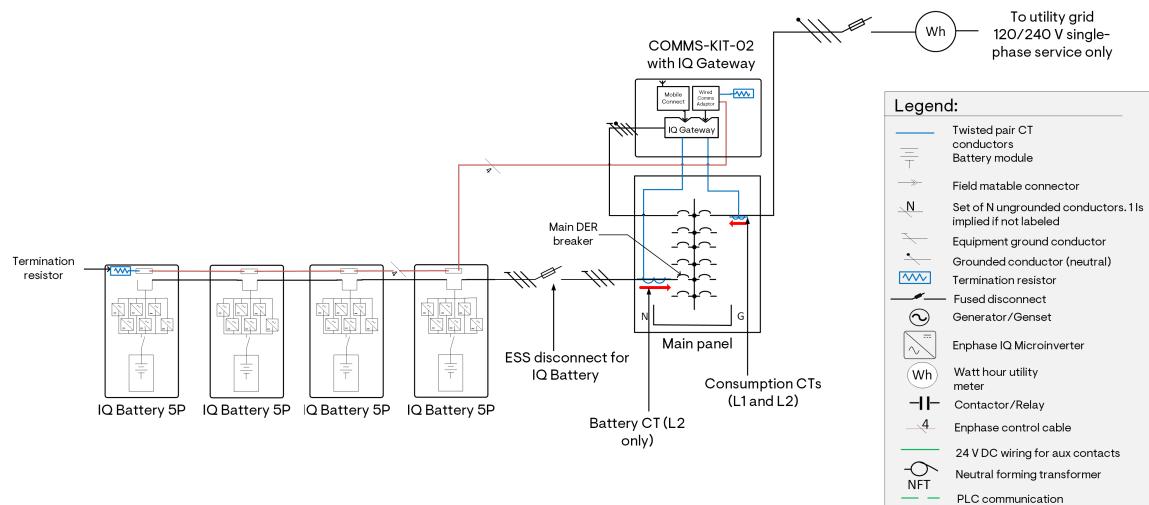


Figure 5: Battery Only grid-tied configuration IQ Battery 5P, COMMS-KIT-02, and IQ Gateway

- Up to 16 IQ Battery 5P can be installed in a system.
- Use the power jumper provided with the Communications Kit 2 (COMMS KIT 02) to short the L2 and L3 terminals (marked “L2” and “X,” respectively) on the power terminal block in the IQ Gateway.
- Grid-tied Battery Only systems with IQ Battery 5P require an IQ Gateway with software version 8.X or later.
- DER breaker on the main panel can act as the Rapid shutdown initiator for ESS disconnecting means in grid-tied configuration if the main panel is readily accessible.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- IQ Gateway and Enphase Mobile Connect must be purchased separately from the Enphase COMMS-KIT-02.
- To make it easier to add battery backup functionality in the future, design the system with enough space in the installation area for an IQ System Controller 3/3G/3M and an IQ Battery 5P.

 **NOTE:** An off-the-shelf subpanel can be used if the battery array needs more than one breaker slot on the main panel due to installation-specific requirements or if the battery array is more than 40 kWh. See [Solar + Battery grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Battery 5P, and off-the-shelf DER subpanel](#) on page 109 for the configuration and wiring diagram.

9.2.2 With IQ Battery 3T/10T and IQ Combiner 4/4C

In grid-tied Battery Only configuration, IQ Battery 3/3T/10/10T can be paired with an IQ Combiner 4/4C. IQ Combiner 4/4C can accommodate up to 12 IQ Battery 3/3T or 4 IQ Battery 10/10T. IQ Battery 3T/10T does not support the battery oversubscription Power Control System (PCS) feature.

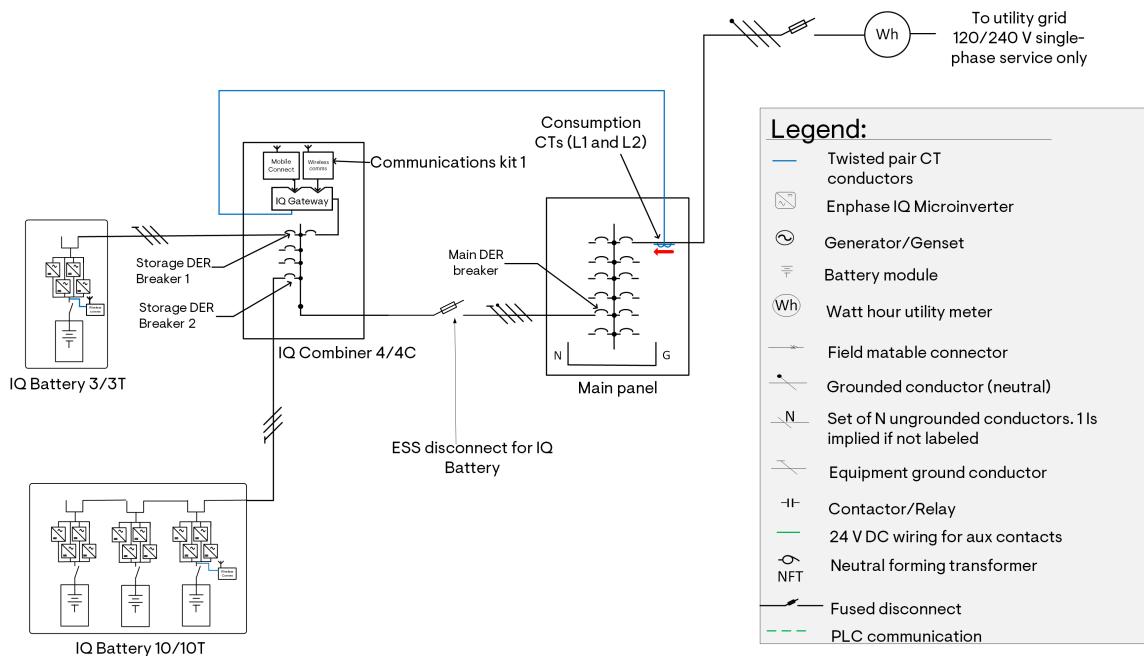


Figure 6: Battery Only grid-tied configuration with IQ Battery 3/3T/10/10T and IQ Combiner 4/4C

- Maximum current rating for each IQ Battery 3/3T/10/10T battery circuit is limited to 32 A, that is, the breaker ampacity is limited to 40 A. Therefore, each battery circuit can accommodate up to six IQ Battery 3/3T or 2 IQ Battery 10/10T.
- Grid-tied Battery Only systems with IQ Battery 3/3T/10/10T require an IQ Gateway (formerly IQ Envoy) software version 7.x or later.
- The main DER breaker (aggregate DER breaker on the main panel) can act as the rapid shutdown initiator for ESS disconnecting means in grid-tied configuration if readily accessible.
- Any system with an IQ Battery 3/3T/10/10T must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

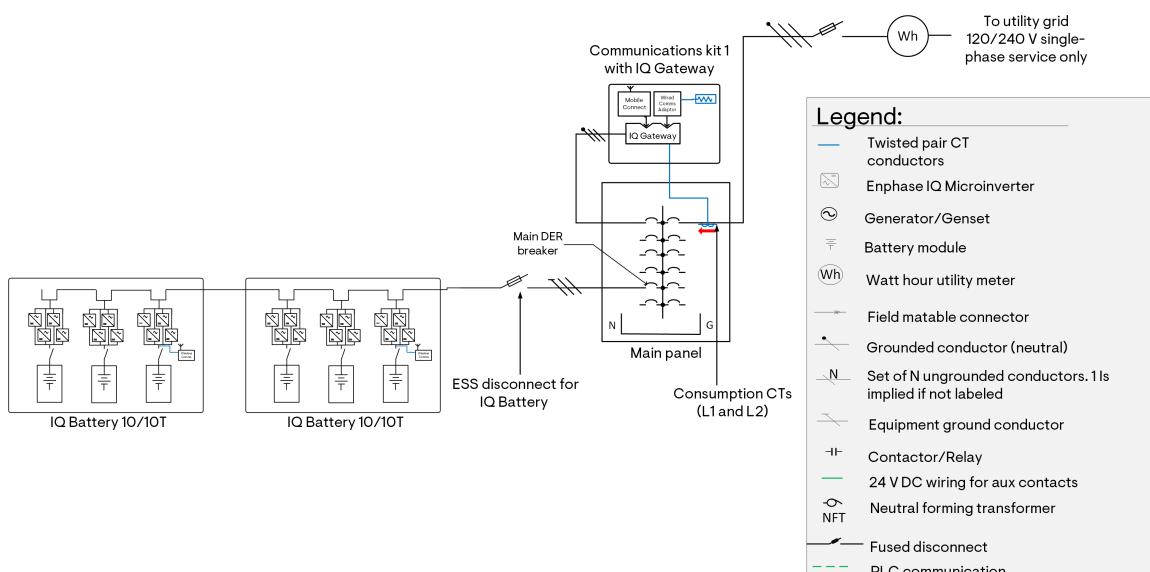


Figure 7: Battery Only grid-tied configuration with IQ Battery 3/3T/10/10T, IQ Gateway, COMMS-KIT-01, and Enphase Mobile Connect

- Maximum current rating for each IQ Battery 3/3T/10/10T battery circuit is limited to 32 A, that is, the breaker ampacity is limited to 40 A. Therefore, each battery circuit can accommodate up to six IQ Battery 3/3T or 2 IQ Battery 10/10T.
- The maximum battery array size for a system using IQ Battery 3/3T/10/10T is 40 kWh.
- Grid-tied Battery Only systems with IQ Battery 3/3T/10/10T require an IQ Gateway software version 7. x or later.
- The main DER Breaker can act as the Rapid shutdown initiator for ESS disconnecting means in grid-tied configuration if readily accessible.
- Any system with an IQ Battery 3/3T/10/10T must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

9.3 Solar + Battery with IQ Battery 5P

Excess energy generated by Enphase microinverters can be exported to the grid. The IQ Battery will store energy generated by microinverters or energy from the grid at lower rates and deliver it to loads when grid tariffs are higher. IQ Battery cannot export energy back to the grid.

9.3.1 With IQ Series Microinverters and IQ Combiner 5/5C

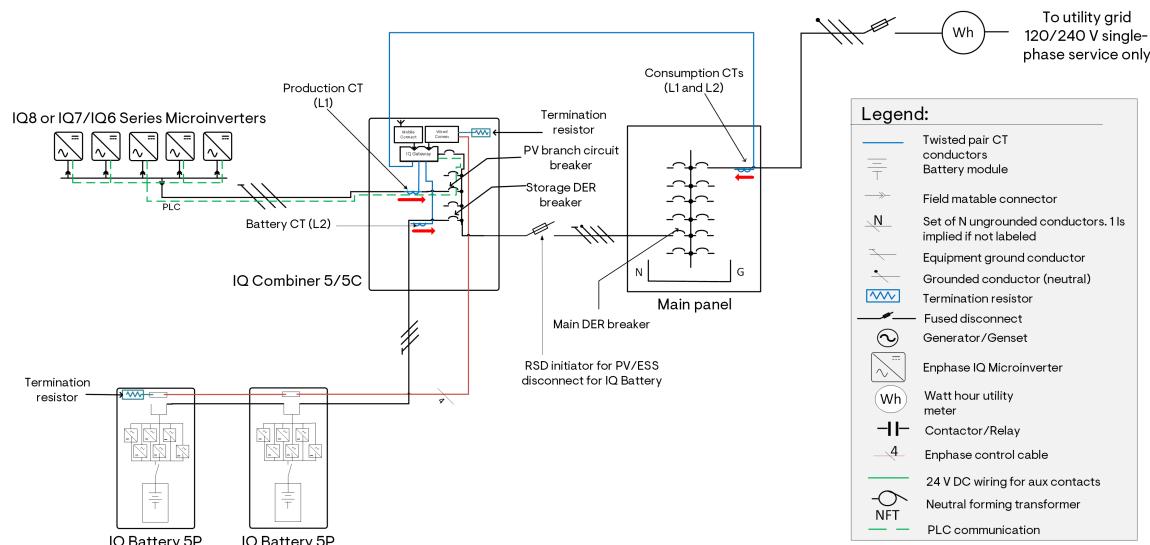


Figure 8: The Solar + Battery grid-tied configuration with IQ Combiner 5C, IQ8 or IQ7/6 Series Microinverters and IQ Battery 5P

- The sum of the microinverter and IQ Battery circuit-rated continuous currents must not exceed 64 A.
- IQ Combiner 5/5C can support DER breakers totaling up to 80 A. Each breaker slot on the combiner can accommodate a breaker rating of up to 60 A.
- On the IQ Combiner 5/5C, the system supports Power Control Systems (PCS) for battery oversubscription on one breaker. By limiting the continuous current from the battery branch, battery oversubscription can double the battery storage capacity that can be connected to that breaker.
- Main panel upgrade avoidance can be achieved by:
 - Using Busbar Overload Control: The recommended approach is where PV and battery are dynamically reduced if the main panel approaches safety limits. See the [Power Control System integration in Enphase Energy System technical brief](#) for more information on how this mode works and how to enable this mode with sample calculations.

- Using Feeder Control: In this approach, the PV and battery currents in aggregate are reduced to a lower value of current based on the NEC 120% rule. This approach is generally not recommended as Busbar Overload Control allows the home to use more power for the same nameplate rating of the PV, battery, and main panel/service size.
- Systems with IQ Battery 5P require IQ Gateway software version 8. X or later. If an update is needed, it will be automatically applied during the commissioning process.
- The main DER breaker (aggregate DER breaker on the main panel) can act as the rapid shutdown initiator for PV and ESS disconnecting means in grid-tied configuration if the main panel is readily accessible.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.



WARNING: IQ8 Series Microinverters are not backward compatible with IQ6 or M Series Microinverters. Enphase Energy System does not support mixing IQ6 Series Microinverters with IQ8 Series Microinverters or M Series Microinverters.



IMPORTANT: IQ8 Series Microinverters can be added to existing IQ7 systems on the same IQ Gateway in the following grid-tied configurations only: Solar Only and Solar + Battery (IQ Battery 3T/10T or IQ Battery 5P) without backup.



IMPORTANT: IQ7 Series Microinverters cannot be added to a site with existing IQ8 Series Microinverters on the same gateway, as a mixed system of IQ7 and IQ8 will not support IQ8-specific PCS features and grid-forming capabilities. If IQ7 Microinverters need to be added to a site on the same gateway where IQ8 Microinverters are present, the IQ8 Microinverters must be retired and recommissioned after commissioning the IQ7 Microinverters.



NOTE: If the sum of the rated continuous currents of PV branches and IQ Battery 5P branch is greater than 64 A, an IQ Combiner 5/5C cannot be used to aggregate all PV branch circuits. An appropriately sized, off-the-shelf DER subpanel and a standalone IQ Gateway in a NEMA 3R or higher-rated box can be used for such systems. See [Solar + Battery grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Battery 5P, and off-the-shelf DER subpanel](#) on page 109 for the configuration and wiring diagram.

9.3.2 With IQ Series Microinverters and IQ Combiner 4/4C

IQ Combiner 4C can be paired with COMMS-KIT-02 to support IQ8/IQ7/IQ6 Series Microinverters and IQ Battery 5P in Solar + Battery grid-tied configuration. The sum of maximum current from PV branches and Battery branches should not exceed 80 A—IQ Combiner 4C supports DER breakers totaling up to 80 A.

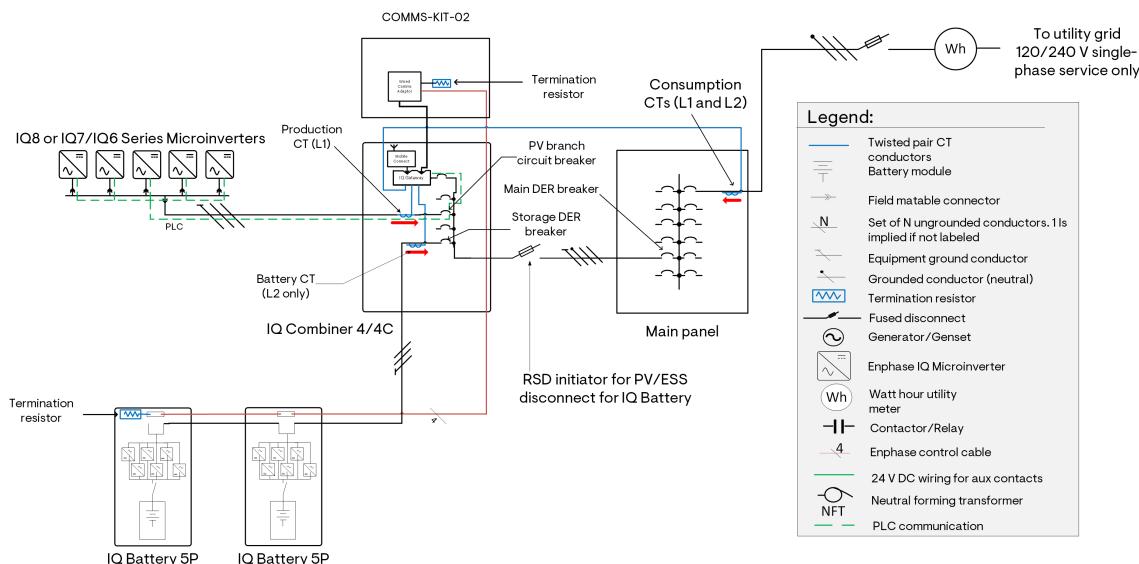


Figure 9: The Solar + Battery grid-tied configuration with IQ Combiner 4C, IQ8/7/6 Series Microinverters and IQ Battery 5P

- The sum of the microinverter and IQ Battery circuit-rated continuous currents must not exceed 64 A.
- IQ Combiner 4/4C can support DER breakers totaling up to 80 A. Each breaker slot on the combiner can accommodate a breaker rating of up to 60 A.
- Use the power jumper provided with the Communications Kit 2 (COMMS KIT 02) to short the L2 and L3 terminals (marked “L2” and “X,” respectively) on the power terminal block in the IQ Gateway.
- Systems with IQ Battery 5P require IQ Gateway software version 8. X or later. If an update is needed, it will be automatically applied during the commissioning process.
- The aggregate DER breaker on the main panel can act as the Rapid shutdown initiator for PV and ESS disconnecting means in grid-tied configuration if the main panel is readily accessible.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.



WARNING: IQ8 Series Microinverters are not backward compatible with IQ6 or M Series Microinverters. Enphase Energy System does not support mixing IQ6 Series Microinverters with IQ8 Series Microinverters or M Series Microinverters.



IMPORTANT: IQ8 Series Microinverters can be added to existing IQ7 systems on the same IQ Gateway in the following grid-tied configurations only: Solar Only and Solar + Battery (IQ Battery 3T/10T or IQ Battery 5P) without backup.



IMPORTANT: IQ7 Series Microinverters cannot be added to a site with existing IQ8 Series Microinverters on the same gateway, as a mixed system of IQ7 and IQ8 will not support IQ8-specific PCS features and grid-forming capabilities. If IQ7 Microinverters need to be added to a site on the same gateway where IQ8 Microinverters are present, the IQ8 Microinverters must be retired and recommissioned after commissioning the IQ7 Microinverters.



NOTE: If the sum of the rated continuous currents of PV branches and IQ Battery 5P branch is greater than 64 A, an IQ Combiner 4/4C cannot be used to aggregate all PV branch circuits. An appropriately sized, off-the-shelf DER subpanel and a standalone IQ Gateway in a NEMA 3R or higher-rated box can be used for such systems. See [Solar + Battery grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Battery 5P, and off-the-shelf DER subpanel](#) on page 109 for the configuration and wiring diagram.

9.3.3 With M Series Microinverters, Envoy S Metered, and COMMS-KIT-02

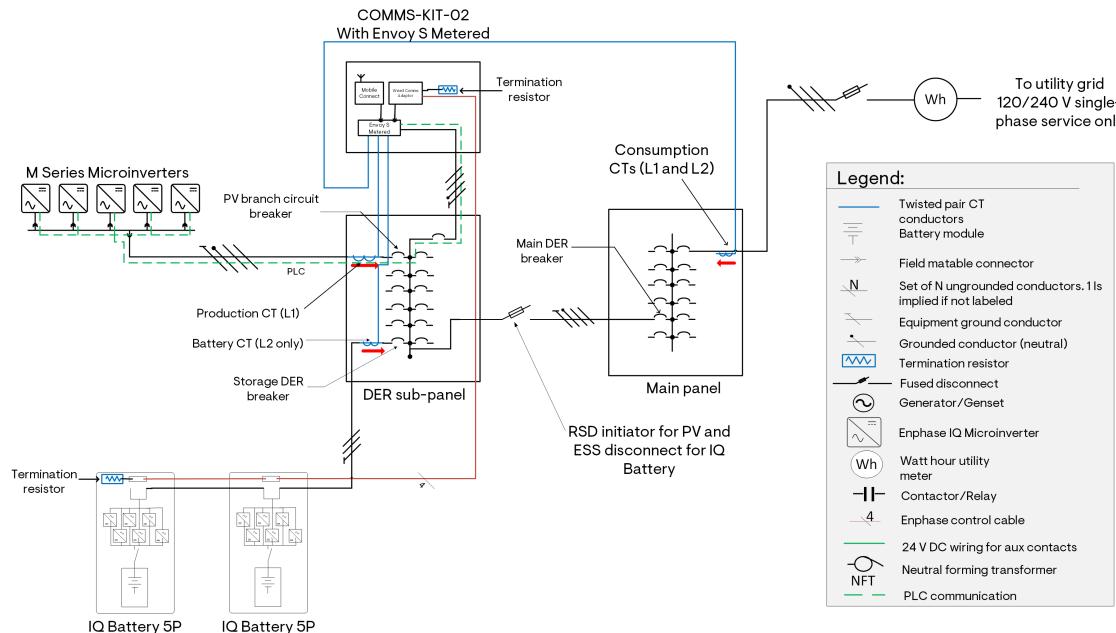


Figure 10: The Solar + Battery grid-tied configuration with M Series Microinverters, IQ Battery 5P, Envoy S Metered, Enphase COMMS-KIT-02, Enphase Mobile Connect, and third-party combiner box

- Enphase COMMS-KIT-02 and Enphase Mobile Connect can be added to existing M Series Microinverters to enable IQ Battery 5P installation.
- M Series Microinverters are incompatible with newer IQ8 or IQ6/IQ7 Microinverters. This applies to all system configurations with and without storage.
- Up to 16 IQ Battery 5P (80 kWh) can be installed in a system.
- Use a jumper cable to connect the L2 and L3 terminals in the Envoy S Metered power terminal block. These terminals are marked "B" and "C" respectively.
- Systems with IQ Battery 5P require IQ Gateway software version 8. X or later. If an update is needed, it will be automatically applied during the commissioning process.
- The DER subpanel breaker (main DER breaker) on the main panel can act as the rapid shutdown initiator for PV and ESS disconnecting means in grid-tied configuration if the main panel is readily accessible.
- The Mobile Connect cell modem has to be purchased separately from COMMS-KIT-02.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

9.4 Solar + Battery with IQ Battery 3T/10T

To learn about grid-tied systems with Solar + Battery and IQ Battery 3T/10T, see the following topics.

9.4.1 With IQ Series Microinverters and IQ Combiner 4/4C

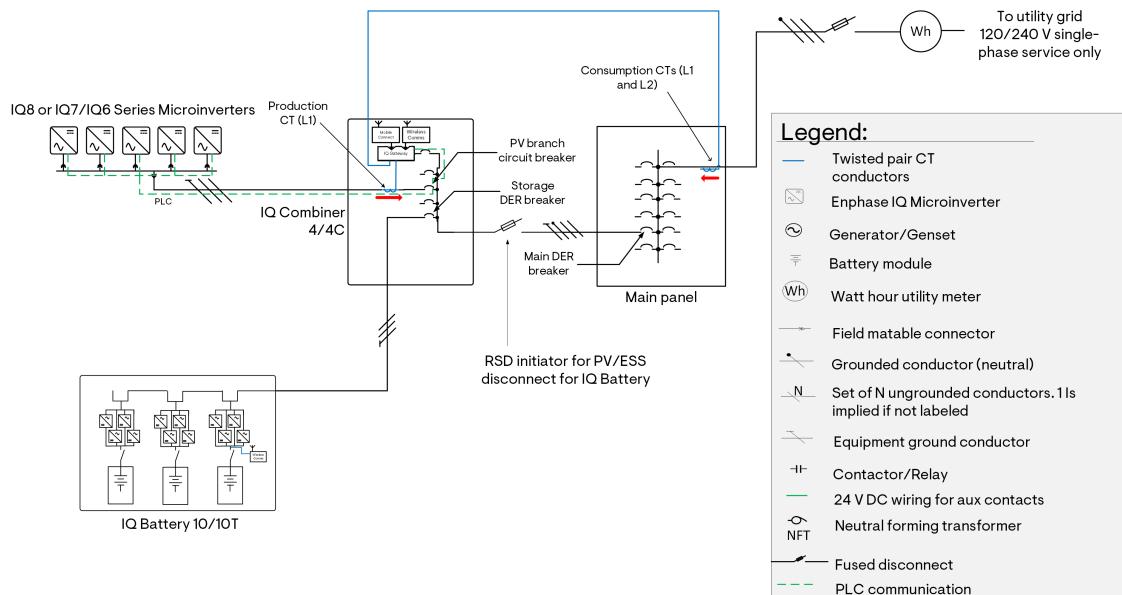


Figure 11: Solar + Battery grid-tied configuration with IQ Battery 3T/10T and IQ Combiner 4/4C

- The sum of the microinverter and IQ Battery circuit-rated continuous currents must not exceed 64 A.
- Maximum current rating for each IQ Battery 3/3T/10/10T battery circuit is limited to 32 A, that is, the breaker ampacity is limited to 40 A. Therefore, each battery circuit can accommodate up to six IQ Battery 3/3T or 2 IQ Battery 10/10T.
- The maximum battery array size for a system using IQ Battery 3/3T/10/10T is 40 kWh.
- IQ Combiner 4/4C can support DER breakers totaling up to 80 A. Each breaker slot on the combiner can accommodate a breaker rating of up to 60 A.
- The aggregate DER breaker on the main panel can act as the Rapid shutdown initiator for PV and ESS disconnecting means in grid-tied configuration if the main panel is readily accessible.
- Any system with an IQ Battery 3/3T/10/10T must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.



WARNING: IQ8 Series Microinverters are not backward compatible with IQ6 or M Series Microinverters. Enphase Energy System does not support mixing IQ6 Series Microinverters with IQ8 Series Microinverters or M Series Microinverters.



IMPORTANT: IQ8 Series Microinverters can be added to existing IQ7 systems on the same IQ Gateway in the following grid-tied configurations only: Solar Only and Solar + Battery (IQ Battery 3T/10T or IQ Battery 5P) without backup.



IMPORTANT: IQ7 Series Microinverters cannot be added to a site with existing IQ8 Series Microinverters on the same gateway, as a mixed system of IQ7 and IQ8 will not support IQ8-specific PCS features and grid-forming capabilities. If IQ7 Microinverters need to be added to a site on the same gateway where IQ8 Microinverters are present, the IQ8 Microinverters must be retired and recommissioned after commissioning the IQ7 Microinverters.



NOTE: If the sum of the rated continuous currents of PV branches and IQ Battery 3T/10T branch is greater than 64 A, an IQ Combiner 4/4C cannot be used to aggregate all PV branch circuits. An appropriately sized, off-the-shelf PV subpanel and a standalone IQ Gateway in

a NEMA-3R or higher-rated boxes can be used for such systems. See [Battery Only grid-tied configuration with IQ Battery 5P, IQ Gateway, Communications Kit 2, off-the-shelf subpanel, and two battery circuits on page 110](#) for the configuration and wiring diagram.

9.4.2 With M Series Microinverters, Envoy S Metered, and COMMS-KIT-01

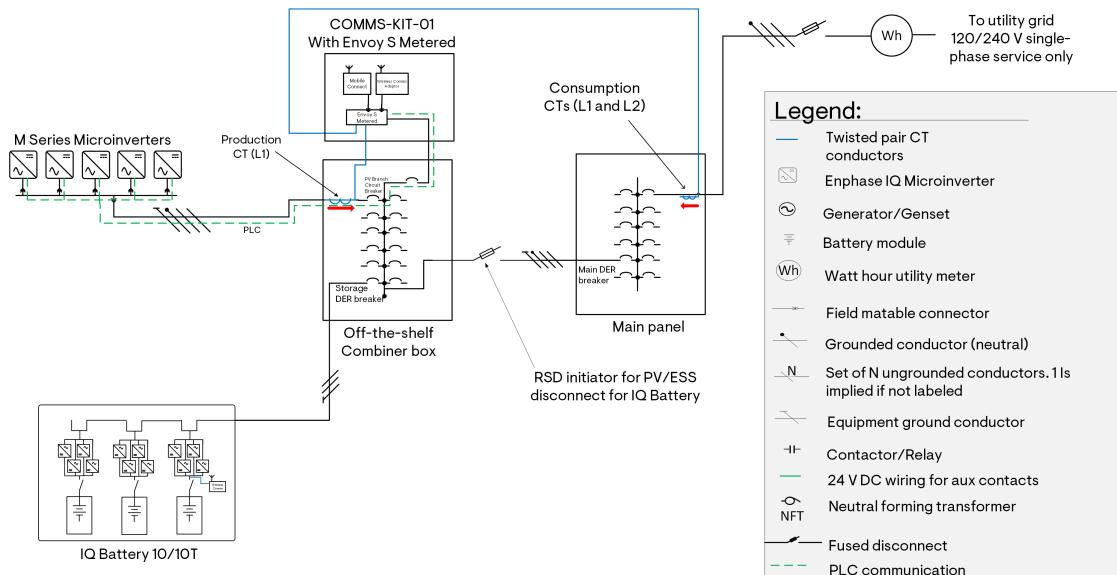


Figure 12: The Solar + Battery configuration with M Series, third-party combiner box, COMMS-KIT-01, and Enphase Mobile Connect cell modem

- Enphase COMMS-KIT-01 and Enphase Mobile Connect can be added to existing M Series Microinverters to enable IQ Battery 3/3T/10/10T installation.
- M Series Microinverters are incompatible with newer IQ8 or IQ6/IQ7 Microinverters. This applies to all system configurations with and without storage.
- Each battery circuit can accommodate up to six IQ Battery 3/3T or two IQ Battery 10/10T. As a result, the maximum breaker sizing for a battery circuit is 40 A.
- The maximum battery array size for a system using IQ Battery 3/3T/10/10T is 40 kWh.
- The main DER breaker on the main panel can act as the rapid shutdown initiator for PV and ESS disconnecting means in grid-tied configuration if the main panel is readily accessible.
- Any system with an IQ Battery 3/3T/10/10T must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

10. Grid-forming (with backup) system configurations

To learn about various grid-forming system configurations without backup, see the following topics.

10.1 Sunlight Backup (partial home backup)

Sunlight Backup or solar-only grid-forming systems can run essential loads during a grid outage.

10.1.1 With IQ System Controller 3

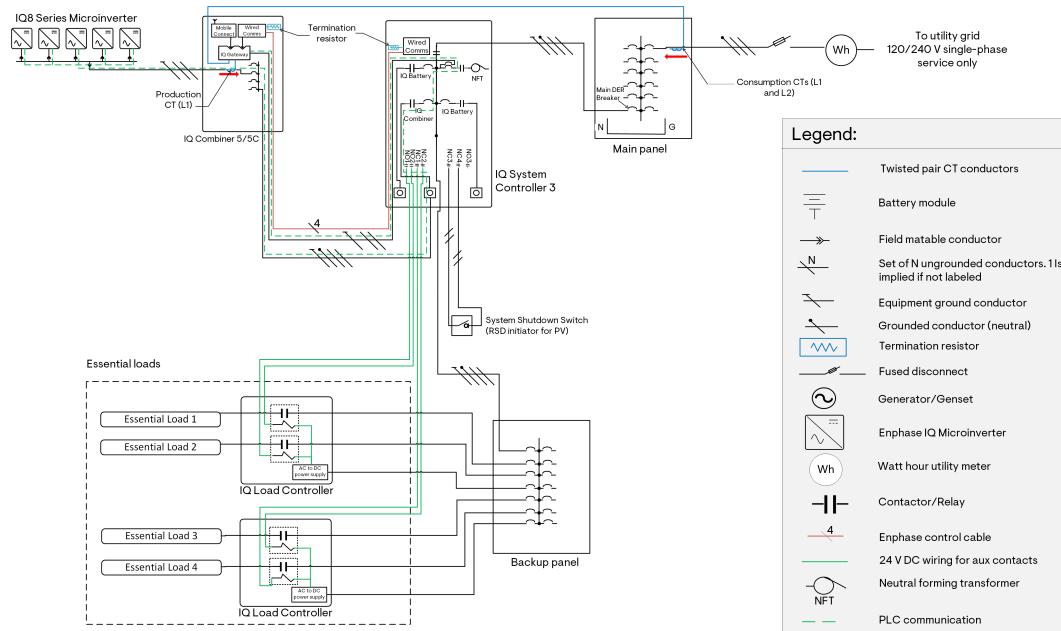


Figure 13: Sunlight Backup configuration with IQ System Controller 3 in partial home backup configuration

- This configuration is only supported by IQ8 Series Microinverters.
- The system supplies power only when the sun is shining.
- The system can support PV branch circuits with continuous current output ratings of up to 64 A.
- This configuration requires the use of an essential loads solution. An essential loads solution consists of the following:
 - An off-the-shelf panel with a maximum of four pre-selected, essential load circuits backed up by the system.
 - Up to two IQ Load Controllers, each enabling fine-grained, circuit-level control for two 240 V or four 120 V essential load circuits. Sunlight Backup needs at least one IQ Load Controller to be installed on-site.
 - Whole home backup using this configuration is not supported, as it will result in a bad customer experience.

Refer to the [Understanding Sunlight Backup system installers and system designers](#) tech brief for system installation and commissioning details.

10.1.2 With IQ System Controller 3G

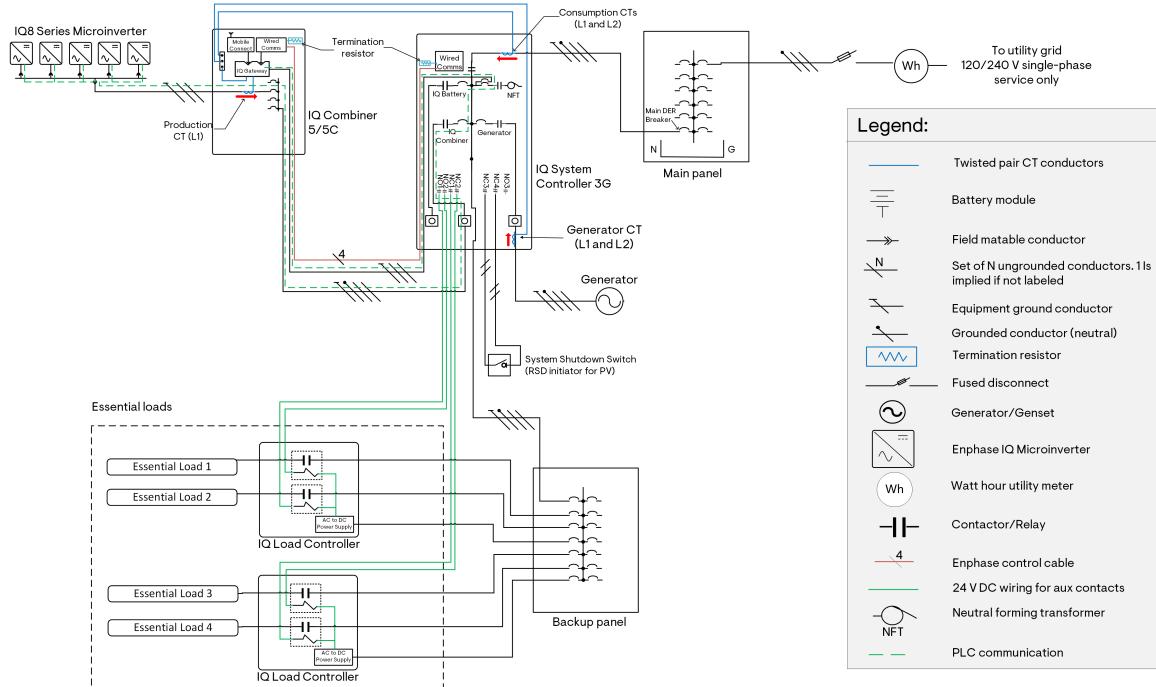


Figure 14: Sunlight Backup configuration with IQ System Controller 3G and generator in partial home backup configuration

- This configuration is only supported by IQ8 Series Microinverters.
- The system supplies power only when the sun is shining.
- The rated continuous power output of the generator must be at least equal to the rated continuous power out of the generator. Refer to the [Generator sizing](#) on page 19 section for more details. If the microinverter array exceeds this ratio, use PV shedding to drop the excess PV circuits when the system transitions to off-grid mode.
- Heavier loads can be configured to run in off-grid only when the generator is operating by connecting them to the IQ Load Controller.
- The system can support PV branch circuits with continuous current output ratings of up to 64 A.
- This configuration requires the use of an essential loads solution. An essential loads solution consists of the following:
 - An off-the-shelf panel with a maximum of four pre-selected, essential load circuits backed up by the system.
 - Up to two IQ Load Controllers, each enabling fine-grained, circuit-level control for two 240 V or four 120 V essential load circuits. Sunlight Backup needs at least one IQ Load Controller to be installed on-site.
 - Whole home backup using this configuration is not supported, as it will result in a bad customer experience.

Refer to the [Understanding Sunlight Backup system installers and system designers](#) tech brief for system installation and commissioning details.

10.1.3 With IQ System Controller 2

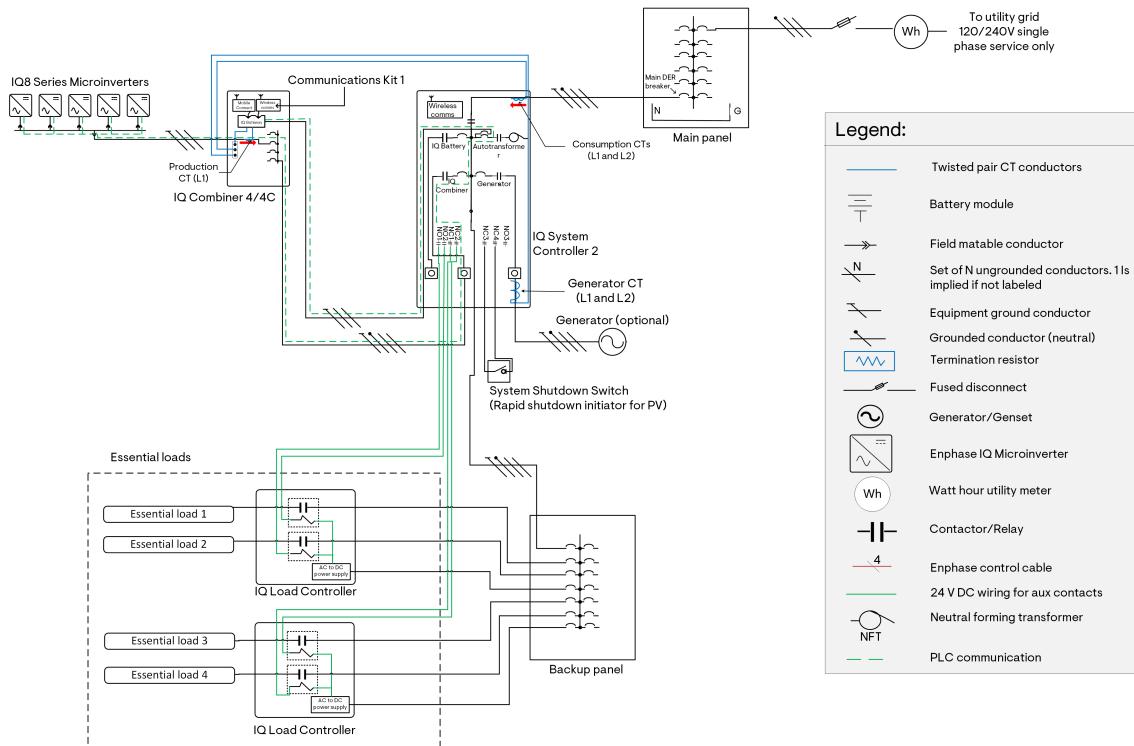


Figure 15: Sunlight Backup configuration with IQ System Controller 2 in partial home backup configuration

- This configuration is only supported by IQ8 Series Microinverters.
- The system supplies power only when the sun is shining.
- In the case of a system with a generator, the rated continuous power output of the generator must be at least equal to the rated continuous power out of the generator. Refer to the [Generator sizing](#) on page 19 section for more details. If the microinverter array exceeds this ratio, use PV shedding to drop the excess PV circuits when the system transitions to off-grid mode.
- Heavier loads can be configured to run in off-grid only when the generator is operating by connecting them to the IQ Load Controller.
- The system can support PV branch circuits with continuous current output ratings of up to 64 A.
- This configuration requires the use of an essential loads solution. An essential loads solution consists of the following:
 - An off-the-shelf panel with a maximum of four pre-selected, essential load circuits backed up by the system.
 - Up to two IQ Load Controllers, each enabling fine-grained, circuit-level control for two 240 V or four 120 V essential load circuits. Sunlight Backup needs at least one IQ Load Controller to be installed on-site.
 - Whole home backup using this configuration is not supported, as it will result in a bad customer experience.

Refer to the [Understanding Sunlight Backup system installers and system designers](#) tech brief for system installation and commissioning details.

10.2 Battery Only

Battery Only grid-forming systems will store energy from the grid and support the home load during high tariff periods or a grid outage.

10.2.1 Whole home backup

This configuration provides backup for all loads in a home at all times of day and night. The battery array must be appropriately sized to supply the loads. Depending on the size of the IQ Battery array, the system will be able to operate off-grid for extended periods. Up to two IQ Load Controllers can be used for circuit-level load control of backed-up loads.

10.2.1.1 Without generator and with IQ Battery 5P and IQ System Controller 3

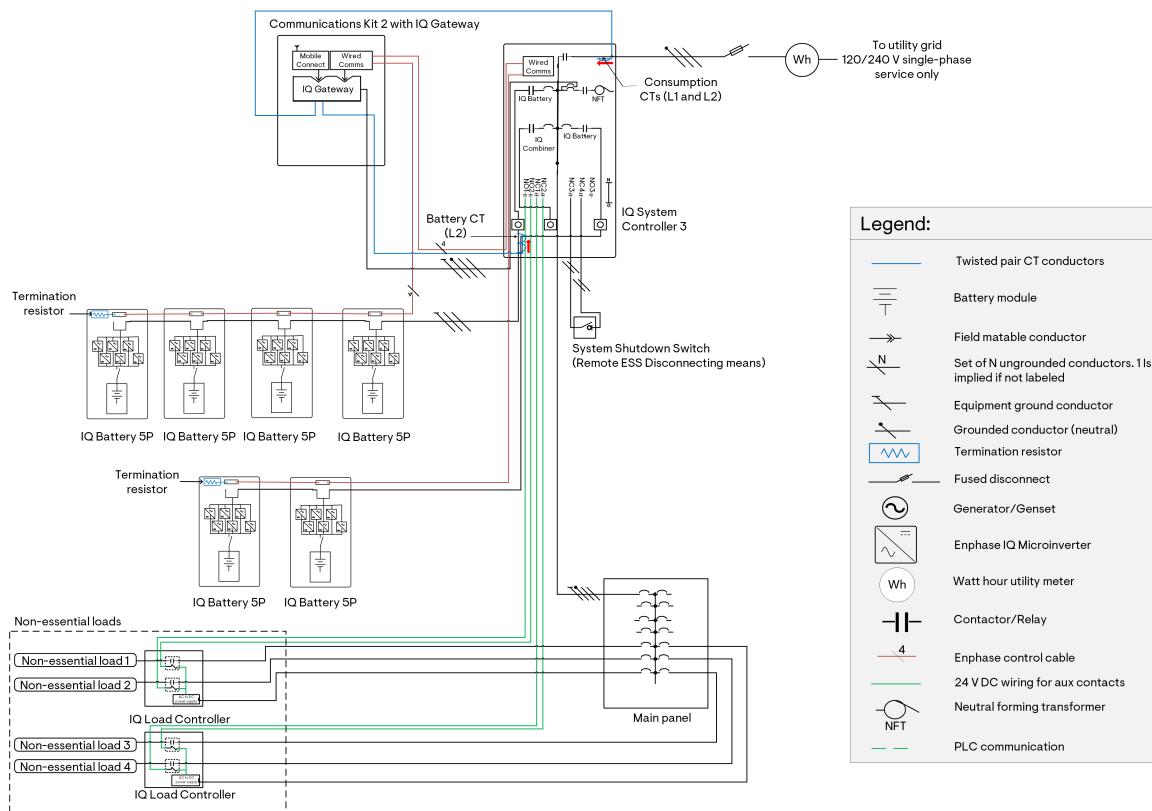


Figure 16: Battery Only grid-forming whole home backup configuration with IQ Battery 5P and IQ System Controller 3

- The power control system with battery oversubscription support for systems using IQ Gateway and older generation IQ Combiners is being evaluated. In the meantime, IQ Combiner 5/5C can be used instead of the IQ Gateway and Communications Kit 2 to enable battery oversubscription and install up to 80 kWh, that is, 16 IQ Battery 5P.
- Self-Consumption battery mode is not available in battery-only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- IQ Gateway and a Mobile Connect cellular modem must be ordered separately from COMMS-KIT-02.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.

- Any system with an IQ Battery 3/3T/10/10T must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

10.2.1.2 Without generator and with IQ Battery 5P, IQ Meter Collar, and IQ System Controller 3M

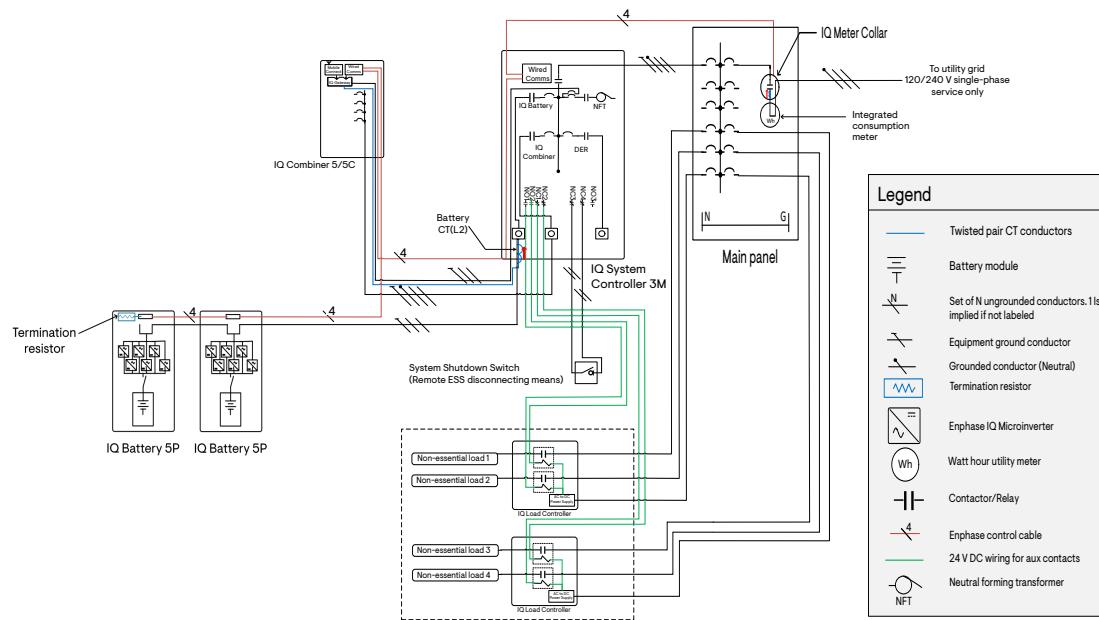


Figure 17: Battery Only grid-forming whole home backup configuration with IQ Battery 5P, IQ Meter Collar, and IQ System Controller 3M

- The IQ Meter Collar should be connected to IQ System Controller 3M and not to any other Enphase components. It is always a terminating node in this configuration. In IQ System Controller 3M, the top control wiring connector, supplying 24 V DC power, is reserved for the IQ Meter Collar and must NOT be connected to any other Enphase components such as IQ Battery or IQ Combiner to prevent electrical damage.
- The power control system with battery oversubscription support for systems using IQ Gateway and older generation IQ Combiners is being evaluated. In the meantime, IQ Combiner 5/5C can be used instead of the IQ Gateway and Communications Kit 2 to enable battery oversubscription and install up to 80 kWh, that is, 16 IQ Battery 5P.
- Self-Consumption battery mode is not available in battery-only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the Abbreviations section for details on system behavior in these modes.
- The System Shutdown Switch can be used as a remote disconnecting means for EES.

10.2.1.3 Without generator and with IQ Battery 3/3T/10/10T and IQ System Controller 2

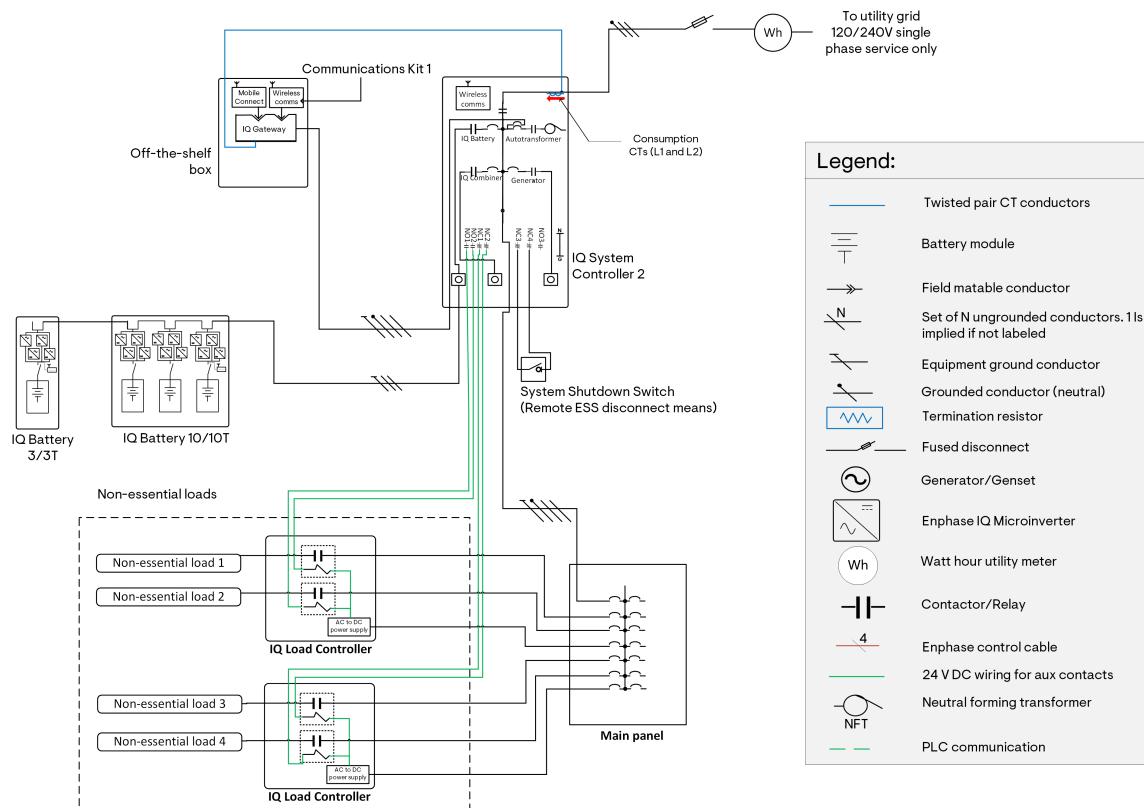


Figure 18: Battery Only grid-forming whole home backup configuration with IQ Battery 3/3T/10/10T and IQ System Controller 2

- EES systems using IQ System Controller 2 and IQ Battery 3/3T/10/10T do not support the battery oversubscription feature and can only support battery storage up to 40 kWh.
- Self-Consumption battery mode is not available in Battery Only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- Any system with an IQ Battery 3/3T/10/10T must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

10.2.1.4 With generator, IQ Battery 5P, and IQ System Controller 3G

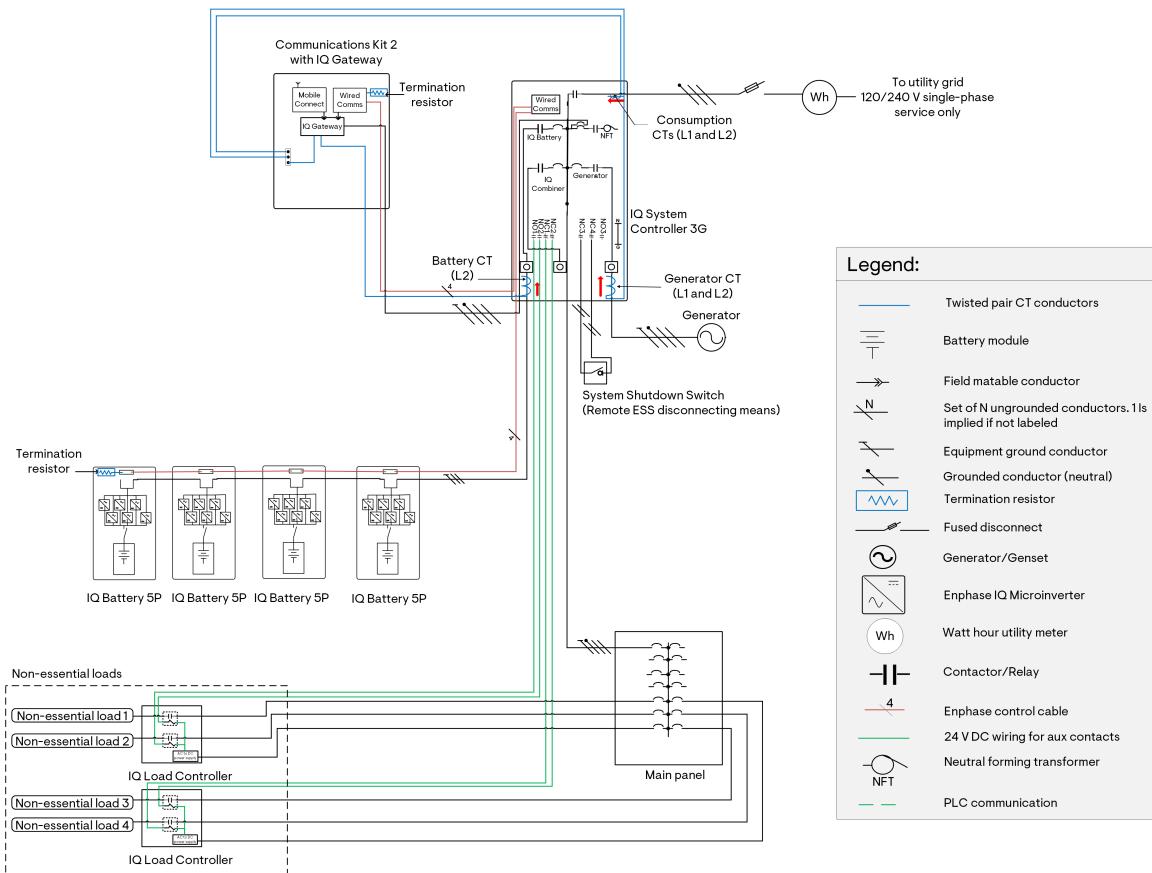


Figure 19: Battery Only grid-forming whole home backup configuration with IQ Battery 5P and IQ System Controller 3G

- The power control system for battery oversubscription support for systems using IQ Gateway and older generation IQ Combiners is being evaluated. In the meantime, IQ Combiner 5/5C can be used instead of the IQ Gateway and Communications Kit 2 to enable battery oversubscription and install up to 40 kWh, that is, eight IQ Battery 5Ps.
- Self-Consumption battery mode is not available in Battery Only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- IQ Gateway and a Mobile Connect cellular modem must be ordered separately from COMMS-KIT-02.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator tech brief](#) for details on supported generator makes and additional installation requirements.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- This figure does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.2.1.5 With generator, IQ Battery 3/3T/10/10T, and IQ System Controller 2

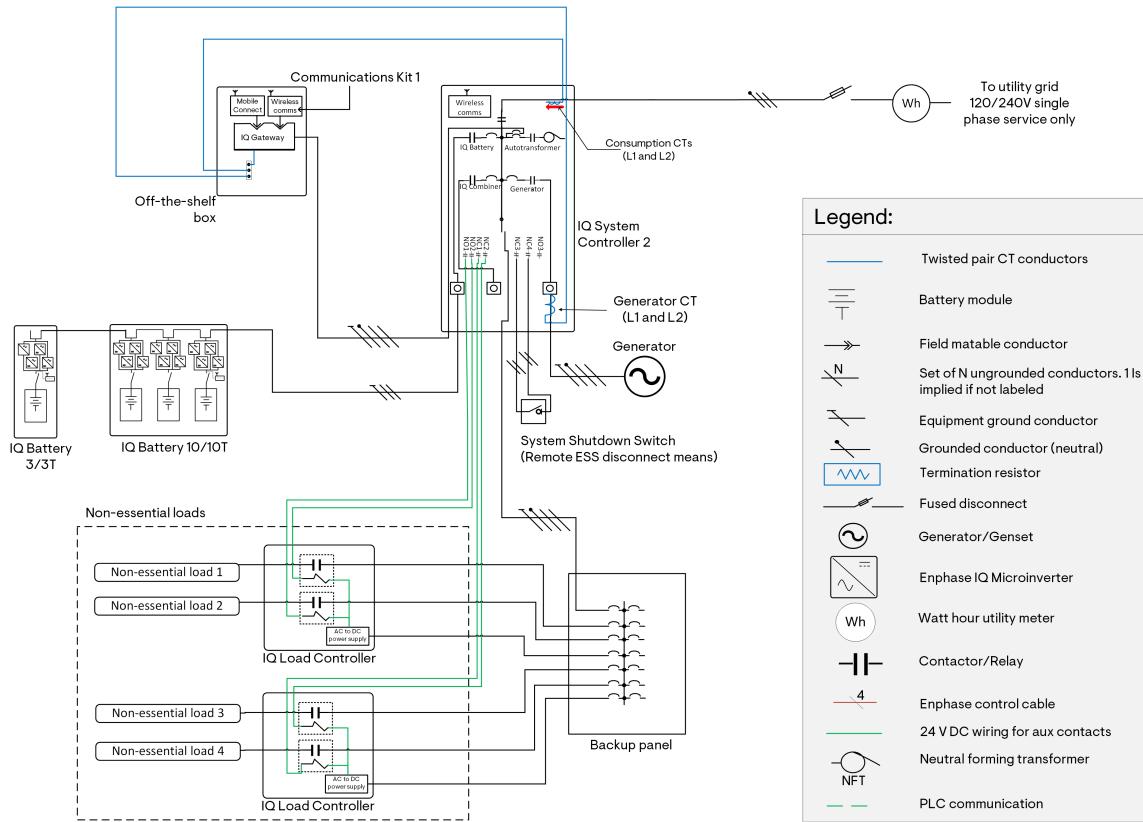


Figure 20: Battery Only grid-forming whole home backup configuration with IQ Battery 3/3T/10/10T and IQ System Controller 2

- EES systems using IQ System Controller 2 and IQ Battery 3/3T/10/10T can support battery storage of up to 40 kWh.
- Self-Consumption battery mode is not available in Battery Only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator tech brief](#) for details on supported generator makes and additional installation requirements.
- Any system with an IQ Battery 3/3T/10/10T must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.2.2 Partial home backup

In this configuration, essential loads are aggregated on a backup load panel. All the loads connected to the backup load panel will transition to off-grid seamlessly. It is strongly advised to use up to two IQ Load Controllers to eliminate heavy 240 V loads like HVACs, electric ovens, EV chargers, and so on when the system enters backup mode.

10.2.2.1 Without generator and with IQ Battery 5P and IQ System Controller 3

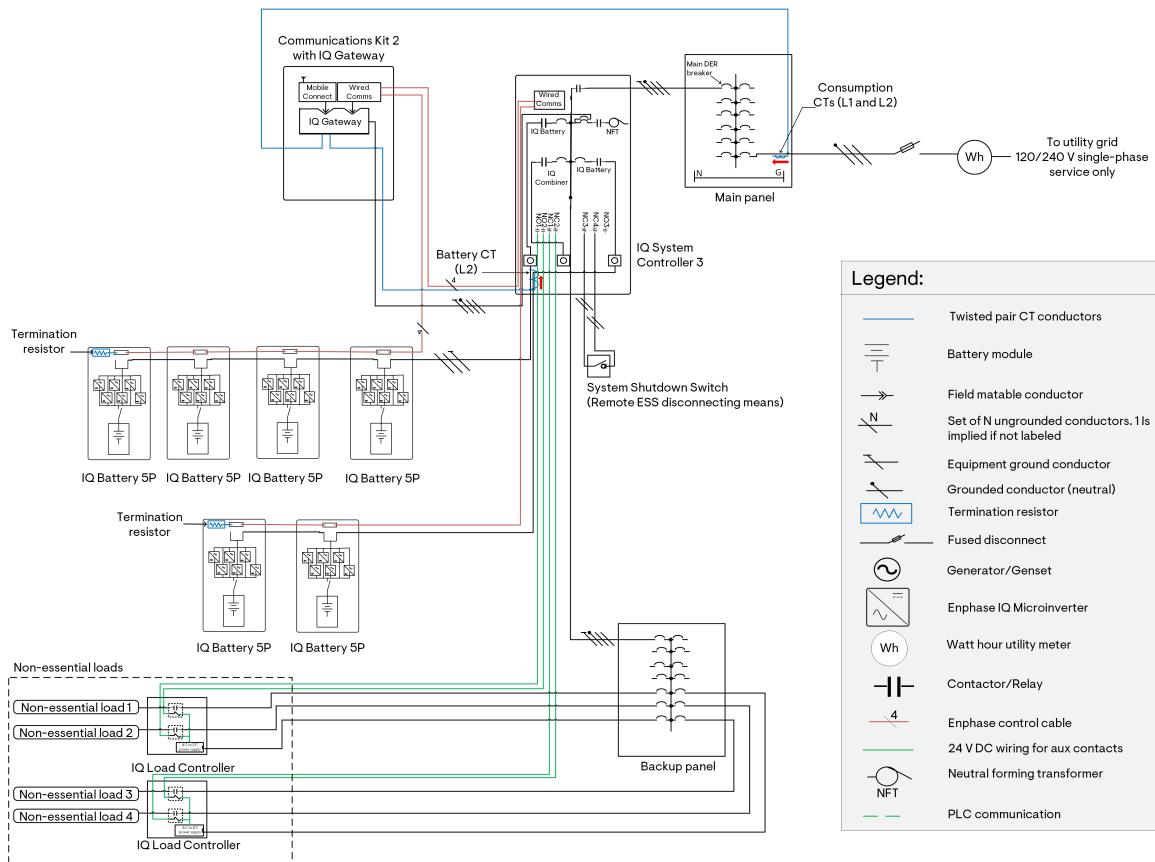


Figure 21: Battery Only grid-forming partial home backup configuration with IQ Battery 5P and IQ System Controller 3

- The power control system for battery oversubscription feature support for systems using IQ Gateway and older generation IQ Combiners is being evaluated. In the meantime, IQ Combiner 5/5C can be used instead of the IQ Gateway and Communications Kit 2 to enable battery oversubscription and install up to 80 kWh, that is, 16 IQ Battery 5P.
- Self-Consumption battery mode is not available in Battery Only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- IQ Gateway and a Mobile Connect cellular modem must be ordered separately from COMMS-KIT-02.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

10.2.2.2 Without generator and with IQ Battery 3/3T/10/10T and IQ System Controller 2

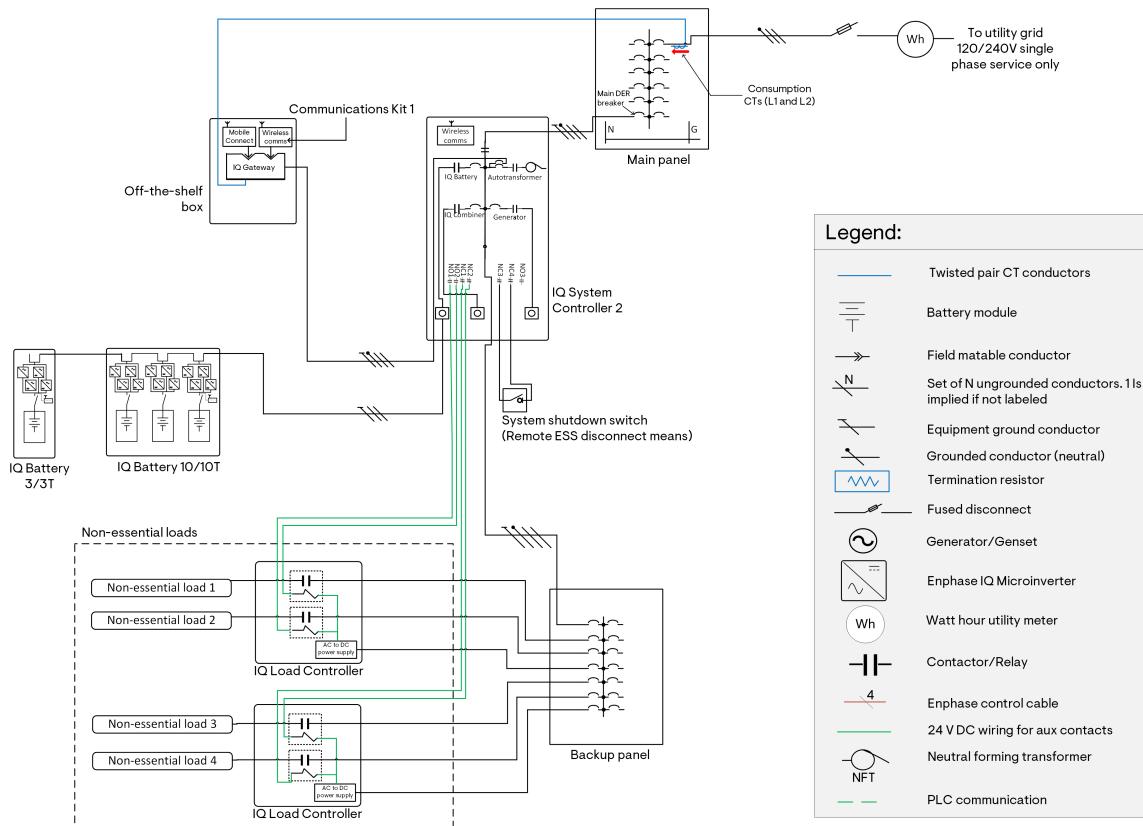


Figure 22: Battery Only grid-forming partial home backup configuration with IQ Battery 3/3T/10/10T and IQ System Controller 2

- EES systems using IQ System Controller 2 and IQ Battery 3/3T/10/10T can only support battery storage of up to 40 kWh.
- Self-Consumption battery mode is not available in Battery Only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.

10.2.2.3 With generator, IQ Battery 5P, and IQ System Controller 3G

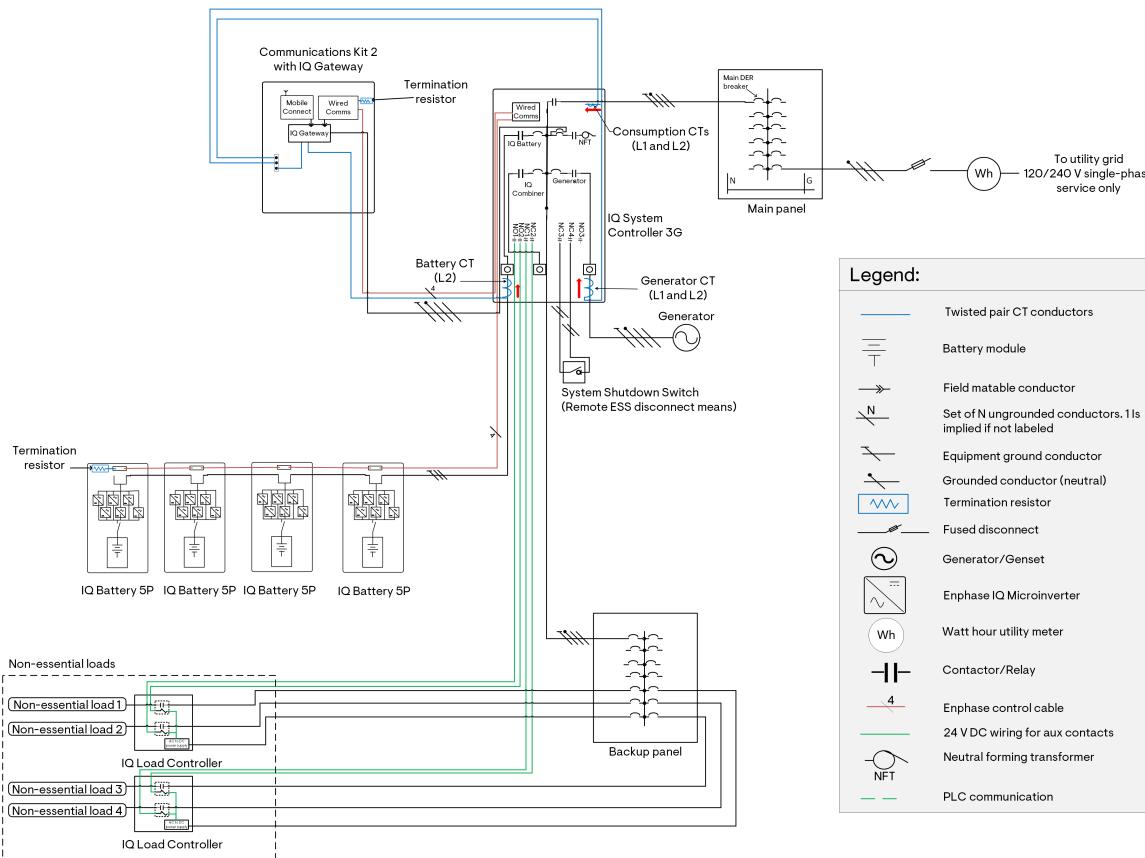


Figure 23: Battery Only grid-forming partial home backup configuration with IQ Battery 5P and IQ System Controller 3G

- The power control system for battery oversubscription feature support for systems using IQ Gateway and older generation IQ Combiners is being evaluated. In the meantime, IQ Combiner 5/5C can be used instead of the IQ Gateway and Communications Kit 2 to enable battery oversubscription and install up to 40 kWh, that is, eight IQ Battery 5P.
- Self-Consumption battery mode is not available in Battery Only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- IQ Gateway and a Mobile Connect cellular modem must be ordered separately from COMMS-KIT-02.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator tech brief](#) for details on supported generator makes and additional installation requirements.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.2.2.4 With generator, IQ Battery 3/3T/10/10T, and IQ System Controller 2

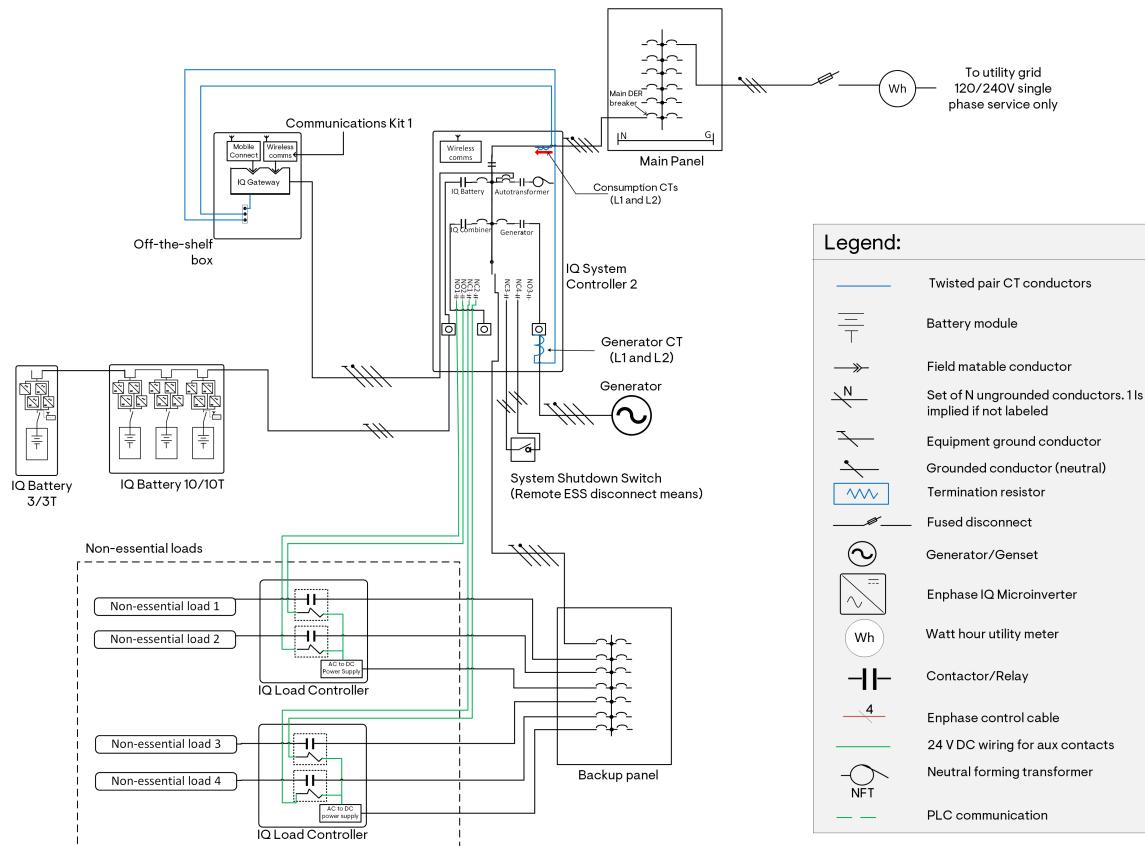


Figure 24: Battery Only grid-forming partial home backup configuration with IQ Battery 3/3T/10/10T and IQ System Controller 2

- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- Self-Consumption battery mode is not available in Battery Only configurations. Savings and Full Backup modes are available and can be accessed using the settings in the Enphase Installer App or Enphase App. Refer to the [Abbreviations](#) section for details on system behavior in these modes.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator tech brief](#) for details on supported generator makes and additional installation requirements.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3 Solar + Battery

To learn about grid-forming (with backup) systems with Solar + Battery configuration, see the following topics.

10.3.1 Whole home backup

This configuration provides backup for all loads in a home at all times of day and night. The battery array must be appropriately sized to supply the loads. Depending on the size of the IQ Battery array, the system will be able to operate in off-grid mode for extended periods. Up to two IQ Load Controllers can be used for circuit-level load control of backed-up loads.

10.3.1.1 Without generator and with IQ Battery 5P With IQ8 Series Microinverters, IQ Combiner 5/5C and IQ System Controller 3

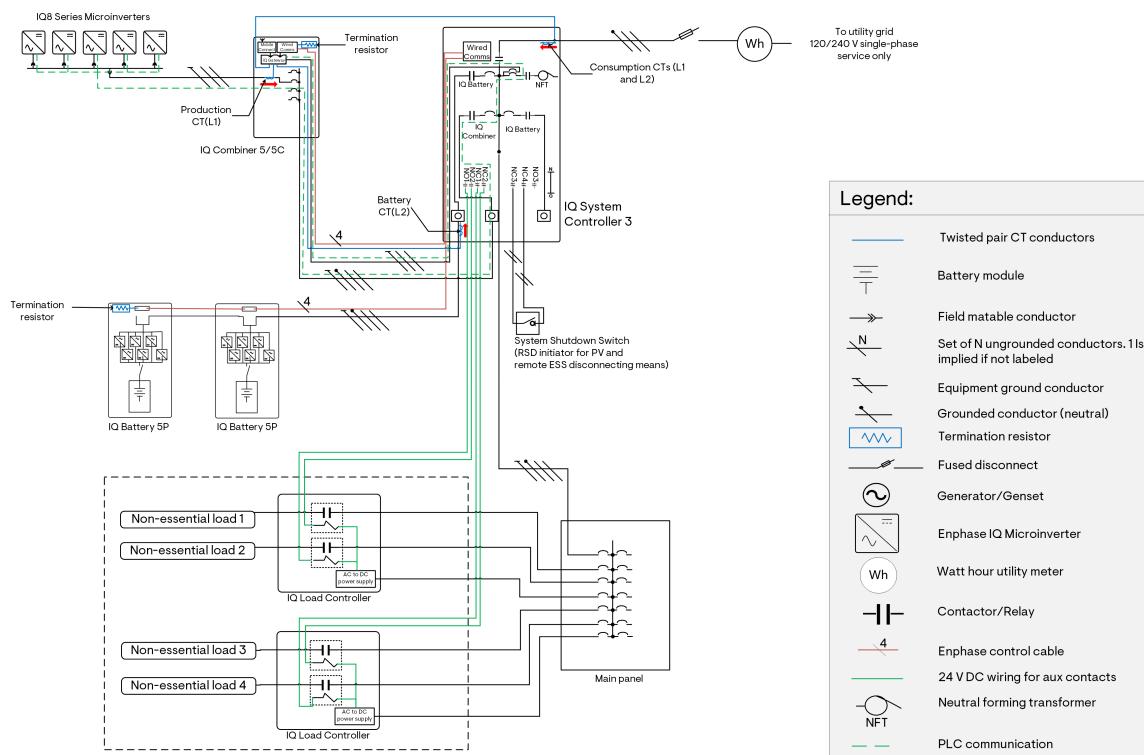


Figure 25: Whole home backup configuration with IQ8 Series Microinverters and IQ Battery 5P

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ System Controller 3 can support up to 80 kWh (40 kWh on each Battery port) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on each Battery port).
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.
- If more than 64 A of IQ8 Series Microinverters need to be installed, the additional PV can be added to the third DER port or split into a grid-tied system.

10.3.1.2 Without generator and with IQ Battery 5P With IQ Series Microinverters, IQ Combiner 5/5C, IQ Meter Collar, and IQ System Controller 3M

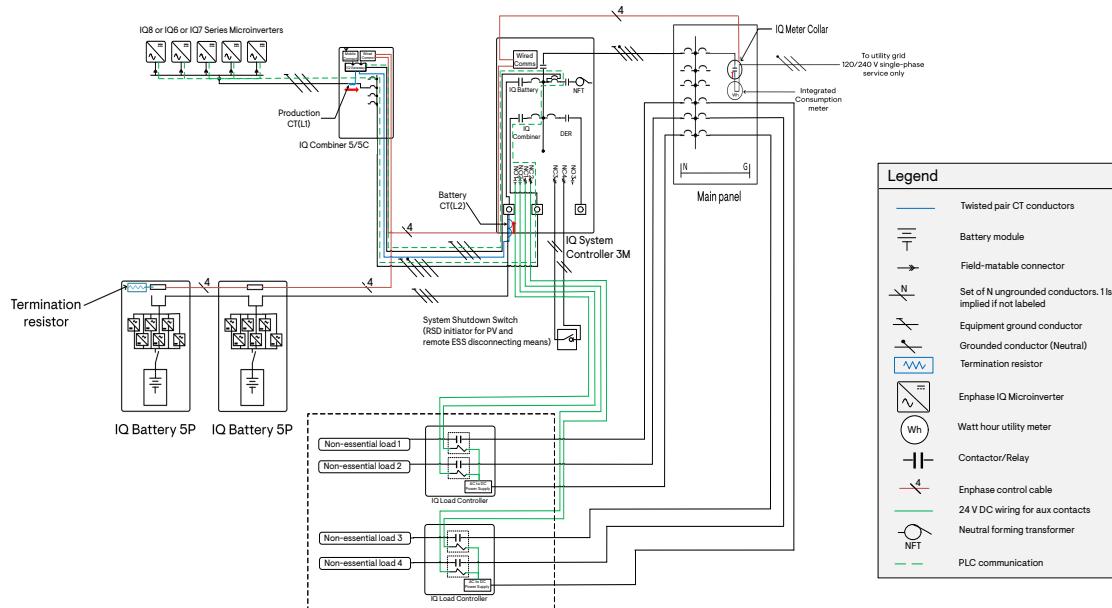


Figure 26: Whole home backup configuration with IQ Series Microinverters, IQ Meter Collar, IQ Battery 5P, and IQ System Controller 3M

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ Meter Collar should be connected to IQ System Controller 3M and not to any other Enphase components. IQ Meter Collar is always a terminating node in this configuration. In IQ System Controller 3M, the top control wiring connector, supplying 24 V DC power, is reserved for the IQ Meter Collar and must NOT be connected to any other Enphase components such as IQ Battery or IQ Combiner to prevent electrical damage.
- Additional IQ8/IQ7/IQ6 Microinverters can be added on the third DER port using an off-the-shelf panel. Use the Enphase Installer App to configure the third DER port for PV microinverters.
- Production CTs must be placed around the PV port and the third DER port. To achieve this, an additional Production CT can be bought, or the existing Production CT in the IQ Combiner can be extended to the IQ System Controller 3M. Ensure that the wire length from the Production CT to the IQ Gateway terminals does not exceed 5 meters.
- The IQ System Controller 3M can support up to 80 kWh (40 kWh on battery and DER ports) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on battery and DER ports). Each battery circuit's continuous current rating must be less than or equal to 64 A, that is, it must be protected by an 80 A breaker.
- Use the Enphase Installer App to assign batteries to the respective ports.
- If there are two battery circuits, the control cable connected to the IQ System Controller 3M will first link to the first branch of batteries before looping back to the controller. It will then extend to the second branch of batteries, where it will terminate with a resistor at the last battery in that branch.



WARNING: Splicing two circuits on the control header will result in a tree configuration rather than a bus, leading to communication issues.

- Hold-down kits must be installed for breakers inside IQ Combiner 5/5C, whereas IQ Combiner 5 HDK/5C HDK comes with preinstalled hold-down kits.

- It is recommended to add four batteries to one port before adding batteries to the other port.
- IQ System Controller 3M has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.

10.3.1.3 Without generator and with IQ8 Series Microinverters, IQ Combiner 5/5C, IQ System Controller 3, and more than four IQ Battery 5P units

The extra battery port on the IQ System Controller 3 can accommodate additional batteries.

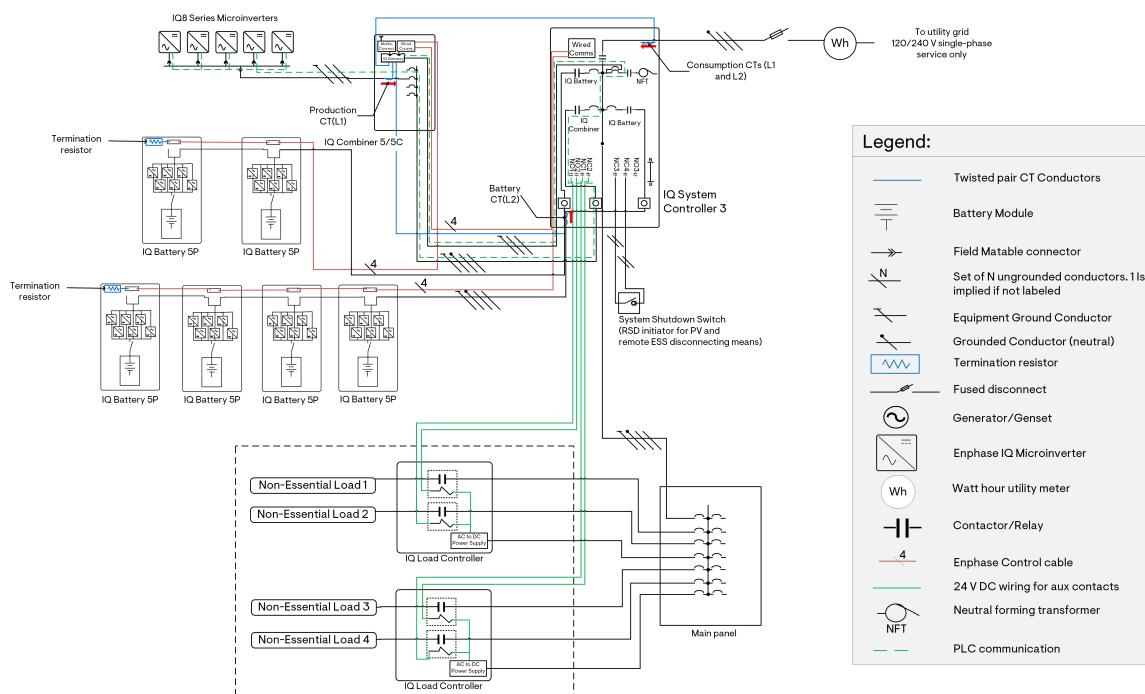


Figure 27: Example of a whole home backup configuration with more than four IQ Battery 5P units

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ System Controller 3 can support up to 80 kWh (40 kWh on each Battery port) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on each battery port). Each battery circuit's continuous current rating must be less than or equal to 64 A, that is, it must be protected by an 80 A breaker.
- Use the Enphase Installer App to assign batteries to the respective ports.
- It is recommended to add four batteries to one port before adding batteries to the other port.
- If the battery oversubscription feature is used, add four batteries on each port before oversubscribing one port with more than four batteries.
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.
- When using the additional battery port to install IQ Battery 5P, Termination resistors should be used to terminate the Enphase Control cable at the end of the two IQ Battery branches.

10.3.1.4 Without generator and with IQ Series Microinverters, IQ Combiner 5/5C, IQ Meter Collar, IQ System Controller 3M, and more than four IQ Battery 5P units

The extra battery port on the IQ System Controller 3M can accommodate additional batteries.

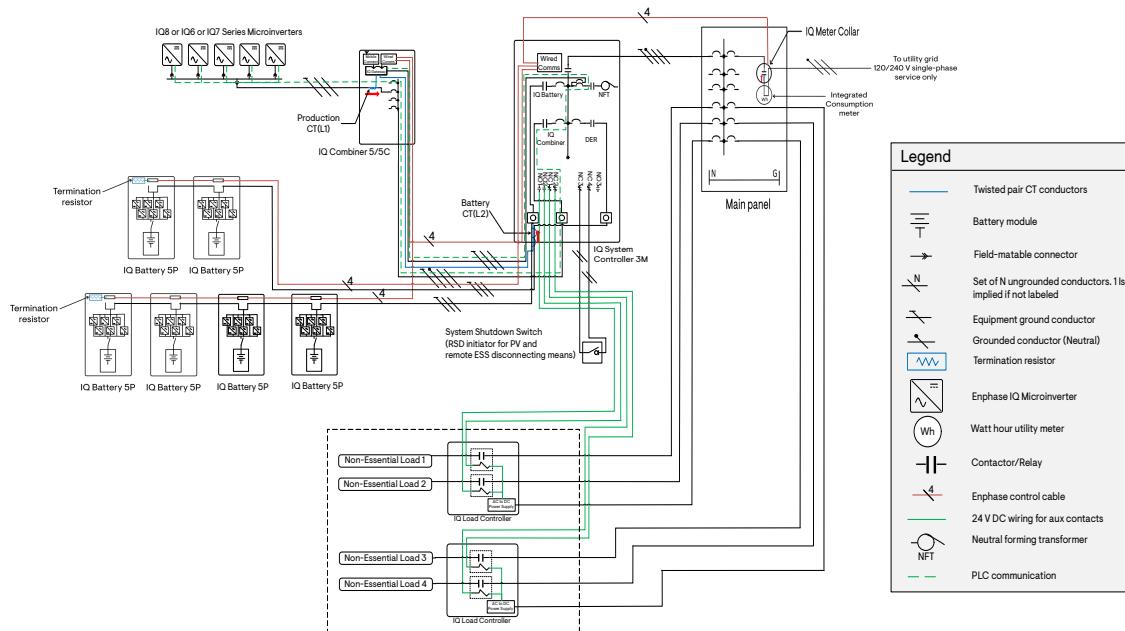


Figure 28: Example of a whole home backup configuration with more than four IQ Battery 5P units

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ Meter Collar should be connected to IQ System Controller 3M and not to any other Enphase components. IQ Meter Collar is always a terminating node in this configuration. In IQ System Controller 3M, the top control wiring connector, supplying 24 V DC power, is reserved for the IQ Meter Collar and must NOT be connected to any other Enphase components such as IQ Battery or IQ Combiner to prevent electrical damage.
- The IQ System Controller 3M can support up to 80 kWh (40 kWh on battery and DER ports) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on battery and DER ports). Each battery circuit's continuous current rating must be less than or equal to 64 A, that is, it must be protected by an 80 A breaker.
- Use the Enphase Installer App to assign batteries to the respective ports.
- If there are two battery circuits, the control cable connected to the IQ System Controller 3M will first link to the first branch of batteries before looping back to the controller. It will then extend to the second branch of batteries, where it will terminate with a resistor at the last battery in that branch.



WARNING: Splicing two circuits on the control header will result in a tree configuration rather than a bus, leading to communication issues.

- Hold-down kits must be installed for breakers inside IQ Combiner 5/5C, whereas IQ Combiner 5 HDK/5C HDK comes with preinstalled hold-down kits.
- It is recommended to add four batteries to one port before adding batteries to the other port.
- IQ System Controller 3M has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.

- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.

10.3.1.5 Without generator and with IQ Battery 5P, IQ System Controller 3, and IQ Microinverters on two ports

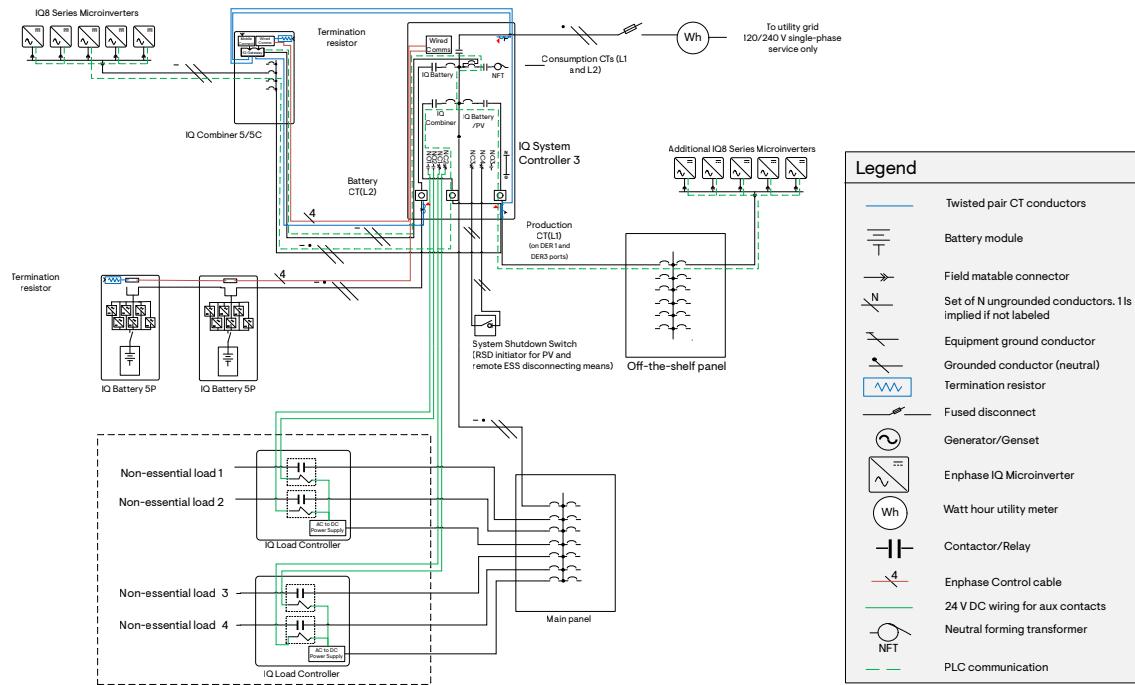


Figure 29: Whole home backup configuration with IQ Battery 5P, IQ System Controller 3, and IQ Microinverters on two ports

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage, and across both DERs.
- Additional IQ8 Microinverters can be added on the third DER port using an off-the-shelf panel.
- Use the Enphase Installer App to configure the third DER port for PV microinverters.
- Production CTs must be placed around the PV port and the third DER port. To achieve this, an additional Production CT can be bought, or the existing Production CT in the IQ Combiner can be extended to the IQ System Controller 3. Ensure that the wire length from the Production CT to the IQ Gateway terminals does not exceed 5 meters.
- IQ System Controller 3 can support up to 40 kWh of IQ Battery 5P on the battery port using the IQ Battery oversubscription feature when used in conjunction with additional PV microinverters on the third DER port. Without battery oversubscription, the battery storage capacity is 20 kWh in conjunction with additional PV microinverters on the third DER port. Each battery circuit's continuous current rating must be less than or equal to 64 A, that is, it must be protected by an 80 A breaker.
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C and the off-the-shelf panel.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.

10.3.1.6 Without generator and with IQ Battery 5P, IQ Meter Collar, IQ System Controller 3M, and IQ Series Microinverters on two ports

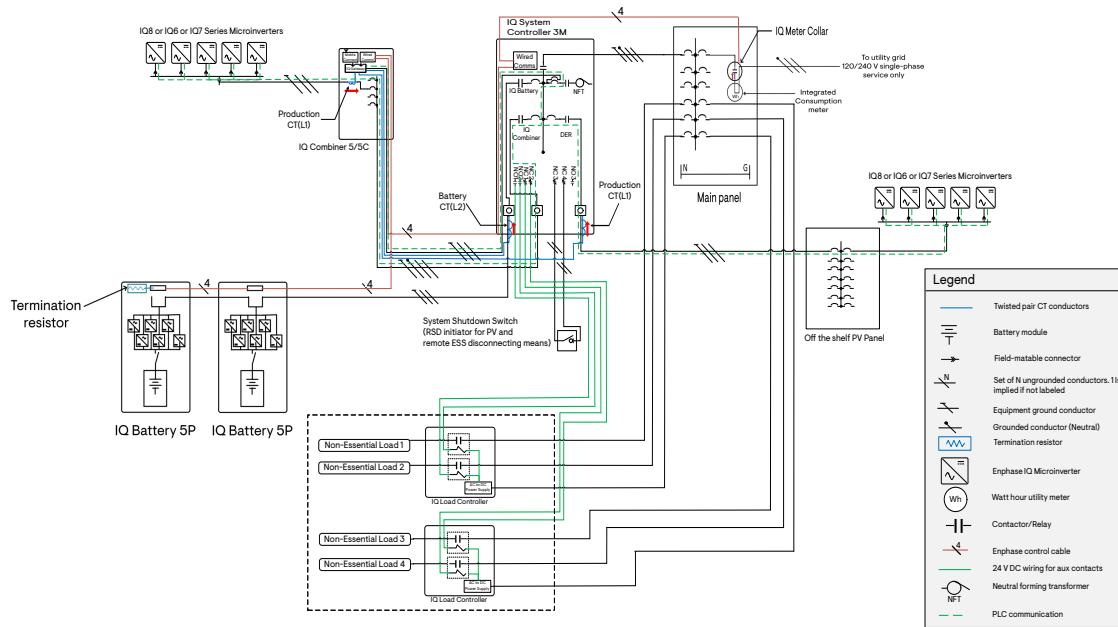


Figure 30: Whole home backup configuration with IQ Battery 5P, IQ System Controller 3M, IQ Meter Collar, and IQ Microinverters on two ports

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage, and across both DERs.
- Additional IQ8 Microinverters can be added on the third DER port using an off-the-shelf panel.
- Use the Enphase Installer App to configure the third DER port for PV microinverters.
- Production CTs must be placed around the PV port and the third DER port. To achieve this, an additional Production CT can be bought, or the existing Production CT in the IQ Combiner can be extended to the IQ System Controller 3M. Ensure that the wire length from the Production CT to the IQ Gateway terminals does not exceed 5 meters.
- IQ System Controller 3M can support up to 40 kWh of IQ Battery 5P on the battery port using the IQ Battery oversubscription feature when used in conjunction with additional PV microinverters on the third DER port. Without battery oversubscription, the battery storage capacity is 20 kWh in conjunction with additional PV microinverters on the third DER port. Each battery circuit's continuous current rating must be less than or equal to 64 A, that is, it must be protected by an 80 A breaker.
- Hold-down kits must be installed for breakers inside IQ Combiner 5/5C, whereas IQ Combiner 5 HDK/5C HDK comes with preinstalled hold-down kits.
- IQ System Controller 3M has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.

10.3.1.7 Without generator and with IQ6/IQ7 Series Microinverters, IQ Combiner 5/5C and IQ System Controller 3

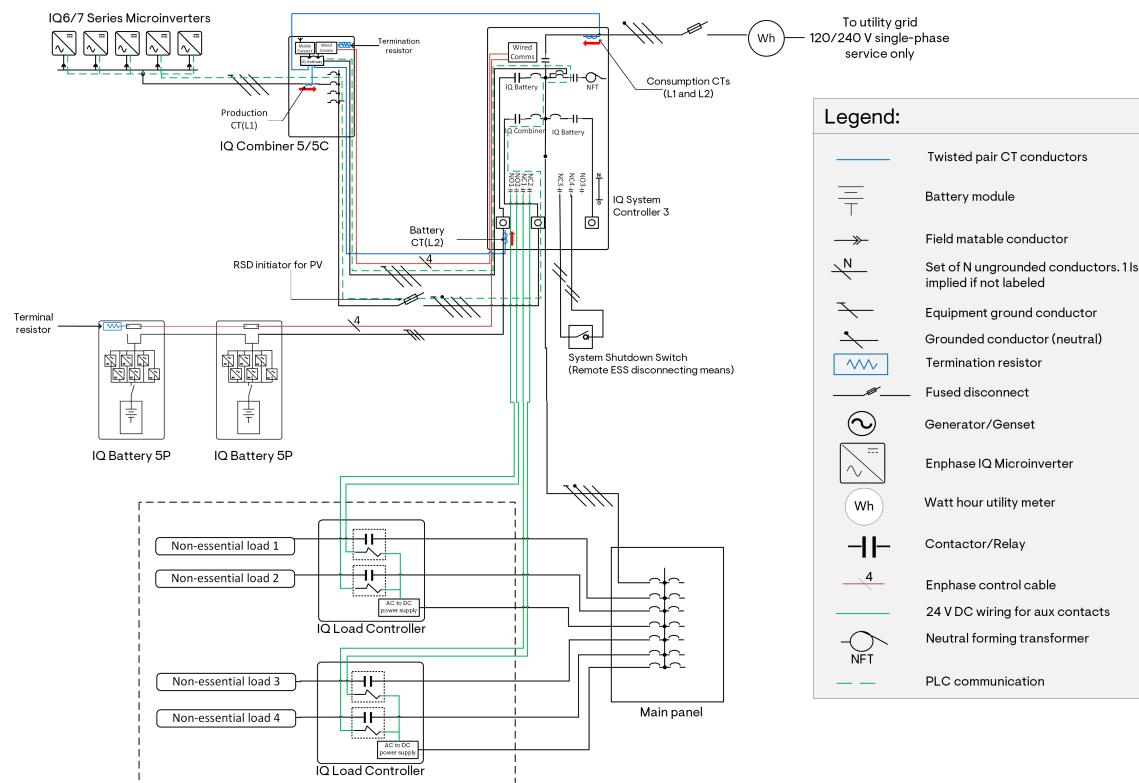


Figure 31: Whole home backup configuration using IQ6/IQ7 Series Microinverters and IQ Battery 5P

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ System Controller 3 can support up to 80 kWh (40 kWh on each battery port) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on each battery).
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required. For systems with more than 64 A of IQ7/IQ6 Series Microinverters, microinverters exceeding 64 A rating can be added to the main panel.

10.3.1.8 Without generator and with M Series Microinverters, COMMS-KIT-02, and IQ System Controller 3

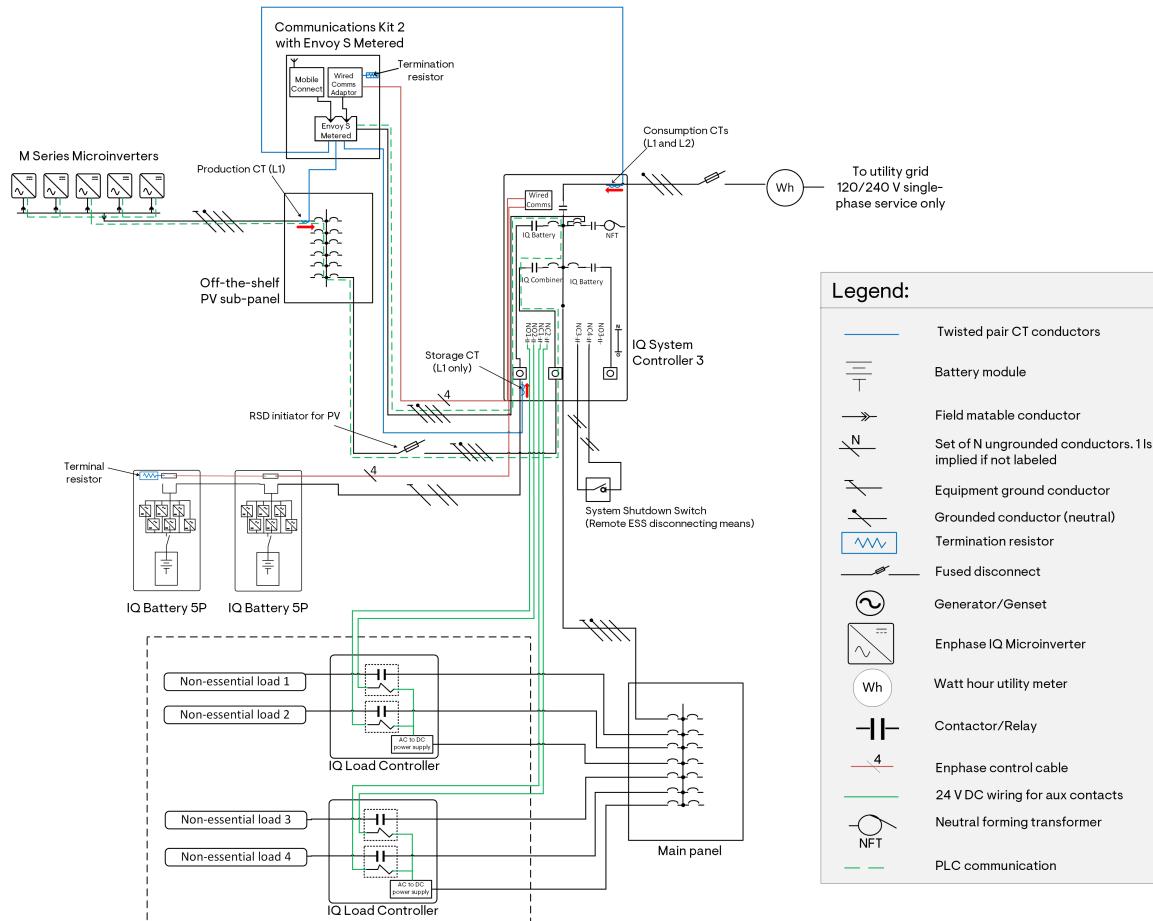


Figure 32: Whole home backup configuration using M Series Microinverters and IQ Battery 5P with IQ System Controller 3

- M Series Microinverters are incompatible with newer IQ8 or IQ6/IQ7 Microinverters. This applies to all system configurations with and without storage.
- Use a jumper cable to shorten the L2 and L3 terminals in the Envoy S Metered power terminal. These are marked "B" and "C" respectively.
- COMMS-KIT-02 does not ship with Envoy S Metered and Mobile Connect cellular modem. These must be ordered separately.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- For systems with more than 64 A of M Series Microinverters, microinverters exceeding 64 A rating can be added to the main panel.

10.3.1.9 Without generator and with IQ Battery 5P with IQ6/IQ7 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3

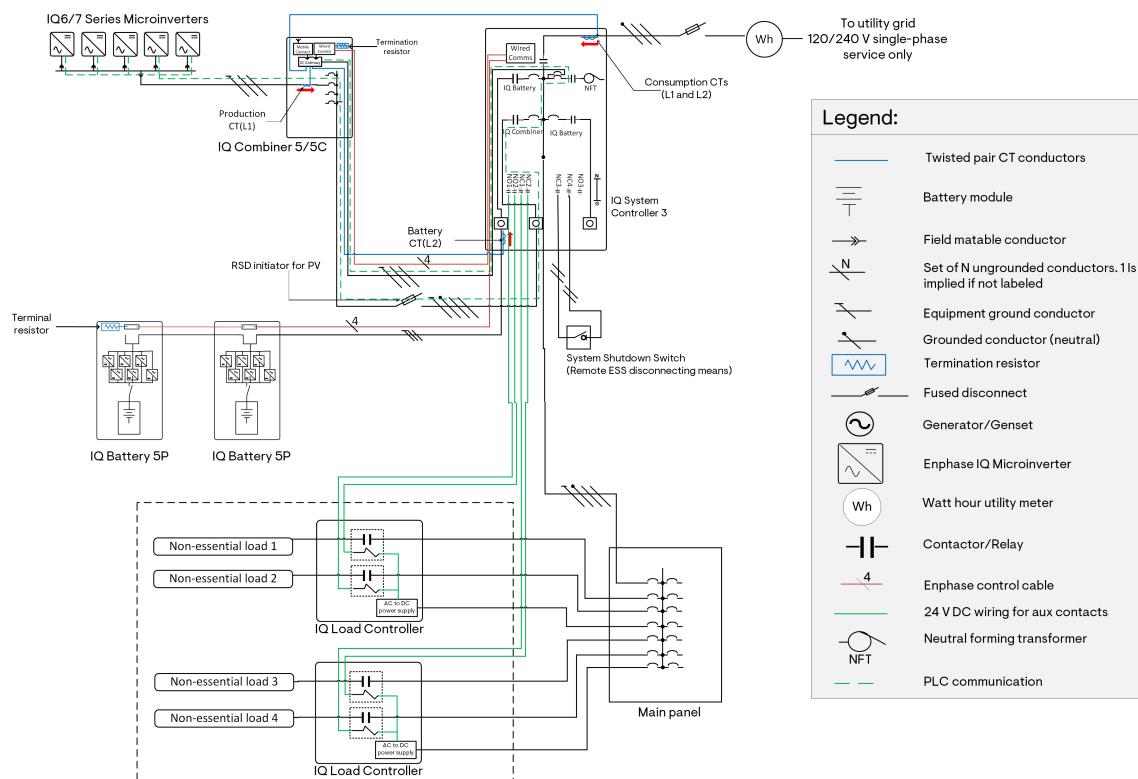


Figure 33: Whole home backup configuration using IQ6/IQ7 Series Microinverters and IQ Battery 5P

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ System Controller 3 can support up to 80 kWh (40 kWh on each battery port) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on each battery).
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a

disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.

 **NOTE:** IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required. For systems with more than 64 A of IQ7/IQ6 Series Microinverters, microinverters exceeding 64 A rating can be added to the main panel.

10.3.1.10 Without generator and with IQ Battery 5P With M Series Microinverters, COMMS-KIT-02, and IQ System Controller 3

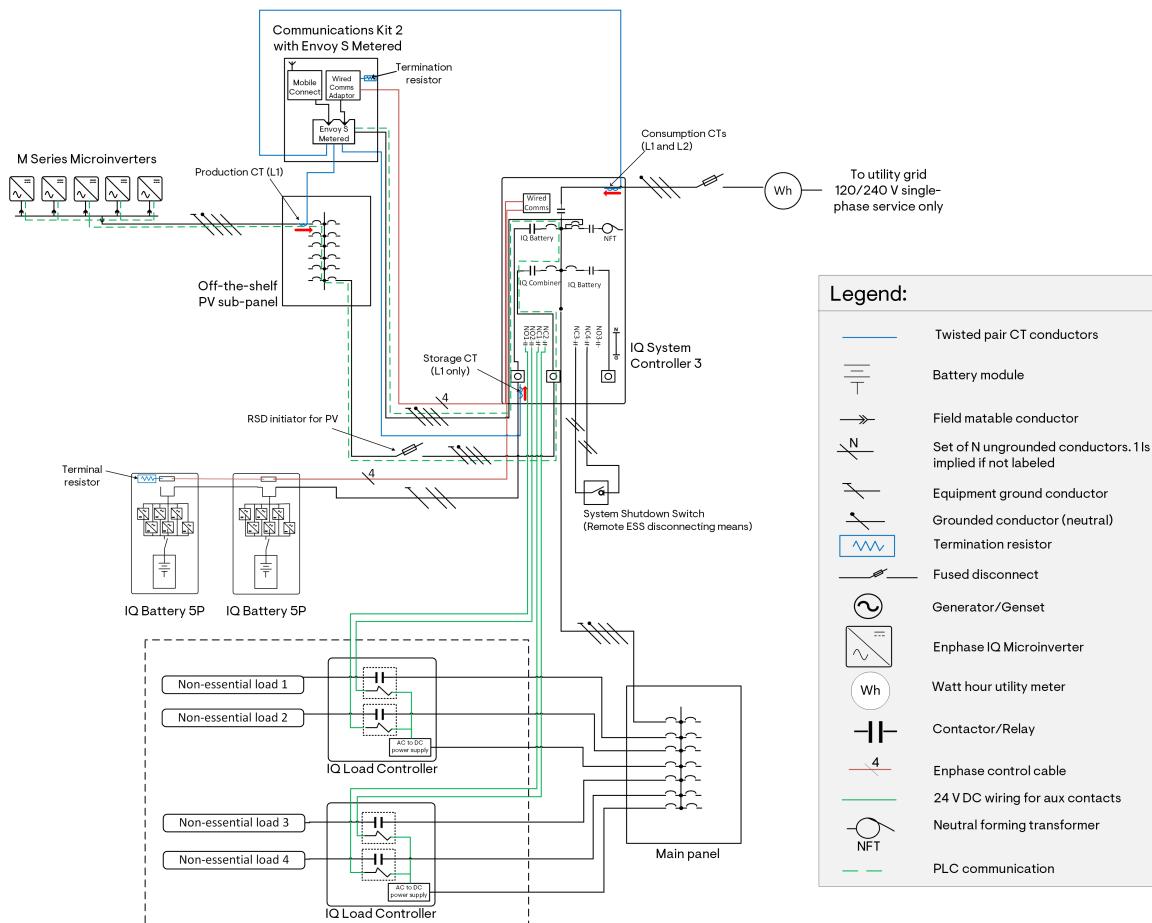


Figure 34: Whole home backup configuration using M Series Microinverters and IQ Battery 5P with IQ System Controller 3

- M Series Microinverters are incompatible with newer IQ8 or IQ6/IQ7 Microinverters. This applies to all system configurations with and without storage.
- Use a jumper cable to shorten the L2 and L3 terminals in the Envoy S Metered power terminal. These are marked "B" and "C" respectively.
- COMMS-KIT-02 does not ship with Envoy S Metered and Mobile Connect cellular modem. These must be ordered separately.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.

- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- For systems with more than 64 A of M Series Microinverters, microinverters exceeding 64 A rating can be added to the main panel.

10.3.1.11 Without generator and with IQ Battery 3/3T/10/10T, IQ8 Series Microinverters, IQ Combiner 4/4C, and IQ System Controller 2

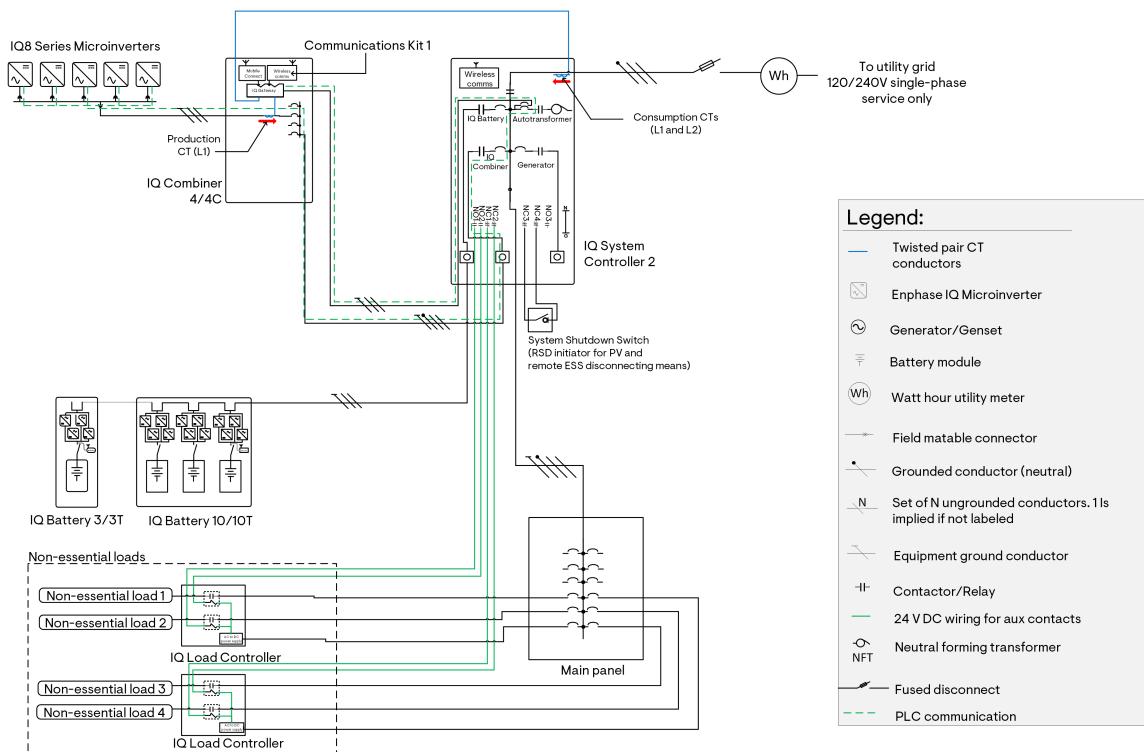


Figure 35: Whole home backup configuration using IQ8 Series Microinverters and IQ Battery 3/3T/10/10T

- The IQ System Controller 2 can support up to 40 kWh IQ Battery 3T/10T.
- Hold-down kits must be installed with breakers inside IQ Combiner 4/4C.
- Hold-down kits must be used in IQ System Controller 2.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.
- If more than 48 IQ8 series microinverters are installed in a system with a single IQ Battery 3T, implement PV shedding to remove additional PV when the system transitions to the microgrid, or add additional batteries.

- If more than 64 A of IQ8 Series Microinverters need to be installed, the excess PV must be split into a grid-tied system.

10.3.1.12 Without generator and with IQ Battery 3/3T/10/10T, IQ6/IQ7 Series Microinverters, IQ Combiner 4/4C and IQ System Controller 2

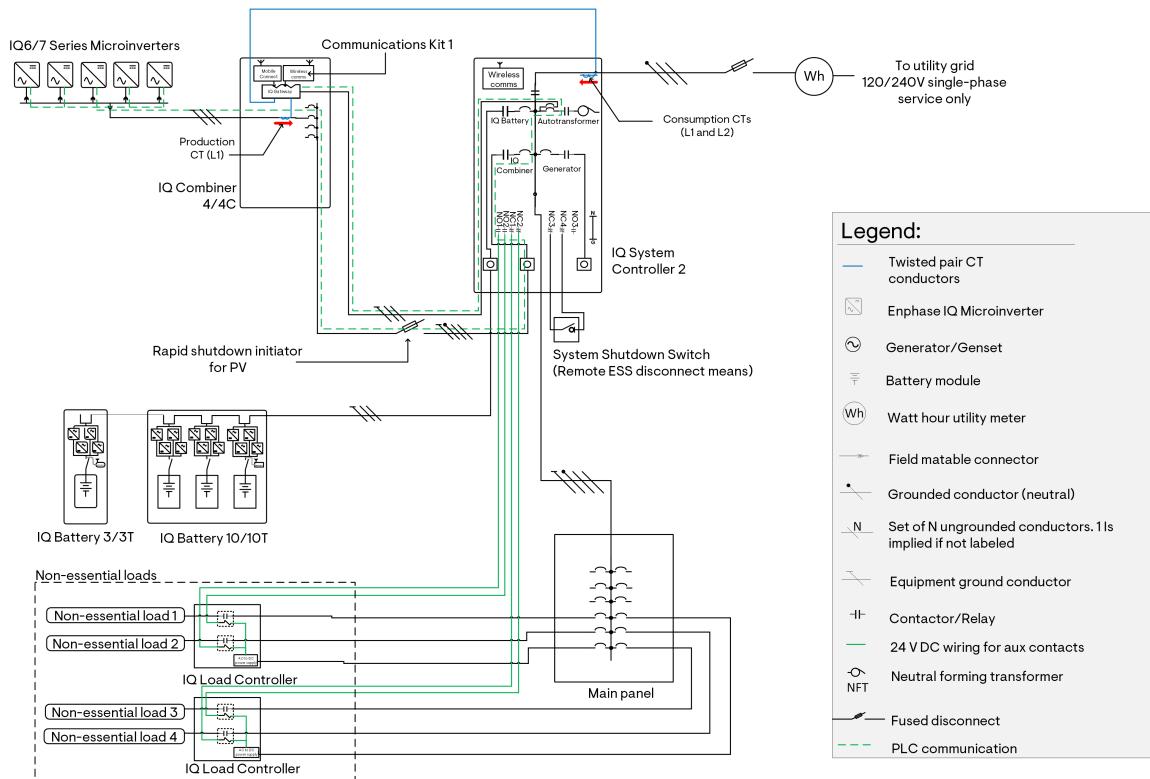


Figure 36: Whole home backup configuration using IQ6/IQ7 Series Microinverters and IQ Battery 3/3T/10/10T

- Hold-down kits must be used in IQ System Controller 2.
- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- For systems with more than 64 A of IQ7/6 Series Microinverters, microinverters exceeding 64 A rating can be added to the main panel.

10.3.1.13 Without generator and with IQ Battery 3/3T/10/10T, M Series Microinverters, COMMS-KIT-01, and IQ System Controller 2

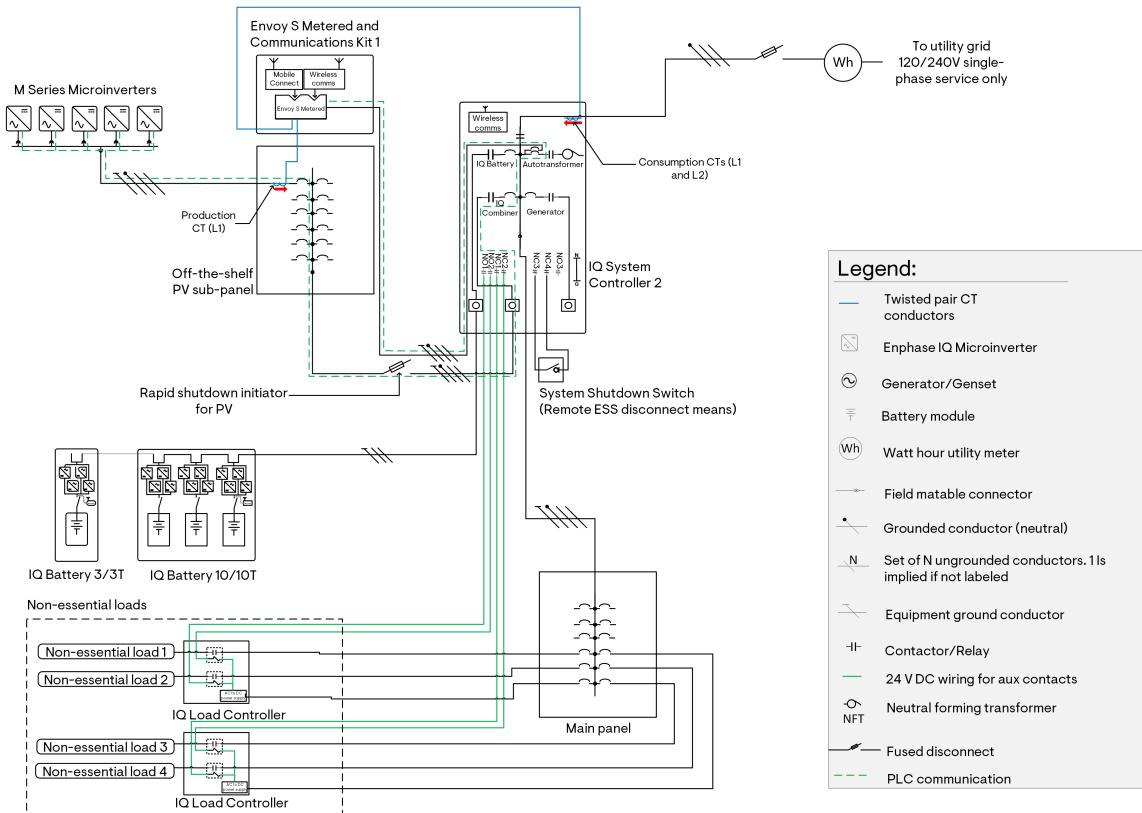


Figure 37: Whole home backup configuration using M Series Microinverters and IQ Battery 3/3T/10/10T

- M Series Microinverters are incompatible with newer IQ8 or IQ6/IQ7 Microinverters. This applies to all system configurations with and without storage.
- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- Off-the-shelf combiner is used to house the IQ Gateway, COMMS-KIT-01, and Mobile Connect.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.

NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety. IQ Battery 3/3T/10/10T requires the use of hold-down kits on IQ System Controller 2.

- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- For systems with more than 64 A of M Series Microinverters, microinverters exceeding 64 A rating can be added to the main panel.

10.3.1.14 With generator, IQ Battery 5P, IQ8 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3G

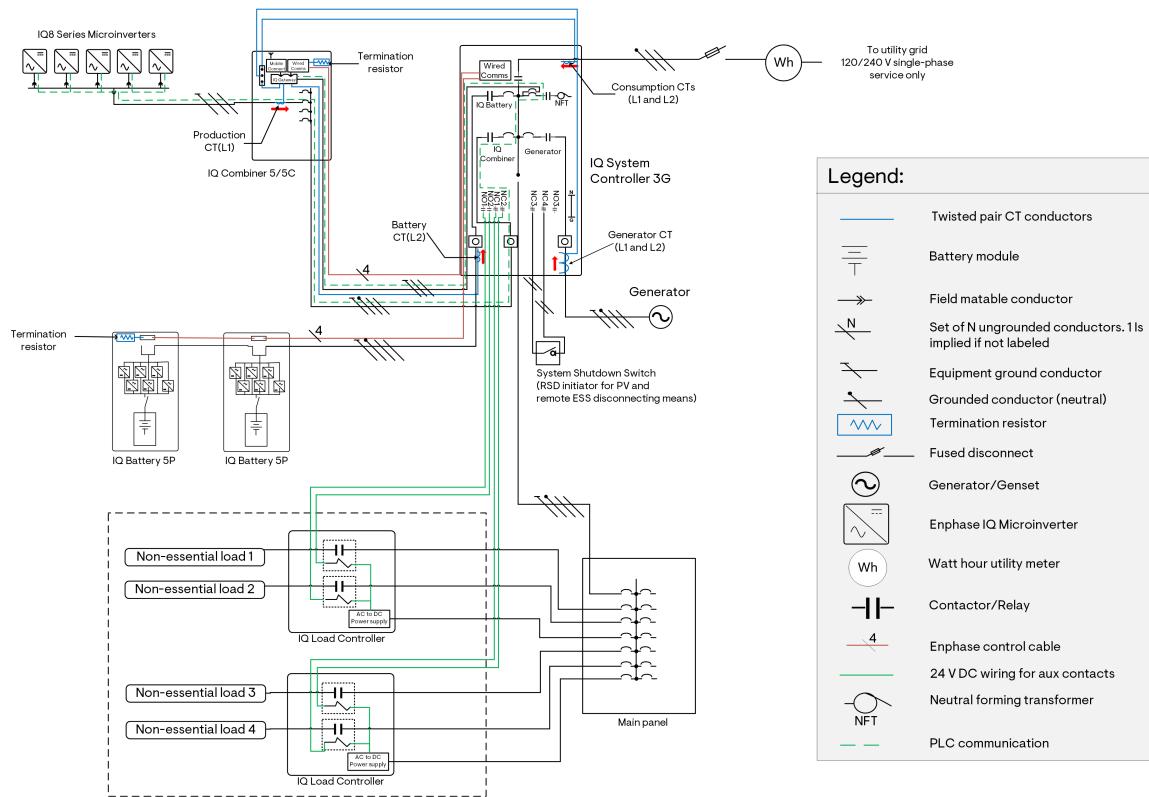


Figure 38: Whole home backup configuration with IQ8 Series Microinverters and IQ Battery 5P

- The IQ System Controller 3G can support up to 40 kWh IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 20 kWh.
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating or 100% of the microinverter array continuous power rating, whichever is higher. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- To monitor the consumption from the generator, the system will require an additional pair of generator CTs linked in parallel with the Consumption CTs. These CTs (2x CT-200-CLAMP or 2x CT-200-SPLIT) must be purchased separately.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.
- If more than 64 A of IQ8 Series Microinverters need to be installed, the excess PV must be split into a grid-tied system.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3.1.15 With generator, IQ Battery 5P, IQ6/IQ7 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3G

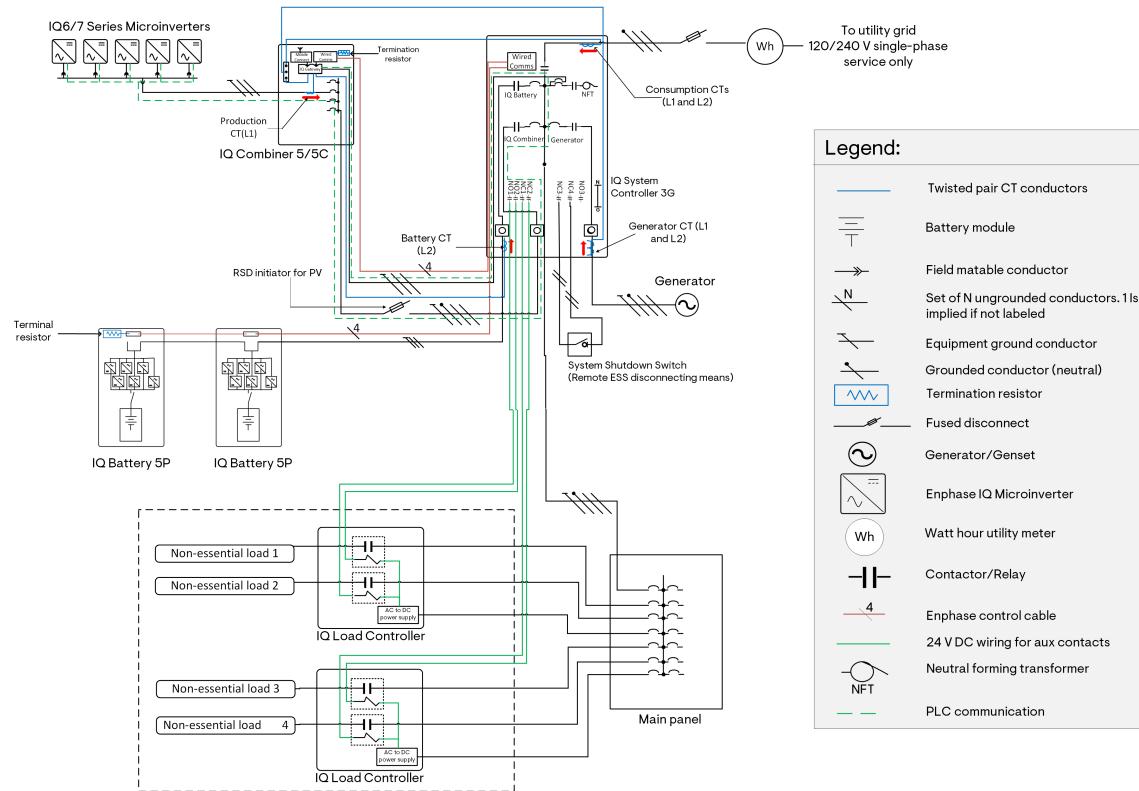


Figure 39: Whole home backup configuration with IQ6/IQ7 Series Microinverters and IQ Battery 5P

- The IQ System Controller 3G can support up to 40 kWh IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 20 kWh.
- Hold-down kits need not be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- To monitor the consumption from the generator, systems with a generator will require an additional pair of generator CTs linked in parallel with the Consumption CTs. These CTs (2x CT-200-CLAMP or 2x CT-200-SPLIT) must be purchased separately.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3.1.16 With generator, IQ Battery 5P, M Series Microinverters, COMMS-KIT-02, and IQ System Controller 3G

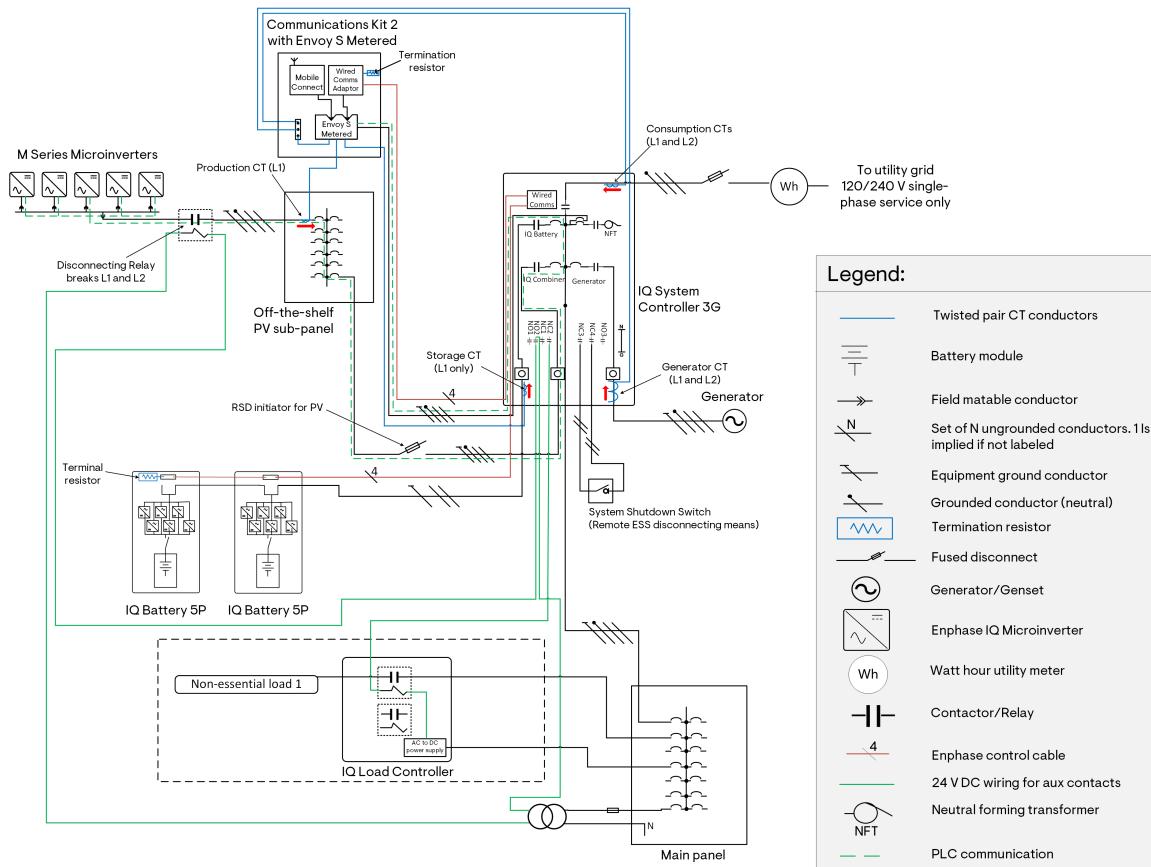


Figure 40: Whole home backup configuration with M Series Microinverters and IQ Battery 5P

- Use a jumper cable to shorten the L2 and L3 terminals in the Envoy S Metered power terminal. These are marked "B" and "C" respectively.
- The IQ System Controller 3G can support up to 40 kWh IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 20 kWh.
- Hold-down kits need not be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- PV shedding must be implemented to shed the microinverter array when the generator is connected to the microgrid and producing power. Refer to the [Generator integration technical brief](#) for details on PV shedding implementation.

- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and other details.
- To monitor the consumption from the generator, systems with a generator will require an additional pair of generator CTs linked in parallel with the Consumption CTs. These CTs (2x CT-200-CLAMP or 2x CT-200-SPLIT) must be purchased separately.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3.1.17 With generator, IQ Battery 3/3T/10/10T, IQ8 series Microinverters, IQ Combiner 4/4C, and IQ System Controller 2

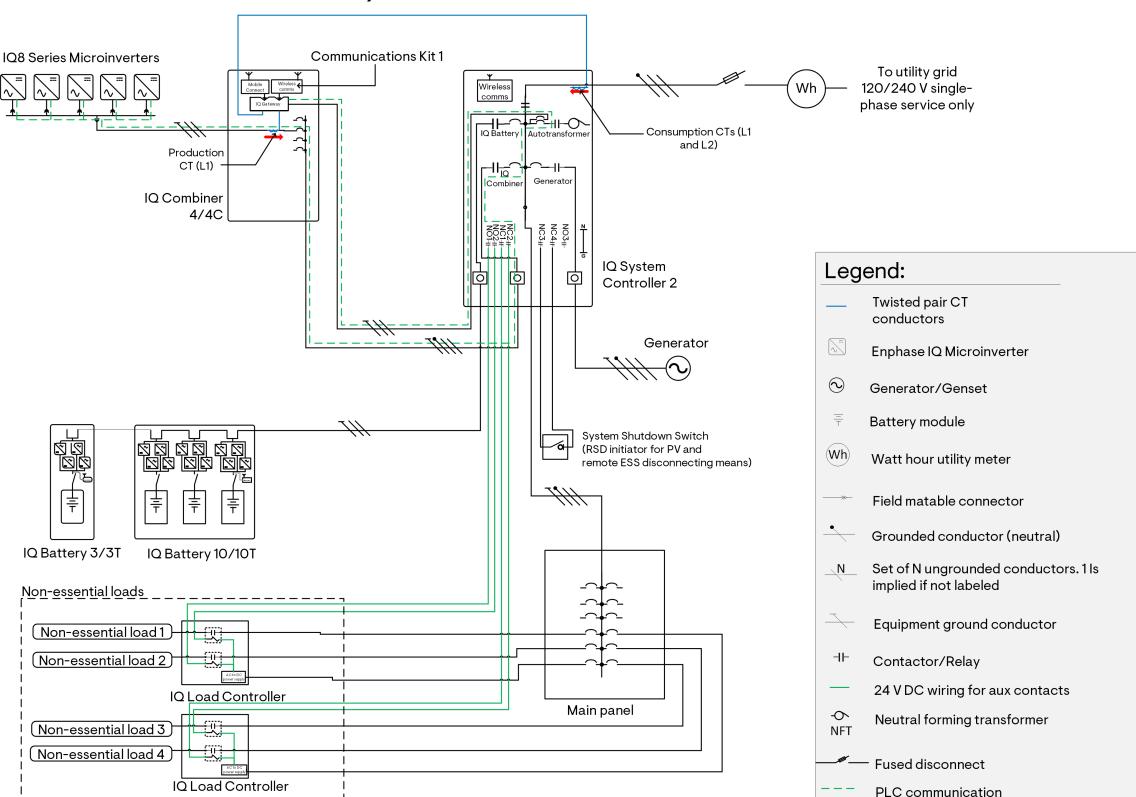


Figure 41: Whole home backup configuration with IQ8 Series Microinverters and IQ Battery 3/3T/10/10T

- The IQ System Controller 2 can support up to 40 kWh IQ Battery 3T/10T.
- Hold-down kits must be installed with breakers inside IQ Combiner 4/4C.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating or 100% of the microinverter array continuous power rating, whichever is higher. Refer to the [Generator sizing](#) on page 19 section for details.

- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- If more than 48 IQ8 Series Microinverters are installed in a system with a single IQ Battery 3T, implement PV shedding to remove additional PV when the system transitions to off-grid or add additional batteries.
- If more than 64 A of IQ8 Series Microinverters need to be installed, the excess PV must be split into a grid-tied system.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3.1.18 With generator, IQ Battery 3/3T/10/10T, IQ6/IQ7 Series Microinverters, IQ Combiner 4/4C, and IQ System Controller 2

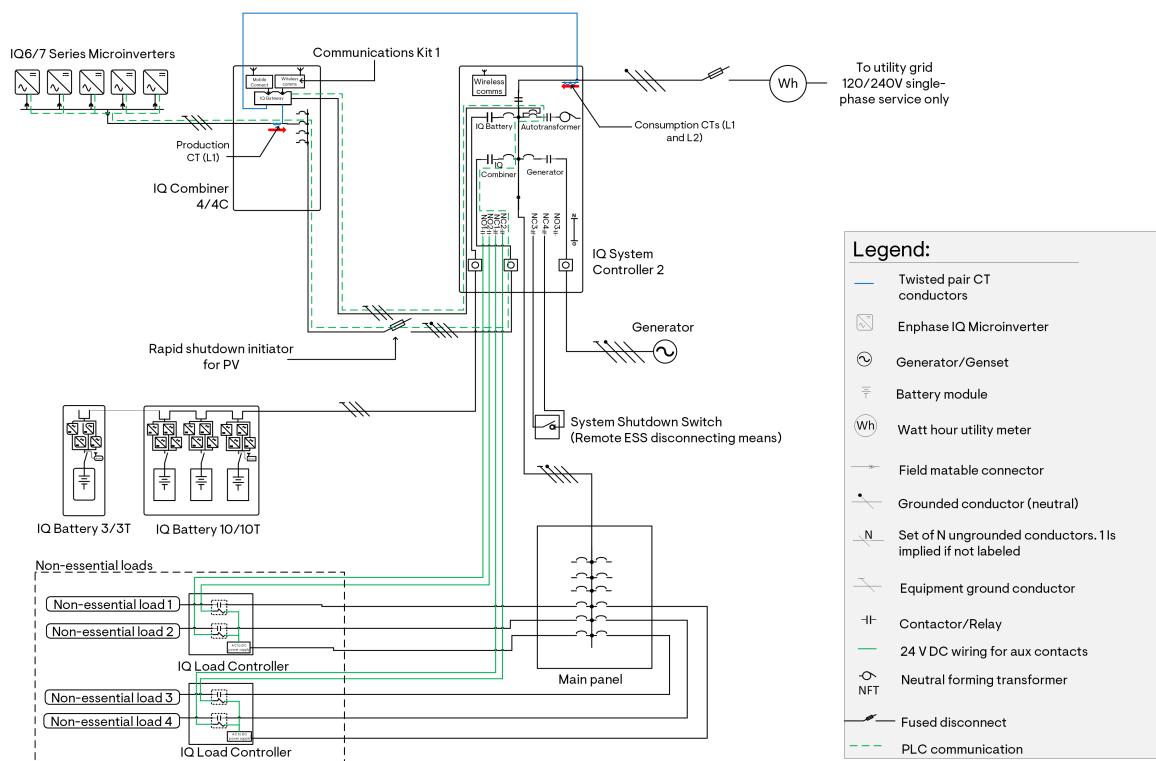


Figure 42: Whole home backup configuration with IQ6/IQ7 Series Microinverters and IQ Battery 3/3T/10/10T

- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator

and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- IQ Battery 3/3T/10/10T requires the use of hold-down kits on IQ System Controller 2
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) for details.

10.3.1.19 With generator, IQ Battery 3/3T/10/10T, M Series Microinverters, COMMS-KIT-01, and IQ System Controller 2

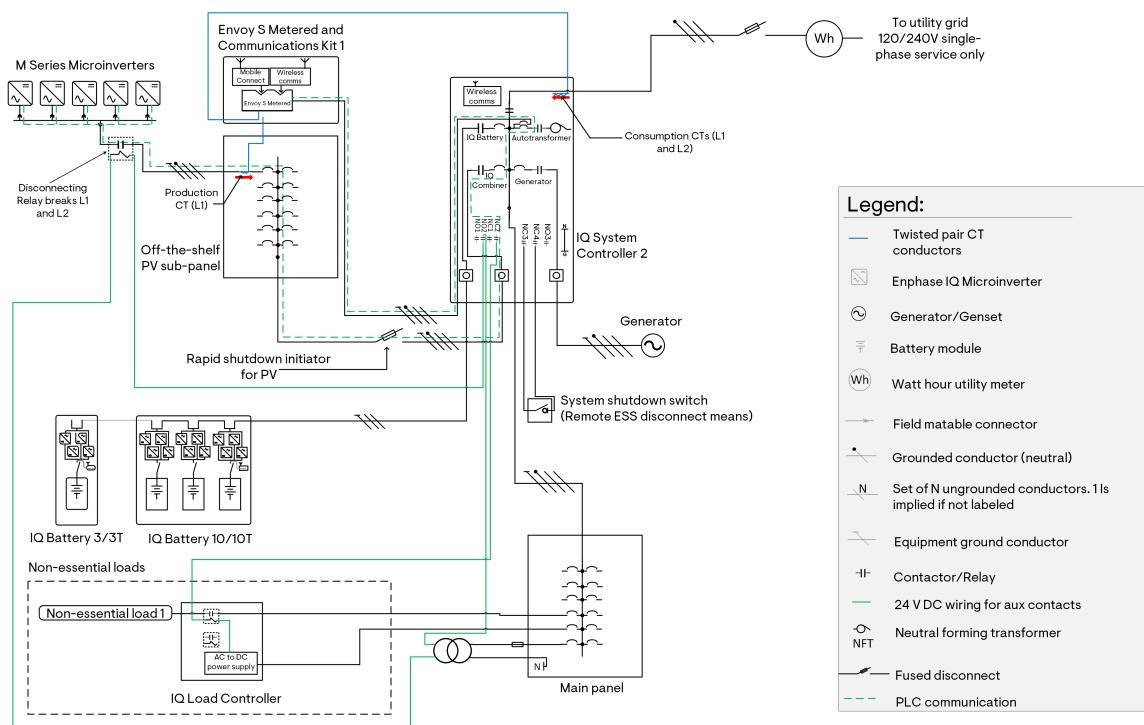


Figure 43: Whole home backup configuration with M Series Microinverters and IQ Battery 3/3T/10/10T

- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output.
- PV shedding must be implemented to shed the microinverter array when the generator is connected to the microgrid and producing power. Refer to the [Generator integration technical brief](#) for details on PV shedding implementation.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety. IQ Battery 3/3T/10/10T requires the use of hold-down kits on IQ System Controller 2.

- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) for details.

10.3.2 Partial home backup

In this configuration, essential loads are aggregated on a backup load panel. All the loads connected to the backup load panel will transition to off-grid seamlessly. It is strongly advised to use up to two IQ Load Controllers to eliminate heavy power demand when the system enters a backup mode.

10.3.2.1 Without generator and with IQ Battery 5P with IQ8 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3

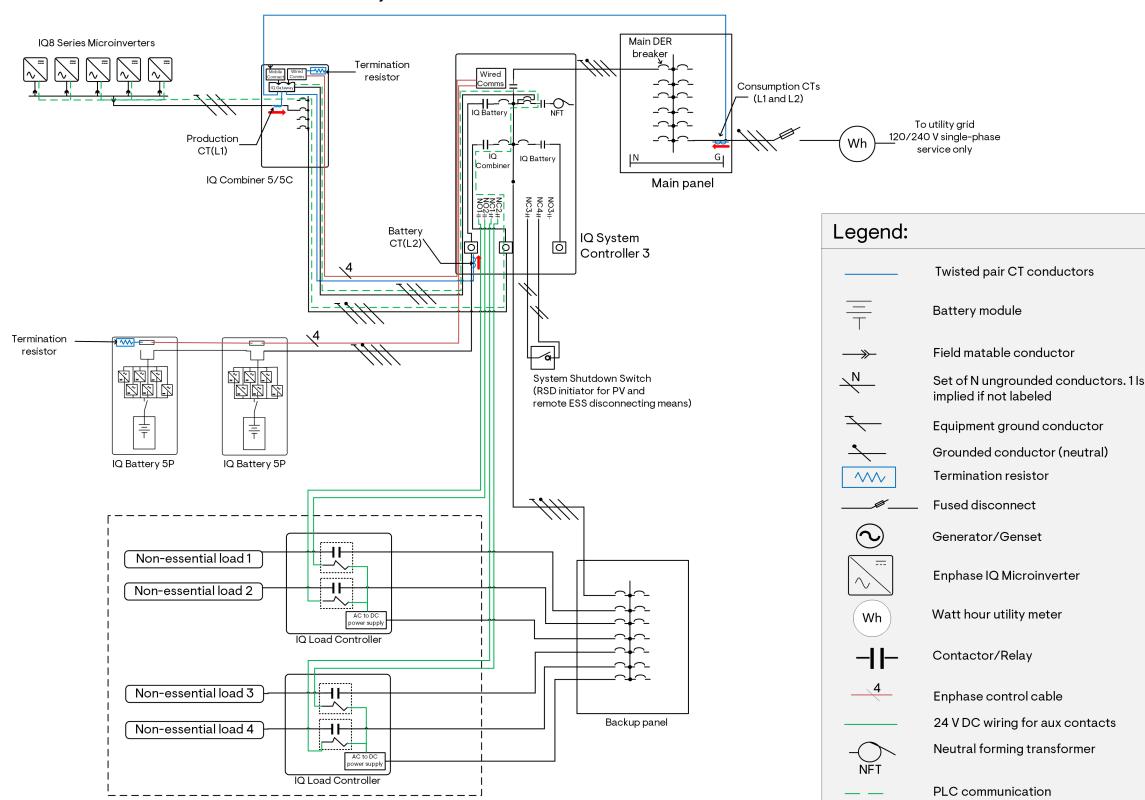


Figure 44: Partial home backup configuration with IQ8 Series Microinverters and IQ Battery 5P

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ System Controller 3 can support up to 80 kWh (40 kWh on each Battery port) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on each battery port).
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.

- If more than 64 A of IQ8 Series Microinverters need to be installed, the additional PV can be added to the third DER port or split into a grid-tied system.

10.3.2.2 Without generator and with more than four IQ Battery 5P units

The extra battery port on the IQ System Controller 3 may accommodate additional batteries. The batteries can only be added to the extra battery port if four IQ Battery 5P units are plugged into it, as illustrated in the following figure.

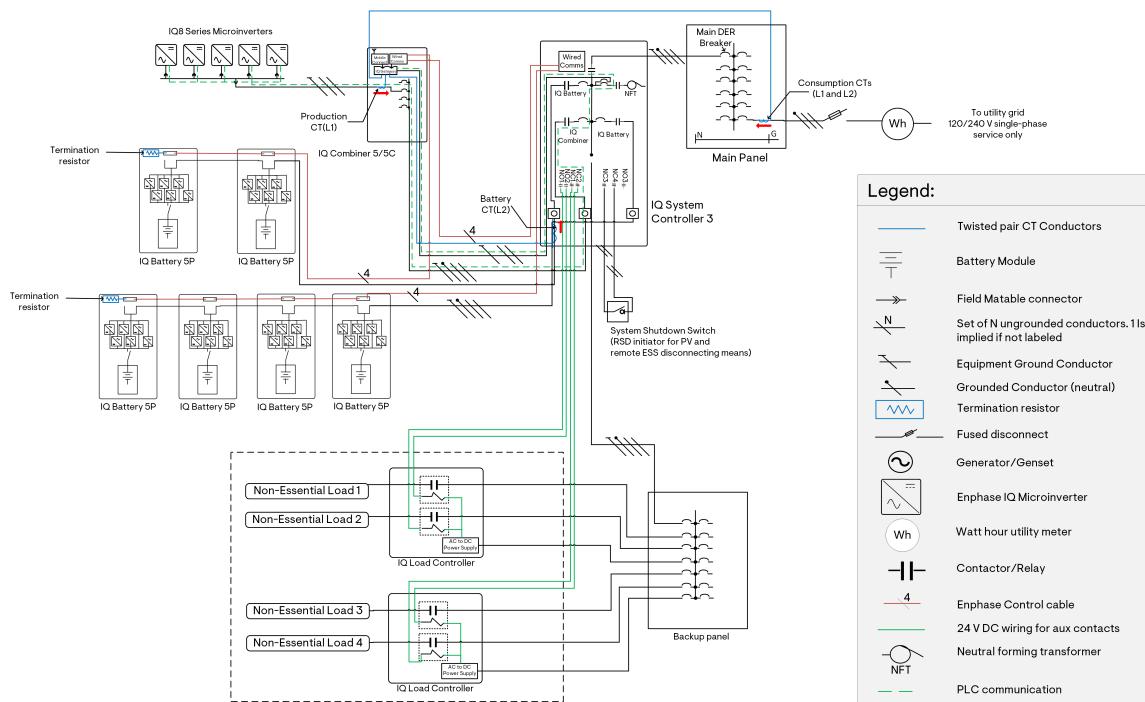


Figure 45: Example of a partial home backup configuration with more than four IQ Battery 5P units

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ System Controller 3 can support up to 80 kWh (40 kWh on each battery port) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on each battery port). Each battery circuit's continuous current rating must be less than or equal to 64 A, that is, it must be protected by an 80 A breaker.
- Use the Enphase Installer App to assign batteries to the respective ports.
- It is recommended to add four batteries to one port before adding batteries to the other port.
- If the battery oversubscription feature is used, add four batteries on each port before oversubscribing one port with more than four batteries.
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.
- When using the additional battery port to install IQ Battery 5P, Termination resistors should be used to terminate the Enphase Control cable at the end of the two IQ Battery branches.

10.3.2.3 Without generator and with IQ Battery 5P, IQ System Controller 3 and IQ Microinverters on two ports

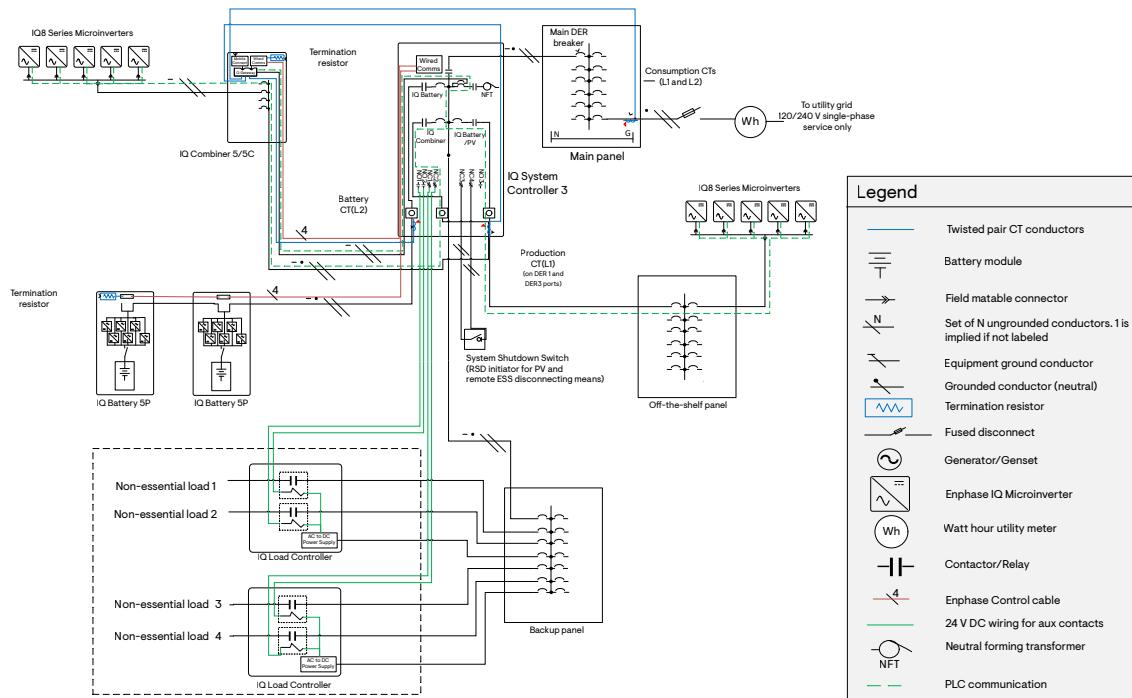


Figure 46: Partial home backup configuration with IQ Battery 5P, IQ System Controller 3, and IQ Microinverters on two ports

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage, and across both DERs.
- Additional IQ8 Microinverters can be added on the third DER port using an off-the-shelf panel.
- Use the Enphase Installer App to configure the third DER port for PV microinverters.
- Production CT must be placed around the PV port and the third DER port. To achieve this, an additional Production CT can be bought, or the existing Production CT in the IQ Combiner can be extended to the IQ System Controller 3. Ensure that the wire length from the Production CT to the IQ Gateway terminals does not exceed 5 meters.
- IQ System Controller 3 can support up to 40 kWh of IQ Battery 5P on the battery port using the IQ Battery oversubscription feature when used in conjunction with additional PV microinverters on the third DER port. Without battery oversubscription, the battery storage capacity is 20 kWh in conjunction with additional PV microinverters on the third DER port. Each battery circuit's continuous current rating must be less than or equal to 64 A, that is, it must be protected by an 80 A breaker.
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C and the off-the-shelf panel.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. It can also be used as a remote ESS disconnecting means where required.

10.3.2.4 Without generator and with IQ Battery 5P, IQ6/IQ7 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3

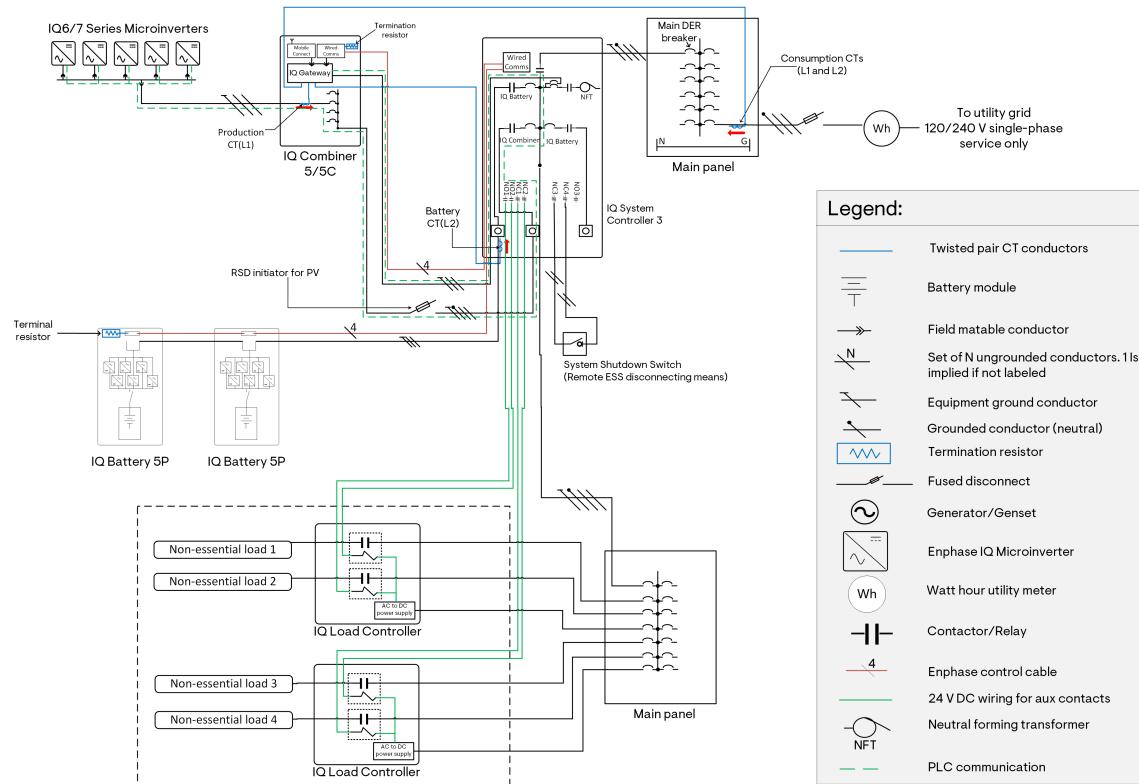


Figure 47: Partial home backup configuration with IQ6/IQ7 Series Microinverter and IQ Battery 5P

- IQ8 Series Microinverters cannot be mixed with other Enphase microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- The IQ System Controller 3 can support up to 80 kWh (40 kWh on each battery port) IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 40 kWh (20 kWh on each battery).
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.

10.3.2.5 Without generator and with IQ Battery 5P, M Series Microinverters, COMMS-KIT-02, and IQ System Controller 3

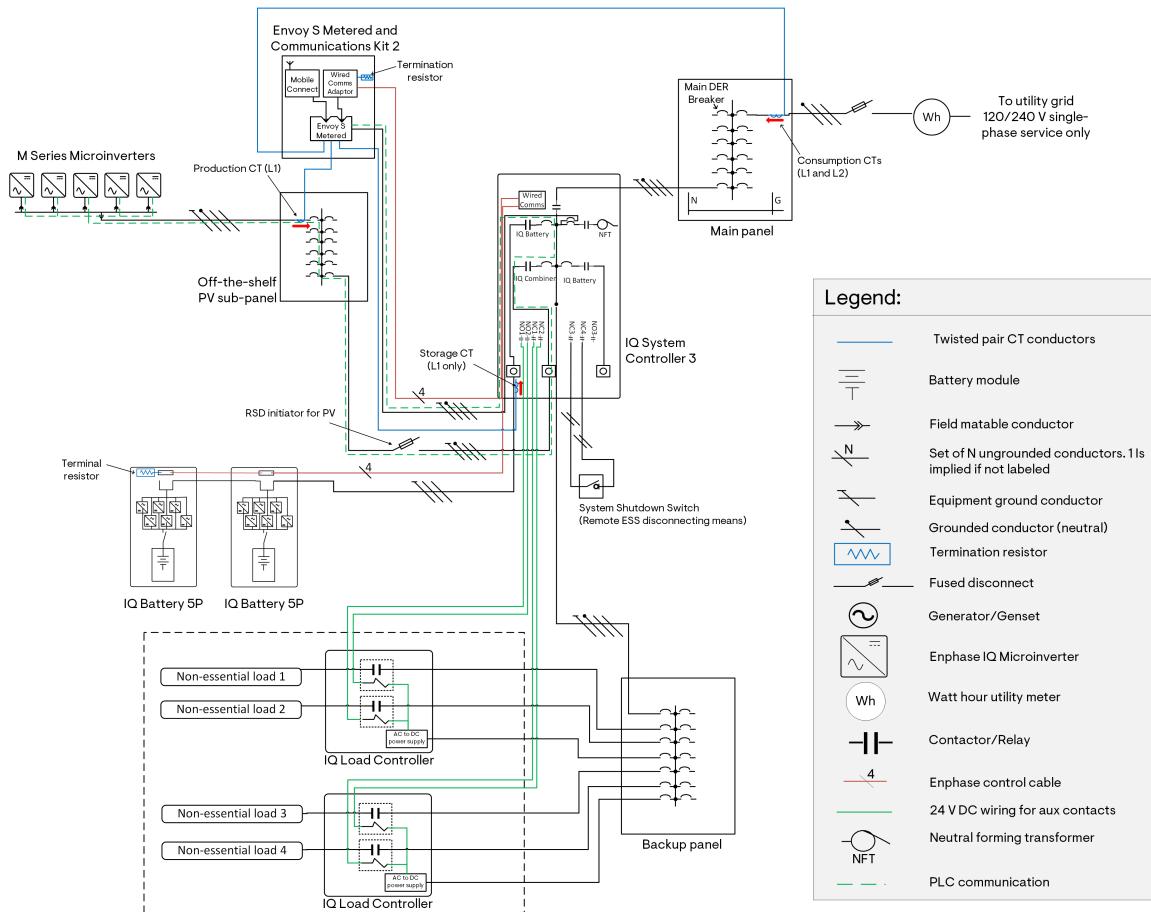


Figure 48: Partial home backup configuration with M Series Microinverters and IQ Battery 5P

- M Series Microinverters are incompatible with newer IQ8 or IQ6/IQ7 Microinverters. This applies to all system configurations with and without storage.
- Use a jumper cable to shorten the L2 and L3 terminals in the Envoy S Metered power terminal. These are marked "B" and "C" respectively.
- COMMS-KIT-02 does not ship with Envoy S metered and Mobile Connect cellular modem. These must be ordered separately.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The System Shutdown Switch is *not* the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- Any system with an IQ Battery 5P must have Wi-Fi or Ethernet as the primary mode of internet connectivity and an Enphase Mobile Connect as a backup mode of internet connectivity.
- For systems with more than 64 A of M Series Microinverters, microinverters exceeding 64 A rating can be added to the main panel.

10.3.2.6 Without generator and with IQ Battery 3/3T/10/10T, IQ8 Series Microinverters, IQ Combiner 4/4C, and IQ System Controller 2

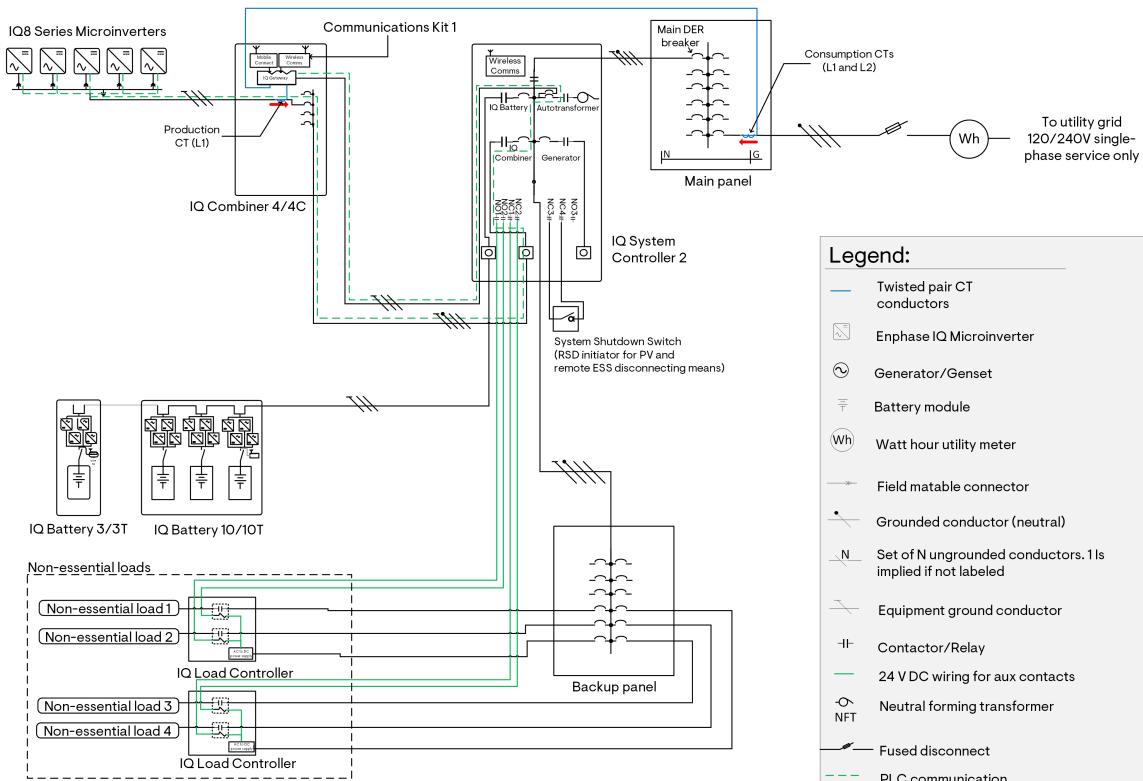


Figure 49: Partial home backup configuration using IQ8 Series Microinverters and IQ Battery 3/3T/10/10T

- The IQ System Controller 2 can support up to 40 kWh IQ Battery 3T/10T.
- Hold-down kits must be installed with breakers inside IQ Combiner 4/4C.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- If more than 48 IQ8 Series Microinverters are installed in a system with a single IQ Battery 3T, implement PV shedding to remove additional PV when the system transitions to microgrid or add additional batteries.
- If more than 64 A of IQ8 Series Microinverters need to be installed, the excess PV must be split into a grid-tied system. For line diagrams, refer to the Appendix.

10.3.2.7 Without generator and with IQ Battery 3/3T/10/10T, IQ6/IQ7 Series Microinverters, IQ Combiner 4/4C, and IQ System Controller 2

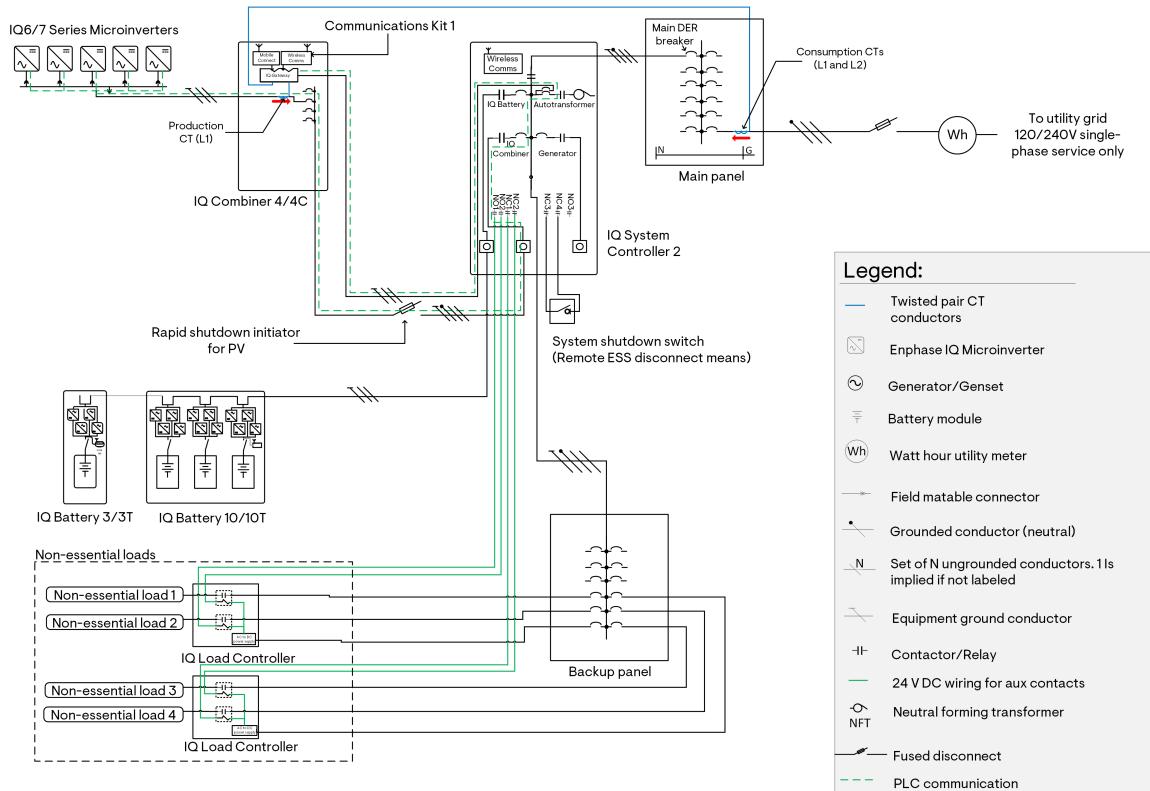


Figure 50: Partial home backup configuration using IQ6/IQ7 Series Microinverters and IQ Battery 3/3T/10/10T

- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can only support battery storage of up to 40 kWh.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- Hold-down kits must be used in IQ System Controller 2.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- For a line diagram of systems with more than 64 A of PV, refer to the Appendix.

10.3.2.8 Without generator and with IQ Battery 3/3T/10/10T, M Series Microinverters, COMMS-KIT-01, and IQ System Controller 2

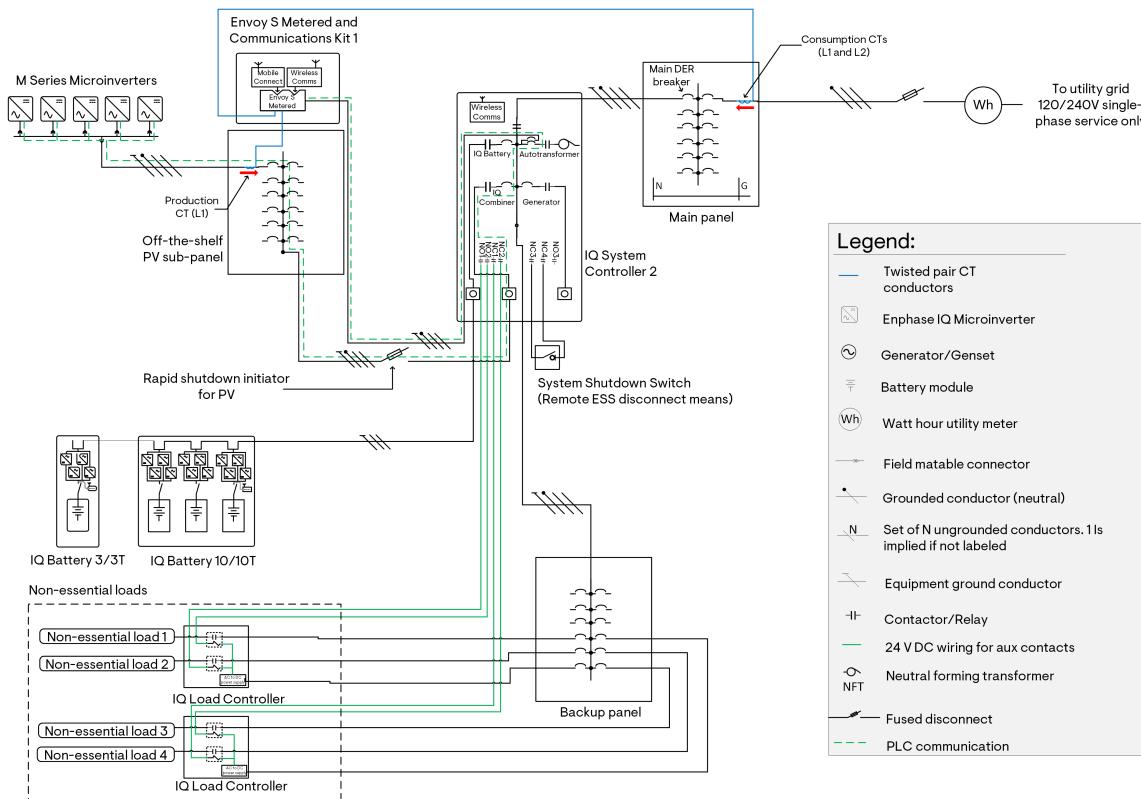


Figure 51: Partial home backup configuration using M Series Microinverters and IQ Battery 3/3T/10/10T

- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- PV shedding must be implemented to shed the microinverter array when the generator is connected to the microgrid and producing power. Refer to the [Generator integration technical brief](#) for details on PV shedding implementation.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.

 **NOTE:** IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety. IQ Battery 3/3T/10/10T requires the use of hold-down kits on IQ System Controller 2.

- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3.2.9 With generator, IQ Battery 5P, IQ8 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3

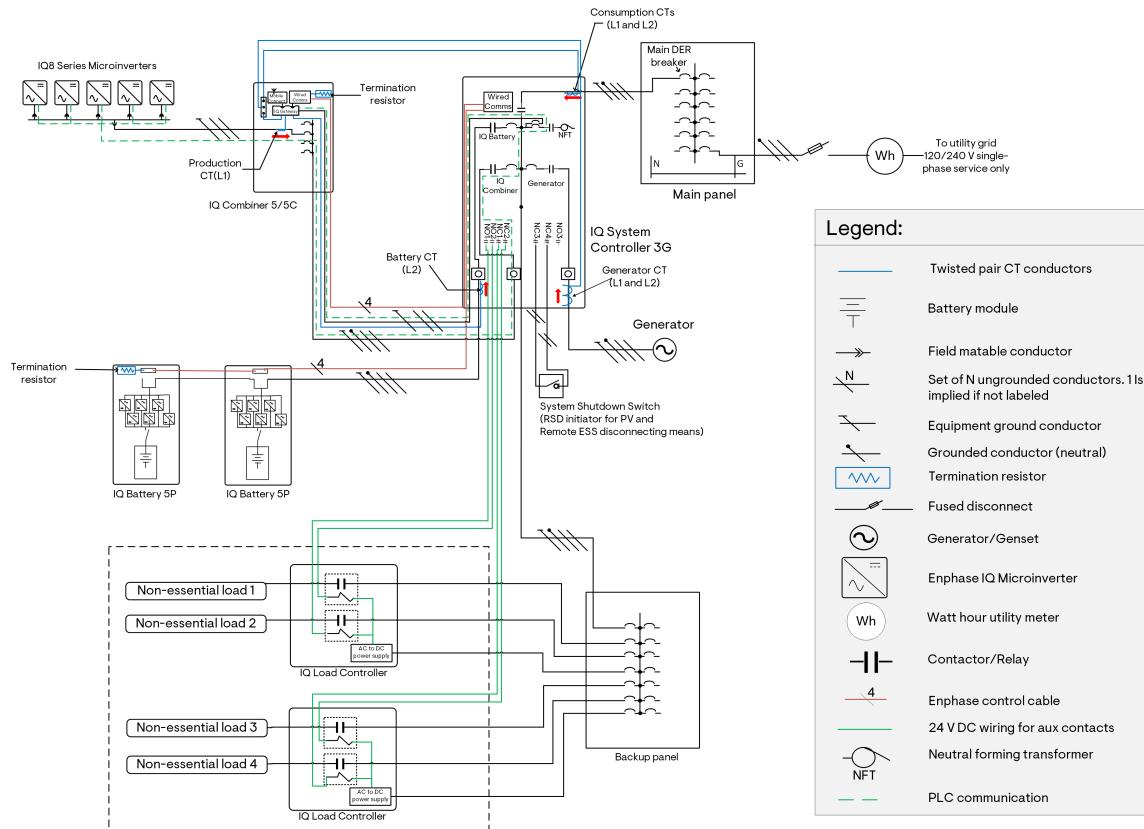


Figure 52: Partial home backup configuration with IQ8 Series Microinverters and IQ Battery 5P

- The IQ System Controller 3G can support up to 40 kWh IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 20 kWh.
- Hold-down kits must be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating or 100% of the microinverter array continuous power rating, whichever is higher. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- To monitor the consumption from the generator, systems with a generator will require an additional pair of generator CTs linked in parallel with the Consumption CTs. These CTs (2x CT-200-CLAMP or 2x CT-200-SPLIT) must be purchased separately.
- The System Shutdown Switch is the Rapid shutdown initiator for PV. The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- If more than 64 A of IQ8 Series Microinverters need to be installed, the excess PV must be split into a grid-tied system. For a line diagram of such a system, refer to the appendix.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3.2.10 With generator, IQ Battery 5P, IQ6/IQ7 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3

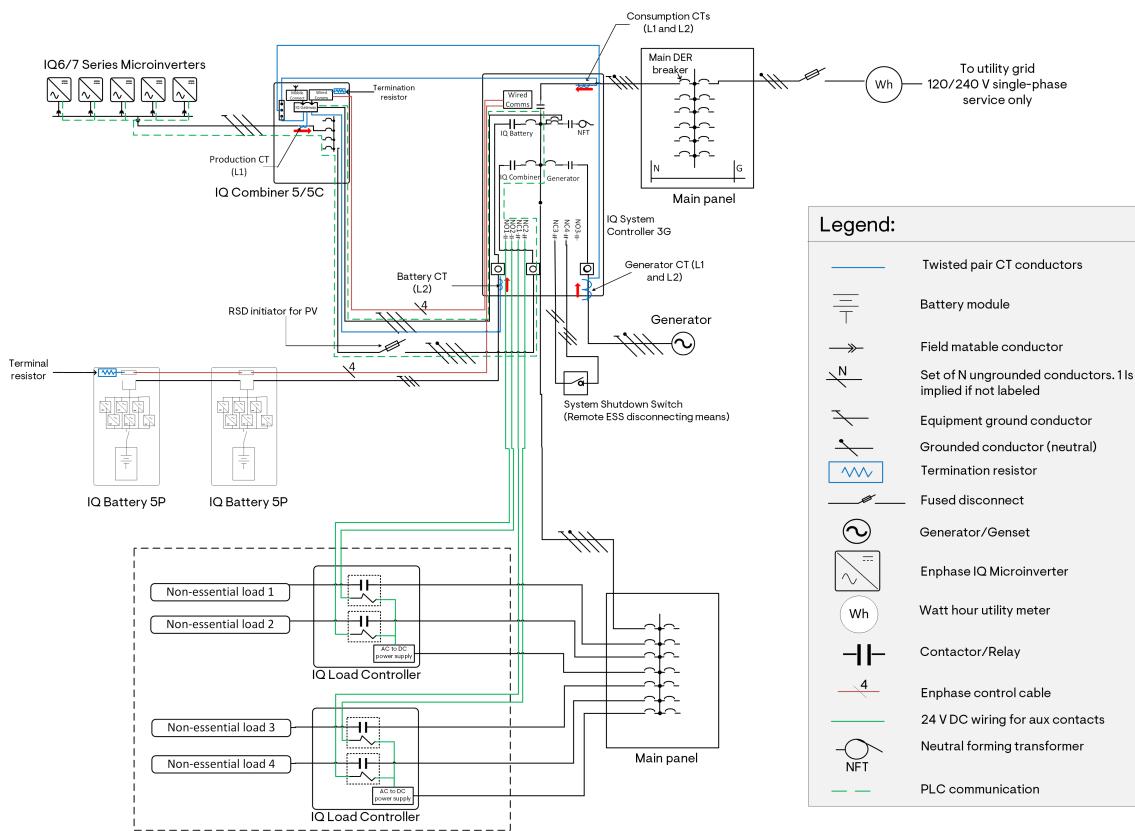


Figure 53: Partial home backup configuration with IQ6/IQ7 Series Microinverters and IQ Battery 5P

- The IQ System Controller 3G can support up to 40 kWh IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 20 kWh.
- Hold-down kits need not be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- To monitor the consumption from the generator, systems with a generator will require an additional pair of generator CTs linked in parallel with the Consumption CTs. These CTs (2x CT-200-CLAMP or 2x CT-200-SPLIT) must be purchased separately.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) for details.

10.3.2.11 With generator, IQ Battery 5P, M Series Microinverters, COMMS-KIT-02, and IQ System Controller 3

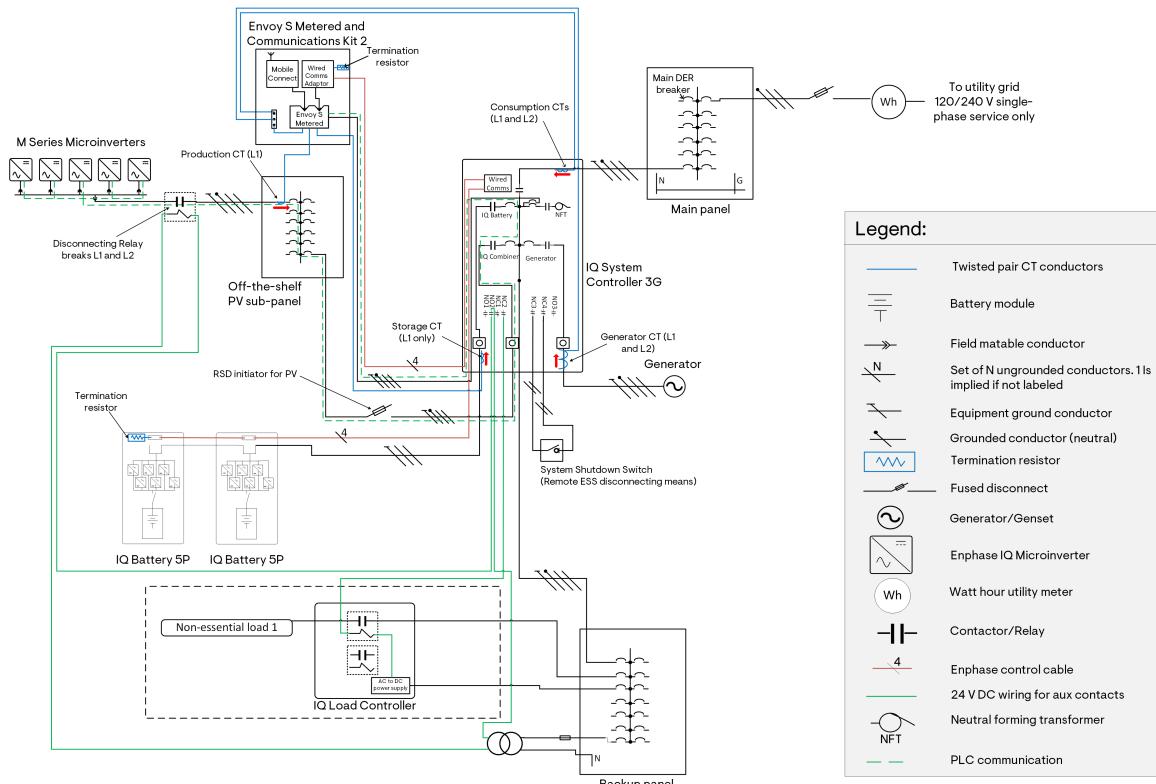


Figure 54: Partial home backup configuration with M Series Microinverters and IQ Battery 5P

- Use a jumper cable to shorten the L2 and L3 terminals in the Envoy S Metered power terminal. These are marked "B" and "C" respectively.
- The IQ System Controller 3G can support up to 40 kWh IQ Battery 5P using the IQ Battery oversubscription feature. Without battery oversubscription, the battery storage capacity is 20 kWh.
- Hold-down kits need not be installed with breakers inside IQ Combiner 5/5C.
- IQ System Controller 3/3G has an integrated hold-down kit and is compatible with Eaton, ABB/GE, and Siemens breakers for DERs.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output.
- PV shedding must be implemented to shed the microinverter array when the generator is connected to the microgrid and producing power. Refer to the [Generator integration technical brief](#) for details on PV shedding implementation.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- To monitor the consumption from the generator, systems with a generator will require an additional pair of generator CTs linked in parallel with the Consumption CTs. These CTs (2x CT-200-CLAMP or 2x CT-200-SPLIT) must be purchased separately.

- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) for details.

10.3.2.12 With generator, IQ Battery 3/3T/10/10T, IQ8 Series Microinverters, IQ Combiner 4/4C, and IQ System Controller 2

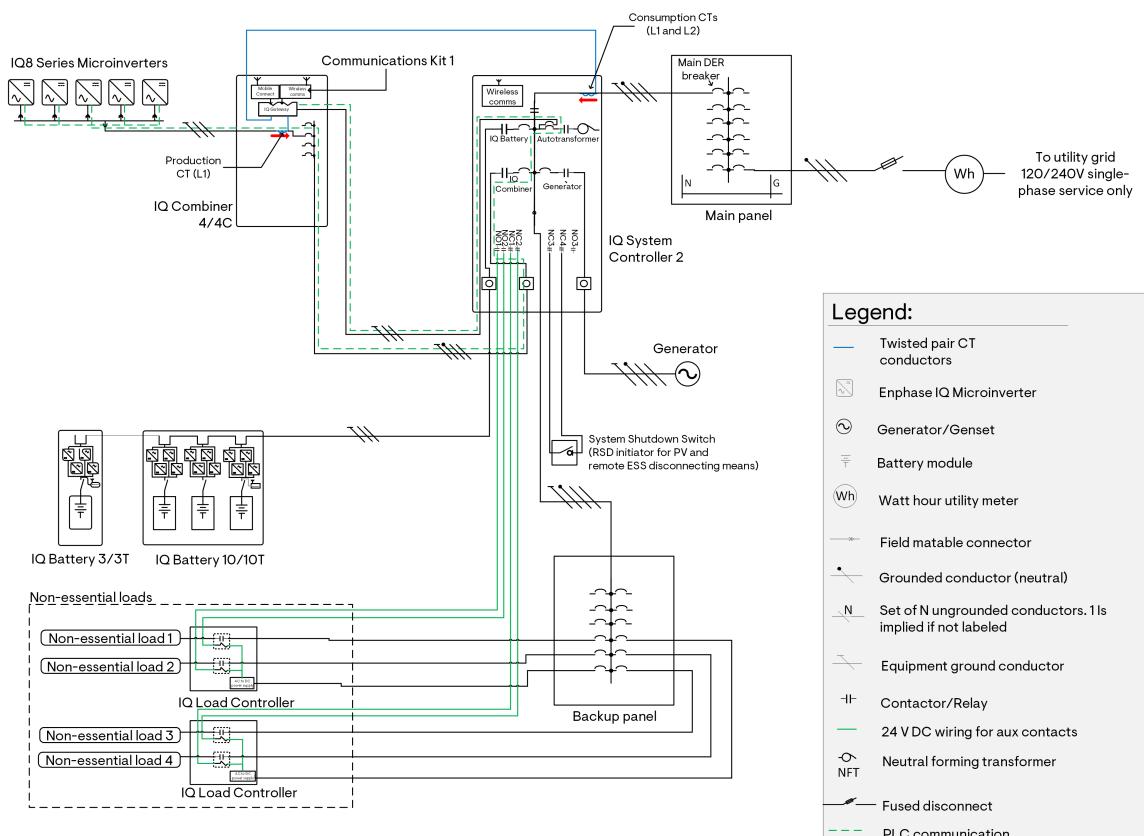


Figure 55: Partial home backup configuration with IQ8 Series Microinverters and IQ Battery 3T/10T

- The IQ System Controller 2 can support up to 40 kWh IQ Battery 3T/10T.
- Hold-down kits must be installed with breakers inside IQ Combiner 4/4C.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating or 100% of the microinverter array continuous power rating, whichever is higher. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.

- The System Shutdown Switch is the Rapid shutdown initiator for PV. The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- If more than 48 IQ8 Series Microinverters are installed in a system with a single IQ Battery 3T, implement PV shedding to remove additional PV from the microgrid or add additional batteries.
- If more than 64 A of IQ8 Series Microinverters need to be installed, the excess PV must be split into a grid-tied system.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) on page 111 for details.

10.3.2.13 With generator, IQ Battery 3/3T/10/10T, IQ6/IQ7 Series Microinverters, IQ Combiner 4/4C, and IQ System Controller 2

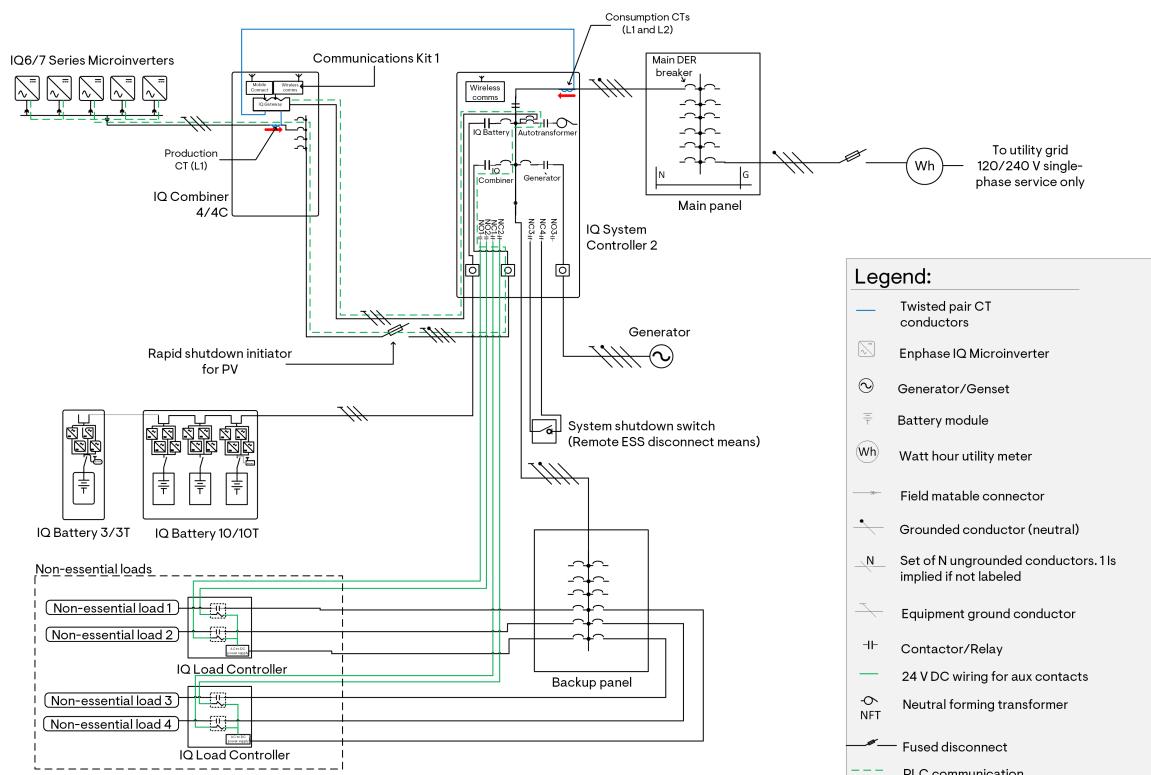


Figure 56: Partial home backup configuration with IQ6/IQ7 Series Microinverters and IQ Battery 3/3T/10/10T

- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output. If the microinverter array exceeds this ratio, PV load shedding must be implemented to shed excess PV when the system transitions to off-grid mode.
- The generator power rating must be at least 143% of the IQ Battery array continuous power rating. Refer to the [Generator sizing](#) on page 19 section for details.
- Refer to the [Generator integration technical brief](#) for generator integration, operating modes, system commissioning, and so on.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a

disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.

 **NOTE:** IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety.

- IQ Battery 3/3T/10/10T requires the use of hold-down kits on IQ System Controller 2.
- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) for details.

10.3.2.14 With generator, IQ Battery 3/3T/10/10T, M Series Microinverters, COMMS-KIT-01, and IQ System Controller 2

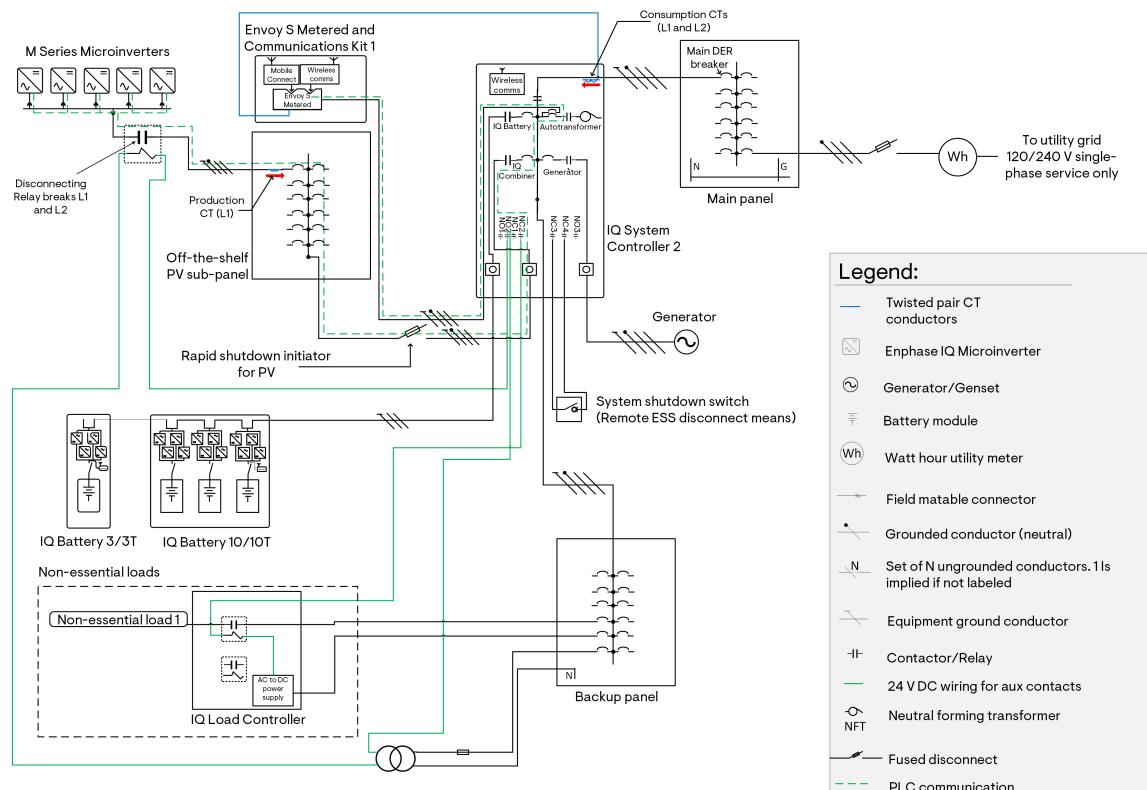


Figure 57: Partial home backup configuration with M Series Microinverters and IQ Battery 3/3T/10/10T

- EES systems using IQ System Controller 2 and IQ Battery 3T/10T can support battery storage of up to 40 kWh.
- The rated continuous power output of the microinverter array must not exceed 150% of the IQ Battery array's rated power output.
- PV shedding must be implemented to shed the microinverter array when the generator is connected to the microgrid and producing power. Refer to the [Generator integration technical brief](#) for details on PV shedding implementation.
- The System Shutdown Switch can be used as a remote ESS disconnecting means where required.
- The System Shutdown Switch is not the Rapid shutdown initiator for PV. The PV breakers inside the IQ Combiner or PV subpanel can be used as the Rapid shutdown initiator if the NEC code adopted does not specify a single initiator. If the NEC code mandates a single initiator and if the IQ System Controller is readily accessible, the aggregate PV breaker inside the IQ System Controller can act as the Rapid shutdown initiator. If it is not readily accessible, a disconnect must be installed between the IQ System Controller and IQ Combiner 5C/PV subpanel to function as the PV Rapid shutdown disconnect.



NOTE: IQ System Controller's door is lockable, enabling it to be locked when the breaker is off for safety. IQ Battery 3/3T/10/10T requires the use of hold-down kits on IQ System Controller 2.

- The diagram does not show a remote start for the generator. Refer to [Generator auxiliary contact wiring](#) for details.

11. Control wiring

An Enphase Energy System using IQ System Controller 3/3G/3M and IQ Battery 5P needs control cables to be wired between IQ Combiner 5/5C, Communications Kit 2 (in case of systems with standalone IQ Gateway or Envoy S Metered), IQ System Controller 3/3G/3M, and IQ Battery 5P.

The control cable required for IQ Battery 5P, IQ Combiner 5/5C, and IQ System Controller 3/3G must comply with UL 3003, UL 1277, and UL 83 standards.



NOTE: Enphase has validated performance using the Enphase Control cable (SKU: CTRL-SC3-NA-01). Enphase cannot guarantee performance when a third-party control cable is used.



NOTE: Enphase Control cable (SKU: CTRL-SC3-NA-01) can be routed along with the power cables in the same conduit.

Enphase control wiring has the following components:

- The signal wires (two twisted pair wires) within the control cable (CTRL L = Blue, CTRL H = Orange, Ground = Black, NA = Red)
- The drain wire of the shield
- Termination resistor

11.1 Installation guidelines

Ensure the following guidelines are followed to avoid failures during system commissioning.

- At the end of the control network, each component should have one header fitted with a termination resistor.
- The drain wire should only be terminated on one end of the control wiring between system components.
- It is recommended that the drain wire be terminated at the component from which the control wiring for the section is initiated.
- The same conduits can be used for power and control wire routing only when using an Enphase Control Cable (CTRL-SC3-NA-01).

11.2 Common control wiring sequences

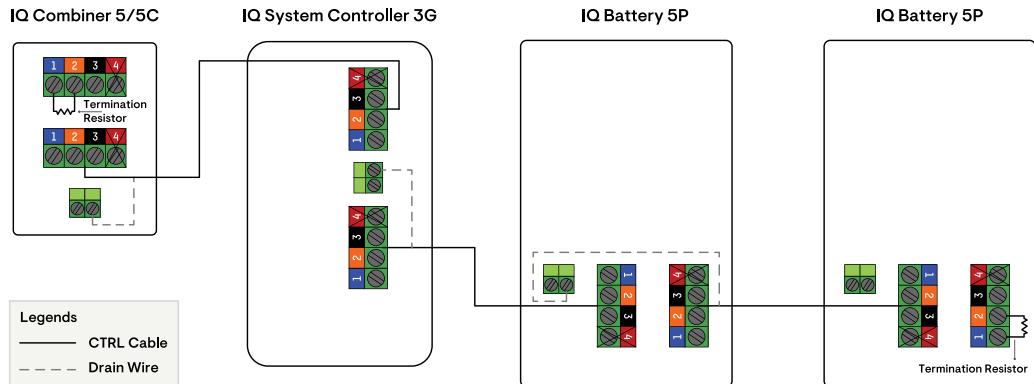


Figure 58: Control wiring sequence 1a: IQ Combiner 5/5C → IQ System Controller 3G → IQ Battery(s) 5P

This only applies to IQ System Controller 3/3M, where the third DER port can be used for an additional battery.

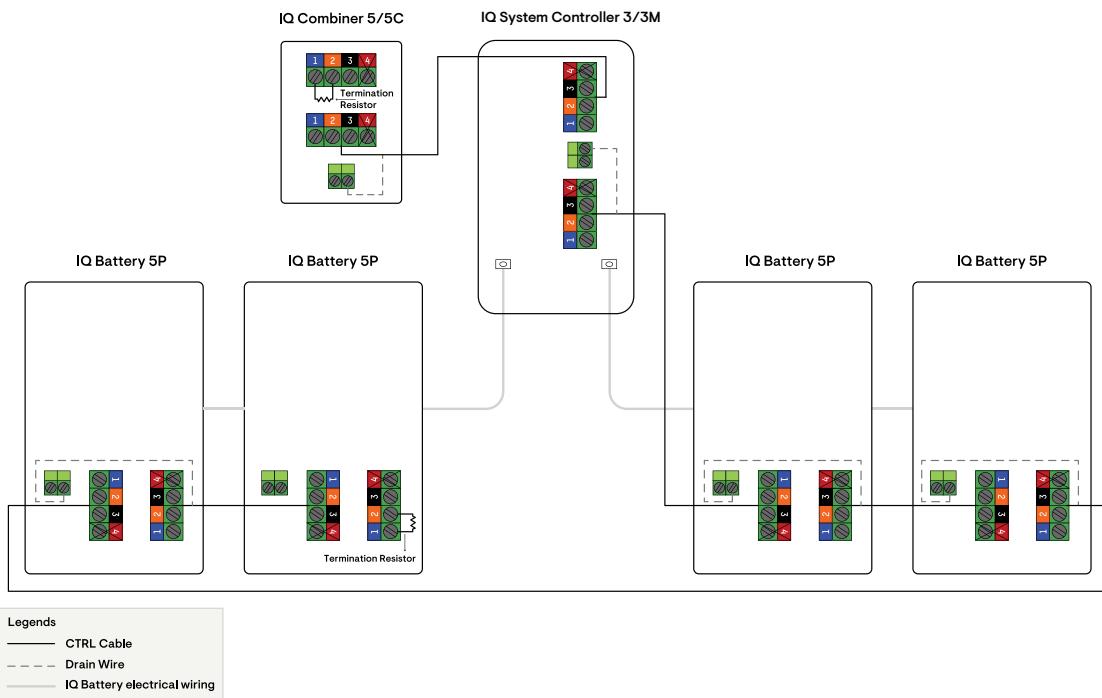


Figure 59: Control wiring sequence 1b: IQ Combiner 5/5C → IQ System Controller 3/3M → IQ Battery(s) 5P

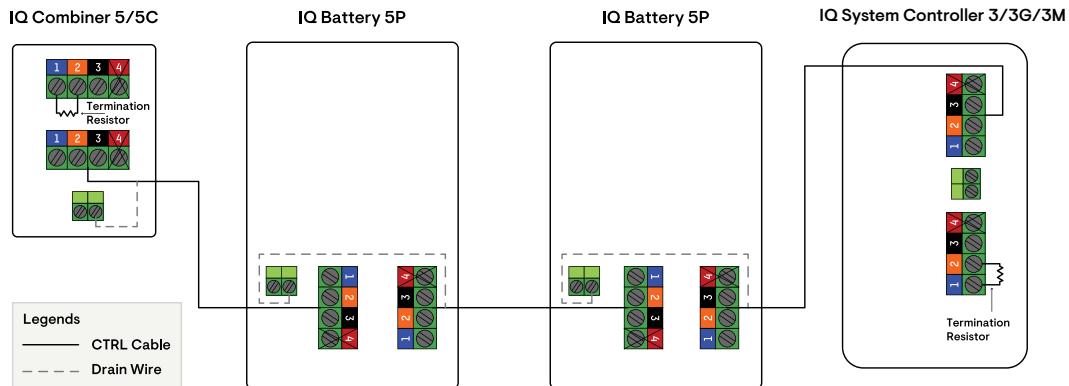


Figure 60: Control wiring sequence 2: IQ Combiner 5/5C → IQ Battery(s) 5P → IQ System Controller 3/3G/3M

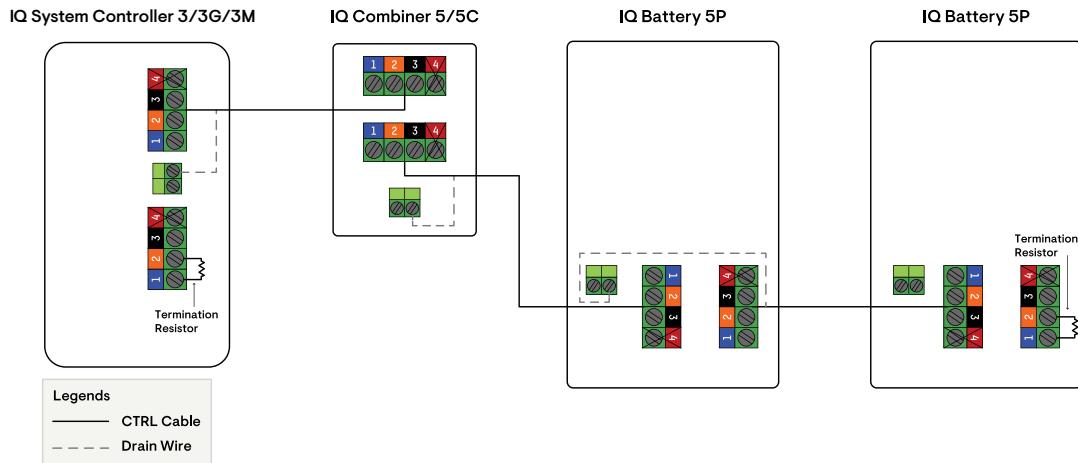


Figure 61: Control wiring Sequence 3: IQ System Controller 3/3G/3M → IQ Combiner 5/5C → IQ Battery(s) 5P

Table 19: Termination resistor location

Control wiring sequence	Termination resistor location
IQ Combiner 5/5C → IQ System Controller 3G → IQ Battery(s) 5P	<ol style="list-style-type: none"> IQ Combiner 5/5C Last IQ Battery 5P in the daisy chain
IQ Combiner 5/5C → IQ System Controller 3 → IQ Battery(s) 5P	<ol style="list-style-type: none"> IQ Combiner 5/5C Last IQ Battery 5P in the daisy chain
IQ Combiner 5/5C → IQ Battery(s) 5P → IQ System Controller 3/3G/3M	<ol style="list-style-type: none"> IQ Combiner 5/5C IQ System Controller 3/3G/3M
IQ System Controller 3/3G/3M → IQ Combiner 5/5C → IQ Battery(s) 5P	<ol style="list-style-type: none"> IQ System Controller 3/3G/3M Last IQ Battery 5P in the daisy chain

11.3 Preparing for the wiring

Preparing for the wiring involves the following steps.

1. Getting the right cable length.
2. Stripping the cables that have been cut.
3. Connecting cables to headers.

11.3.1 Getting the right cable length

Each cable run must be cut to the required lengths based on the conduit lengths. Additional wire length is needed to ensure the control cable can be wired to the control ports in the respective devices. Refer to the respective device quick installation guide for the additional cable length.

The total control cable length = conduit length + additional wiring for the device at one end + additional wiring at the other end of the cable.

The total control cable length must be less than 75 meters (250 feet).

 **NOTE:** Follow instructions in the device quick installation guides while routing the control cable inside the devices.

11.3.2 Stripping the cables that have been cut

The cable ends must be stripped to connect them to the headers. Refer to the device quick install guide for the additional cable length needed.

 **NOTE:** Cut the drain wire in the cable end, which is not connected to the header.

11.3.3 Connecting cables to headers

The control cable connections to the header are as follows.

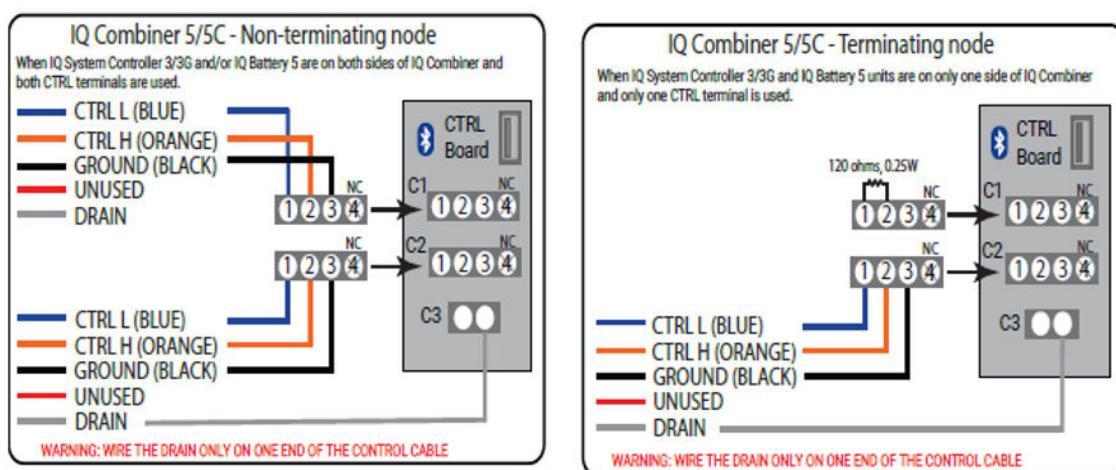


Figure 62: Control cable wiring instructions

 **NOTE:** These connections are standardized across all Enphase devices.



NOTE: Secure the unconnected drain wire to avoid accidental contact with other terminals or ground.

11.4 Voltage regulation considerations

When the IQ Battery 3T/10T/5P is charging, it acts like a load, and the voltage decreases at the battery's terminals based on Ohm's law and wire resistance. When the IQ Battery 3T/10T/5P discharges to feed loads, it behaves like a source, and the voltage increases at the battery's terminals.

The voltage rise to voltage drop delta divided by the nominal voltage is roughly equivalent to voltage regulation. Since the peak charge and discharge values for IQ Battery 3T/10T/5P are the same, voltage rise and voltage drop will be the same.

Voltage regulation in an Enphase Energy System is calculated as $PercentVR = \frac{2 \cdot |V_d|}{V_{nom}}$

where:

V_d is the voltage change from 0 to max current out of IQ Battery 3T/10T/5P, and

V_{nom} is the nominal RMS voltage.

Ensure that the IQ Battery 3T/10T/5P conductors are sized correctly for the number of units on the circuit and that voltage regulation does not exceed 1% between the first IQ Battery 3T/10T/5P and IQ System Controller 2/3/3G.

11.5 Rapid shutdown of Enphase Energy System

2020 NEC 690.12 requires a Rapid shutdown for PV systems on buildings by an initiation device in a readily accessible location. This is often the service disconnecting means, or PV system disconnects in grid-interactive systems. Rapid shutdown requirements do not apply to optional standby systems such as energy storage, and, as seen in Figure 1, the PV system disconnect can still initiate Rapid shutdown.

For an Enphase system using IQ6/IQ7 Series and M215 and M250 Microinverters, the Rapid shutdown initiation device can be either:

- The PV system breaker in IQ System Controller 3/3G.
- An additional disconnect, such as a fusible disconnect between the IQ System Controller 3/3G and the IQ Combiner.
- The circuit breakers in the IQ Combiner since these breakers are fewer than six and grouped.

The Rapid shutdown initiator must be labeled per 2017 NEC 690.56.

For an Enphase Energy System with IQ8 Series Microinverters in grid-agnostic mode, the Enphase System Shutdown Switch (EP200G-NA-02-RSD) must be installed with IQ System Controller 3/3G to act as the only Rapid shutdown device of the system. Refer to the [Quick installation guide of Enphase System Shutdown Switch](#) for instructions on wiring the Rapid shutdown device.



WARNING: IQ System Controller 3/3G and Enphase System Shutdown Switch can enforce Rapid shutdown *ONLY* on IQ8 Series Microinverters connected to the IQ System Controller 3/3G AC combiner port.

12. Abbreviations

Abbreviation	Description
DER	Distributed energy resource
ESS	Energy Storage System
kW	Kilowatt
kVA	Kilovolt-ampere
MID	Microgrid interconnect device
NEC	National electric code
NFT	Neutral forming transformer
OCPD	Overcurrent protection device
PV	Photo voltaic
RSD	Rapid shutdown device
RDE	Rapid shutdown equipment
SKU	Stock keeping unit

Appendix A

Solar-only grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Gateway, and off-the-shelf combiner box

In a Solar Only configuration, if the sum of maximum current from the IQ8/IQ7/IQ6 PV branches is greater than 80 A, an appropriately sized third-party combiner box can be paired with the IQ Gateway.

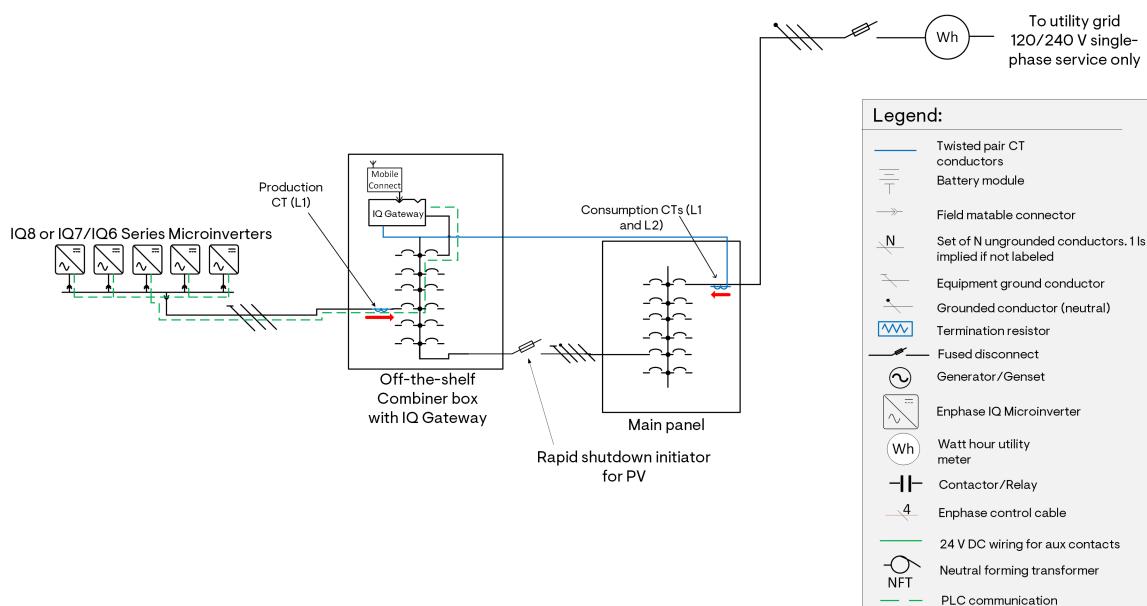


Figure 6.3: Solar-only grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Gateway, and off-the-shelf combiner box

- Systems with IQ8 Series Microinverters must contain only.
- IQ8 Series Microinverters are incompatible with previous generations of Enphase microinverters, such as IQ6, IQ7, and M Series Microinverters, and cannot be installed together. This applies to all system configurations, with and without storage.
- IQ Gateway and Mobile Connect cell modems must be purchased separately and can be housed in the off-the-shelf combiner box or any other enclosure.
- The main DER breaker (aggregate PV breaker on the main panel) can act as the Rapid shutdown initiator for PV in grid-tied configuration if it is readily accessible.

Appendix B

Solar + Battery grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Battery 5P, and off-the-shelf DER subpanel

If the sum of the maximum current from the PV branches and the two IQ Battery 5P branches is greater than 80 A, an appropriately sized third-party combiner box must be used.

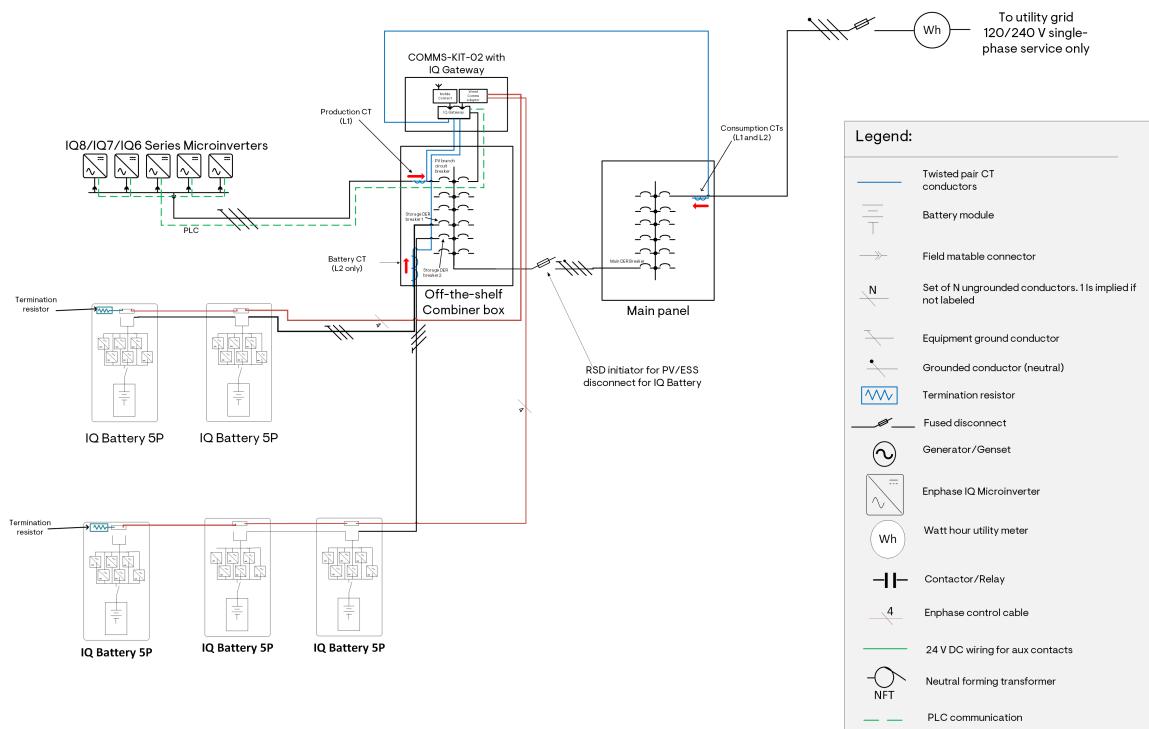


Figure 64: Solar + Battery grid-tied configuration with IQ8/IQ6/IQ7 Series Microinverters, IQ Battery 5P, and off-the-shelf DER subpanel

- Systems with IQ8 Series Microinverters must contain only IQ8 Series Microinverters as they are incompatible with older generations of Enphase microinverters, including IQ6 and IQ7 Series Microinverters. This applies to all system configurations, with and without storage.
- IQ Gateway and Mobile Connect can be housed in the COMMS-KIT-02 box. The IQ Gateway and Mobile Connect cell modem must be purchased independently from the COMMS-KIT-02.
- Systems with IQ Battery 5P require an IQ Gateway software version of 8.X or later. If an update is needed, it will be automatically applied during the commissioning process.
- The battery current transformer (CT) must clamp L2 conductors on both IQ Battery 5P branches.
- The main DER breaker (off-the-shelf combiner box breaker on the main panel) can act as the Rapid shutdown initiator for PV AND ESS disconnecting means in grid-tied configuration if it is readily accessible.

Appendix C

Battery Only grid-tied configuration with IQ Battery 5P, IQ Gateway, Communications Kit 2, off-the-shelf subpanel, and two battery circuits

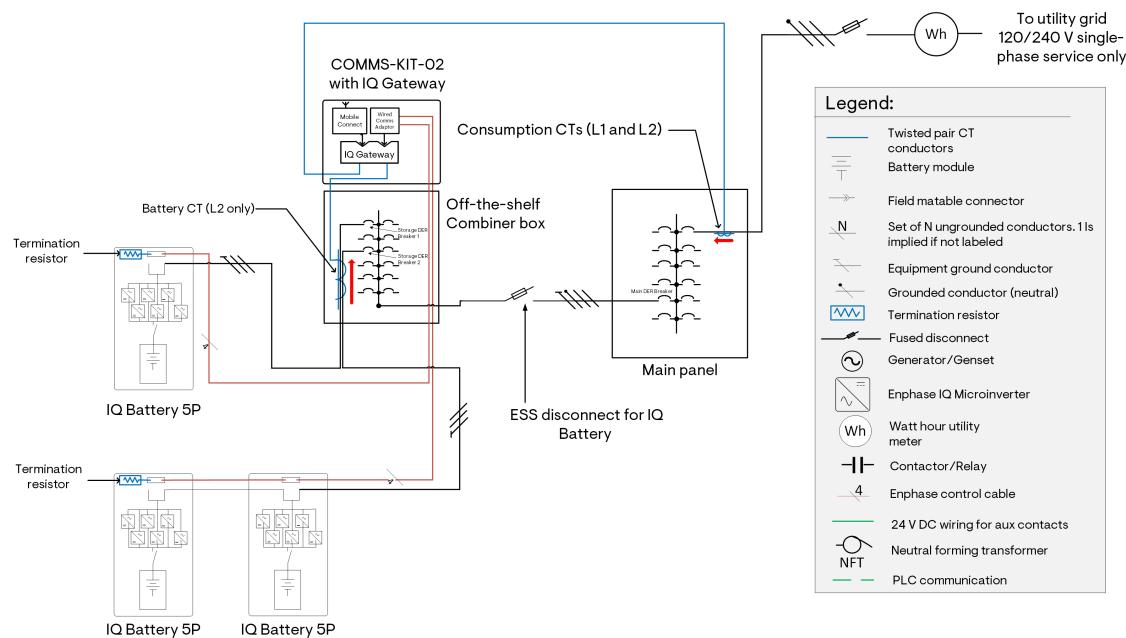


Figure 65: Battery Only grid-tied configuration with IQ Battery 5P, IQ Gateway, Communications Kit 2, off-the-shelf subpanel, and two battery circuits

Appendix D

Generator auxiliary contact wiring

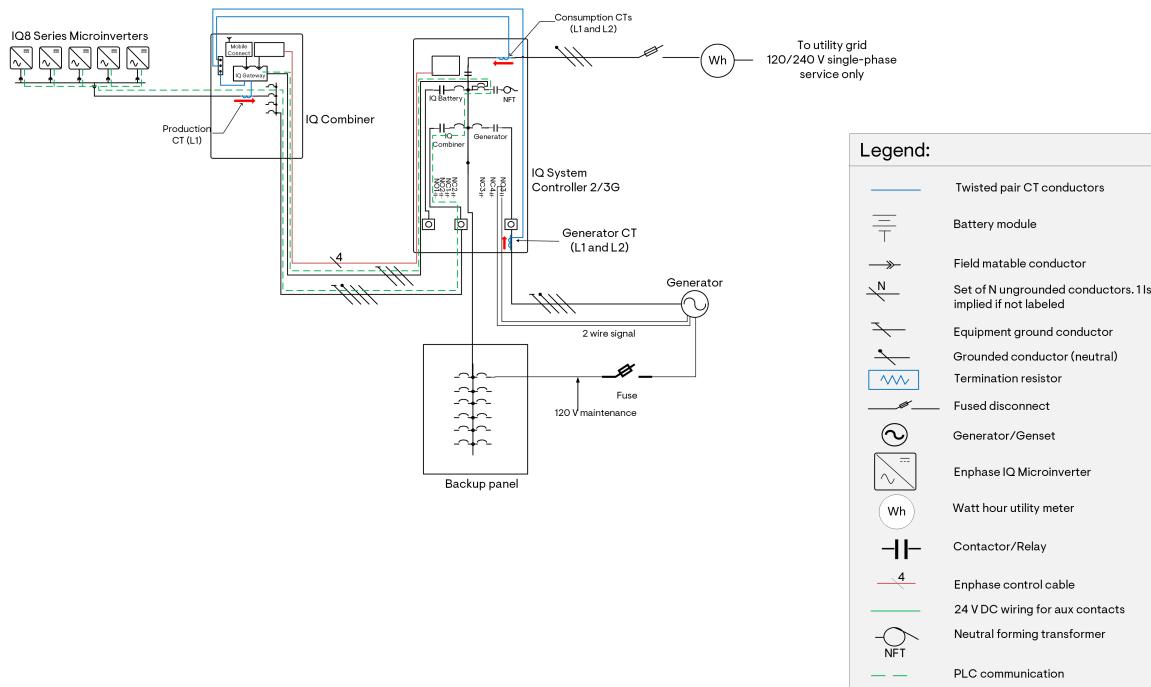


Figure 66: Generator auxiliary contact wiring for two-wire remote-start generator

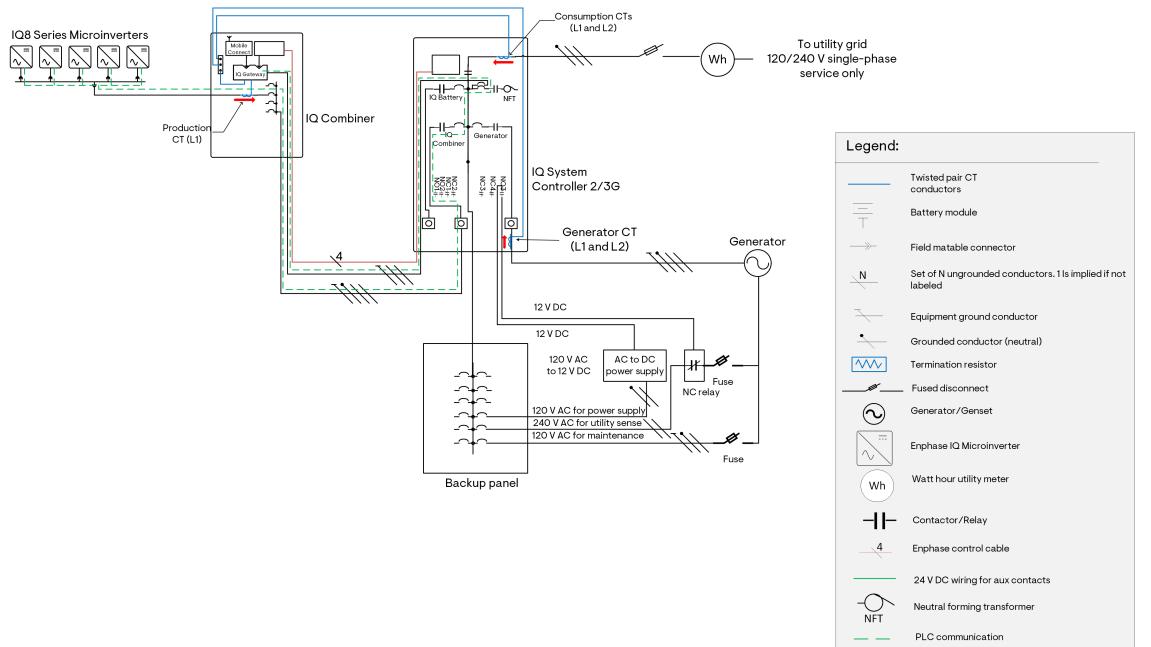


Figure 67: Generator auxiliary contact wiring for utility sense-based remote-start generator

Appendix E

Split Enphase systems on a single site with IQ6/IQ7/IQ8 or M Series Microinverters

It is necessary to “split” the PV systems into a microgrid and a non-microgrid PV system, each with its own IQ Gateway, in the following scenarios:

- Prevent mixing of multiple microinverter series – Due to technical limitations, M Series Microinverters cannot be installed in the same system as IQ6/IQ7 Series Microinverters. Similarly, IQ6/IQ7 Series Microinverters cannot be installed with IQ8 Series Microinverters.
- IQ8 Series Microinverter output exceeding 64 A continuous at the site – IQ System Controller 2 supports only 64 A continuous PV at the AC combiner port. If the PV array exceeds 64 A continuous output, the installer can configure an additional grid-tied system with an IQ Gateway/IQ Combiner 3/3C/4/4C.



WARNING: Each system’s communication must be isolated from the other systems. The isolation involves the guidelines described and illustrated in subsequent diagrams.

- PLC communication occurs in AC cables at very high frequencies (over 100 KHz) and can inductively couple to any adjacent cable running in the same conduit or duct. Such coupling is avoided by physically separating cables from different domains or running them in separate grounded conduits. Where grounded conduits cannot be installed, these cables need to be physically separated by at least 3.3 feet/1 meter.
- PLC coupling may occur when multiple Enphase systems share a common AC line (for example, installed on the same main load panel at a home or installed behind the same distribution transformer in different homes). A PLC line filter installed between two systems will prevent such coupling.
- Never install a PLC line filter between an IQ Gateway and the microinverters. It will prevent the PLC communication between the microinverters and the IQ Gateway and will impact system functioning.



NOTE: We no longer recommend splitting the system if the total PV system size exceeds what can be supported by the total IQ Battery system size. PV shedding shall be used to address this scenario. For guidance on PV system size pairing with an IQ Battery, see the [System sizing](#) on page 15 section.



NOTE: This configuration does not support power export limiting.

The following items are needed to create a split system.

- Two gateways: Multiple IQ Gateways (or Envoy S Metered for M Series Microinverters) are required for split systems because the microgrid and non-microgrid PV microinverters operate with different grid profiles and parameters.
- Installation of a power line filter.
 - When multiple IQ Gateways exist on site, a power line filter must be installed to prevent cross-domain communication.
 - The [Q-LCF-064-1P](#) is a tested solution compatible with IQ6/IQ7/IQ8 Series Microinverters and IQ Gateway for up to 64 A of continuous current.
 - Similarly, the RP220, RP225, RP230, or RP240 Series from Radius Power can be used with M215/M250 Microinverters and the Envoy S Metered.

- The PLC path between the microgrid's IQ Gateway and the microgrid microinverters passes through the IQ System Controller. So, the PLC line filter cannot be installed between the IQ System Controller 3/3G and the microgrid microinverters. Moreover, only Q-LCF-064-1P provides adequate isolation for an IQ8 Series Microinverter-based system. Because of the constraints, the power line filter must be installed only between the non-microgrid system and the main load center, irrespective of the microinverter type in the non-microgrid system. Install the power line filter with the non-microgrid IQ Gateway and all microgrid PV microinverters on the "Load" input of the filter and the main load center on the "Line" input.

Table 20: PLC line filter configuration for systems with IQ8 Series Microinverters in microgrid

No.	Microgrid microinverter series	Non-microgrid microinverter series	PLC line filter SKU
1	IQ8 Series	IQ8 Series	Q-LCF-064-1P
2	IQ8 Series	IQ6/IQ7 Series	Q-LCF-064-1P
3	IQ8 Series	M Series	RP220, RP225, RP230, or RP240

- Installation of additional Consumption CTs: Depending on the configuration of the split system, an additional pair of Consumption CTs may need to be added. The Consumption CTs in split systems can be installed in the following configurations. The system behavior in these configurations will be different.

Table 21: CT placement and behavior of split system configurations

Location of microgrid Consumption CTs	Location where non-microgrid PV interconnects	Additional Consumption CTs	System behavior	Reference line diagram
Between the main panel and energy meter	Load side of microgrid Consumption CT or in the main panel	Yes	If using Self-Consumption or Savings battery profiles in the scenario illustrated in the figures mentioned alongside, the battery is prioritized to discharge to serve loads on the main panel, and the grid-tied PV is dispositioned to export to the grid.	Figure 68: "Split" IQ8 or IQ6/IQ7 PV system with an additional set of Consumption CTs , Figure 69: "Split" M Series PV system with an additional set of Consumption CTs
Between the main panel and energy meter	Line side of microgrid Consumption CT	No		Figure 70: "Split" IQ8 or IQ6/IQ7 Series PV system without an additional set of Consumption CTs

Location of microgrid Consumption CTs	Location where non-microgrid PV interconnects	Additional Consumption CTs	System behavior	Reference line diagram
				Figure 71: "Split" M Series PV system without an additional set of Consumption CTs
Between the IQ System Controller and main panel	In the main panel	No	The battery is prioritized to discharge only to serve loads on the backup panel, and the grid-tied PV is dispositioned to serve loads on the main panel or to export to the grid.	Figure 72: "Split" PV system without an additional set of Consumption CTs – Configuration to prevent the battery from discharging to serve loads on the main panel, Figure 73: M Series "split" PV system without an additional set of Consumption CTs – Configuration to prevent the battery from discharging to serve loads on the main panel



NOTE: The single-line diagrams in this appendix represent a system with IQ System Controller 3 and IQ Battery 5P. However, even systems using IQ System Controller 2, IQ Combiner 4/4C, and IQ Battery 3/3T/10/10T will exhibit the same behavior if the CT placements are similar.

Appendix F

Split systems with additional Consumption CTs

If the non-microgrid PV system is interconnected on the load side of the primary microgrid IQ Gateway's Consumption CT, a second set of Consumption CTs must be added around the non-microgrid PV conductors and connected in parallel with the primary microgrid Consumption CT wiring to the microgrid IQ Gateway. See [Figure 68: "Split" IQ8 or IQ6/IQ7 PV system with an additional set of Consumption CTs](#) for more details and the orientation of the CTs.

 **NOTE:** When using Self-Consumption or Savings battery profiles in the scenario illustrated here, the battery is prioritized to discharge to serve loads on the main panel, and the grid-tied PV is dispositioned to export to the grid. To avoid this behavior, look at the alternate system configurations provided in [Figure 72: "Split" PV system without an additional set of Consumption CTs – Configuration to prevent the battery from discharging to serve loads on the main panel](#) and [Figure 73: M Series "split" PV system without an additional set of Consumption CTs – Configuration to prevent the battery from discharging to serve loads on the main panel](#).

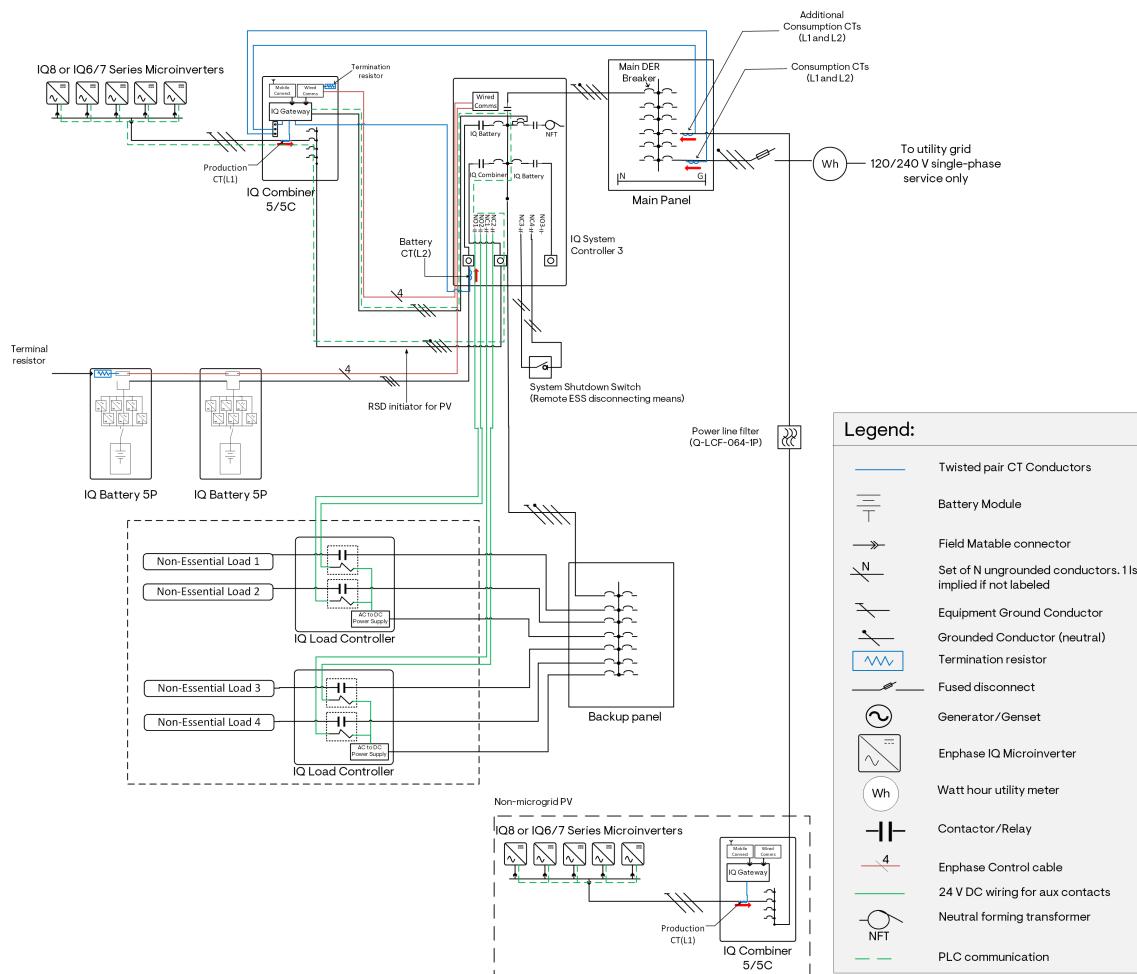


Figure 68: "Split" IQ8 or IQ6/IQ7 PV system with an additional set of Consumption CTs

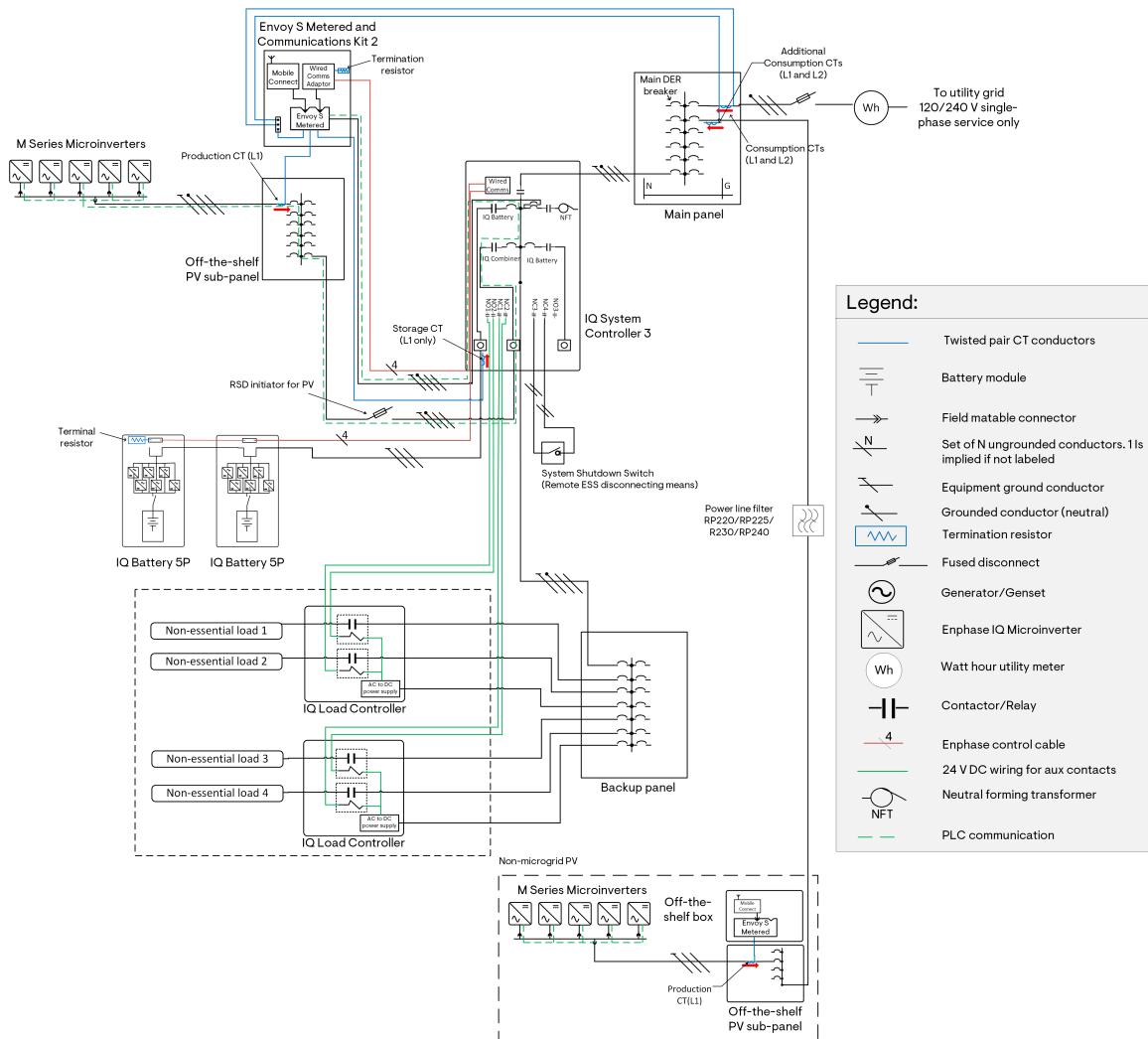


Figure 69: "Split" M Series PV system with an additional set of Consumption CTs

Appendix G

Split systems without additional Consumption CTs

For Enphase Energy Systems, where the non-microgrid PV system is interconnected on the utility side of the primary microgrid gateway's Consumption CTs, no additional Consumption CTs are needed.

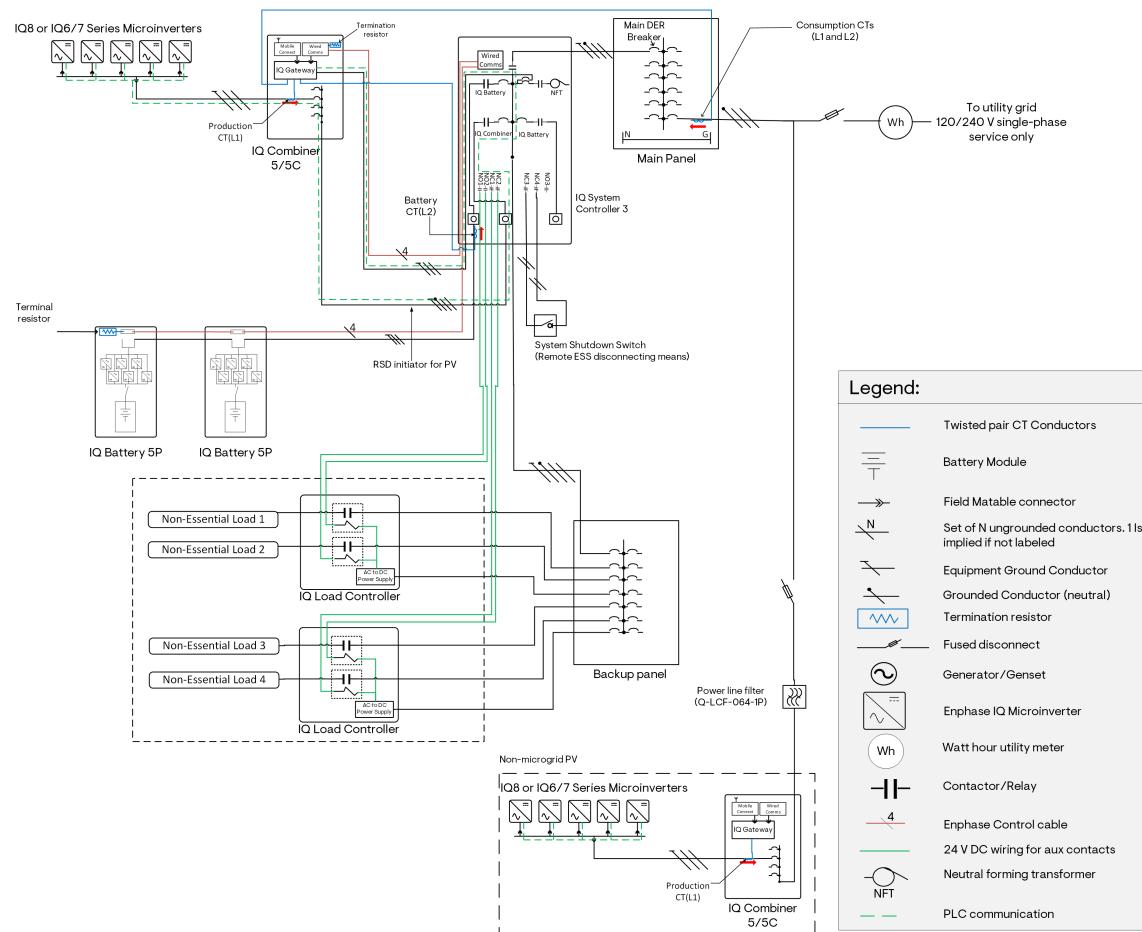


Figure 70: "Split" IQ8 or IQ6/IQ7 Series PV system without an additional set of Consumption CTs

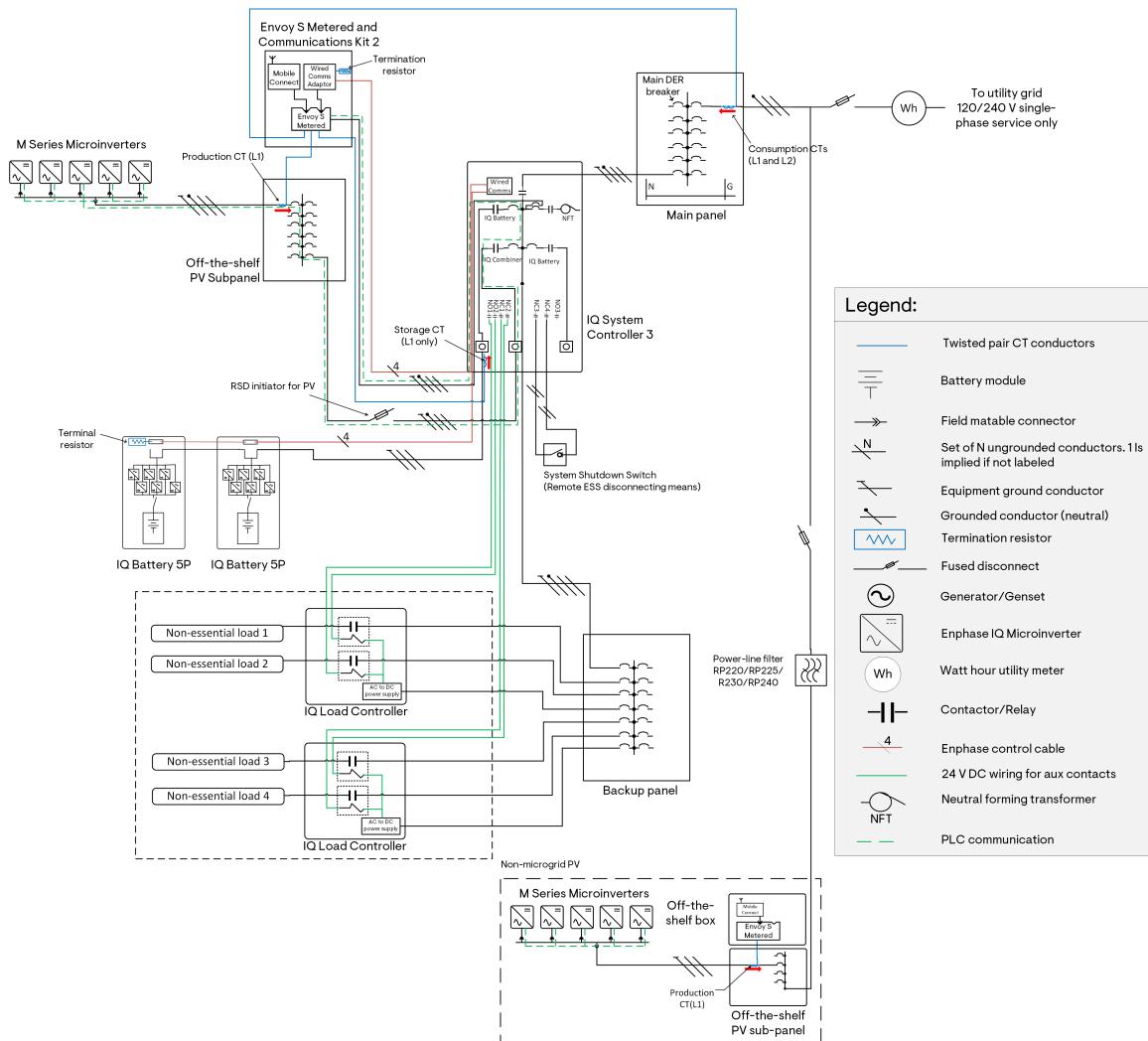


Figure 71: "Split" M Series PV system without an additional set of Consumption CTs

Appendix H

Split system without additional Consumption CTs where batteries prioritize backup loads only

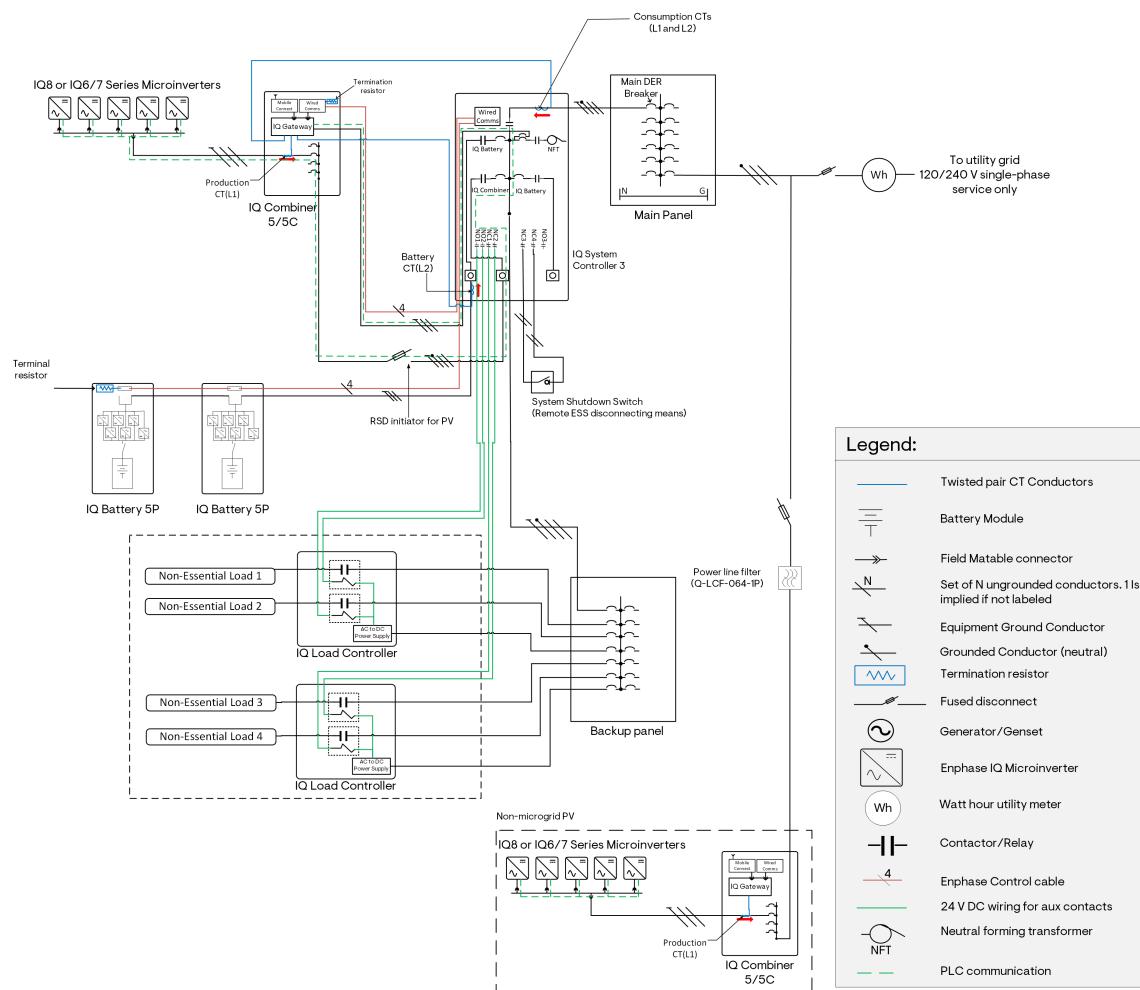


Figure 72: "Split" PV system without an additional set of Consumption CTs – Configuration to prevent the battery from discharging to serve loads on the main panel

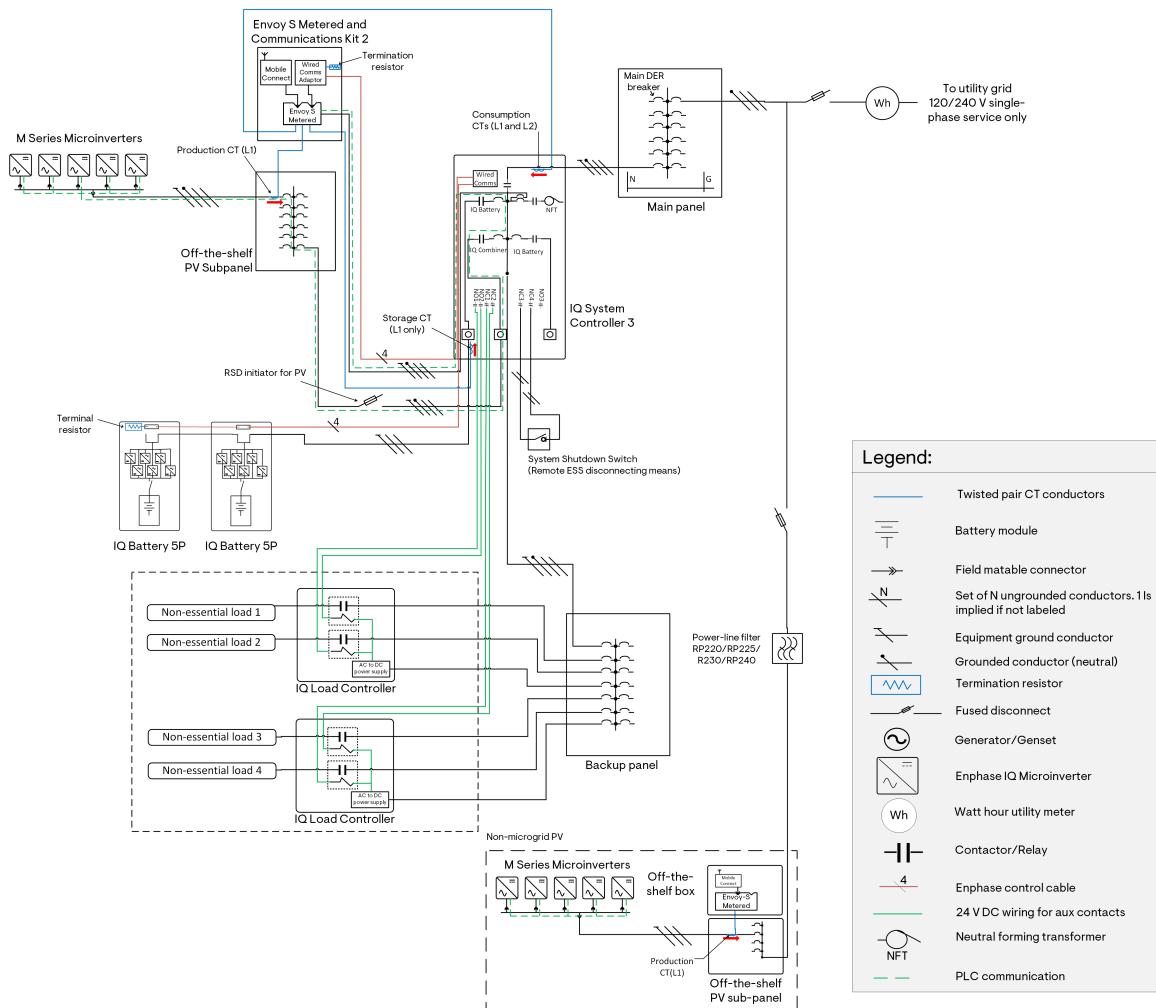


Figure 73: M Series “split” PV system without an additional set of Consumption CTs - Configuration to prevent the battery from discharging to serve loads on the main panel

21. Revision history

Revision	Date	Description
TEB-00004-6.0	May 2025	Added configuration details for IQ System Controller 3M and IQ Meter Collar.
TEB-00004-5.0	November 2024	<ul style="list-style-type: none">Updated the "System profiles", "System sizing", and "Component list for Solar + Battery system configurations" sections.Added the "Without generator and with IQ Battery 5P, IQ System Controller 3, and IQ Microinverters on two ports" topic under the "Whole home backup" and "Partial home backup" topics of the "Grid-forming (with backup) system configurations" chapter.Updated the "Without generator and with IQ Battery 5P with IQ8 Series Microinverters, IQ Combiner 5/5C, and IQ System Controller 3" topic under the "Whole home backup" and "Partial home backup" topics of the "Grid-forming (with backup) system configurations" chapter.
TEB-00004-4.0	September 2023	<ul style="list-style-type: none">Corrected error in Appendix C regarding placement of PLC filter in IQ6/IQ7 Series Microinverter systems.Figures are updated to show the PLC filter placement for IQ6/ IQ7 Series Microinverters like IQ8 Series Microinverters. IQ6/IQ7 and IQ8 Microinverter figures are now combined as well.Corrected label description for M Series systems.Removed note on non-availability of IQ Battery oversubscription.Removed note on non-availability of PCS features to IQ8 AC, MC, HC.Added sections "Load analysis" and "Optimal placement of IQ Battery 5P(s) on two ports in IQ System Controller 3" for grid-forming systems.Removed note on non-availability of PCS with IQ Combiner 4/4C.Removed duplicate note regarding support for M Series Microinverters.Modified note to specify legacy microinverters such as M Series and S Series are not supported.
TEB-00004-3.0	August 2023	<ul style="list-style-type: none">Added system configurations with IQ Battery 5P, IQ System Controller 3/3G, IQ Combiner 5/5C, and Communications Kit 2.Added grid-tied solar and grid-tied battery system configurations.Added generator sizing instructions.Added Appendix A "Other supported configurations".Added Appendix B "Generator remote start wiring".

Revision	Date	Description
		<ul style="list-style-type: none">Removed section “Split Enphase Systems on a single site with IQ6/IQ7/IQ8 or M Series Microinverters” and added to Appendix C.Removed section “Physical Installation considerations”.Removed section “Enphase Energy System Products”.Added section “Control wiring”.Removed reference to energy essentials and full energy independence; replaced with whole home backup and partial home backup, wherever applicable.
TEB-00004-2.0	April 2023	Editorial updates.
TEB-00004-1.0	April 2023	Internal release.

Previous releases.