

Enphase Energy System planning guide— single-phase backup systems

Applicable regions: United Kingdom

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1. Applicable countries

- United Kingdom

2. Overview

This guide contains information for site surveyors and design engineers to analyse a site and plan the design, installation, and support of home energy systems using the Grid-Agnostic Enphase Energy System (EES). This guide is not for installation and operation. This document supplements the information in the data sheets, quick install guides (QIGs), and product manuals. The diagrams and information demonstrate system configurations and installations. However, they may not include all additional local standards and regulations applicable to a site.

3. Enphase Energy System overview

The following table lists the three use cases supported by EES.

Energy sources at the site	Description
Solar + Battery grid-agnostic operation	<p>Pairing IQ Series Microinverters with IQ Batteries and IQ System Controller, this configuration combines solar and storage to help maximize financial benefits, increase self-consumption, and provide backup power to the home in the event of a grid outage.</p> <p>A Solar + Battery system, apart from providing backup power, makes a home more energy-independent and can offer significant long-term savings by minimizing the homeowner’s electricity bills. In this configuration, the microinverters power the house using solar energy when the sun is shining. Excess solar energy is used to charge the IQ Batteries. Once the battery is fully charged, the extra solar energy is exported back to the grid in exchange for electricity bill credits (in countries that allow it). Once the sun sets, the battery powers the home.</p>
Battery upgrade (installed on existing PV site)	<p>If a home has an existing Enphase solar PV system, adding IQ System Controller and IQ Batteries can help maximize financial benefits by storing excess solar power and using this stored energy to power the home once the sun sets or during a time of a grid outage.</p>
Solar-only grid-tied (backup-ready)	<p>This configuration is an ideal solution for homeowners who want to go solar and optimize savings on their electricity bills.</p> <p>By producing and consuming the electricity generated from their solar plant, homeowners reduce their dependence on the grid and go green.</p> <p>The IQ System Controller installed makes the system future proof and the system owner can add IQ Battery 5Ps in the future to this system to have storage and backup abilities.</p>

4. Product overview

- **IQ Series Microinverters and accessories:** IQ Series Microinverters pack more power into less space than other rooftop solar systems and make rooftop solar more productive, reliable, smart, and safe.
- **IQ Battery 5P:** This is an all-in-one AC-coupled battery system that is powerful, reliable, simple, and safe. It has a total usable energy capacity of 5.0 kWh and includes six embedded IQ8D-BAT Microinverters providing up to 3.20 kVA of continuous power.
- **IQ System Controller 3 INT:** The IQ System Controller 3 INT connects the home to the public electricity grid, the IQ Battery 5P storage system, and IQ7 or IQ8 Series Microinverter circuits. It provides automatic transfer switch (ATS) functionality by automatically detecting and transitioning the home energy system from grid power to backup power in the event of a power cut. It consolidates interconnection equipment, and IQ Gateway Metered functionalities into a single enclosure and streamlines grid-independent capabilities of PV and storage installations by providing a consistent, pre-wired solution, including CTs.
- **Control cable:** The control cable enables communication between Enphase Energy System components.

5. Product generation and interoperability

Table 1: Supported and unsupported configurations with the IQ Battery 5P

	Product	Compatible with IQ Battery 5P
1	IQ7 Series	Yes
2	IQ8 Series	Yes
3	IQ7 Series + IQ8 Series	Yes. Available in Q4 2025.
4	M Series	Needs a separate IQ Gateway/Envoy-R.
5	M Series + IQ7/IQ8 Series	Needs a separate IQ Gateway/Envoy-R.
6	String inverter	Yes ¹
7	String + IQ7/IQ8 Series	Yes ¹
8	AC Battery	No

¹ For sites with a third-party string inverter, it is mandatory to wire the power terminals of the string inverter through an external NO (Normally Open) contactor connected to an auxiliary terminal on the I/O board (IO1). Refer to point 5 in [System sizing guidelines](#) on page 7 for details.

6. Design an Enphase Energy System

6.1 System modes

The Enphase Energy System supports the following system modes of operation:

- **Self-Consumption:** The PV system and battery are optimised to enable maximum self-consumption of energy produced by the PV system. The battery's capacity caters to home loads to minimise energy import from the grid.
 - **Charge-from-grid:** This is an advanced setting in which the battery can charge from the grid according to a specific schedule the user sets.
 - **Discharge-to-grid:** This is an advanced setting where the battery can discharge to the grid during a specific schedule set by the user.
- **AI-based Optimization:** Maximizes savings by using electricity rates, consumption habits, and solar forecasts. Works with Time-of-Use or dynamic rates in applicable regions. Check local websites for availability in your country.
- **Full-Backup:** This profile is for providing backup power from the PV and Battery system in the event of a grid outage. During on-grid operation, the battery would charge from PV and/or from the grid to reserve 100% of the capacity for backup operation. The battery will only discharge in the event of grid outage. For this mode, the IQ System Controller is a must-have.

6.2 Key planning considerations

Read each product's quick installation guides for detailed information about installing the Enphase Energy System.

Key considerations at the system level for the Enphase Energy System

- **Solar + Battery grid-agnostic operation:** For all new grid-agnostic system (on-grid and backup) installations, installers are required to procure the IQ Series Microinverters, IQ Battery, and IQ System Controller and connect, as per the wiring diagrams in the following sections.
- **Retrofit (battery upgrade on existing PV site):** For retrofitting an IQ Battery to an existing IQ Series Microinverter or string inverter PV-only system for backup, installers are required to remove the existing IQ Gateway, IQ Relay (where installed), Production and Consumption CTs from the site. The IQ Series Microinverter circuit(s) can be directly connected to the designated terminals in the IQ System Controller. The IQ Battery circuit(s) can be connected to the battery terminals in the IQ System Controller.
- **Solar only (backup-ready):** Installers are suggested to procure the IQ System Controller and connect the IQ Series Microinverters circuit(s) to the designated PV terminals. Separate IQ Gateway, CTs, and IQ Relay (where installed) are not required as these products are integrated inside the IQ System Controller itself. IQ Batteries can be added in the future to the designated battery terminals to provide backup to the house.

Key considerations for components of the Enphase Energy System

IQ System Controller 3 INT:

- IQ System Controller 3 INT shall be used only in installations with single-phase grid connection in the UK with IQ Battery 5P single-phase.

- PV, IQ Battery, load, and fuses/RCDs/RCBOs should be sized as per local requirements and cable sizes used on site. These are not supplied with the IQ System Controller 3 INT. If the DIN space on the IQ System Controller is insufficient to house all the protective devices, an additional enclosure may need to be planned to house them.
- When wiring power cables from grid supply, PV, and battery onto IQ System Controller 3 INT mains, PV, and IQ Battery terminals respectively, ensure you correctly terminate the L1 and N cables on the designated L1 and N terminals, as highlighted by IEC colour coding. Failure to do so will result in incorrect system operation.
- A local earth electrode is necessary to ensure safe operation during backup scenarios. Follow local electrical regulations and best practices.
- The supported earthing systems are TN-C-S, TN-S, and TT. The earthing systems that are not supported are TN-C and IT.
- For monitoring the consumption of all home loads (backup and non-backup) and for the best system performance to support during On-grid operation, it is recommended to wire all the home loads through the designated backup and non-backup loads terminals in the IQ System Controller, as the Consumption CTs are pre-wired in the unit.
- For sites with a third-party string inverter, it is mandatory to wire the power terminals of the string inverter through an external NO (Normally Open) contactor connected to an auxiliary terminal on the I/O board of the IQ System Controller 3 INT. Refer to point 5 in [System sizing guidelines](#) on page 7 and the *IQ System Controller quick install guide* for details.

IQ Series Microinverters:

- Determine the length and cross-section of the AC conductor between the end of the IQ Cable and the electrical panel per the local electrical regulations. It is recommended that the voltage drop across these conductors does not exceed 1% and that the overall voltage drop in the PV circuit from the point of connection to the most remote microinverter does not exceed 2%. Depending on the size of the PV system and the length of the supply cable, the cross-section of the supply cable may need to be increased to stay within this voltage rise limit.
- Install any equipotential bonding between PV module frames, array mounting structures, and metal microinverter mounting brackets per local electrical regulations.
- Install a 20 A B-curve circuit breaker that usually protects the 2.5 mm² IQ Cable per PV circuit. However, it is essential to understand and follow local regulations where this may not be the case.
- Surge protection devices (SPD) and residual current devices (RCD/FI) must be installed in accordance with the electrical standards applicable in the country of installation. Enphase microinverters have an integrated Type III SPD device.
- The microinverters contain an RF transformer that ensures the function of galvanic isolation between the DC PV module and the AC network. A Type A or Type B RCD may be required in accordance with the electrical standards applicable to the installation.

IQ Battery 5P:

- The IQ Battery 5P with IQ System Controller 3 INT shall be installed only in installations with single-phase grid connections.
- Up to seven IQ Battery 5P units can be connected to IQ System Controller 3 INT in the UK.
- The maximum conductor size compatible with IQ Battery 5P is 10 mm² (without ferrule). Use a 20 A C curve circuit breaker for one IQ Battery 5P. Follow all local standards and regulations while selecting the AC circuit breaker.
- Any system with an IQ Battery installed must have Wi-Fi or Ethernet as the primary mode of internet connectivity.


Others:

- Installers must procure a suitable length of control cable for the installation. Procure the required length of control cable from your Enphase distributor. The Enphase order code for the cable is CTRL-BL-EU-01.
- Install surge protection devices (SPDs) and residual current devices (RCDs) per local electrical regulations.
- Circuit breakers for PV and battery circuits shall be selected according to the system size and local regulations.

6.3 System sizing guidelines

When sizing the PV and battery system for on-grid and backup operation, the following considerations on the limits must be followed.

1. Total grid supply connection to IQ System Controller 3 INT cannot exceed 100 A in a single-phase system.
2. The total installed capacity for PV and Battery each cannot exceed 100 A in a single-phase system. Refer to the following tables to understand the maximum allowed PV and battery counts.

 **NOTE:** Although the PV and battery installed can be 100 A single-phase, the total output power from both PV and Battery collectively will be controlled via software to never exceed 100 A.


Configuration	Max. IQ Battery 5P count	Max. count of IQ8 Series Microinverters	Max. count of IQ7 Series Microinverters
1-phase configuration	IQ Battery 5P - 7	IQ8HC - 58 IQ8AC - 62 IQ8MC - 68	IQ7A - 62 IQ7PLUS - 77 IQ7 - 92

3. Total home loads (backup + non-backup) cannot exceed 100 A in a single-phase system.
4. The following table lists the limitations of the system with respect to the ratio of PV power (in kW) to battery power (in kW) for off-grid operation of the system.


System type	Type of inverter	Max. ratio of PV power (in kW) to battery power (in kW)
PV + IQ Battery 5P-1P + IQSC	IQ8 Series Microinverters	200%
PV + IQ Battery 5P-1P + IQSC	IQ7 Series Microinverters	150%
PV + IQ Battery 5P-1P + IQSC	String inverter/M Series	100%

5. For sites with a third-party string inverter, it is mandatory to wire the power terminals of the string inverter through an external Normally Open (NO) contactor connected to an auxiliary terminal on the I/O board of the IQ System Controller 3 INT, which will allow the string-inverter to operate as explained:

- When the ratio of PV power to battery power is within 100%, the string inverter shall be connected to system and operate normally even in an off-grid condition along with an on-grid operation. As the battery approach 100% state of charge, the contactor will be used to disconnect the string inverter and will remain dsiconnected until state of charge drops to allow further battery charging. This percentage setting can be ajdusted within the Enphase App.
- When the ratio of PV power to battery power is higher than 100%, string inverter shall be connected to system only in on-grid operation and will be disconnected when system goes off-grid.

 **NOTE:** These same string inverter requirements must also be applied to M Series Microinverter systems.

6. Refer to the following tables and calculate the total batteries a site would need depending on home load parameters.

 **NOTE:** The following considerations must be kept in mind for the following table:

- The tables consider a whole home backup use case where all the home loads are connected to the backup terminals in the IQ System Controller 3 INT.
- The tables consider power and current as an aggregate rating.

Table 2: IQ7 Series Microinverters

Battery count	Total battery power (kW)	Total battery capacity (kWh)	Max. supported PV (kW)	Max. night-time backup power capability (kW)
1	3.20	5	4.80	≤3.20
2	6.40	10	9.60	≤6.40
3	9.60	15	14.40	≤9.60
4	12.80	20	19.20	≤12.80
5	16.00	25	23.00	≤16.00
6	19.20	30	23.00	≤19.20
7	22.40	35	23.00	≤22.40

Table 3: IQ8 Series Microinverters

Battery count	Total battery power (kW)	Total battery capacity (kWh)	Max. supported PV (kW)	Max. night-time backup power capability (kW)
1	3.20	5	6.40	≤3.20
2	6.40	10	12.80	≤6.40
3	9.60	15	19.20	≤9.60
4	12.80	20	23.00	≤12.80
5	16.00	25	23.00	≤16.00
6	19.20	30	23.00	≤19.20
7	22.40	35	23.00	≤22.40

As a reference for electrical symbols, refer to the following legend to better understand the system diagrams. The following sample Enphase Energy System diagrams help you design your PV and storage systems.

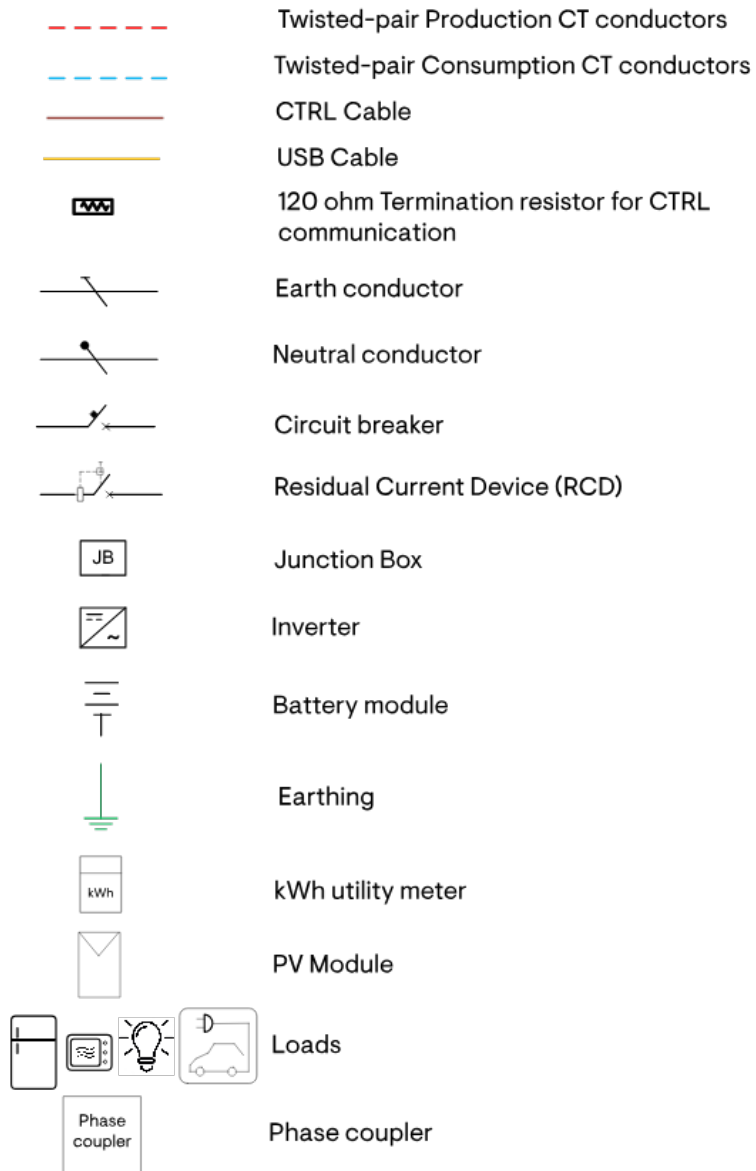


Figure 1: System diagram: Legend

7. PV only grid-tied (back-up ready): Single-phase IQ7/IQ8 Series Microinverters with IQ System Controller 3 INT

System size: PV—up to 23 kW AC

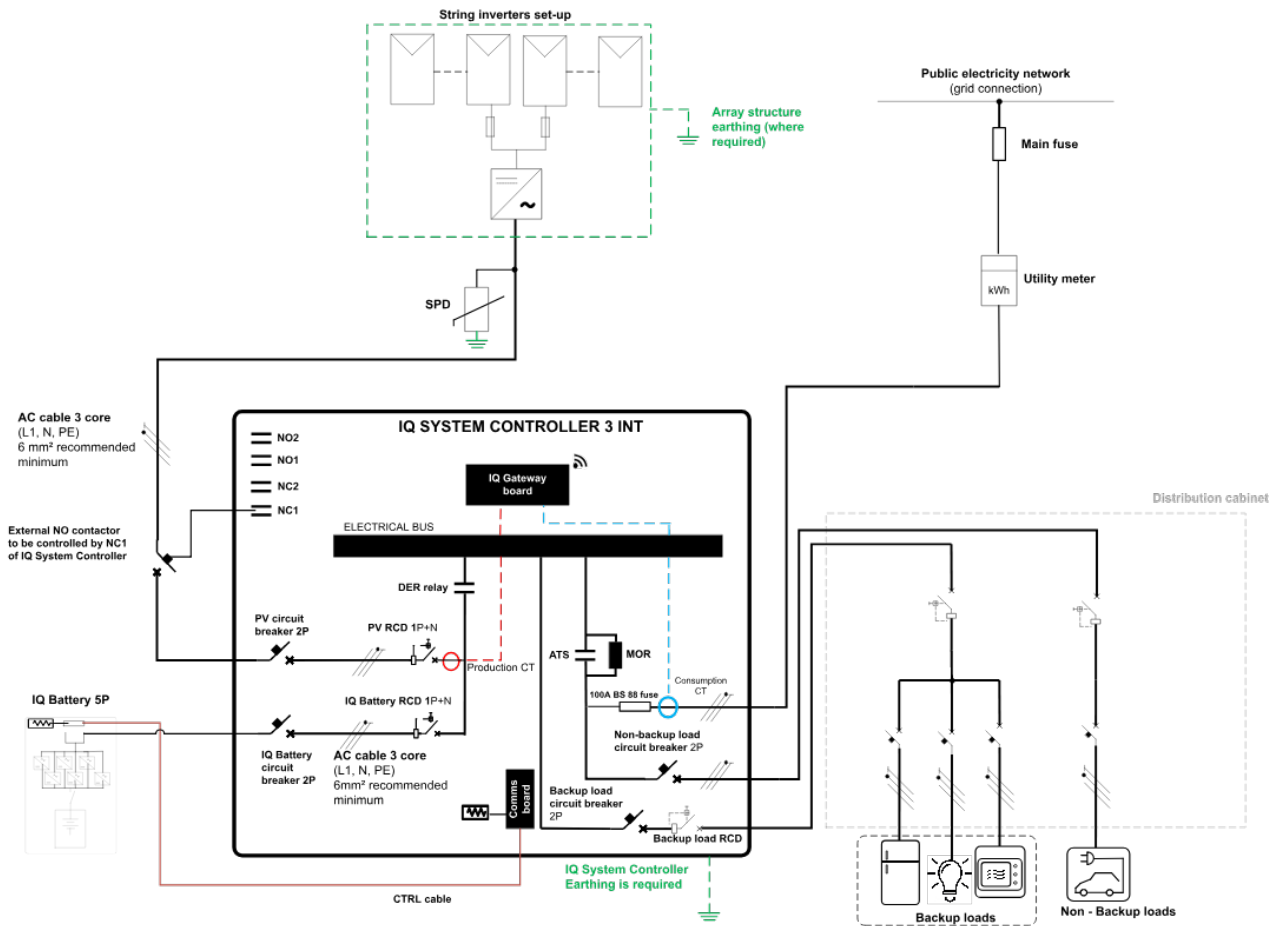


Figure 2: Single-phase IQ7/IQ8 Series PV only (back-up ready) system diagram



NOTE:

- Size the production RCD to the production circuit size or higher when installing inside a PV subpanel.

8. Solar PV + Battery: Single-phase IQ7/IQ8 Series Microinverters and IQ Battery 5P with IQ System Controller 3 INT

System size: PV—up to 6.4 kW AC; storage—5 kWh

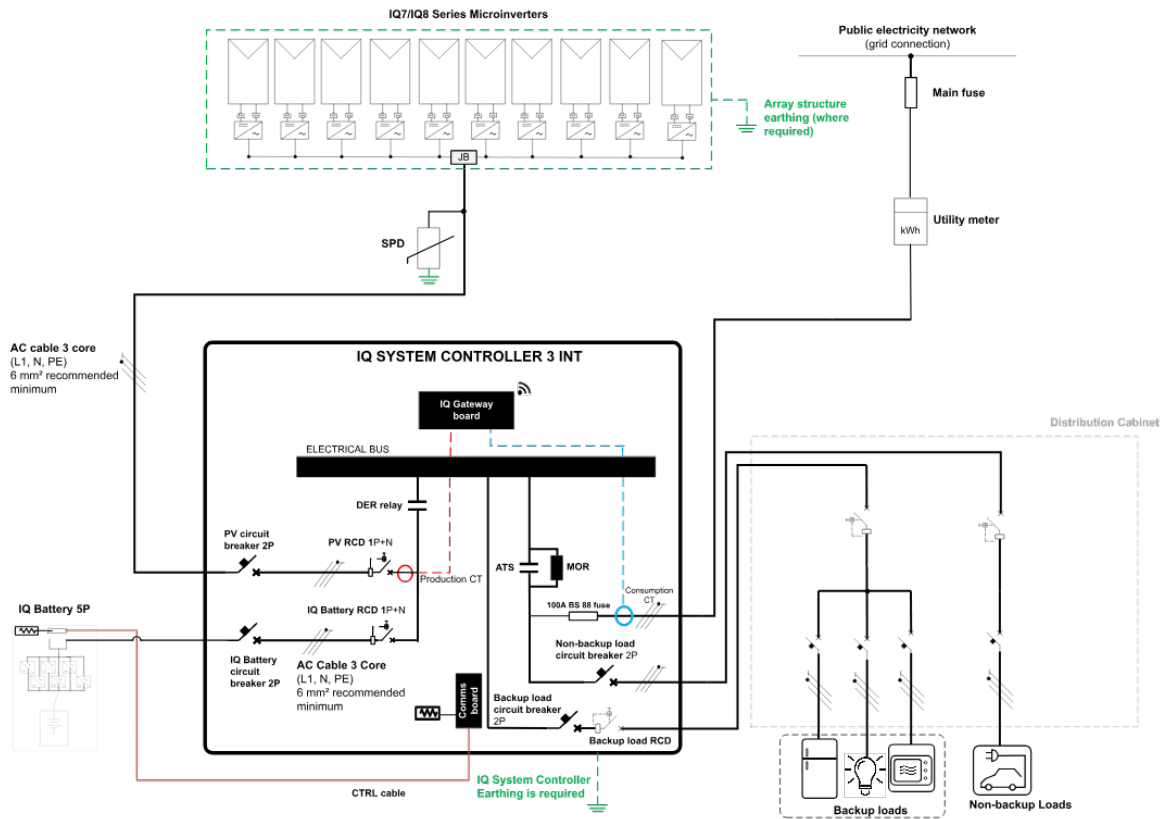


Figure 3: Single-phase IQ7/IQ8 Series PV and IQ Battery 5P system diagram



NOTE:

- Size the production RCD to the production circuit size or higher when installing inside a PV subpanel.

9. Solar PV + Batteries: Single-phase IQ7/IQ8 Series Microinverters (multiple branches) and IQ Battery 5Ps with IQ System Controller 3 INT

System size: PV—up to 12.8 kW AC; storage—10 kWh

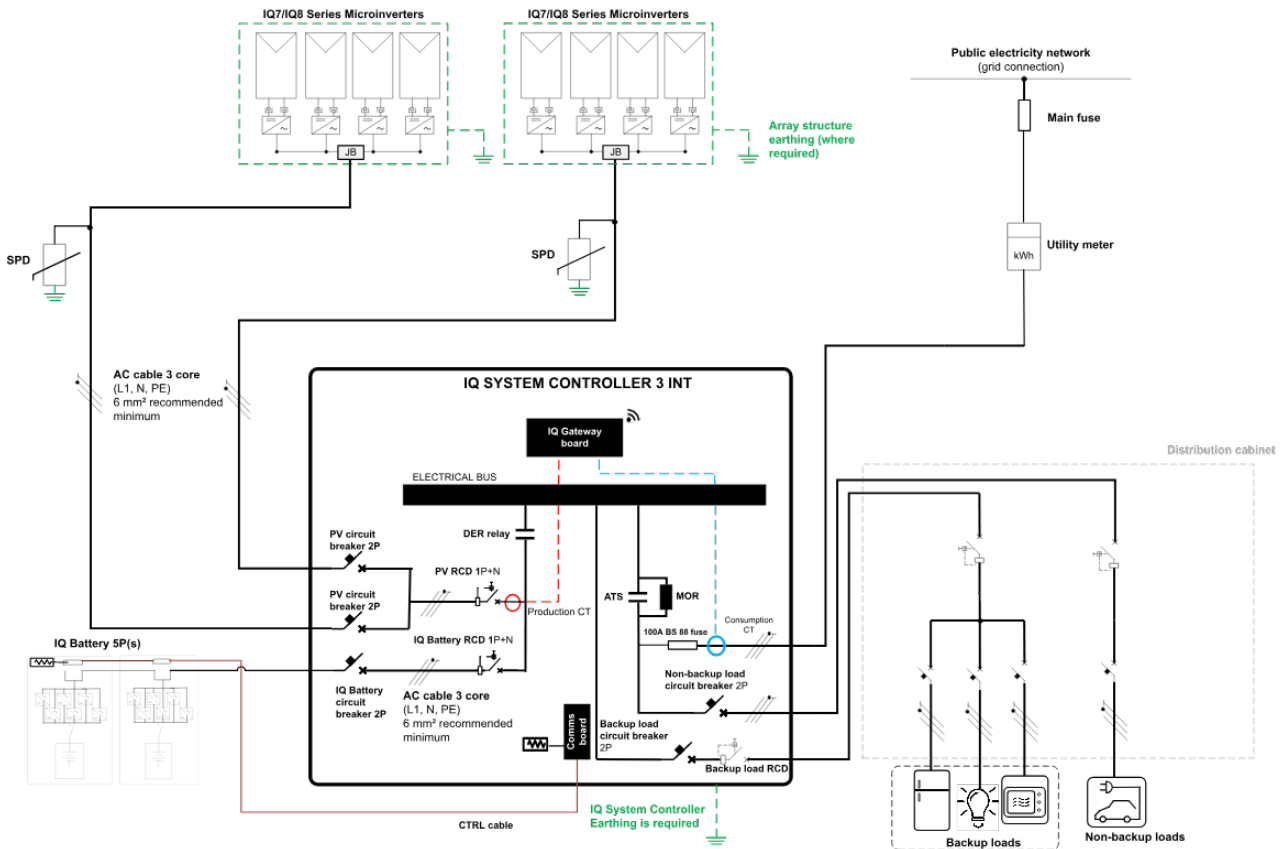


Figure 4: Single-phase IQ7/IQ8 Series PV (multiple branches) and multiple IQ Battery 5Ps in control circuit



NOTE:

- Either you can have SPD per PV branch or 1 SPD for the entire PV in the IQ System Controller as per local regulations.
- A maximum of four IQ Battery 5Ps can be connected in a battery circuit.
- Size the production RCD to the production circuit size or higher.

10. Solar PV + Battery: Single-phase string inverter and IQ Battery 5P with IQ System Controller 3 INT

System size: PV—up to 6.4 kW AC; storage—5 kWh

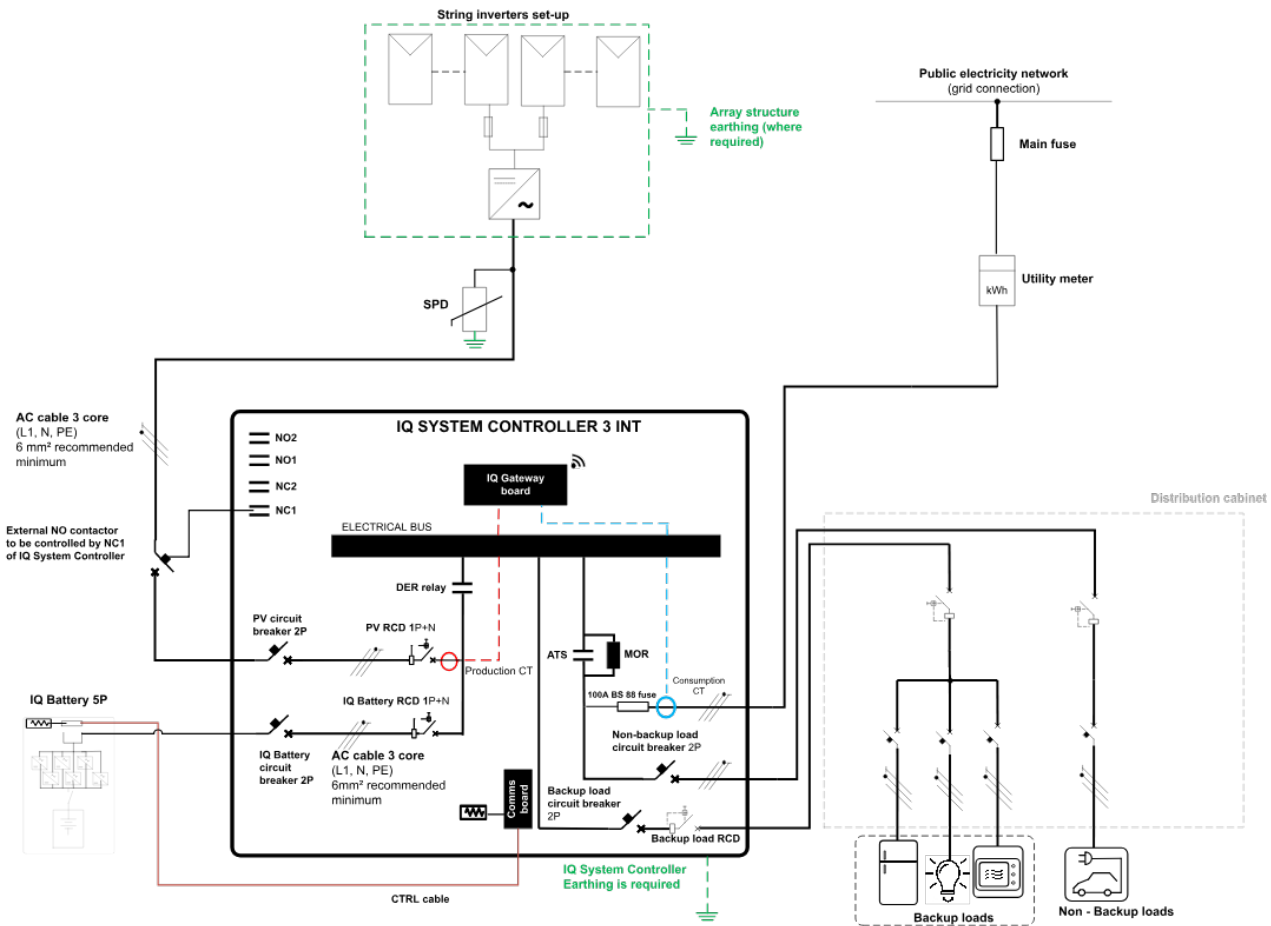


Figure 5: Single-phase string inverter PV and IQ Battery 5P system diagram



NOTE:

- The string inverter shall be connected to the PV circuit breaker of the IQ System Controller through an external NO contactor. Energizing coil of NO contactor to be controlled by NC1 Aux contact of the IQ System Controller.
- In case of M Series, only the IQ System Controller shall measure the production current and the existing IQ Gateway to be retained to control M Series Microinverters.
- Size the production RCD to the production circuit size or higher.

11. Control wiring

An Enphase Energy System communicates over a wired communications interface and needs control wiring between the IQ Gateway and the IQ Battery 5P via the Communications Kit 2.

Enphase has tested and qualified a control cable (order code: CTRL-BL-EU-01) and recommends installation of the Enphase Energy System only with this control cable for optimal system performance. Use of non-approved cables can result in issues in system performance and loss of warranties.

The following figure shows the guidance for correctly stripping the control (CTRL) cable.

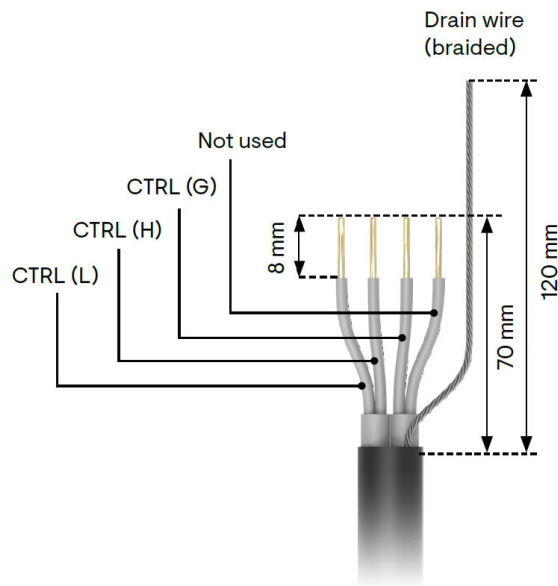


Figure 6: CTRL cable wire stripping guidance

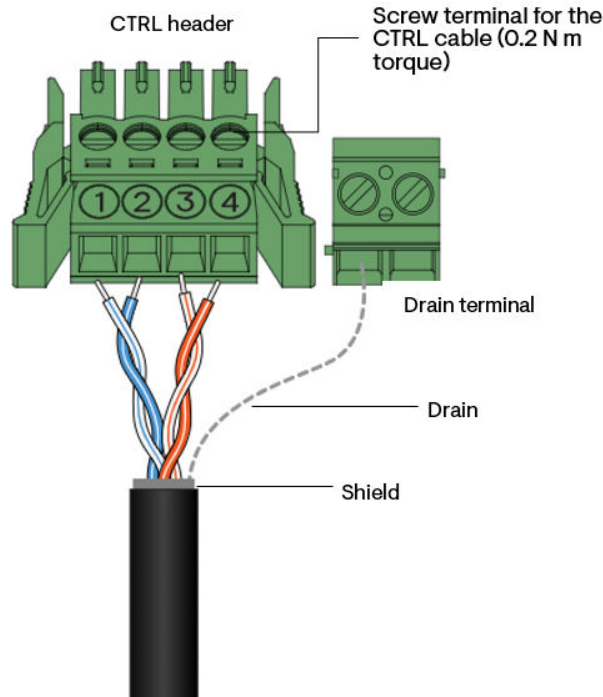


Figure 7: CTRL cable wire landing guidance

The following table lists the guidance for landing the CTRL cable wires into the CTRL header for the IQ Battery 5P and the Communications Kit 2.

Table 4: CTRL cable wire termination guidance

CTRL header numbers	CTRL signals	Wire designation
Screw terminal 1	CTRL L—LOW	White with blue stripe
Screw terminal 2	CTRL H—HIGH	Blue with white stripe
Screw terminal 3	CTRL G—GROUND	White with orange stripe
Screw terminal 4	Not used	Orange with white stripe

Control wiring guidance for installing IQ Battery 5P with a Communications Kit 2 INT

Refer to the following wiring scenarios to understand the position of the header with termination resistor, wiring order, and drain wire termination location.

- ✓ **NOTE:** The total length of CTRL wiring across the system must not exceed 100 m to ensure optimal system performance.
- ✓ **NOTE:** Follow the guidelines to avoid failures during system commissioning:
 - One header with a termination resistor should be installed on each component that is at the end of the control network.
 - The drain wire should be terminated only at one end of each control wiring section or length.
 - Terminating the drain wire at the component from which the control wiring for the section is initiated is recommended.

The following are the wiring sequences:

Sequence 1: IQ System Controller 3 INT > IQ Battery 5Ps

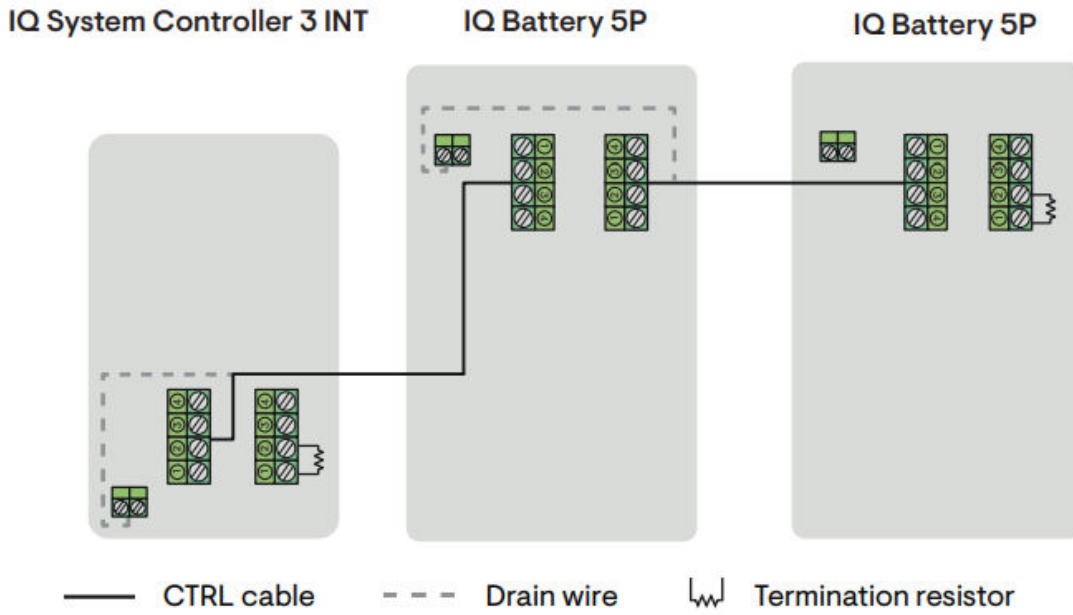


Figure 8: CTRL cable wire sequence 1

Sequence 2: IQ Battery 5Ps > IQ System Controller 3 INT

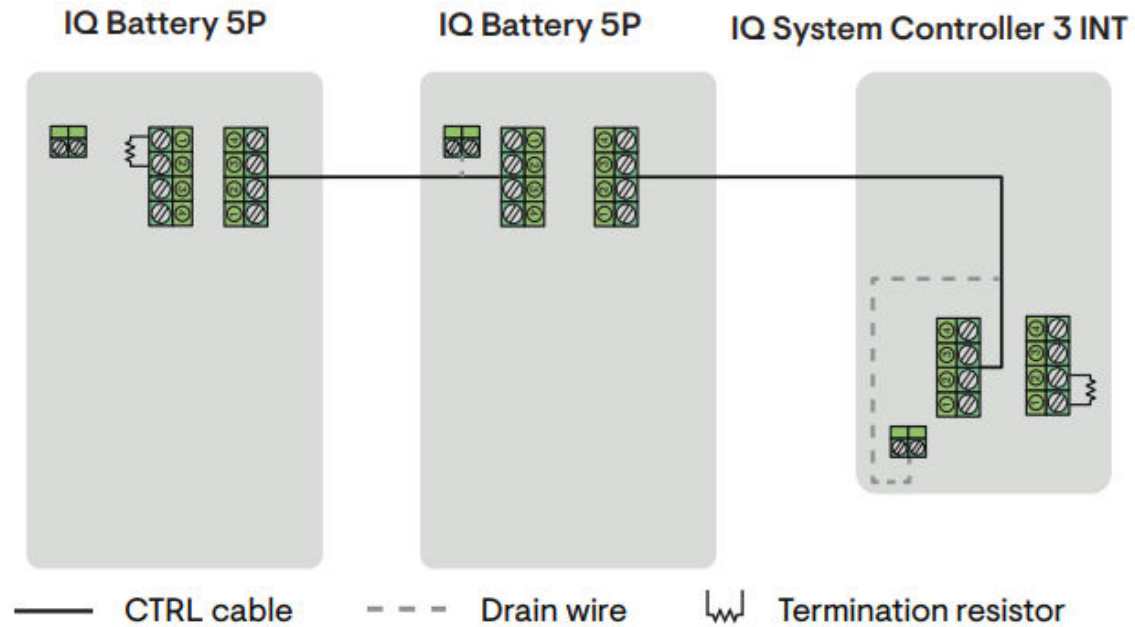


Figure 9: CTRL cable wire sequence 2

Sequence 3: IQ Battery 5P > IQ System Controller 3 INT > IQ Battery 5P

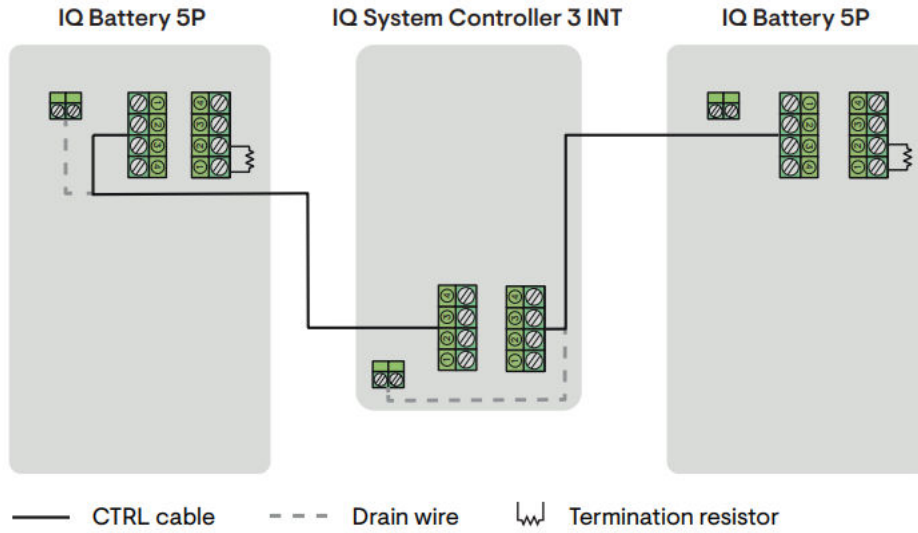


Figure 10: CTRL cable wire sequence 3

The following table lists the termination resistor locations for the preceding sequences.

Table 5: Termination resistor position guidance

Control wiring sequence	Termination resistor location
IQ System Controller 3 INT – IQ Battery 5P – IQ Battery 5P	Resistor 1: IQ System Controller 3 INT Resistor 2: Last IQ Battery 5P in the control circuit
IQ Battery 5P – IQ Battery 5P – IQ System Controller 3 INT	Resistor 1: First IQ Battery 5P in the control circuit Resistor 2: IQ System Controller 3 INT
IQ Battery 5P – IQ System Controller 3 INT– IQ Battery 5P	Resistor 1: First IQ Battery 5P Resistor 2: Last IQ Battery 5P

Appendix A

Appendix

The following table lists the order code for the Enphase components required to complete a PV and battery installation. Refer to the *IQ7/IQ8 PV and IQ Battery 5P with FlexPhase QIG* and the data sheet at the [Enphase Documentation Center](#) to ensure you select the appropriate components for your installation.

Table 6: Enphase components

Product type	Product	SKU
Enphase microinverters	IQ7 Microinverter	IQ7-60-2-INT IQ7-60-M-INT IQ7A-72-2-INT IQ7A-72-M-INT IQ7PLUS-72-2-INT IQ7PLUS-72-M-INT IQ7X-96-2-INT
	IQ8 Microinverter	IQ8MC-72-M-INT IQ8AC-72-M-INT IQ8HC-72-M-INT IQ8PLUS-72-M-INT IQ8M-72-M-INT IQ8P-72-2-INT IQ8X-80-M-INT
Microinverter accessories	IQ Cable	Single-phase: Q-25-17-240 2.5 mm ² IQ Cable for 60/96 cells, 1.7 m landscape module pitch
		Single-phase: Q-25-17-240 2.5 mm ² IQ Cable for 72 cells, 2.0 m landscape module pitch
		Single-phase: Q-25-10-240 2.5 mm ² IQ Cable for 60/72/96 cells, 1.0 m portrait module pitch
	IQ Terminator	Single-phase: Q-TERM-R-10

Product type	Product	SKU
	IQ Sealing Cap	Q-SEAL-10
	IQ Field Wireable Connectors (female)	Single-phase: Q-CONN-R-10F
	IQ Field Wireable Connectors (male)	Single-phase: Q-CONN-R-10M
	Raw IQ Cable (meters)	Single-phase: Q-25-RAW-300
	IQ Cable Clips	ET-CLIP-100
	IQ Disconnect Tool	Single-phase: Q-DISC-10
IQ System Controller	IQ System Controller 3 INT	SC100G-M230-3P
Battery accessories	Handles for IQ Battery 5P (LH and RH)	IQBATTERY-HNDL-5
	Pedestal ground mount for IQ Battery 5P	B05-PM-0550-O
Enphase-Belcom control cable	Control cable	CTRL-BL-EU-01

13. Revision history

Revision	Date	Description
TEB-00305-1.0	July 2025	Initial release.