

Application Note - SolarEdge Inverter - Alternative Power Source

Version History

- Version 1.5 (May 2022) – add note - Disabled external control functions in Alternative Power Source mode
- Version 1.4 (March 2020) – Update of the minimum supported CPU version for three phase inverters to 4.8.xxx
- Version 1.3 (January 2020) – Addition of dry/wet contacts connection diagrams
- Version 1.2 (August 2019) – Configuration of Power Source mode in Inverters with SetApp
- Version 1.1 (June 2019) – Addition of Alternative power source mode – Self Test
- Version 1.0 (November 2018) – Initial release

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Introduction

Energy-generation systems (such as PV inverters) connected to the grid may consist of different types of energy generating sources. In some cases, when grid power is disconnected, PV inverters should operate in parallel with other voltage sources, such as generators. In this document, “generator” is used as a general term for such sources.

When inverters operate concurrently with generators, they may be subjected to voltage and frequency fluctuations that exceed trips, which are preset according to regional grid connection requirements. To support simultaneous operation of the inverter and a generator, the inverter extends its voltage and frequency operating range once it receives a signal that the grid is unavailable (“Alternative Power Source mode”). When the grid power is restored, the inverter automatically reverts to its default country setting, which includes the original voltage and frequency operating range.

This document describes how to configure a SolarEdge inverter for simultaneous operation with a generator.

**NOTE**

After setting the inverter to Alternative Power Source mode, all external Power Control Options over the inverter are disabled.

For examples of the Power Control Options disabled, see;

https://www.solaredge.com/sites/default/files/application_note_power_control_configuration.pdf in the Power Control Options section.

Supported Inverter Models

- Three phase inverters with CPU version 4.8.xxx or later configured by SetApp or 3.2467 or later for inverters with an LCD.
- Single phase inverter with HD-Wave technology with CPU version 4.8.xx or later configured by SetApp, or 3.25 or later for inverters with an LCD.

System Requirements

- The inverter connected to the generator through the PRI CONNECTOR should be the *master on the RS485bus*. For master/slave connection and configuration information, refer to https://www.solaredge.com/sites/default/files/solaredge-communication_options_application_note_v2_250_and_above.pdf
- Before connecting the wires of the dry contact signal from the generator, verify that the L1 and V terminals of PRI connector of the inverter are available.
- The generator(s) must be able to support the entire load independently.
- The generator(s) must not work in parallel with the grid (either grid or generator supply the power).
- In a multiple generator site, a Power Plant Controller (PPC) is required to consolidate the operation of all generators.
- The generator connected to the master inverter must have dry contact discrete outputs.



NOTE

If Power Control is enabled, the order of grid lines connection to the inverter is important. A 120deg phase difference between L1 to L2 and between L2 to L3 should be kept (L1-L2-L3 and not, for example L1-L3-L2). If the grid lines are not in this order, the following error will be displayed on the LCD and the inverter will not produce power.

```
ERROR 112
Wrong AC
Connection
```

Functionality

One or multiple generators can be used to independently support a power system or be switched on as backup if grid power is unavailable.

Systems containing generators and inverters can be configured as follows:

- Single generator without a Power Plant Controller (PPC)
- Single or multiple generators with a Power Plant Controller

Single Generator without a Power Plant Controller

This system consists of a single diesel generator and an Automatic Transfer Switch (ATS). Multiple inverters may be connected in an RS485 bus using Modbus protocol for communication (See Figure 1). The generator(s) is connected to the master inverter via its PRI (Power Reduction interface) connector, using dry contacts.

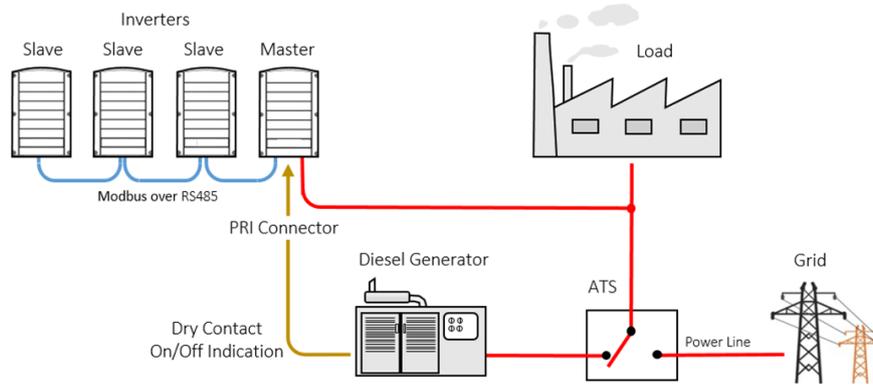


Figure 1: Single Generator System without a Power Plant Controller

When grid power is lost, the ATS switches to diesel generator power. The generator sends an ON indication to the master inverter. Upon receiving the signal, the master inverter starts operating in Alternative Power Source mode and sets all slave inverters to Alternative Power Source mode. In this mode, the inverter trip settings change from the country setting to a wider trip range.

When grid power resumes, the generator sends an OFF indication to the master inverter. Upon receiving the OFF indication, the master inverter moves out of Alternative Power Source mode, reverting to the original country setting. The master inverter sets all slave inverters back to the original country setting.



CAUTION!

To protect the generator(s) and avoid damage, ensure that the maximum power produced by the PV system does not exceed 35% of the maximum power produced by the generator(s).

Single or Multiple Generators with a Power Plant Controller

This system consists of single or multiple generators and an Automatic Transfer Switch (ATS). Multiple inverters may be connected in an RS485 bus using Modbus protocol for communication (See Figure 2). The generator(s) is connected to the master inverter via its PPC (Power Plant Controller), communicating via Modbus over TCP or RTU.

The PPC serves as a load manager that ensures that power generating sources are managed in a most efficient and effective way. Modbus protocol is used for communication between the PPC and the inverter (TCP or TRU). Connection of more than one generator can be done via the PPC.

When grid power is lost, the ATS switches to diesel generator power. The generator sends an ON indication to the PPC, which sends an ON signal to the master inverter. Upon receiving the signal, the master inverter starts operating in Alternative Power Source mode and sets all slave inverters to Alternative Power Source mode. In this mode, the inverter trip setting change from the country setting to a wider trip range.

When grid power resumes, the generator turns off and sends an OFF indication to the PPC. Upon receiving the OFF indication, the PPC moves the master inverter out of Alternative Power Source mode reverting to the original default country settings. The master inverter sets all slave inverters back to the default country settings.

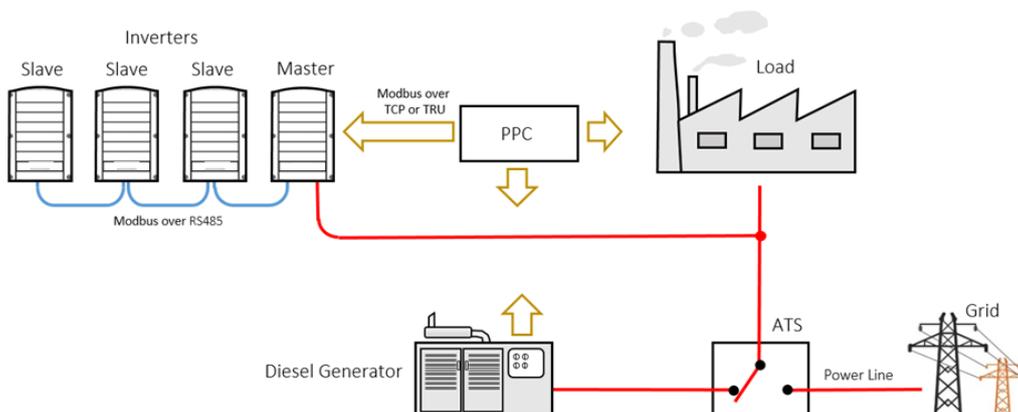


Figure 2: Single or Multiple Generators with a Power Plant Controller

Configuration Options

Alternative Power Source mode (in inverters with SetApp) or Diesel Gen mode (in inverters with display) should be configured on the master inverter.

Once configured, the master inverter automatically sets all detected slave inverters to Alternative Power Source mode.

Configuration of inverter by SetApp

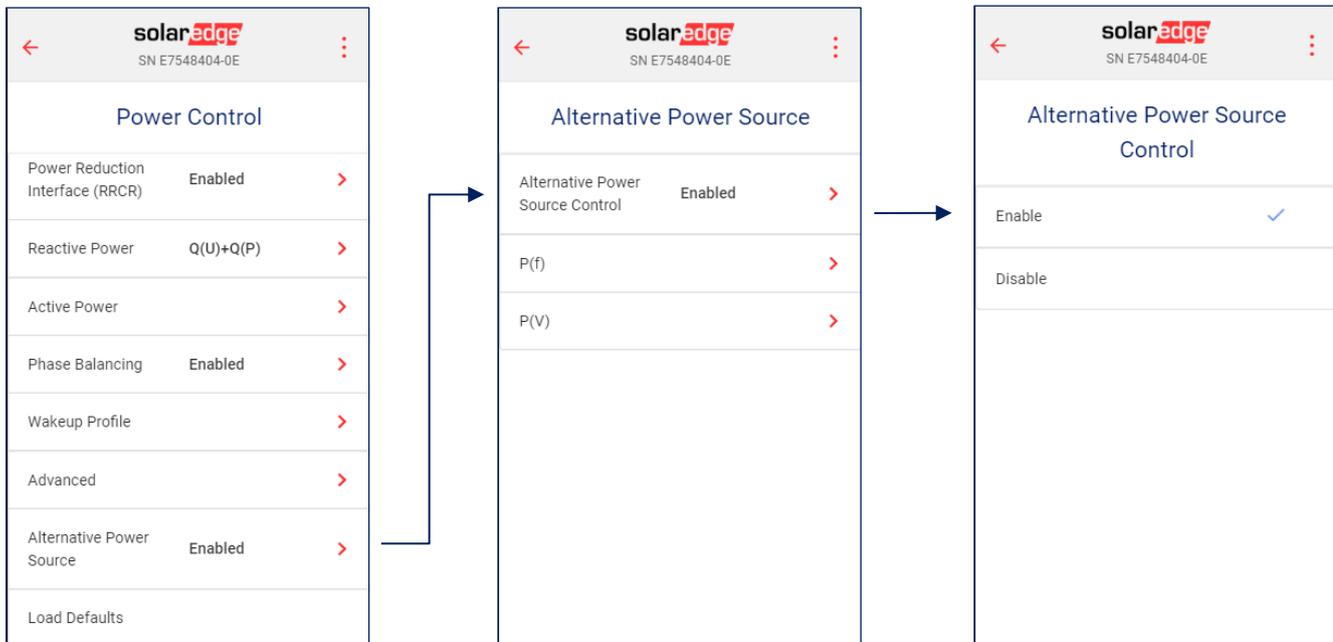
The Alternative Power Source menus appear under the **Configuration** → **Power Control** menu, accessible from the SetApp smartphone application.

Advanced Frequency/Voltage Based Stabilization

When inverters operate concurrently with an alternative power source, they may be subjected to frequency and voltage fluctuations caused by the power source. For advanced system stabilization, frequency and/or voltage based power reduction can be used. The inverter de-rates power according to the configured graph, until the frequency or voltage will reach the trip value and the inverter will disconnect.

→ To enable Alternative Power Source mode:

On the master inverter, select: **Commissioning** → **Power Control** → **Alternative Power Source** → **Alternative Power Source Control** → **Enable**.



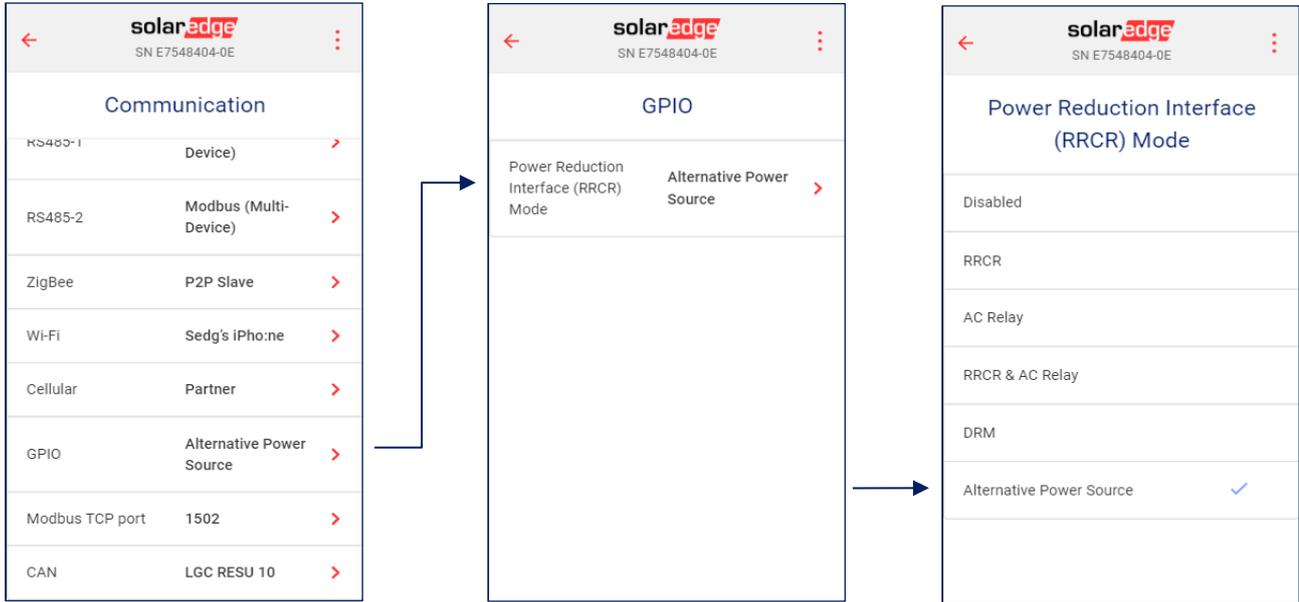
→ To disable the Alternative Power Source:

On the master inverter, select: **Commissioning** → **Power Control** → **Alternative Power Source** → **Alternative Power Source Control** → **Disable**.

→ To enable the Alternative Power Source signaling to the master inverter:

In a [Single Generator without a Power Plant Controller](#) mode, the dry/wet contacts of the Power Source are connected to the PRI (Power Reduction Interface) connector of the master inverter.

To enable the master inverter to receive dry/wet contact signals from the generator, select: **Commissioning** → **Communication** → **GPIO** → **Power Reduction Interface (RRCR) Mode** → **Alternative Power Source**.

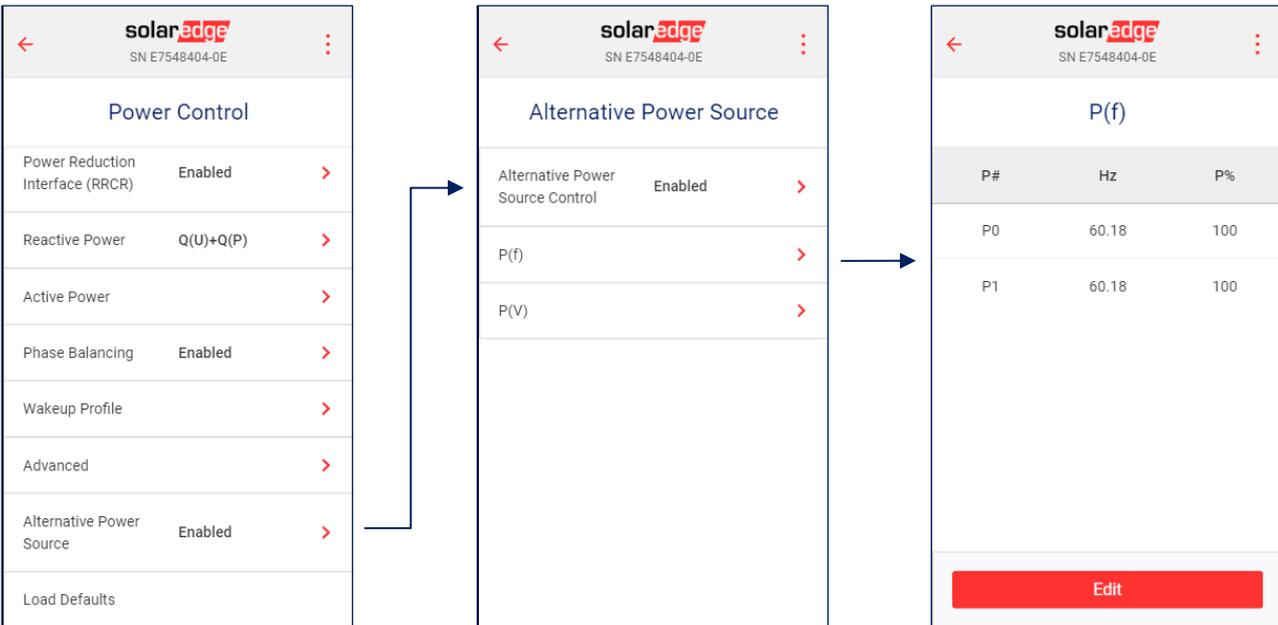


2.

→ To set P(f) and change P or f values:

P(f) – used when frequency-based power reduction is required. P(f) is defined by a linear graph set by two points P0 and P1.

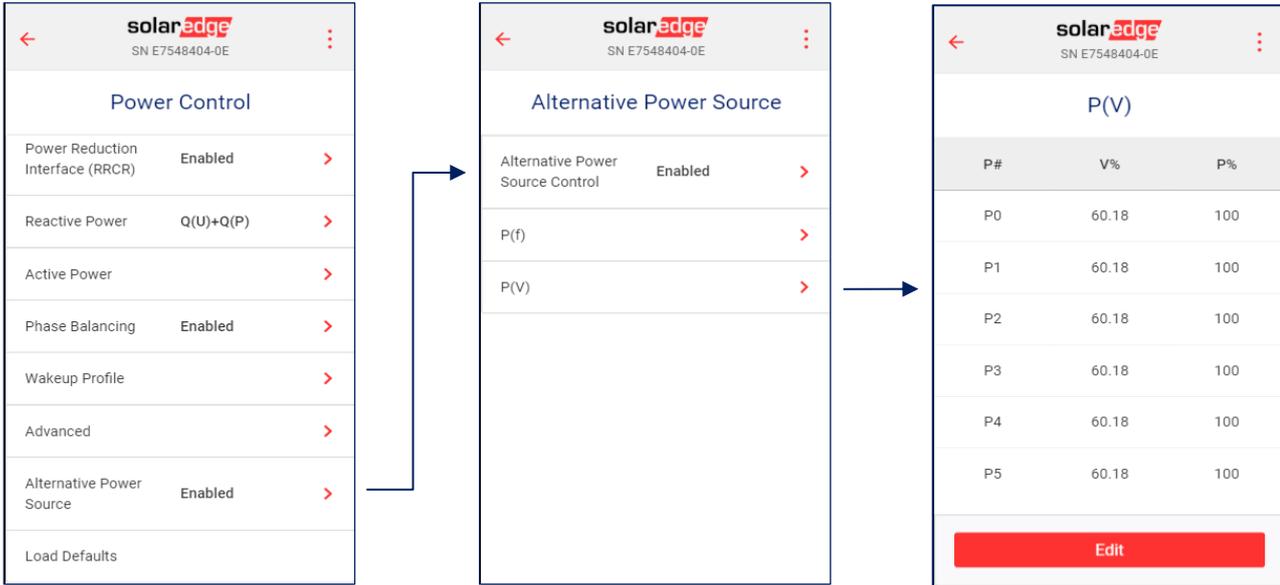
On the master inverter, select: **Commissioning** → **Power Control** → **Alternative Power Source** → **P(f)** and click **Edit** to set the frequency and percentage of nominal active power.



→ To set P(V) and change P or V values:

P(V) – used when voltage-based power reduction is required. P(v) is defined by a linear graph set by six points – P0 to P5.

On the master inverter, select: **Commissioning** → **Power Control** → **Alternative Power Source** → **P(V)** and click **Edit** to set the Voltage and percentage of nominal active power.



Configuration of inverters with an LCD

The Alternative Power Source menus appear under the **Power Control** menu, accessible from the inverter LCD main menu. Refer to the "Inverter User Interface" chapter in the *SolarEdge installation guide* for LCD navigation instructions.



NOTE

For detailed description of the Power Control features, refer to the Application Note - SolarEdge Inverters, Power Control Options for Grid at

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



NOTE

Alternative Power Source support is available from inverter CPU version 3.2467 and later To check the inverter CPU version, refer to [Identifying the Inverter CPU Version](#).

The Diesel Gen menu includes the following options:

```
Grid Control <En>
Energy Manager
RRCR Conf. <En>
Reactive Pwr Conf
Active Pwr Conf
Wakeup Conf
P(f)
Advanced
Diesel Gen <Dis>
Load Defaults
```

```
> Enable <En> Diesel Gen
```

```
> P(v)
P(f)
Disable
```

→ To enable generator mode:

On the master inverter, select Power Control → Grid Control → Scroll to Diesel Gen <Dis> → Enable → Press Enter

→ To disable generator mode:

On the master inverter, select Power Control → Grid Control → Scroll to Diesel Gen <En> → Scroll to Disable → Press Enter

→ To enable generator signaling to the master inverter:

In a [Single Generator without a Power Plant Controller](#) mode, the generator dry/wet contacts are connected to the PRI (Power Reduction Interface) connector of the master inverter.

To enable the master inverter to receive dry/wet contact signals from the generator, select Communication → GPIO conf → Gen → Press Enter.

Advanced Frequency/Voltage Based Stabilization

When inverters operate concurrently with generators, they may be subjected to frequency and voltage fluctuations caused by the generator. For advanced system stabilization, frequency and/or voltage based power reduction can be used. The inverter will de-rate power according to the configured graph, until the frequency or voltage will reach the trip value and the inverter will disconnect.

→ To set P(f) and change P or f values:

P(f) – used when frequency-based power reduction is required. P(f) is defined by a linear graph set by two points.

1. Select **Diesel Gen <En>** → Scroll to **P(f)** → Press Enter.
2. When changing values, scroll to the relevant point → Press Enter → Input the required value → Press Enter.

Each point includes the following fields: <frequency, % of nominal active power>.

```
P 0 < 5 0 . 2 0 , 1 0 0 . 0 >
P 1 < 5 1 . 2 0 , 6 0 . 0 0 >
```

The ranges for P(f) parameters are:

- Frequency: 0 to 100 [Hz]
- P: 0 to 100 [% of nominal active power].

→ To set P(V) and change P or V values:

P(V) – used when voltage-based power reduction is required. P(v) is defined by a linear graph set by six points.

1. Select **Diesel Gen <En>** → Scroll to **P(v)** → Press Enter.
2. When changing values, scroll to the relevant point → Press Enter → Input the required value → Press Enter.

Each point includes the following fields: <voltage, % of nominal active power>.

```
S e t   P o i n t
< V , P % >
```

The ranges for P(V) parameters are:

- Voltage: 0 to 200 [% of 230V].
- P: 0 to 100 [% of nominal active power].

```
P 0 < 2 0 0 . 0 , 1 0 0 . 0 >
P 1 < 1 0 0 . 0 , 1 0 0 . 0 >
P 2 < 1 0 0 . 0 , 1 0 0 . 0 >
P 3 < 1 2 0 . 4 , 1 0 0 . 0 >
P 4 < 1 0 0 . 0 , 1 0 0 . 0 >
P 5 < 1 0 0 . 0 , 1 0 0 . 0 >
```

Alternative Power Source mode – Self Test

Once the inverter is configured and ready to operate in Alternative Power Source mode, testing is required to verify that the inverter is switching in and out of Alternative Power Source mode.

Using voltage from the inverter to test switching to Alternative Power Source mode

In this test, use a jumper to short terminals on the communication board for simulating close dry contacts of a generator.

1. Enable inverters Alternative Power Source mode in SetApp inverters (See Configuration of inverter by SetApp) or Enable Generator mode in inverters with LCD (See [To enable generator mode](#)).
3. Verify the correct country and CPU version (See Identifying the Inverter CPU Version).
4. Use a jumper to short the **L1** and **V** terminals of the Communication Board (See Figure 3).
5. In inverters with LCD, verify that **Country: <Gen>** is displayed on the ID Status window.
6. Remove the jumper from the **L1** and **V** terminals on the communication board.
7. In inverters with LCD, verify that **Country: <default country>** is displayed on the ID Status window.

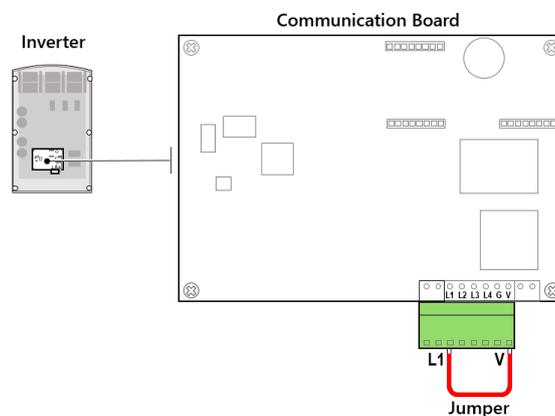


Figure 3 Using the inverter as voltage source to test Alternative Power Source mode

Using the communication board DC voltage source

In case your external signal device (ATS, or other) does not have a voltage source, the inverter voltage source can be used.

1. Enable inverters Alternative Power Source mode in SetApp inverters (See Configuration of inverter by SetApp) or Enable Generator mode in inverters with LCD (See [To enable generator mode](#)).
8. Verify the correct country and CPU version (See Identifying the Inverter CPU Version).
9. Use the V terminal as the voltage source to connect it to the ATS. The ATS output should be connected to L1 (See Figure 4).
10. In SetApp inverters, **Gen** is shown **Country** section of the Status screen. In inverters with LCD, when switching the mode on the ATS, verify that **Country: Gen** is shown on the ID Status window.

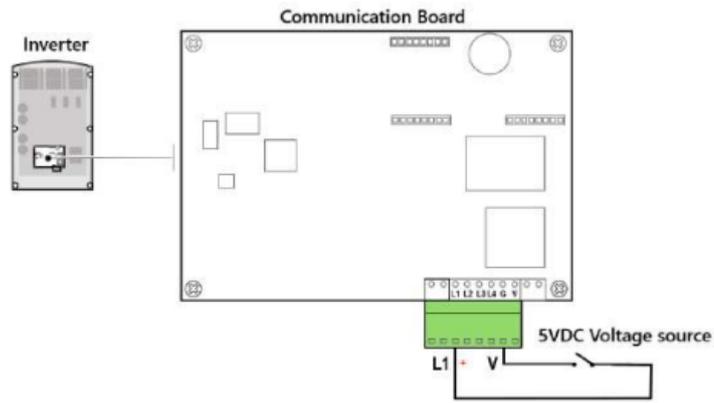


Figure 4 Alternative Power Source mode self-test - using the generator as voltage source

Dry and Wet Contacts Wiring

In this configuration, the dry or wet contacts of the generator are wired to the PRI (Power Reduction Interface) connector of the master inverter for moving the inverter to alternative power source mode.

Use a twisted pair CAT 5 cable to wire terminals of the PRI connector on the communication board of the inverter for simulating close dry contacts of a generator.

Dry contact wire connections

1. Enable inverters Alternative Power Source mode in SetApp inverters (See Configuration of inverter by SetApp) or Enable Generator mode in inverters with LCD (See [To enable generator mode](#)).
2. Verify the correct country and CPU version (See Identifying the Inverter CPU Version).
3. Connect twisted pair wires to the L1 and V terminals of the Communication Board (See Figure 3).
4. Connect the other end of the twisted pair wires to the dry contact terminals of the generator.
5. In SetApp inverters, **Gen** is shown **Country** section of the Status screen. In inverters with LCD, verify that **Country: <Gen>** is displayed on the ID Status window.

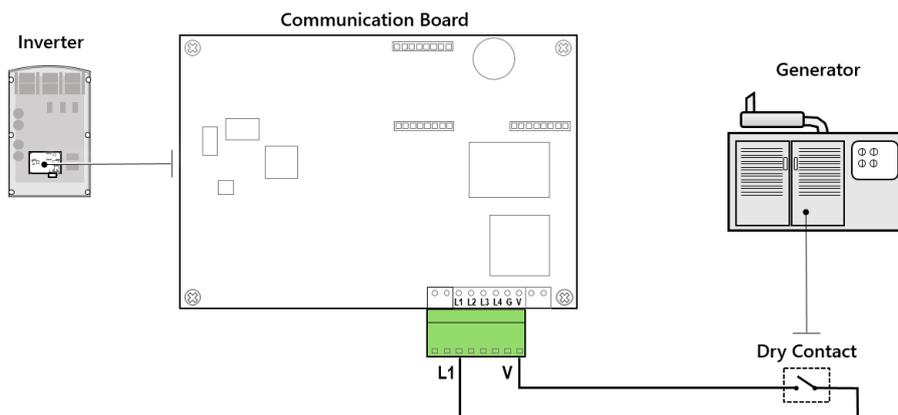


Figure 5 Dry Contact Wire Connections

Wet contact wire connections

1. Enable inverters Alternative Power Source mode in SetApp inverters (See Configuration of inverter by SetApp) or Enable Generator mode in inverters with LCD (See [To enable generator mode](#)).
2. Verify the correct country and CPU version (See Identifying the Inverter CPU Version).
3. Connect twisted pair wires to the L1 and G terminals of the Communication Board (See Figure 4).

- In SetApp inverters, Gen is shown Country section of the Status screen. In inverters with LCD, when switching the mode on the voltage source, verify that Country: Gen is shown on the ID Status window.

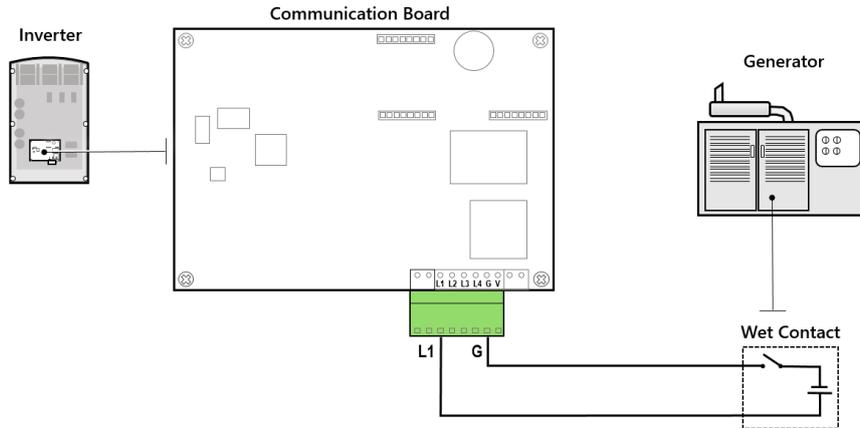


Figure 6 Wet Contact Wire Connections

Identifying the Inverter CPU Version

Inverters with LCD

Once the inverter is connected to the AC grid, the CPU version can be verified by pressing the inverter LCD button several times until the ID Status window appears:

```

ID : # # # # # # # # # #
DSP 1 / 2 : x . x x x x / x . x x x x
CPU : 0 0 0 3 . 2 4 6 7
Country : X X X X X
```

For upgrade instructions, refer to https://www.solaredge.com/sites/default/files/upgrading_an_inverter_using_micro_sd_card.pdf

Inverters configured by SetApp

To identify the CPU version of inverters configured by SetApp: from the Commissioning screen, select: Information → CPU Version.

To automatically obtain the latest firmware version, run SetApp when your smartphone is connected to the internet. Then, to upgrade an inverter, connect to the inverter Wi-Fi station.

To check the latest available firmware version available, visit our [firmware updates webpage](#).

To ensure that the latest SetApp version is running on your smartphone, enable automatic updates.