SAVANT

Savant Power Storage Generator Installation and ATS Integration Guide

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Document Supports	Savant OS 11.1 and Higher Firmware 1.5 and Higher

This document serves as a supplemental guide and guides the installer through the process of installing a generator and(or) automatic transfer switch with an existing Savant Power Storage system (PS20 or PS50) configured using the Savant Power Storage App and either RacePoint™ Blueprint or the Savant Power & Light App. Visit the Getting Started - Installer page, or the Savant Power Documentation Portal for Savant Community users to review the relevant documentation listed below before continuing with the steps outlined in this guide:

- Savant Power Storage 20 Installation Guide or Savant Power Storage 50 Installation Guide
- Savant Power Storage App Setup Guide
- Savant Power System Deployment Guide - RacePoint Blueprint
- Savant Power System Deployment Guide - Power & Light App

45 Perseverance Way, Hyannis, MA 02601
Savant.com/power | 508.683.2500

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1. Before You Begin

- Savant Power Storage systems are only compatible with permanently installed, non-separately derived generators as per NEC 250.35(B).
- The generator shall be an AC home standby generator that is hardwired. Portable and/or manual start generators are not supported.
- Savant is only compatible 2-wire start/stop capability. The Power Storage system uses these control wires to START/STOP the generator based off Power Storage battery State of Charge (SoC).
- Savant supports (2) ways of connecting the generator AC output cables to the Power Storage unit:
  1. **Generator to GEN Terminal**: Connecting directly into the Power Storage GEN terminal.
     A. GEN terminal is rated up to 24kW (100A/240V).
  2. **Generator to GRID Terminal**: Connecting the load side of an upstream Generator Automatic Transfer Switch (ATS) to the Power Storage GRID terminal.
     A. Utility / Grid cables are connected to the **Normal** side of the Generator ATS.
     B. Generator cables are connected to the **Emergency** side of the Generator ATS.
     C. Load side cables of the Generator ATS are connected to the GRID terminal of the Power Storage unit.
     D. Generator ATS (NC/NO) auxiliary contact monitoring is required for Generator to GRID terminal designs.
        - Via the Savant Director, the Power Storage system can determine the position of the ATS (Utility vs Generator).
     E. GRID terminal is rated up to 24kW (100A/240V).
- Power Storage system supports DC and AC coupled solar with generator installations. The Power Storage system is designed to ensure that neither DC nor AC coupled solar is back-fed to a connected generator system while the generator is running.
  1. **DC Coupled Solar:** Connected to the Savant Inverter via two (2) MPPTs rated 6.5kW / 26A DC, located on each Power Storage inverter. DC coupled solar is supported for both the Generator to GEN terminal and Generator to GRID terminal designs.
     A. Sell back / export to the grid of any DC coupled solar will be disabled when a Power Storage system is passing through generator power to charge the batteries and feed the downstream loads.
     B. DC Solar PV import through the MPPTs is allowed to supplement the generator charging the batteries.
  2. **AC Coupled Solar:** Connected directly to the Power Storage system via the GEN terminal. AC Coupled solar is supported **only** with generator to GRID terminal designs. Contact Savant Support for design assistance and/or guidance.
     A. Limit AC coupled solar to 12.5kW / 52A at 240V at the GEN terminal.
     B. The AC coupled solar will be shutoff (using frequency shift) and physically disconnected (by opening GEN terminal relays) when the generator is required or AC Solar Stopping SOC has been reached. It is not possible to operate both AC coupled solar and generator simultaneously.
     C. The GEN terminal relay will close to re-introduce AC coupled solar once the battery has reached the Generator Stop SOC or grid power has returned.

NOTE: It is the design engineer and installer's responsibility to ensure that appropriate provisions are in place at the customer's site to allow the Power Storage system to connect, control, and communicate with the generator. This also includes any additional generator controller programming coordination required by the generator manufacturer. Always check the generator manual or contact the generator manufacturer for the engine start requirements and generator exercising procedures.

It is the design engineer's responsibility to ensure the generator, and any associated Over Current Protection Devices (OCPD) are appropriately sized to handle charging each battery stack while ensuring the downstream critical loads are also powered.

A 120V/240V line is required from utility to the generator for the battery charger inside the generator.

2. Generator to GEN Terminal Installation

Installation steps for a Generator to GEN Terminal design include physical wiring, configuration with the Savant Power Storage app, and configuration using the Savant Power & Light app or RacePoint Blueprint software.

When off grid, a Generator to GEN Terminal installation allows the batteries of the Power Storage system to be charged via a generator in the following scenario:

1. When an individual battery stack discharges and reaches its generator starting state of charge (configured using the Savant Power Storage app. See section 2.2), the inverter calls on the generator to start.

2. Once the generator has qualified the generator signal at the Power Storage GEN terminal, the inverter closes the internal GEN terminal relays. Power from the generator will first supply downstream loads. Unused generation capacity will be used to charge the batteries.

3. The inverter stops the generator once the battery reaches its generator stopping state of charge parameter (configured in the Savant Power Storage (SPS) app. See section 2.2).

NOTE: In a Generator to GEN Terminal parallel system design, once one battery stack reaches the "Gen Start SOC" parameter, that battery stacks will charge. Any battery stack that does not reach the "Gen Start SOC" will not charge. All downstream loads are also being fed by the generator.

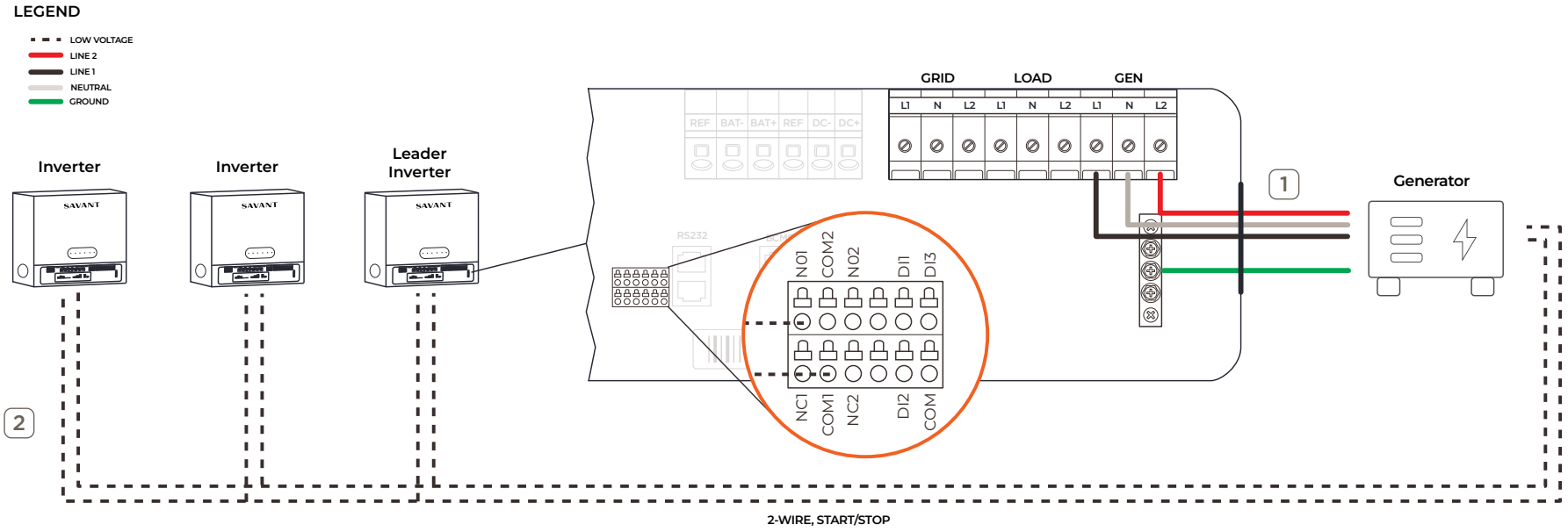
⚠ **IMPORTANT! The generator must be sized accordingly to feed all critical loads and charge the batteries at the same time. The battery charge rate will automatically adjust to stay below the limit set by the Generator Control - Maximum Power setting, taking downstream load consumption into account.**

2.1. Physical Installation

Follow the instructions below to install a generator with an existing Savant Power Storage system. See Appendix: Generator to GEN Terminal Wiring Diagram for wiring example.

1. Connect the AC output and ground terminal of the generator into all Power Storage GEN terminals (L1/L2/N/G). This can be done either directly onto the Power Storage GEN terminals or through a Generator Combiner Breaker Panel for a parallel Power Storage configuration. Ensure OCPDs are present upstream of each Power Storage GEN terminal, properly sized for the generator with a maximum rating up to 100A/2P.

2. Connect generator 2-wire START/STOP control wiring to every parallel Power Storage unit (see figure below). The Power Storage generator START/STOP functionality is controlled via a normally open (NO) dry contact.



2.2. Generator to GEN Terminal Savant Power Storage App Setup

Use the Savant Power Storage (SPS) App to program the AUTO-START/STOP parameters of the connected generator for each Power Storage system. All units need to be configured with the same values.

From the Settings menu in the SPS App, navigate to **Connected Power Sources** and access the **Generator Control** page to configure the following fields:

1. **Maximum Power** is the total power drawn through each inverter GEN terminal (covering both downstream loads and battery charging). See appendix and generator sizing chapter.

   NOTE: The generator must be sized to cover all downstream loads. Excess power will be used to charge the batteries. Batteries will not discharge when generator is operating.

   - **Single unit installation** – This value equals the maximum usable size (kW) of the generator connected to the system.
     *Maximum Power = Generator Size * 80%*
   - **Parallel unit installation** – This value equals the maximum usable size (kW) of the generator divided by the number of Power Storage inverter connected in the system.
     *Maximum Power = (Generator Size * 80%)/ Number of Inverters*

   NOTE: The maximum usable size of the generator shall be determined by the EOR "Engineer on Record" and/or per the generator manufacturer's instructions. Most generator manufacturers prefer their gensets run at 80% duty and therefore this value shall be taken into consideration when sizing the generator for handling downstream loads and charging each battery stack.

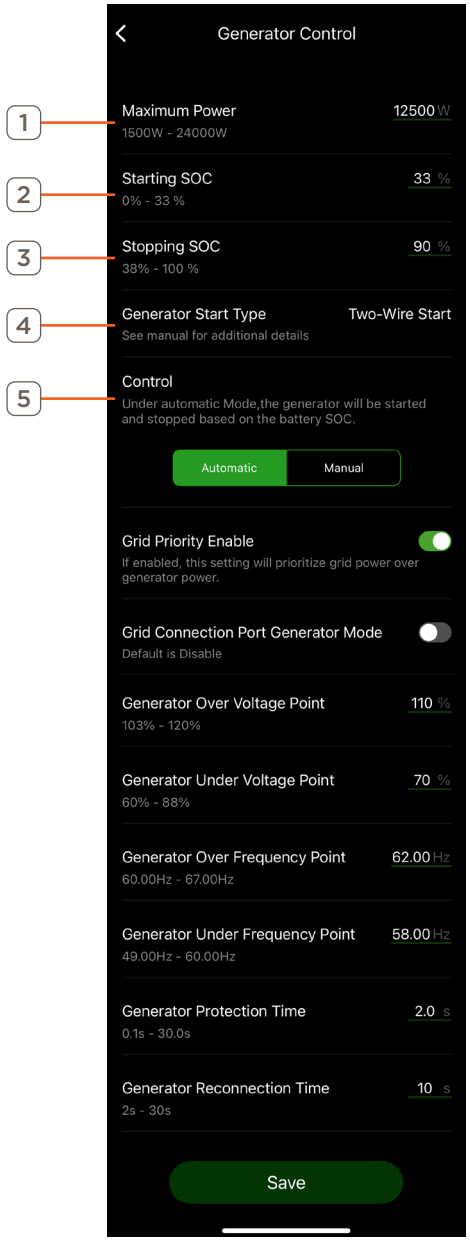
2. Input **Starting SOC** value. (The SOC when the generator is automatically started.)

3. Input **Stopping SOC** value. (The SOC when the generator is automatically stopped.)

4. **Two- Wire Start**: For other generator start configurations contact Savant Support.

5. Set **Control** to "Automatic". This enables the Power Storage unit to automatically start or stop the generator using the Starting SOC/ Stopping SOC thresholds.

   NOTE: "Manual Mode" may be used for generator troubleshooting.



3. Generator to GRID Terminal (Upstream ATS)

Installation steps for a Generator to GRID Terminal design include physical wiring, configuration with the Savant Power Storage app, and configuration using either RacePoint Blueprint or the Savant Power & Light app. Once configuration has been completed in the Savant Power Storage app, additional configuration is required to properly automate generator functionality. Complete configuration using the Savant Power & Light app described in section 4.1 OR RacePoint Blueprint described in section 4.2.

NOTE: A Savant Power Director or HOST with an SSC controller that supports GPIO is required for Generator to GRID terminal configurations so the Savant System knows the ATS position. (Normal vs Emergency)

A Generator to GRID Terminal installation allows the batteries of the Power Storage system to be charged via generator in the following scenario:

1. When an individual battery stack discharges and reaches its generator Starting SOC the inverter calls on the generator to start during a power outage.

2. The upstream generator ATS qualifies the generator signal and switches from “Normal/Utility” position to “Emergency/Generator” position.

3. After the ATS has switched positions, the Power Storage unit starts qualifying the generator signal at the grid terminal.

4. Once qualified, the generator supplies downstream house loads and uses excess power to charge the battery stack(s).
   NOTE: Batteries will not discharge to cover downstream house loads when generator is actively coupled to the downstream system.

5. The inverter stops the generator once the battery reaches its Storm Watch SOC parameter as set in Blueprint or SP&L app.

NOTE: In a parallel Generator to GRID terminal system design, once one battery stack reaches the "Generator Charges Battery Threshold” parameter (set in Racepoint Blueprint), all battery stacks in the system are charged at the same time. Meanwhile, all downstream loads are also being fed by the generator.

⚠ **IMPORTANT! The generator must be sized accordingly to feed all critical loads and charge the batteries at the same time.**

3.1. Generator to GRID Terminal Physical Installation

Follow the instructions below to install a generator with a Savant Power Storage system. See Appendix: Generator to GRID Terminal Wiring Diagram for wiring example.

1. Connect the Utility Power Source onto the Normal terminal of the generator ATS (L1/L2/N/G).

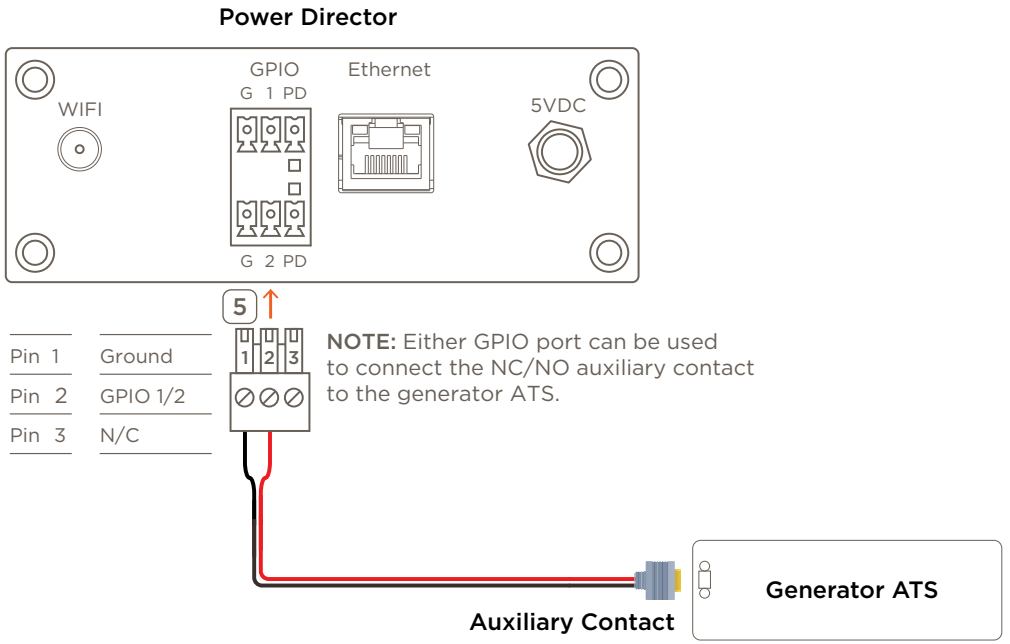
2. Connect the Generator Power Source onto the Emergency terminal of the generator ATS (L1/L2/N/G).

3. Connect the AC ATS load wires onto the GRID terminals of all Power Storage systems (L1/L2/N/G). This can be done either directly onto the Power Storage GRID terminals or through a Grid Combiner Breaker Panel for parallel Power Storage configurations. Install a properly sized OCPD upstream of each Power Storage GRID terminal. Single line drawing examples are available upon request.

4. Refer to the ATS and generator wiring diagram/manual for auxiliary connection (NC/NO) locations.
   - Connect the generator 2-wire START to the Leader Inverter. See Appendix: Generator to GRID Terminal Wiring Diagram.
   - Connect a NC/NO auxiliary contact in the generator ATS to the GPIO port on the Savant Power Director/ Panel Bridge Controller. This NC/NO auxiliary contact gives the positional status of the generator ATS (Normal position vs Emergency).
   - The Director can support ATS position sensing from either a NC or NO dry contact. During system setup, the director will be programmed to indicate the normal position of the auxiliary contact

   NOTE: A dedicated Savant Controller (e.g. SSC-0012, SSC-0014) is required for systems using a different Savant Host than the Savant Power Director.

5. Connect generator 2-wire START/STOP control wiring to the Leader Power Storage unit (see Appendix: Generator to GRID Terminal Wiring Diagram). The Power Storage generator START/STOP functionality is controlled via a normally open (NO) dry contact.



3.2. Generator to GRID Terminal Savant Power Storage App Setup

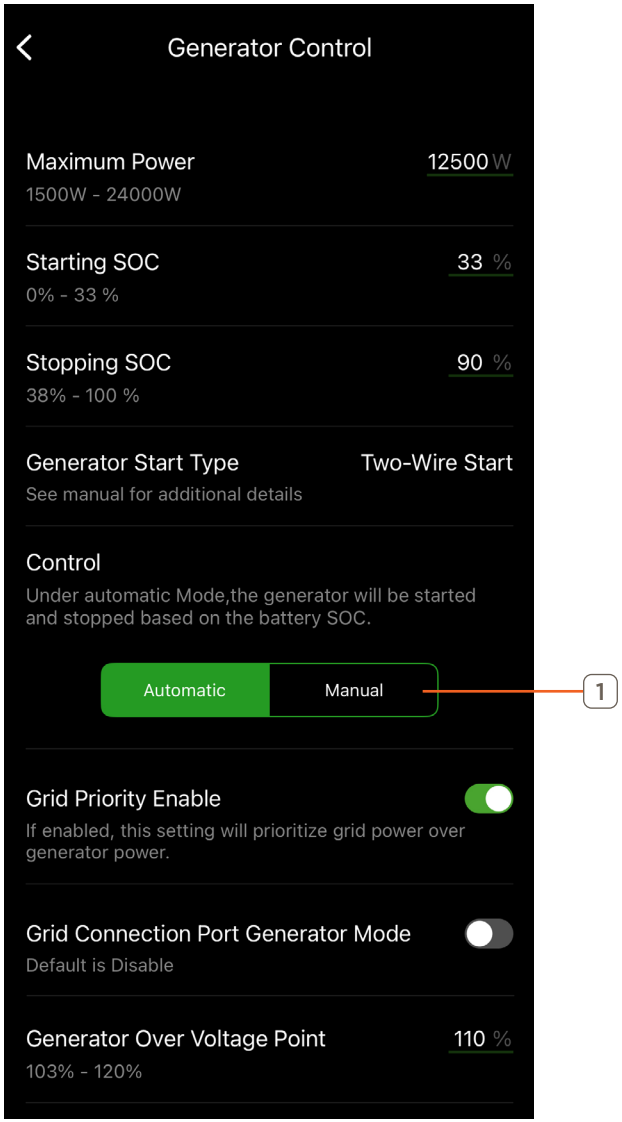
When using the Generator to GRID Terminal option, the Generator Terminal may only be used for AC Coupled Solar installations. See Savant Power Storage App Guide for detailed configuration.

NOTE: AC coupled solar is not permitted to operate simultaneously with the generator and will be automatically disabled when generator is required.

From the Settings menu in the SPS App, navigate to **Connected Power Sources** and access the Generator Control screen to configure the following fields:

1. Select **Manual** for the control field.

   NOTE: All remaining configuration will be completed in Racepoint Blueprint.

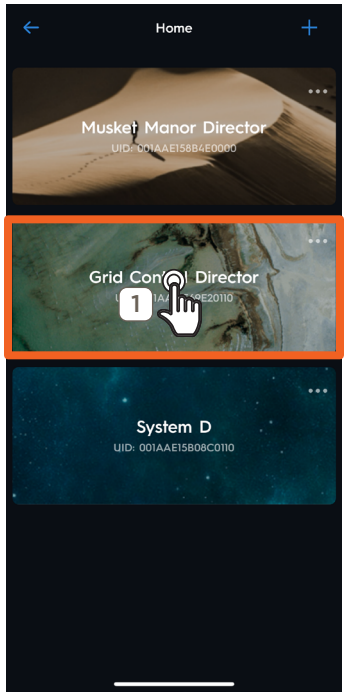


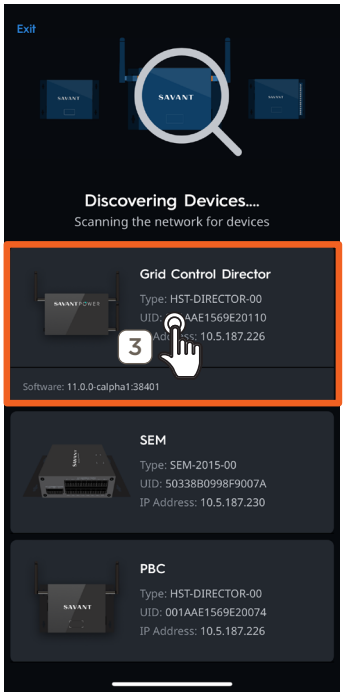
4. Configuration

4.1. Savant Power & Light App Configuration

Additional configuration is required to properly automate generator functionality once configuration in the Savant Power Storage app is completed. Only one configuration tool is needed. (RacePoint Blueprint OR Savant Power & Light app.) Below are the configuration steps for SP&L. Alternatively, see the Blueprint Configuration section for configuration steps in RacePoint Blueprint. These steps assume the installer has an already configured Savant Power Storage system using the SPS and SP&L app and is adding a generator to the SP&L configuration. For information configuring a Savant Power Storage system in the SP&L App, see the Savant Power System Deployment Guide - Savant Power & Light App on the Savant Customer Community.

2. In the SP&L App, select **Home**.
3. Select **System Configuration**.
4. Once the SP&L App is finishing discovering, Select the Director for this installation. Get configuration from host if necessary.
5. Select **Power Sources**.



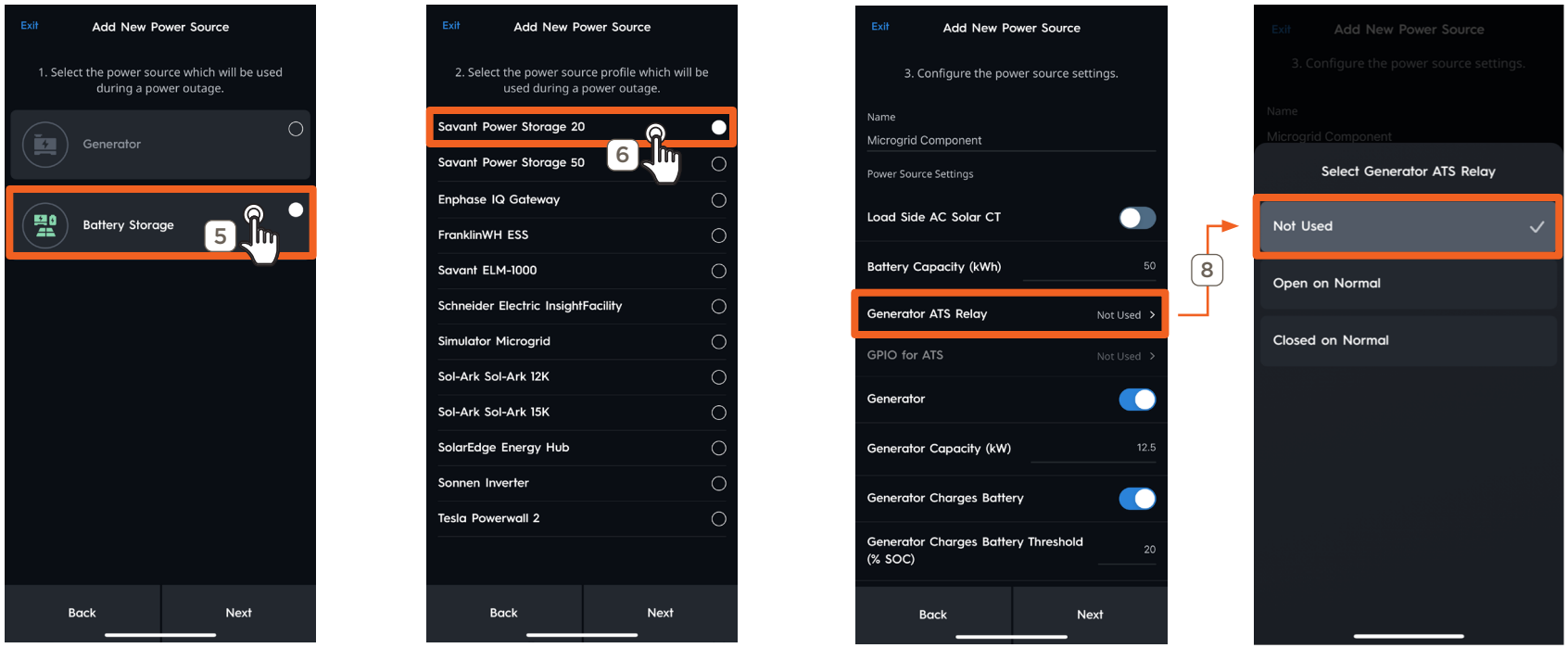


6. Select **Battery Storage**.

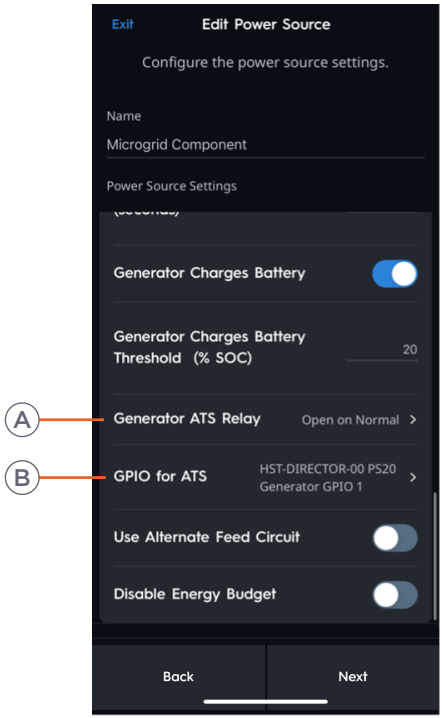
7. Select **Savant Power Storage 20** or **Savant Power Storage 50** as the power source profile.

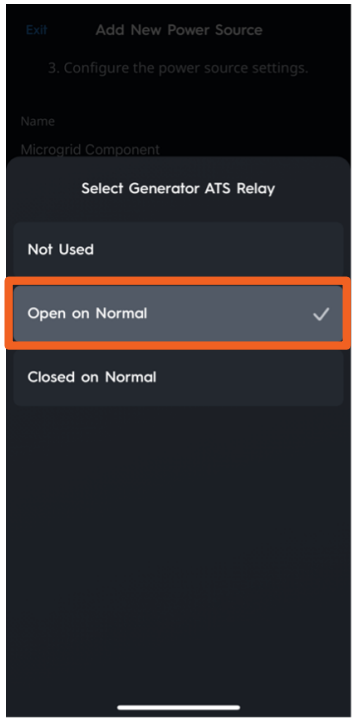
8. Determine the configuration from the options below and continue onto the appropriate steps:
   - No external generator configured. (There is no generator sitting on an upstream ATS). Continue to step 8.
   - External generator configured with a Normally Open ATS (Not ASCO). Continue to step 9.
   - External generator configured with a Normally Closed ATS. Continue to step 10.

9. If no external generator configured, (there is no generator sitting on an upstream ATS) set **Generator ATS Relay** to **Not Used**. (The GPIO for ATS option will be unavailable).

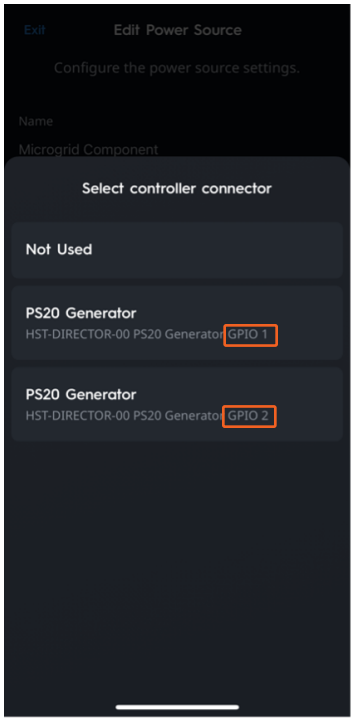


10. If there is an external generator configured with a Normally Open ATS, (Not ASCO) follow the steps below:





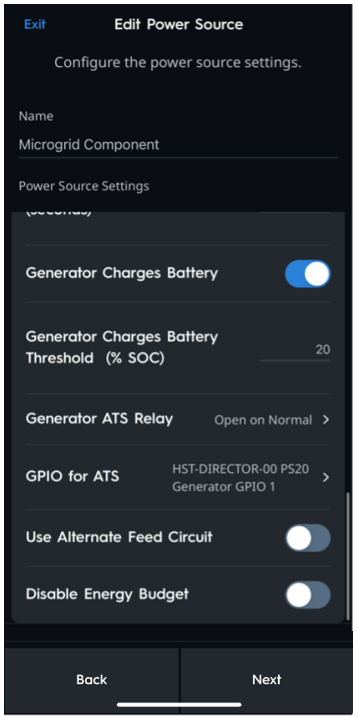
Ⓐ Set **Generator ATS Relay** to **Open on Normal** if the ATS auxiliary connection is Open on Normal.



Ⓑ Set **GPIO for ATS** to the GPIO port on the network which the ATS auxiliary is connected to.

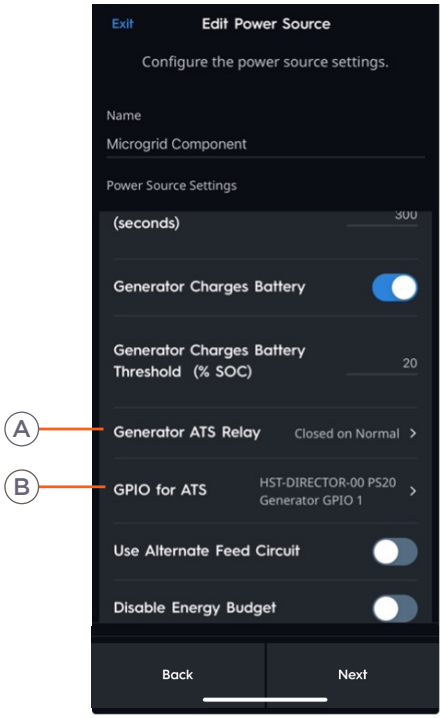
In this example a standard director is displayed.

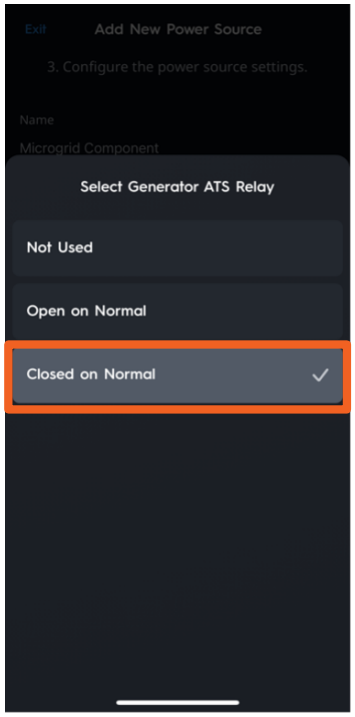
The name is typically HST-DIRECTOR-00 Unconfigured #UUID Number#.



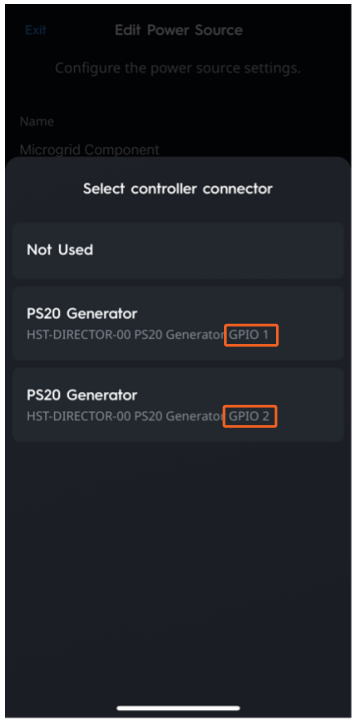
Ⓒ Both ports have been selected and are shown in the SP&L app. Select **Next** and **Sync** the configuration.

11. If there is an external generator configured with a Normally Closed ATS, (ASCO typically) follow the steps below:





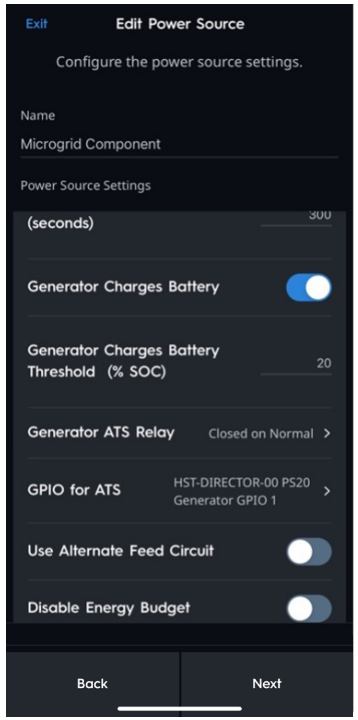
Ⓐ Set **Generator ATS Relay** to **Closed on Normal** if the ATS auxiliary connection is Closed on Normal.



Ⓑ Set **GPIO for ATS** to the GPIO port on the network which the ATS auxiliary is connected to.

In this example a standard director is displayed.

The name is typically HST-DIRECTOR-00 Unconfigured #UUID Number#.



Ⓒ Both ports have been selected and are shown in the SP&L app. Select **Next** and **Sync** the configuration.

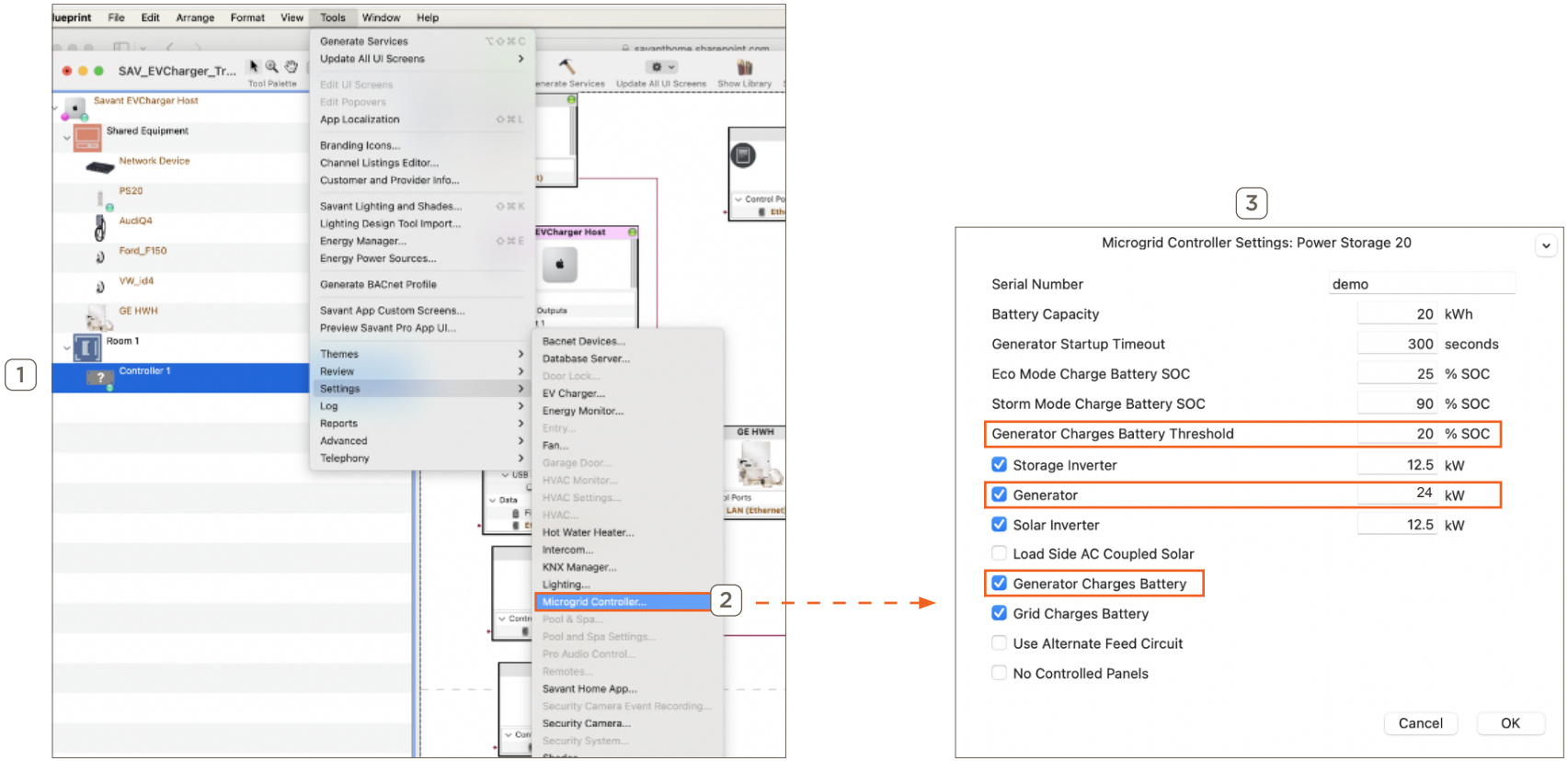
4.2. RacePoint Blueprint Configuration (Generator to GRID Terminal ONLY)

Additional configuration is required to properly automate generator functionality once configuration in the Savant Power Storage app is completed. Follow the instructions below. Alternatively, see the Savant Power & Light app section for configuration steps with the SP&L app.

1. In Blueprint, select the controller that will be used for installation.

2. Navigate to **Tools** > **Settings** > **Microgrid Controller**.

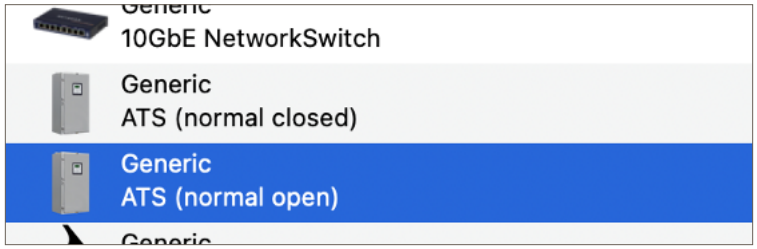
3. Set the following parameters under Microgrid Controller Settings:
   - Set **Generator Charges Battery Threshold** to an SOC percentage that will turn on the generator when in an off-grid scenario.
   - Enable **Generator Charges Battery**.
   - Select **Generator** and set generator size.



4. Select the ATS profile for the Generator Connection. The ATS will have a relay to represent its Normal State. If the Normal State is open, select the Normally Open profile. If it is closed, select the Normally Closed profile.

5. Connect the ATS auxiliary contact to GPIO ports used in installation.

4



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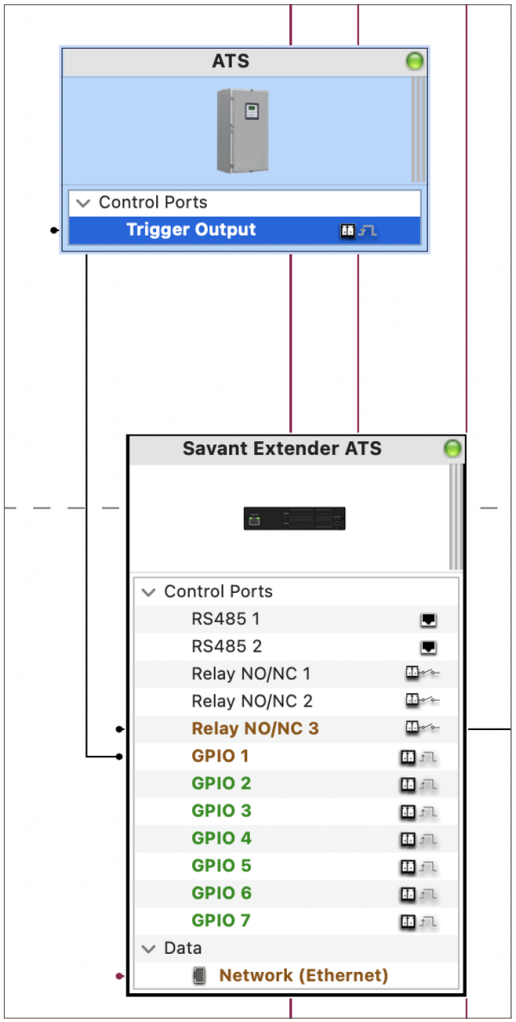
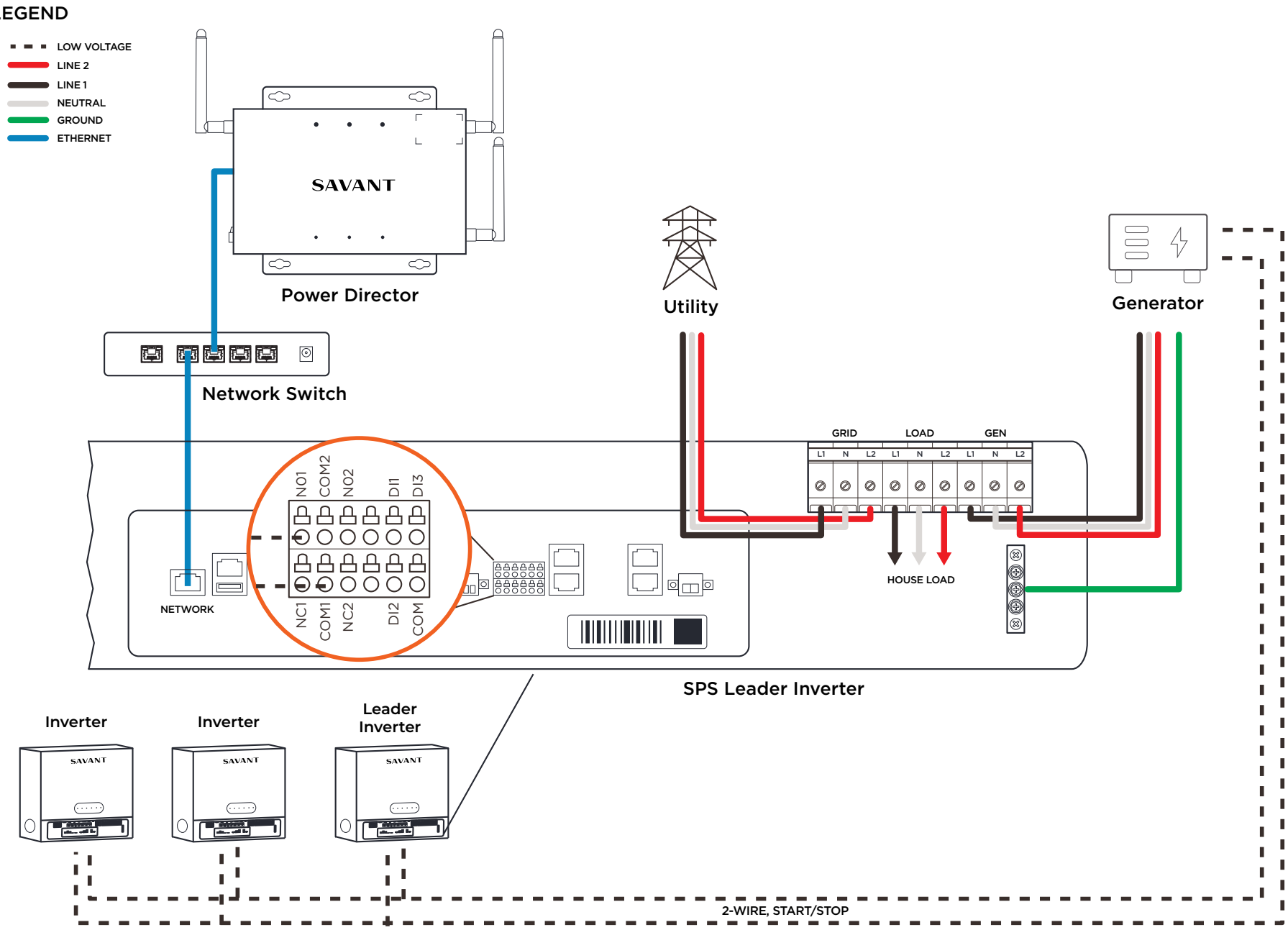
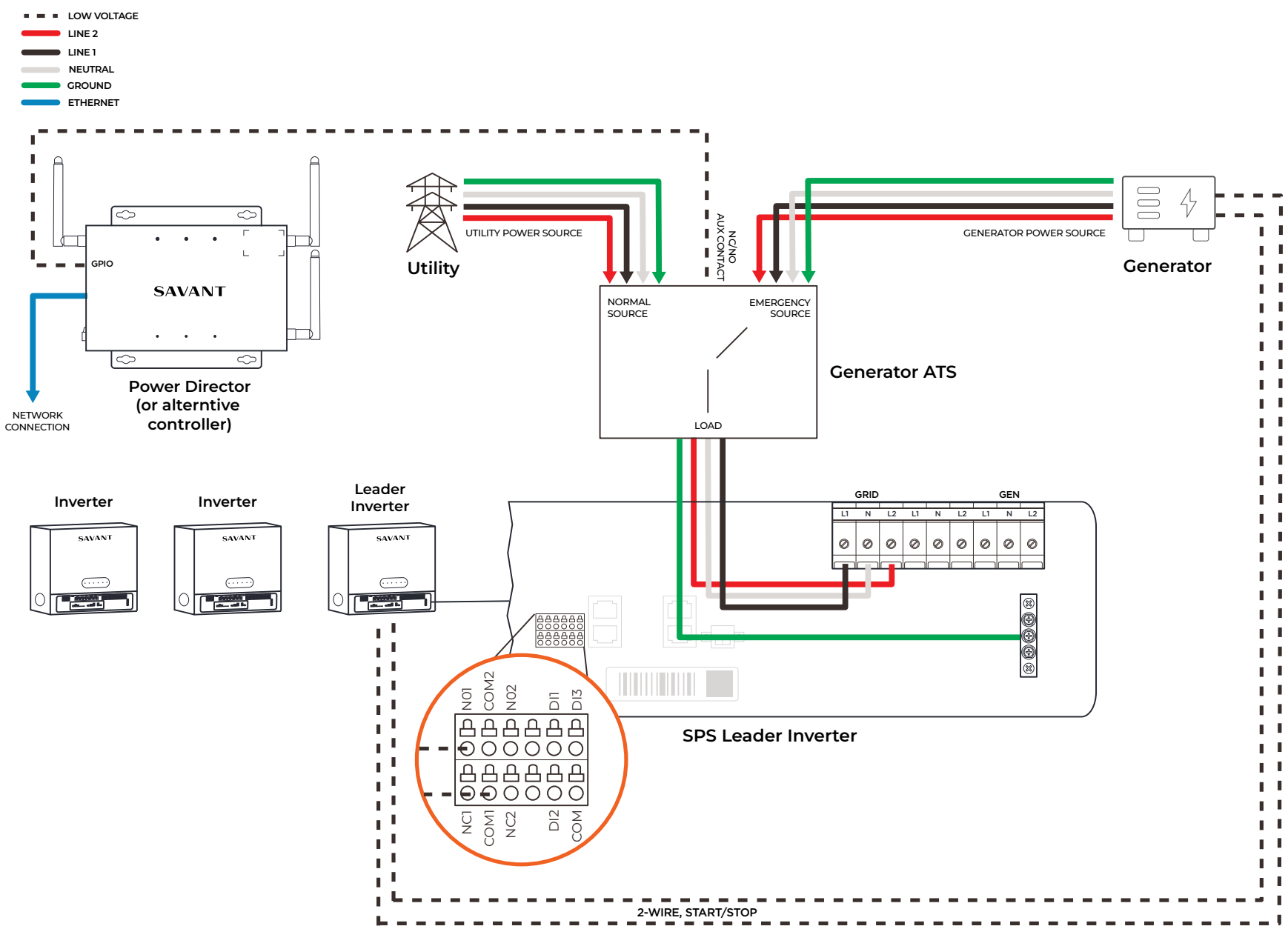


Appendix: Generator to GEN Terminal Wiring Diagram



Appendix: Generator to GRID Terminal Wiring Diagram



Appendix: Maximum Power Calculations and Generator Sizing

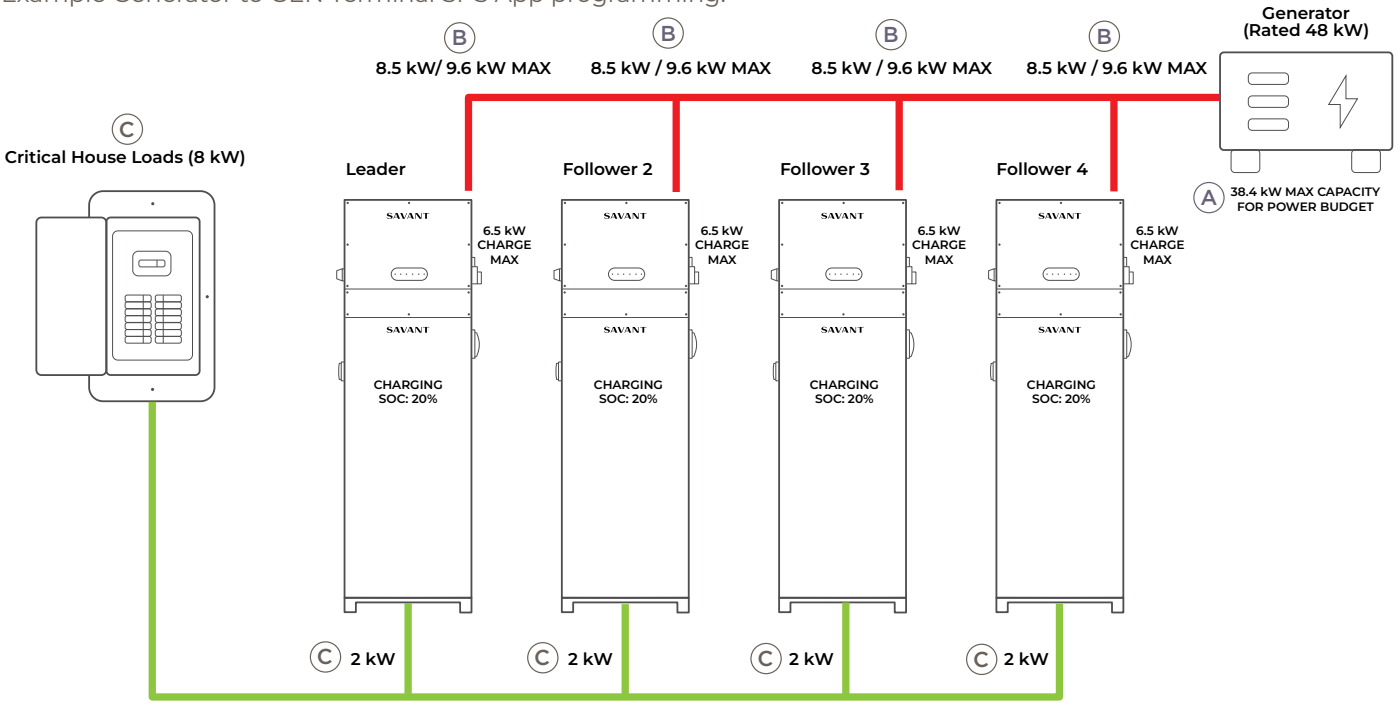
It is recommended (for Generator to GEN terminal and Generator to GRID terminal designs) that the total sum of the charge rate of each battery stack and maximum critical loads downstream, shall not exceed 80% of the generator rating to prolong the life of the generator.

Flexible load management through the use of Savant Power Modules may be used to shed load while the generator is running to maximize the charge rate. Each inverter can charge up to 6.5kW per battery stack at a time.

Sizing Calculations (Use the example chart diagram below for reference)

- Generator Rating divided by 1.25 = **Maximum Generator Capacity** for Savant Power Budget (Ⓐ)
- (Ⓐ) divided by the number of Inverters = **Maximum Power** setting in SPS App (Ⓑ) This is the maximum Power Budget per inverter at 80% of the total generator rating. This is the unit charge rate + maximum unit load contribution.
- Max Critical Load divided by number of Inverters = **Max Load Contribution** per Inverter (Ⓒ)

Example Generator to GEN Terminal SPS App programming:

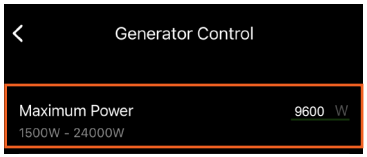


Ⓐ **Maximum Generator Capacity**
48 kW / 1.25 = 38.4 kW

Maximum Power
38.4 kW / 4 Inverters = 9.6 kW (9600 W)

NOTE: Always keep this value as high as possible per the calculations above.

Ⓑ



Ⓒ **Maximum Load Contribution**
8 kW / 4 Inverters = 2 kW

Generator Rating	Max Generator Capacity for Power Budget	Total Critical House Load	Number of Inverters	Inverter Charge Rate (with Critical Loads Consuming)
48 kW	38.4 kW	36 kW	4	0.6 kW*
48 kW	38 kW	8 kW	4	6.5 kW*

* Batteries will charge up to their maximum rated power. Battery charging rate adjusts dynamically based on the Total Critical House Load. The battery will never discharge when the generator is operating.