

Application Note—Backup Interface Installation Best Practices

Revision History

- **Revision 1.0** - November 2020
Initial release

Introduction

SolarEdge's Backup Interface is designed to create a microgrid during power outages by disconnecting the home from the grid.

This application note provides information about the best installation methodology and typical backup configurations. All installation work must be conducted by a licensed and bonded electrician.

Before Installation




Discuss with the homeowner what needs to be backed up during a grid outage. When the loss of power occurs, the Backup Interface will only restore power to the selected circuits (within 3 seconds), and these circuits will continue to receive power as long as there is solar, battery, and generator power (to be supported in a future firmware version). If, at any time, all three sources of energy are exhausted, then the loads will turn off until more energy is available.

Before starting the installation, read carefully the installation guide and the accompanying documentation provided with the Backup Interface and other equipment.

Recommended Installation Equipment

This section recommends specialty tools that will make your work easier and more efficient.

- **Conduit benders** are included in most electricians' tool kits. However, the Backup Interface accommodates conduits of up to 2". This size of conduit is outside of the typical range of most installation work. Bending a conduit larger than 1", requires a hydraulic bender.
 - [Central Machinery Hydraulic Bender](#)
 - [RIDGID Hydraulic Bender](#)
- **Cable cutters** come in a variety of shapes and sizes. Most electricians will carry cable cutters that are capable of cutting 2AWG wires. The Backup Interface has a maximum wire size of 4/0. This wire size can be cut with a portable band saw, or a specialty hand tool.
 - [Milwaukee Cordless Portable Band Saw](#)
 - [Klein 32" Standard Cable Cutter](#)
 - [Klein Ratcheting Cable Cutter](#)
- **Cable benders** can make tight bend radii with a 4/0 cable. Plan the installation with large junction boxes and straight conduit runs whenever possible, however if a 2" LB is used, a cable bender improves the ease of installation.
 - [Rack-A-Tiers Bend-All-Cable Bender](#)
 - [Bulldog 18" Bender](#)
 - [Greenlee Bender-Cable Ratchet](#)
- **Torqueing screw drivers and wrenches** are required tools for a successful installation. Most installers have these tools for everyday use. The Backup Interface requires specific torque values on all electrical connections, listed here with the required tool.

| Connection | Torque Value | Required Tool | Head Shape |
|----------------------------------|---------------------|------------------------|---|
| Mounting bracket seismic screws | 2.9 ft lbs / 4.0 Nm | 4mm Alan or 5/32" Alan |  |
| Conduit holder screws | 3.4 ft lbs / 4.7 Nm | 4mm Alan or 5/32" Alan |  |
| Ground-to-neutral bonding jumper | 3.4 ft lbs / 4.7 Nm | 4mm Alan or 5/32" Alan |  |

| | | | |
|---------------------------------------|-----------------------|------------------------|--|
| Grounding and neutral connections | 16.7 ft lbs / 22.5 Nm | 6mm Alan or 1/4" Alan | |
| Generator L1 and L2 connections | 8.5 ft lbs / 11.5 Nm | 5mm Alan or 3/16" Alan | |
| Backed-up loads connections | 16.7 ft lbs / 22.5 Nm | 6mm Alan or 1/4" Alan | |
| Grid connections | 16.7 ft lbs / 22.5 Nm | 6mm Alan or 1/4" Alan | |
| Inverter breaker screws – wire side | 1.8 ft lbs / 2.0 Nm | P1 or P2 Phillips | |
| Inverter breaker screws – busbar side | 1.8 ft lbs / 2.0 Nm | P1 or P2 Phillips | |
| Inverter grounding and neutral bar | 2.9 ft lbs / 4.0 Nm | 1/4" Flat Blade | |
| Backup Interface cover screws | 2.2 ft lbs / 3.0 Nm | 4mm Alan or 5/32" Alan | |

Lug kits and two-pole breakers

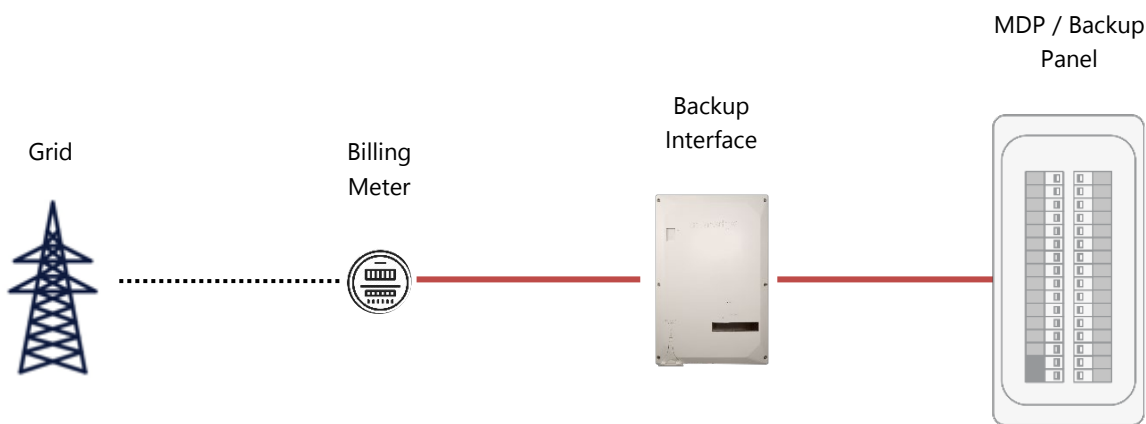
Some panel manufacturers have accessory devices, such as lug kits, which allow the installation to extend the bus of the main service panel (MSP). The use a large two-pole circuit breaker is the other method of connecting the Backup Interface to the MSP, is using a two-pole circuit breaker that matches the manufacturer and type of the existing panel. If all of the loads are moved to a new backup panel, then the typical 120% rule (705.12) doesn't apply to back-feeding devices. The justification comes from the location of the energy sources. All energy sources to the backup panel are fed through the Backup Interface. There are no back-feeding devices to the new backup loads panel. From the consideration of the MSP, the lug kit is not an over current protection device. The bussing inside of the Backup Interface is designed and listed to handle the input current from all of the generation sources. Furthermore, the exception in 705.12(D)(2) allows this method of oversizing if an energy storage systems is connected to the system.

This list of tools does not include every tool necessary for a successful installation. Additional tools will be required.

Relevant NEC Articles

Article 220

Article 220 is a five part article that focuses on the requirements for calculating the minimum size of the branch circuit, feeder and service conductors. This article should be considered when determining the calculation of a feeder for an existing load center. 220.87 bases the feeder size on the maximum demand for one year. The feeders are identified in red in the diagram below.



Article 445

Article 445 contains the electrical installation and other requirements for generators. Generators need overload protection, and it is necessary to size the conductors that come from the generator. Below are relevant sections within Article 445 and how the Backup Interface supports them.

445.12: Over Current Protection

The generator should be protected from overload by inherent design, and it should contain overcurrent protective devices, such as circuit breakers, fuses, etc. If the selected generator does not contain any over current protection devices, then a fused AC disconnected switch should be used between the generator and the inverter.

445.13 Ampacity of Conductors

The ampacity of the conductors from the generator to the Backup Interface must not be less than 115% of the name plate current rating of the generator. For the neutral conductor sizing, the Backup Interface does not transfer the neutral, therefore, is not considered a separately derived system per Article 100. Consequently, the neutral conductors are required to provide the low-impedance fault current path back to the power source and shall be sized to carry the maximum unbalanced current as determined by Article 220.61.

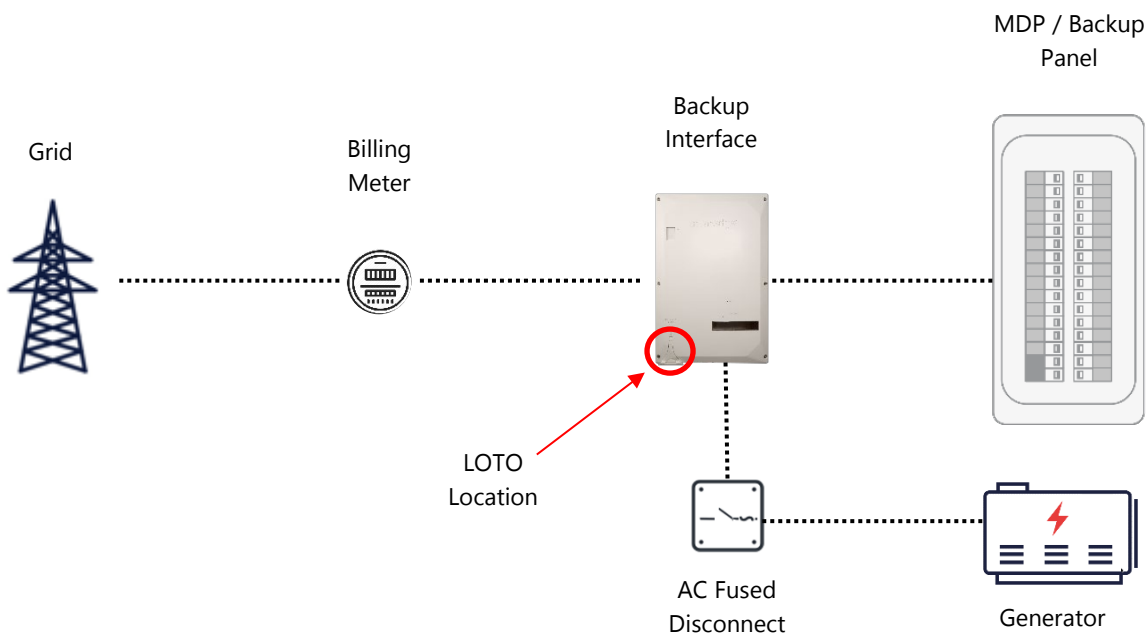
445.18 Disconnecting Means

The generator is required to have at least one disconnecting means, and it can be electrically isolated from the grid and locked open using the pull handle on the front of the Backup Interface.



NOTE

Where possible, SolarEdge recommends installing a reverse current protection device on the generator output.



If the inverter is still on, it will go into backup mode, even if the main circuit breaker is locked into the open position. Install an emergency stop button to shut off the system. Refer to the installation manual for more details about the remote shutdown switch.

Article 690–Photovoltaics

All relevant sections in this article still apply to the PV system.

Articles 700 and 701

These articles do not apply to the Backup Interface. While capable of providing backup power in emergencies, the system is not identified as such. Emergency systems and required standby systems are legally required for life saving devices.

Article 705–Interconnected Electric Power Productions Sources

This article covers installations of multiple electric power production sources that operate in parallel with the grid.

705.12(B) Load Side Point of Connection

When calculating the ampacity of the feeders of the power source, use 125% as the safety factor. The Backup Interface has dedicated termination points for all power sources, therefore none should be located in the backup panel. It ships with one 40A 2P breaker for an SE7600H. If a different inverter is used, order the appropriate sized breaker.

| SE Energy Hub Inverter | Max Continuous output (A) | Recommended Breaker Size (A) |
|------------------------|---------------------------|------------------------------|
| SE3800H US | 16 | 40 |
| SE6000H US | 25 | 40 |
| SE7600H US | 32 | 40 |
| SE10000H US | 42 | 63 |
| SE11400H US | 48 | 63 |

705.14

The output characteristics of the generator shall comply with the voltage and frequency found in North America.

705.40–Loss of Primary Source

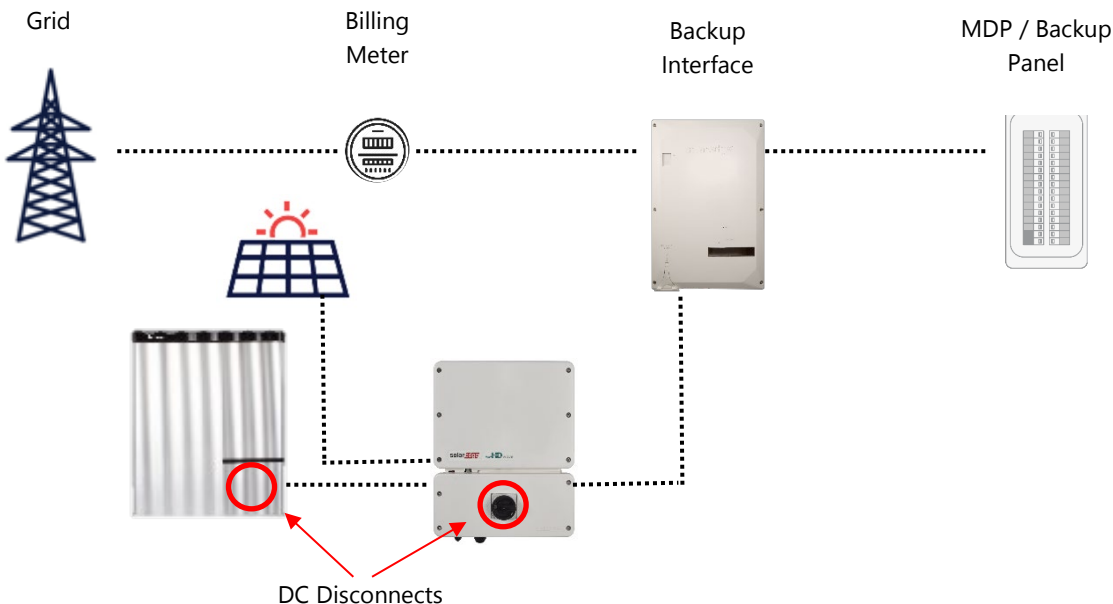
Inherent to the design of the Backup Interface, if a grid loss occurs, the supply side becomes electrically isolated from the load side, and the PV inverter will automatically cease exportation to the grid, and will resume generation once the nano-grid has been isolated.

Article 706–Energy Storage Systems (690.71)

This article relates to all permanently installed energy storage systems (ESS) that may be stand-alone or interactive with other electrical power productions sources. The Backup Interface is commonly used in conjunction with ESS's therefore this article applies to the installation.

706.7–Disconnecting Means

The LG Chem Battery has a factory installed disconnect that meets the requirements of this section. If the batter is not within 5 ft of the system, a second disconnect is not required, because the inverter has an integrated DC disconnect switch that shuts down the battery as well.



706.20 and 706.21 Circuit Sizing and Over Current Protection Requirements

All conductors for the micro-grid are sized per Articles 240 and 310. However Article 706.20 may alter the sizing of OCPD's and conductors.

706.23 Charge Control

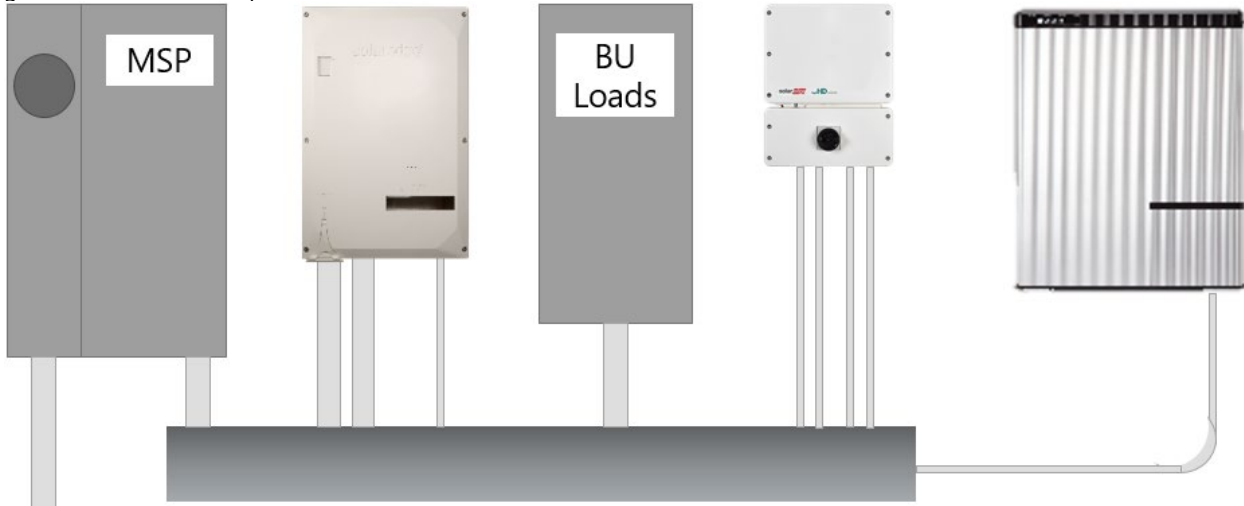
While the energy storage system is DC-coupled, there is no need for traditional charge controllers.

Installation and Equipment Location Guidelines

When selecting mounting locations for the equipment, note that the inverter, Backup Interface, Smart EV Charger, and battery are rated for exterior use. Equipment placement will be influenced by the site limitations, but these guidelines should be followed whenever possible.

- Place the Backup Interface close to the main service panel (MSP) or main distribution panel (MDP) and/or the backed up (BU) loads panel.

This reduces the length of large gauge wire required for the installation. Because all conduit entrances feed through the bottom of the Backup Interface, it is advised to install a large junction box or gutter below the Backup Interface. Transitions from inside to outside of the house will also be easier to accomplish, if there is a large junction box or gutter below the Backup Interface.



- Some installations will not need a backup panel. If the site requires a backup panel, locate it close to the MSP. By locating the backup panel adjacent to the main panel, it is possible to relocate the existing wiring into the new panel with minimal drywall work.
- The inverter can be installed in proximity to the Backup Interface. The battery must be installed within 30 ft of the inverter. Wherever these pieces of equipment are located, their proximity is crucial.

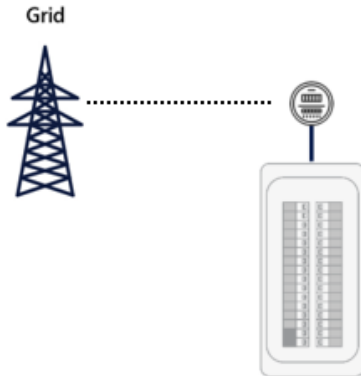


- The Smart EV Charger can be installed outside, but installation inside the garage is recommended.
- Generators should always be located away from the building. Refer to the manufacturer's recommendations for more information.

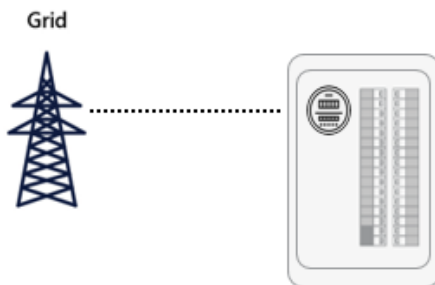
Wiring and Interconnection Methods

The Backup Interface is designed for a 240V split phase grid connection. In North America, there are two typical service entrance styles:

- **Meter only:** This service entrance type has a line side connection entering a metallic enclosure that serves as the point of common coupling (PCC) and has the utility billing meter. There may or may not be a disconnect switch or over current protection device (OCPD) that supplies the main distribution panel (MDP). These service entrance types are common in Hawaii, on the East Coast, or in older homes.



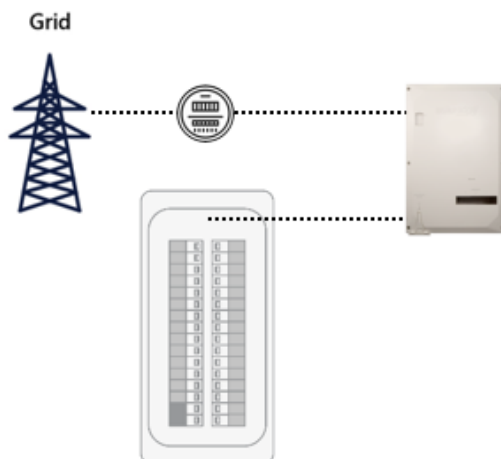
- **Meter main combination panel:** This service entrance type is configured with the PCC and billing meter integrated into the MDP. This service entrance type is the most common in the continental US.



Flexible Backup Solutions

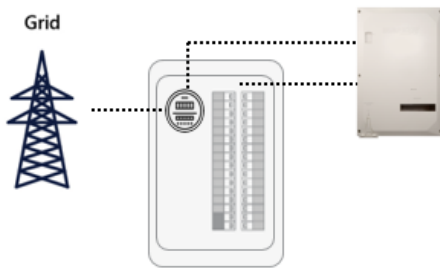
After you determine which loads will receive power during a grid outage, there are multiple ways to configure the site.

- **Whole home backup (separate meter and MSP/MDP):** After backing up the whole home, when the meter is separate from the MSP, it is not necessary to relocate any of the existing circuits into a new BU panel. This installation type can be as simple as intercepting the conductors from the PCC to the MSP and wiring them to the Backup Interface. This is easier when there is an AC disconnect or OCPD that feeds the MDP. If the PCC cannot be isolated, call the utility and pull the meter to work safely. When performing this type of backup, follow jurisdictional guidelines.



- **Whole home backup (combined meter and MSP):** This method is comparable to a main panel upgrade and should be treated like one. There are two ways to connect the Backup Interface to the busing of the existing MSP. For either of these connection methods, the BI-Nxxxx (main lug only) variant is recommended.

- Intercept the busbar or cabling that feeds the main circuit breaker (MCB). Verify that the manufacturer of the panel allows for this method, and work with the utility to pull the meter for safe work. This method does not require re-wiring the backed-up circuits.



- Create an essential loads panel including all of the circuits from the main panel. The advantage of this method is safety, not having to work with the utility to isolate the MSP, and maintaining certifications and warranties of the existing equipment.



- **Partial home backup:** Partial backup with a MSP that has an integrated meter offers backup capability with a reduced installation cost. This installation method will back up smaller loads, such as general lighting and receptacles, and leave larger loads such as HVAC, or dryers in the main panel. This method has lower installation costs and stored-energy longevity while in backup mode.



Other Considerations

It is important to keep in mind any local or national regulatory requirements when sizing conductors, conduit, and integration methods. For example, partial or whole-home backup can utilize a lug kit instead of an OCPD (breaker) to transition from the MSP busbar to the Backup Interface. With the Backup Interface, SolarEdge provides the most flexibility with multiple inverter inputs, as well as generator support.