



Pre-Charge Feature FAQ

1. What is a Pre-Charge Feature?

All modern power inverters and motor controllers have a large capacitor bank at their DC input terminals to reduce the ripple current and its associated EMI interference. Input capacitors help to provide smooth power conversion from DC to an AC sine wave and back to DC when charging the battery. When initially connecting a battery to a capacitive input, there is an inrush of current as the input capacitance is charged up to the battery voltage. With large batteries (with a low source resistance) and powerful loads (with large capacitors across the input), the inrush current can easily peak 1000A or more. A pre-charge circuit limits that inrush current, without limiting the operating current.

Below is the snapshot from the operation manual of the popular SMA Sunny Island inverters, stating the large values of their input capacitors.

- Due to the input capacity of the Sunny Island, high inrush current from the battery to Sunny Island might occur when the battery is connected to the input terminals of Sunny Island:
 - SI3.0M: approximately 30,000µF
 - SI4.4M: approximately 30,000µF
 - SI8.0H: approximately 49,000µF
 - SI6.0H: approximately 49,000µF

2. Why do I need a Pre-Charge Feature?

When connecting a Lead Acid battery to a DC input of the inverter, there is a nasty spark, which can tack weld the battery lug to the input terminal. This spark is caused by the inrush current to charge the input capacitors. Lithionics Battery has an intelligent BMS, which includes a contactor allowing the BMS to turn the battery power on/off when needed. Without the pre-charge feature that initial contact spark would happen inside the contactor and could tack weld it, preventing its normal operations and damaging the BMS and battery modules. The pre-charge feature eliminates this initial inrush of current and eliminates the nasty spark.

3. How does the Pre-Charge Feature work?

The pre-charge feature adds a resistor and another smaller contactor across the main power contactor inside the BMS. When the BMS switches on the battery power, it first closes the pre-charge contactor, which limits the inrush current via the resistor circuit to approximately 1A, safely charging the capacitors in less than 10 seconds, while the BMS is monitoring the voltage rise at the inverter input. Once the input voltage has risen to approximately 90% of the battery voltage, the main contactor is closed, and the system is ready to operate at full power.

4. How much does Lithionics Battery Pre-Charge feature cost?

To prevent possible BMS damage due to capacitive inrush and in order to ensure your warranty is in effect, the customer is recommended to purchase a low-cost pre-charge system integrated into our BMS at a cost of \$149.00 (MSRP). The pre-charge circuit is comprised of a custom printed circuit board with integrated logic, resistor network and a pre-charge contactor system. A view of the pre-charge assembly is shown below.

