# SOLID STATE MARINE BATTERY MANUAL

Models: SSM8D-48V120A

SSM8D-48V210A


TEL (401) 608-0077 EMAIL: sales@solidstatemarine.com

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# Introduction

Solid State Marine (SSM) 48V Series Deep Cycle Marine Battery are designed for the drop-in replacement of deep-cycle lead-acid and lithium batteries with its standard Battery Council International (BCI) 8D group size.

Weighing almost half as much as a Lithium Iron Phosphate (LFP) batteries and a quarter of lead-acid counterparts, our battery has more power, lighter weight, and can be safely discharged to 100% Depth of Discharge (DOD). Manufactured with high grade solid state flat battery cells and featuring an advanced Battery Management System (BMS) provides comprehensive protection to the battery.

# Features

Solid State Marine (SSM) 48V Series Deep Cycle Marine Battery features a greater energy density, a deeper discharge capability, a higher round-trip efficiency, and a faster charging speed in a smaller size over counterparts in the market.

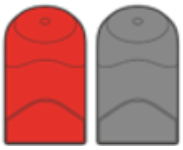
- **More Power / Less Weight:** The 48V210Ah Delivers 10,920Wh of power while weighing just 104lbs., all within a compact Group 8D package! The 48V120Ah Delivers 6,240Wh of power while weighing just 64 lbs., in the same Group 8D package.
- **Greater Safety:** Solid State design is safer than Lithium / LFP or AGM batteries as the electrolyte is a solid and non-combustible.
- **Superior Temperature Performance:** Operates and charges at -4$^0$F without the use of a heater! Operates in extreme conditions up to 155$^0$F
- **Bluetooth:** IOS and Android Apps control and monitor battery functions such as State of Charge.
- **Uncompromising Quality**: Our battery lifespan ensures more than 3000 cycles (80% DOD), a continuous charge current of up to 110A, a continuous discharge current of 250A, and a wide range of operating temperatures
- **Reliable BMS Protection Mechanisms:** Designed to withstand the extremes of marine boating, RV, and gold cart use. The BMS includes multiple levels of protection such as low temperature cut-off and precise cell balancing.

# What's in the box

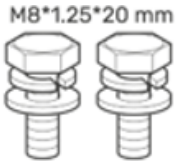
Solid State Marine Series 8D Deep Cycle Low Temperature Battery (1)


User Manual (1)


Insulating Sleave (2)



Long Terminal Bolt (2)




# Safety

While Solid State batteries are inherently safe, as with all batteries, energy storage devices, and electrical equipment, safety and electrical hazards do exist. Failure to follow these safety instructions may result in electrical shock, injury, or death, or may damage the battery or other equipment or property.

## Installation

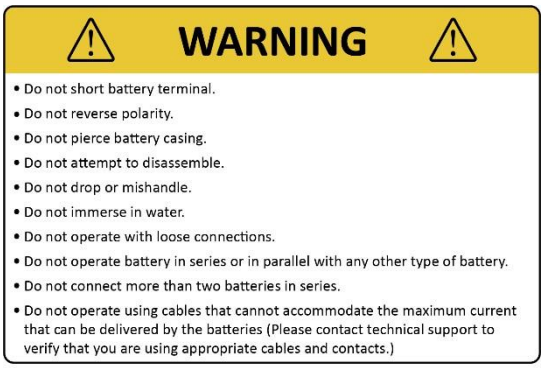
- The battery should be installed as per national and local codes
- The battery should only be installed in locations approved by local building codes.
- Electrical and shock hazards can be minimized by covering the solar array and using insulated tools.
- Do not short the battery terminals.
- Do not install the battery if there are any signs of physical damage
- Do not install the battery in a location that may be flooded.

## Operation

- Use only approved battery chargers for charging the battery.
- Do not disassemble the battery.
- A CSL is required for use with inverters 3500W or higher.

## Emergency

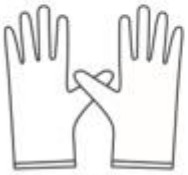
- Disconnect the battery from the system.
- Wear a respirator, eye protection, and rubber gloves where appropriate.
- Use an ABC type dry chemical fire extinguisher.
- Dispose battery as per local regulations.



# What do I need for installation?


Wrench (9/16 in)

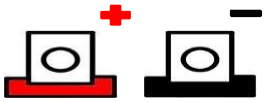

Battery Adapter Cables × 2



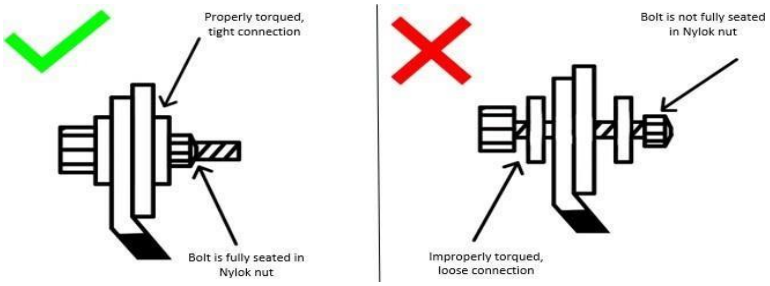
Insulating Gloves

Multimeter

## Connecting Load Cables and Turn-On Batteries



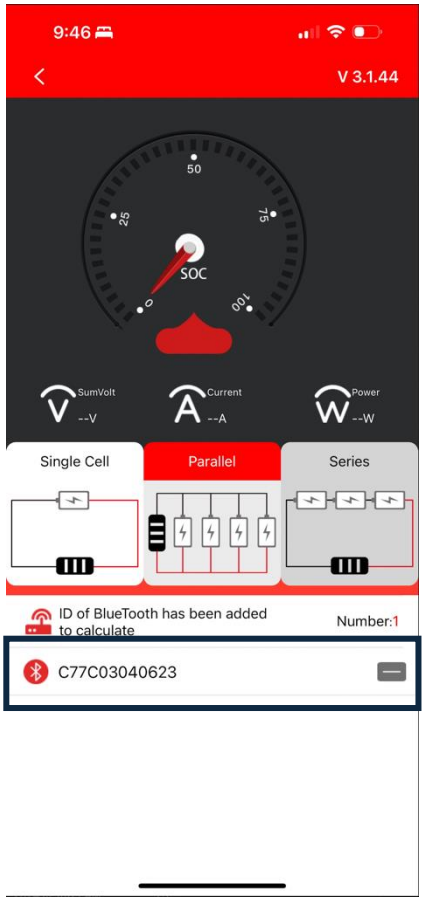
1. Identify the positive and negative terminals. These are labeled and color-coded **red for positive (+)**, **black for negative (–).**
2. Determine which finishing hardware set you will use. Verify that your bolt can fully seat into the battery terminal. If multiple lugs are used, longer bolts may be required for the bolt to fully seat into the battery terminal.
3. When connecting to your battery terminals, **DO NOT** finger tighten. Use a torque wrench to torque your hardware to the specification of 9 to 11 ft-lbs. Failure to adequately secure connections can result in severe damage and will void your warranty. Fig. 2 below demonstrates proper and improper connections.



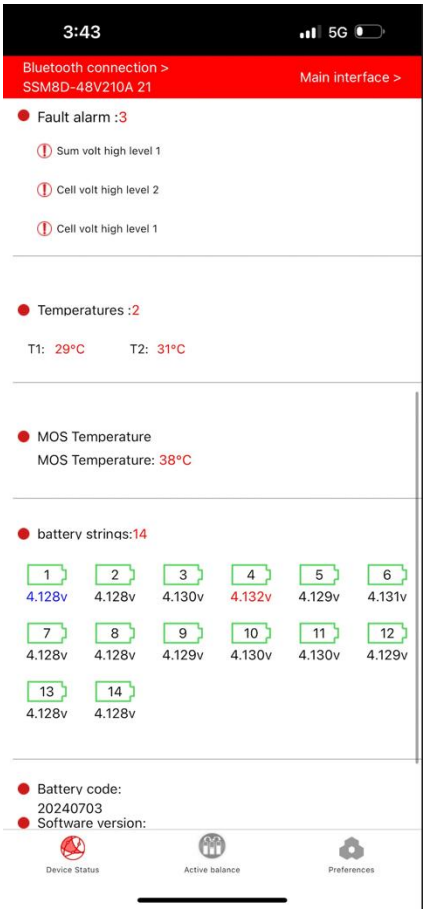
# How to use Bluetooth to Monitor your Batteries using your Smart Phone

1. Download the “SSM Battery Monitor HP” APP on your IOS or Android Smart Phone. Please contact support, support@solidstatemarine.com, if you cannot find the app

2. Find your battery from the list and connect




3. You can monitor your batteries status as well as each individual cell

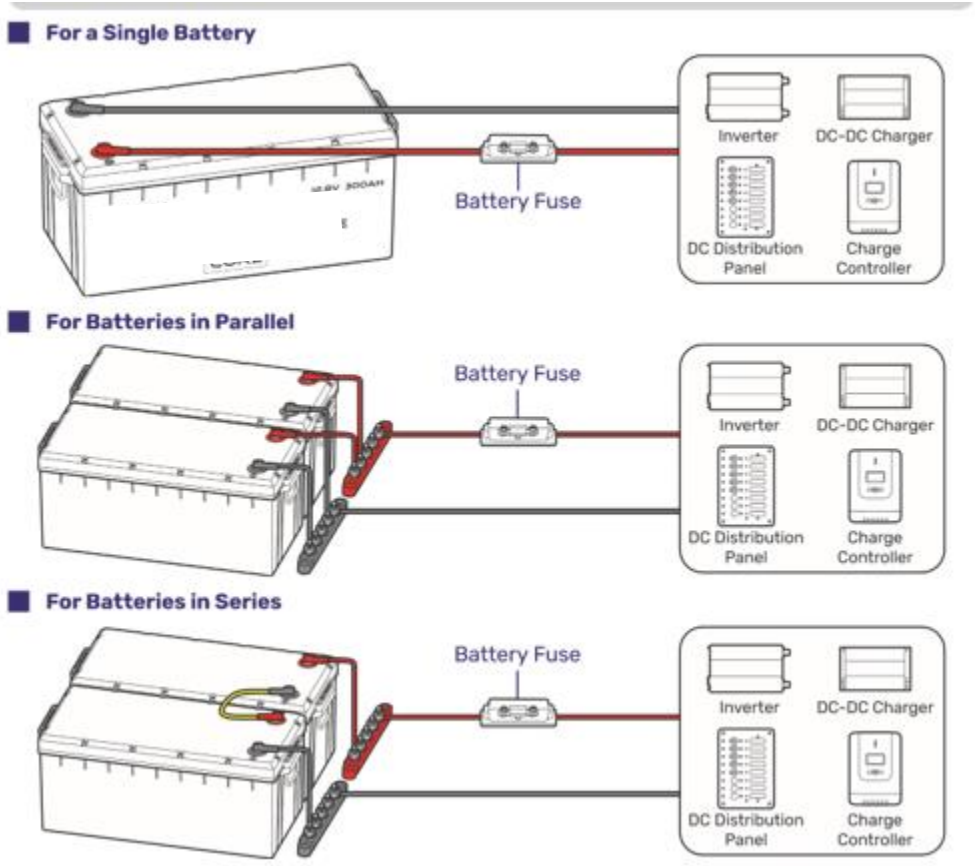


# How to Properly Size Cables for System

Use appropriately sized Battery Adapter Cables (sold separately) based on expected load. Refer to the table below for copper cable ampacities with different gauge sizes.

| Cable Gauge Size | Ampacity | Cable Gauge Size | Ampacity |
|---|---|---|---|
| 14 AWG (2.08 $mm^2$) | 35A | 2 AWG (33.6 $mm^2$) | 190A |
| 12 AWG (3.31 $mm^2$) | 40A | 1 AWG (42.4 $mm^2$) | 220A |
| 10 AWG (5.25 $mm^2$) | 55A | 1/0 AWG (53.5 $mm^2$) | 260A |
| 8 AWG (8.36 $mm^2$) | 80A | 2/0 AWG (67.4 $mm^2$) | 300A |
| 6 AWG (13.3 $mm^2$) | 105A | 4/0 AWG (107 $mm^2$) | 405A |

# How to Incorporate Fuses into the System



# How to Properly Charge the Batteries

The battery will be received at a partial state of charge (SOC) depending on the time between manufacturing and shipping. It is crucial to fully charge the battery before its initial use. In case the battery shuts off due to low SOC, promptly disconnect it from loads and charge it to prevent irreversible damage. Follow the instructions in this user manual for proper charging and usage to ensure optimal battery performance and longevity.

## Charging Logic

The standard charging process for the battery involves charging at a constant current until the battery voltage reaches 58.8V for the 48V battery, followed by charging at a constant voltage of 58.8V while tapering the charge current. When using a 20A charger, the standard charging process typically takes 10 hours for the 210Ah and 5 hours for the 120Ahr. The BMS requires battery temperatures to be between 32°F and 131°F (0°C and 55°C) for safe charging. Leaving the battery on float will continue to balance the battery cells without damaging the battery.

| Model | SSM8D -48V120A | SSM8D- 48V210A |
|---|---|---|
| Peak Charge Voltage | 58.8V | 58.8V |
| Quick Charge Current: Charge to 58.8V at a constant current (CC) of 0.5C and then charge to the degree to which the charging current is less than 0.02C at constant voltage | ≤60A (0.5C) | ≤110A (0.5C) |
| Standard Charge Current: Charge to 58.8V at a constant current (CC) of 0.3C and then charge to the degree to which the charging current is less than 0.02C at constant voltage (CV) | ≤40A (0.3C)<br>Then<br>2.4A (0.02C) | ≤ 63A (0.3C)<br>Then<br>4.2A(0.02C) |
| Disconnect Charge Current[1]<br>(BMS will disconnect if exceeded) | 200A | 200A |
| Float Voltage | 58.1 V | 58.1V |
| Over Voltage Protection | 58.8 V | 58.8 V |
| Over Voltage Reconnect | Automatically at 58.38 V | Automatically at 58.38 V |
| Temperature Compensation Required | None | None |

## Discharging Specification

| Model | SSM8D-48V210A | SSM8D-48V120A |
|---|---|---|
| Recommended Continuous Discharge Current | 250A | 150A |
| Maximum Continuous Discharge Current | 250A | 150A |
| Peak Over Current | 500A | 350A |
| | | |
| Short Circuit Protection | 1000A | 1000A |
| Discharge Cut Off<br>Pulse Recovery Operation | 35.7V | 35.7V |
| Low Voltage Protection | 35.28V | 35.28V |
| Permanent Off Voltage | 35V | 35V |

# How does the BMS protect the batteries?

The battery is equipped with a Battery Management System (BMS) that provides warnings and protections against overvoltage, undervoltage, overcurrent, short circuit, high temperature, and low temperature conditions. Refer to the table below for the triggering and recovery conditions of each warning and protection.

**High Voltage Disconnect (> 58.8V Battery Voltage, > 4.2V Cell Voltage)**

If an individual cell voltage exceeds a prescribed threshold during charging, the BMS will prevent a charge current from continuing. Discharge is always allowed under this condition. If the batteries have not been balanced for a long time, high voltage disconnect could occur at a lower voltage. The batteries will rebalance after several full charges.

**Low-Voltage Disconnect (< 35.28V Battery Voltage, < 2.52V Cell Voltage)**

If an individual cell falls below a prescribed threshold during discharge, the BMS will prevent further discharge. Although the battery is in “low voltage disconnect” mode, it will still allow a charging current.

*NOTE: Many chargers must detect a voltage over 10V to send a charge to the battery. Please be aware that some chargers may not sense a battery in low voltage disconnect and you may need to jump it with a 48V source to “wake up” the battery. You should jump your battery within 24hrs of entering low voltage disconnect otherwise you risk damaging your battery and voiding the warranty.*

**High Temperature Charging and Discharging**

The BMS will not allow a charging current if the internal temperature of the battery has reached 155°F (70°C). If the internal temperature of the battery has reached 155°F (70°C), the BMS will not allow a discharging current.

**Low Temperature Charging (< -4°F/-20°C)**

The BMS will not allow a charging current under -4°F (-20°C) but will continue to discharge down to -4°F (-20°C).

**High Current Discharge Surges**

The BMS will not allow a current that exceeds 500 (+/- 5%) Amps (350A for 120Ah model) for more than 1.5s. After a high current disconnection, the battery will automatically reconnect after 60 seconds.

**Short Current Discharge Surges**

Our BMS has built-in short circuit protection. If the short circuit protection is tripped, the BMS will shut the battery down and will remain disconnected until you remove the battery cables.

**Balancing of Cells**

A passive balancing process is activated by the BMS at the top of each charge cycle when the battery voltage exceeds around 48V. This ensures that all the cells remain at the same state of charge, which helps pack longevity and performance.

# How to Properly Store Batteries

Please follow the tips below to ensure that the battery emerges from storage in a good condition:
Charge the battery to 30% to 50% SOC.

- Disconnect the battery from the system.
- Store the battery in a well-ventilated, dry, clean area with temperatures between -13°F (-25°C) and 149°F (65°C).
- Do not expose the battery to direct sunlight, moisture, or precipitation.
- Handle the battery carefully to avoid sharp impacts or extreme pressure on the battery housing.
- Charge the battery at least once every 3 to 6 months to prevent it from over discharge.
- Fully charge the battery when it is taken out of storage.

# How to Maintain the Batteries

## Inspection

Please perform regular inspections following the steps below:

- Examine the external appearance of the battery. The housing and terminals of the battery shall be clean, dry, and free of corrosion.
- Check battery cables and connections. Replace any damaged cables and tighten any loose connections.

In certain application scenarios, corrosion may occur around the terminals. Corrosion can cause increased resistance and poor contact. It is recommended to regularly apply insulation grease to each terminal. Insulation grease can form a moisture-resistant seal and protect the terminals from corrosion.

## Cleaning

Please clean the battery at regular intervals following the steps below:

- Disconnect the battery from the system.
- Clear the leaves and debris from the battery.
- Clean the battery with a soft, lint-free cloth. The cloth can be dampened with water or mild soap and water if the battery is extremely dirty.
- Dry the battery with a soft, lint-free cloth.
- Keep the area around the battery clean.
- Reconnect the battery to the system.

## Checking Voltage

Please check the battery voltage periodically to assess battery health. If the battery is unable to be activated with a charge/discharge current greater than 1A or the battery is activated with a resting voltage below 10V, the battery may have been severely over-discharged due to self-discharge or parasitic loads. Please stop using the battery until the fault can be corrected and the battery can be charged.

# How to Properly Recycle and Dispose of the Batteries

1. Make sure all loads are removed from your system before removing the batteries. Once the batteries are removed cover the terminals using electrical tape. Now can be a good time to inspect any cable runs or lugs.
2. Visit www.earth911.com or www.call2recycle.org/locator to find a drop off location. Be sure to call ahead of time to confirm that the drop off location is still accepting materials.
3. Give us a call if you are having any trouble finding a drop off location and we can help you find one.

# Limited Warranty

Solid State Marine Inc. (SSM) warranties its batteries from any defects in materials and workmanship for 8 years from the date of purchase. If you have a quality issue with a product, we will repair or replace any defective battery at no charge. Contact our customer service department with proof of purchase to arrange for repairs.

This warranty does not cover damage resulting from misuse, accidents, alterations, improper installation, or normal wear and tear. This warranty is void if the product is modified in any way.

The warranty is limited to the original purchaser and is non-transferable.

# Return Policy

SSM offers 30-day money back guarantee. Returns of undamaged batteries may be issued full refunds less a 20% restocking fee. To be eligible for a return, your item must be in the same condition that you received it, unused and in its original packaging. You'll also require proof of purchase. Please note voltages and internal BMS data will be checked for any usage.

# Customer Service

SSM offers free lifetime technical support & free battery analysis. If you have a quality issue with a product, please contact us at support@solidstatemarine.com to help diagnose the problem. If a product does not meet our high-quality standards, then we will issue you a replacement component or fix the original at no additional cost. SSM is not responsible for return shipping.

# Return Shipping

In the event your Battery must be returned to SSM for any reason, it must be shipped in an approved shipping box. If you did not save the original packaging, SSM will provide packaging to return the Battery. The cost of this service for Batteries weighing up to 79 lbs. will be $25 plus the actual shipping charges to the destination. For batteries weighing more than 79 lbs., please contact SSM for a box and shipping quote.

# Product Specifications

| | SSM8D- 48V120A | SSM8D-48V210A |
|---|---|---|
| Battery Type: | Solid State | Solid State |
| Voltage: | 50.4V | 50.4V |
| Rated Capacity: (25C) | 120 Ah | 210Ah |
| Charge Voltage: | 58.8V | 58.8V |
| Maximum Charge Current: | <60A | <105A |
| Peak Discharge Current: | 350A (BMS) | 500A (BMS) |
| Discharge Current: | 150A | 250A |
| **TEMPERATURE** | | |
| High Temperature Cutoff | 70C (BMS) | |
| Charge Temperature Range | -4°F~155°F (-20°C~70°C) | |
| Discharge Temperature Range | -4°F~155°F (-20°C~70°C) | |
| Storage Temperature | -4°F~113°F (-20C~45°C) | |
| **OTHER** | | |
| Connection Method | Series and Parallel (2S 4P) | |
| Communication Protocol | Optional NMEA 2000 | |
| Terminal Bolt Size | M8 | |
| Recommended Terminal Torque | 10 – 12 Nm | |
| Housing Material | ABS | |
| Protection Rating | IP67 | |
| Accessories | Long Terminal Bolts (2): M8 | |
| Testing | UN38.3, UL1642 | |
| Cycles | 3000 | |
| Warranty | Material and Workmanship: 8 years<br>5 yr Free Replacement | |

# Mechanical Specifications

| Model | SSM8D |
|---|---|
| Dimensions | 20.47 x 10.55 x 10.88 inches |
| Weight | SSM8D 48V120Ah 64 Lbs<br>SSM8D 48V210Ah 104 Lbs |