



# SM Series Battery Chargers

# ◆ INSTALLATION • OPERATION

English

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*Automatic Switch Mode Battery Charger*

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## Sentry SM Battery Chargers

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### **Warnings**

#### **Before Operation**

The manual has vital and essential information. The owner should read and understand this important manual before operation of the charger. Contact Taylor Made Environmental if you do not understand a statement.

#### **Before Installation**

An owner should seek guidance from an authorized Sentry dealer or the factory.

#### **Hazardous Conditions**

Can result from improper installation and:

- Can cause serious injury or death of the occupants.
- Can cause serious damage or destruction of the vessel.

#### **Serial Numbers**

The serial numbers are on the data plate which is located on the right side of the charger. These serial numbers indicate the year, month, and sequence that charger was manufactured. The first letter in serial number actually is a representation of the month it was manufactured (i.e. A–January, B–February, etc.). The following two numbers represent the year the charger was manufactured and the remainder of the serial number simply indicates sequence in which that particular charger was manufactured.

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## Basic Installation Guide

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### **Selecting An Area In The Boat**

Select a dry, well ventilated area, near, but not above the batteries. Mount in a vertical position, to create a natural ventilation for the charger. Note that the wiring connections are at the bottom of the charger. Leave at least three inches clearance above and below the unit for proper ventilation.

### **Internal Charger Settings**

#### A. Voltage Setting:

- Dual voltage chargers only - Connect the jumper wire for 115 VAC input or 230 VAC input.
- Some chargers are 115 or 230 VAC only. Check the data plate for proper input voltage.

B. Battery type - set the battery type selector switch (**double boards: make sure to set both switches to the same position**)

- 1) Check with your battery manufacturer on the recommended charging voltages to ensure proper selection of the Gel/Free switch.

Free Position: For Lead Acid, Absorbed Glass Mat (AGM), and sometimes Gel batteries

Gel Position: For Calcium and sometimes Gel batteries

12 Volt Chargers	Gel	Flooded	24 Volt Chargers	Gel	Flooded
Boost	14.3	13.9	Boost	28.4	27.8
Float	13.6	13.2	Float	27.2	26.4

- 2) SM1210/2 and SM1220/2 - There is no selector device. This charger can be used on lead acid, gel and lead calcium type batteries.

### **AC Wire Connections**

AC wire connections protect the charger with a circuit breaker at the main power panel. See Figure 1 to choose the proper circuit breaker and wire size. The ground connection is very important. Use the ground connection on the metal chassis.

### **DC Battery Connections**

Negative terminals - connect all battery negative terminals to the stud labeled "DC -" or "OV BAT."

Positive terminals - Connect the positive terminal of each battery to individual studs in the charger marked "BAT 1" or "BAT 2" or "BAT 3" (SM1210/2 and SM1220/2 have only two connections). Important: if there is only one battery, the positive lead must be connected to the charger terminal marked BAT 1 (for all chargers other than SM1210/2 and SM1220/2). For SM1210/2 and SM1220/2 use the first available positive DC terminal, marked BAT 2. Use ring terminals for all battery connections at the charger.

To avoid any television or radio interference, do not route the DC and antenna cabling together. Try to separate these cables as far as possible.

All wire insulation should be rated for 105°C. See Figure 2 to choose the proper DC output fuse and wire size.

Figure 1: AC Input Current, Input Fuse, Circuit Breaker and Wire Size

Model	AC Input Current		AC Input Fuse (Internal) Amps	Circuit Breaker Amps	Minimum Wire Size AWG
	115 V Amps	230 V Amps			
SM1210/2	2	1	3*	4	16
SM1220/2	4	2	6*	6	16
SM1220A/2	4	2	6*	6	16
SM1230/3	6	3	10**	10	14
SM1240/3	8	4	15**	15	14
SM1260/3	12	6	15**	20	12
SM1280/3	18	10	20**	30	10
SM12100/3B	20	N/A	2x16**	30	10
SM12100/3C	N/A	10	2x16**	30	10
SM12120/3C	N/A	12	15**	30	10
SM2415/3	5.6	2.8	10**	10	14
SM2430/3	11.2	5.6	15**	20	12
SM2450/3C	N/A	9.5	15**	20	12
SM2480/3C	N/A	15	2x16**	30	10
SM24100/50/3C	N/A	18	2x16**	30	10

\* Fuses are 5mm x 20 mm

\*\* Fuses are 1/4" x 1-1/4"

Figure 2: DC Output Current, Input Fuse, Circuit Breaker and Wire Size

Model	Output Fuse Amps	Distance - Charger to Battery	
		1 - 10 FT AWG	11 - 20 FT AWG
SM1210/2	15	10	8
SM1220/2	25	10	8
SM1220A/2	25	10	8
SM1230/3	2 x 20	6	4
SM1240/3	2 x 25	6	2
SM1260/3	3 x 30	4	1
SM1280/3	4 x 30	2	0
SM12100/3B	4 x 30	2	2/0
SM12100/3C	4 x 30	2	2/0
SM12120/3C	4 x 30	10	3/0
SM2415/3	25	12	10
SM2430/3	2 x 25	10	6
SM2450/3C	3 x 25	6	4
SM2480/3C	4 x 25	6	2
SM24100/50/3C	4 x 30	4	2

## Basic Operation Guide

**Warning:** It is vitally important that you read and understand the contents of this guide before using the equipment and you should keep it on your boat for future reference. If there are statements that you do not understand, contact Taylor Made Environmental for technical assistance before proceeding. Improper installation or operation of this charger could produce hazardous conditions, which could result in serious injury or death of the occupants and damage or destruction of the vessel.

Sentry SM battery chargers are built to the specifications set forth by the American Boat and Yacht Council (ABYC) and Underwriter's Laboratory (UL). Your responsibility is to understand the minimal safe operation of the charger as set forth in this guide and in the operating instructions and manual included. Read all warnings.

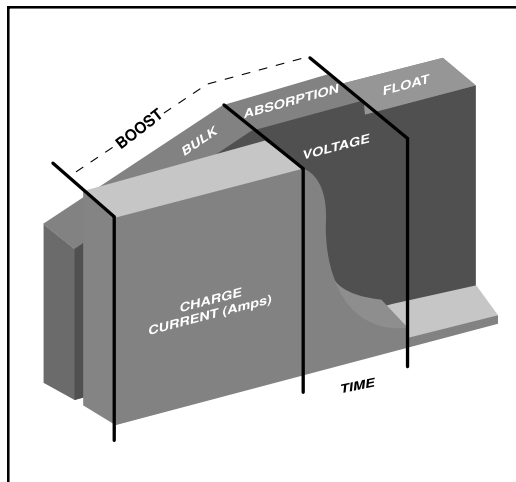
### ***Understanding the "SM Series Charger"***

The basic function of a marine battery charger is to convert the high voltage alternating current (AC), taken from shore electrical circuits or an onboard generator, to low voltage direct current (DC), which is suitable for charging the boat's batteries.

The Sentry switchmode chargers are designed for unattended operation. When current is requested or the battery needs charging, the Sentry SM Series charger responds with the required output. Its three stage operation was designed for maintaining system loads while charging the batteries as quickly as possible without endangering battery life.

### ***Three Stage Operation***

- **Bulk Stage** – This first stage is where a high current is sent to the battery until it reaches approximately 80% of full charge.
- **Absorption Stage** – This second stage is where the voltage level is maintained and current is reduced until the battery becomes 100% charged.
- **Float Stage** – This third stage is where the voltage is reduced and the current is reduced to maintain the battery. It will fulfill the requirements of internal discharge. This is not a "trickle charge," which can be as much as 1 amp in traditional chargers. This "float" gives only what the battery requires.



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### **Stage Transitions**

Float, Absorption, Bulk – Boost is part of the Bulk and Absorption states.

Float - Boost: Output  $\geq$  50%

Boost - Float: 20% < Output < 30%

### **Operating Temperatures**

14°F to 122°F

### **Tolerances**

Input Voltage 115/230 VAC - 15% to 10%

Input Frequency 50/60 Hz  $\pm$  10%

Output Voltage 12/24 VDC  $\pm$  1%

Minimum Battery Voltage -25%

### **Voltage Ripple**

2% Voltage Ripple

### **Efficiency**

12 VDC Charger: 75% - 80%

24 VDC Charger: 80% - 85%

### **Cooling Fan**

The internal cooling fan does not operate at all times. It is controlled by an internal thermostat which turns on the fan at 113°F and shuts the charger down at 185°F to protect the charger from high temperatures. These particular temperatures can not be judged by temperature of the engine room as the thermistor is located on one of the internal heatsinks of the charger which can increase in temperature due to high demands from the charger.

### **SM24100/50/3C**

This charger is somewhat different than the rest, in that it has the capability to charge at half of its rated output. Simply flip the toggle switch on the outside cover and the charger will resume its charging status.

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## **Operating Instructions**

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### **Energize The Charger:**

Turn on the circuit breaker for the charger at the main circuit breaker panel.

### **Functions of LED indicators:**

**On/Off** - LED "on" indicates power to unit. This is the only LED on SM1210/2 and



SM1220/2. A bright glow indicates the charger is active. A dim intermittent flash indicates charger is in a standby mode. \*If the charger is in parallel with another charging source (alternator or charger), and the other charging source is maintaining the system load, the standby mode may be indicated.

**Boost** - LED "on" indicates the charger is in the boost stage. LED "off" indicates the charger is in the Float stage. When the charger reaches the upper limit of the Boost stage, the "Boost" LED goes out, and one of the following occurs, depending on the load on the battery system:

- a) the green "On/Off" LED and/or "Boost" LED will flash (dim, intermittent) as the charger transitions slowly to the Float stage, which will be indicated by the "On/Off" LED glowing steadily, or,
- b) the green "On/Off" LED will glow steadily immediately. The charger system will revert to Boost when the battery system requirements equal 50% of the charger rated output.

**Charger Fault** - LED lights steadily - indicates a fault in the charger AC circuit. See the troubleshooting guide.

**Temp Fault** - LED lights steadily - temperature in charger or engine room is too high. Charger will turn off, reset, and restart. See the troubleshooting guide.

**DC Fuse Fault** - LED lights steadily - DC fuse is blown and/or output terminals are reversed. See the troubleshooting guide.

**\* Secondary Charging Source Detection (Alternator, etc.)**

Prior to July 1998 [Before July 1998 all chargers operated as described below.]

- Detection Source is located on DC+1 only. The charger will go into its standby mode when the secondary source's voltage is higher than that of the charger. This standby mode shuts down all DC+ outputs.
- The following models still operate in this manner: SM1230, SM1240 and SM2415

July 1998 to Present

- This detection technique operates the same as described above except DC+2 and DC+3 still have the capability of maintaining system loads.
- Only the following models were affected by this change: SM1210, SM1220, SM1260, SM1280, SM12100, SM12120, SM2430, SM2450, SM2480, and the SM24100.

If there are any questions concerning the Secondary Charging Source Detection please contact Taylor Made Environmental.

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## Maintenance

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Little maintenance is required for your Sentry SM charger. It is very important to keep the charger dry, and the electrical connections secure. Understanding proper battery maintenance is also important.

**Warning:** The guidelines on the reverse side are given for the various types of maintenance and repairs which can be performed by the owner. All other repairs should be performed only by an authorized Taylor Made Environmental Sentry service representative. Always de-energize the charger by turning off its AC power supply at the main circuit breaker panel before removing the charger cover when performing maintenance or repairs.

**Danger:** Electrical shock hazard exists under the cover of the battery charger. Turn off breaker at main power panel. Wait three minutes after turning off charger before opening cover.

### **Troubleshooting**

**NOTE:** If the same problem continues after taking a suggested action, contact the Service Department or an authorized representative for assistance.

**SYMPTOM:** Charger will not charge and the "On/Off" LED is off.

**Action:**

- 1) The AC circuit breaker may be off at the main power panel. Check the breaker.
- 2) AC fuses may be blown. Fuses may blow due to electrical overvoltage (surges). Check the internal AC fuse. Replace according to the AC fuse chart, Fig 1 in Installation Instructions.
- 3) The 115V/230V selector wire, inside the charger, may be set incorrectly. Check and reset, if necessary. Caution: If the selector wire is on 115 VAC and 230 VAC is applied the charger **will be damaged**.

**SYMPTOM:** The "On/Off" LED (green) is dim and intermittent. [Temperature fault light may flash intermittently] (All SM chargers except SM1210/2 and 1220/2)

**Action:**

- 1) The charger has detected a secondary charging source in the circuitry and has gone into its "Standby Mode." Once the secondary charging source's voltage level has dropped to a value less than the output of the charger, normal operation should begin.
- 2) The optional temperature sensor may be improperly connected. Check for firm connections.
- 3) The resistor (2K ohm, .25W) at the temperature sensor terminal strip on the charger power board is missing or improperly connected. Check; replace or reconnect, as necessary.

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- 4) One battery bank is severely discharged. The battery charger cannot start its cycle. Start the engine to take advantage of the engine alternator for a short period of time; or, if there are two batteries, move battery selector switch to "BOTH." Charge in this position for ten minutes, then move the battery selector switch to the battery of concern.

**SYMPTOM:** The "On/Off" LED (green) is bright and pulsing (SM1210/2 only).

**Action:**

- 1) The battery banks may not be connected. Check for connections.
- 2) The battery terminals may be dirty. Check and clean, if necessary.
- 3) The battery connections are reversed. Check, reattach if necessary.
- 4) The output (DC) fuses are blown. Replace fuses according to the DC fuse chart.
- 5) One battery bank is severely discharged  $\geq 25\%$ . The battery charger cannot start its cycle. Start the engine to take advantage of the engine alternator for a short period of time; or, if there are two batteries, move the battery selector switch to "BOTH." Charge in this position for ten minutes, then move the battery selector switch to the battery of concern.

**SYMPTOM:** The "On/Off" LED does not light, but the charger produces output current and voltage.

**Action:**

The cable between the power board and the display may have a fault or be improperly connected. Inspect. Call the factory or contact an authorized dealer if a replacement is required.

**SYMPTOM:** The "DC Fuse Fault" LED (red) lights steadily and "On/Off" LED is intermittent (dim).

**Action:**

- 1) Output connections may be reversed. Check, correct, if necessary.
- 2) The output (DC) fuses may be blown. Check, replace, if necessary. Use the DC fuse chart for selection.
- 3) The charger has lost its connection on "BAT 1" and/or "DC- or 0 Volt". Check connections.
- 4) The battery terminals may be dirty. Check and clean, if necessary.

**SYMPTOM:** The "Temp Fault" LED (red) lights steadily.

**Action:**

The internal temperature of the charger may be too high. NOTE: the charger will sense high temperature, revert to standby mode, wait for temperature to decrease, reset and restart automatically. Causes:

- 1) The temperature of the engine room is high. Let the temperature decrease.
- 2) The fan on the charger (there is no fan on the SM1210/2) may be broken. If the charger turns "off" every five minutes, it is a possible indication that the fan is not operating. Contact Taylor Made Environmental.



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**SYMPTOM:** The “Charger Fault” LED (red) flashes.

**Action:**

- 1) The control circuit may be faulty. Call Taylor Made Environmental.
- 2) The input voltage may be too high. The charger will shut down until a normal voltage level is present.
- 3) There is a short circuit in the optional temperature sensor or a temperature sensor wire (there are two) is shorted. Check. If the sensor is shorted, call Taylor Made Environmental.



# WARNING

Taylor Made Environmental, Inc. (TME) manufacturers of Cruisair, Grunert, Marine Air, Sentry and Tundra Products, makes the following safety warnings concerning the application, installation, use and care of its products. Although these warnings are extensive, there may be specific hazards which may arise out of circumstances which we have not outlined herein. Use this as a guide for developing an awareness of potential hazards of all kinds. Such an awareness will be a key factor in assuring your SAFETY and comfort.

**ELECTRICITY** - Many TME products operate on 115, 230 or 440 volt AC power. Such voltages can be LETHAL; therefore, the chassis, cabinets, bases, etc., on all components must be grounded together and connected to the vessel's grounding system. Sparks can occur as switches, thermostats and relays open and close in the normal operation of the equipment. Since this is the case, ventilating blowers for the removal of hazardous fumes or vapors should be operated at least 5 minutes before and during operation of any TME product or group of TME products. All electrical connections must be covered and protected so accidental contact cannot be made by persons using the equipment, as such contact could be LETHAL.

**ELECTROLYSIS** - Electrical leakage of any component can cause electrolytic deterioration (electrolysis) of thru-hull components which could result in leakage serious enough to sink a vessel which could result in loss of life. All TME components must be kept clean and dry and checked periodically for electrical leakage. If any electrical leakage is detected, the component should be replaced or the fault causing the leakage corrected before the component is put back into service.

**GAS** - CRUISAIR, MARINE AIR and GRUNERT components utilize R134a refrigerant, tetrafluoro-ethane or R404A, R125/R143a/R134 (44%/52%/47%) which are non-toxic, non-flammable gases; however, these gases contain no oxygen and will not support life. Refrigerant gas tends to settle in the lowest areas of the compartment. If you experience a leak, evacuate all personnel, and ventilate area. Do not allow open flames in the area of leaks because refrigerant gas, when burned, decomposes into other potentially LETHAL gases. Refrigerant components operate at high pressure and no servicing should be attempted without gloves, long-sleeved clothing and eye protection. Liquid refrigerant gas can cause severe frost burns to the skin and eyes.

**VENTILATION** - To cool or heat air, CRUISAIR, MARINE AIR and GRUNERT components are designed to move air through a heat exchanger by a blower or propeller fan. This design necessarily produces a suction on one side of the air handling component and a pressure on the other side. Air handling components must be installed so that the suction-pressure action does not: (1) pressurize an area to the extent that structural failure occurs which could cause harm to occupants or bystanders, or (2) cause a suction or low pressure in an area where hydrogen gas from batteries, raw fuel vapor from fuel tanks, carbon monoxide from operating propulsion engines, power generators or heaters, methane gas from sewage holding tanks, or any other dangerous gas or vapor could exist. If an air handling unit is installed in such a manner that allows potentially lethal gases or vapors to be discharged by the air handling unit into the living space, this could result in loss of life.

Maximum protection against the introduction of dangerous gases or vapors into living spaces can be obtained by providing living spaces which are sealed from all other spaces by use of airtight bulkheads and decks, etc., and through the introduction of clean air into the living space. Bear in mind that the advent of air conditioning, whether it be for cooling or for heating, naturally leads to the practice of closing a living space tightly. Never close all windows and doors unless auxiliary ventilating systems, which introduce clean outside air into the living space, are used. Always leave enough window and door openings to provide adequate ventilation in the event potentially lethal gases or fumes should escape from any source.

**CONDENSATE** - All cooling units produce water condensate when operating on the cooling cycle. This water must be drained from the cooling unit overboard. If condensate is allowed to drip on a wooden structure, rotting or decay and structural failure may occur which could result in loss of life. If condensate is allowed to drip on electrical components, deterioration of the electrical components could result in hazardous conditions. When an air conditioning system is in operation, condensate drains may be subjected to negative pressure. Always locate condensate drains as far as possible from points where engine waste and other dangerous gases are exhausted so no such dangerous gases can be drawn into the condensate drains.

## Warning

Never sleep in a closed area on a boat when any equipment, which functions as a result of the combustion of a volatile fuel, is in operation (such as engines, generators, power plants, or oil-fired heaters, etc.) At any time, the exhaust system of such devices could fail, resulting in a build-up of LETHAL gases within the closed area.

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English



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