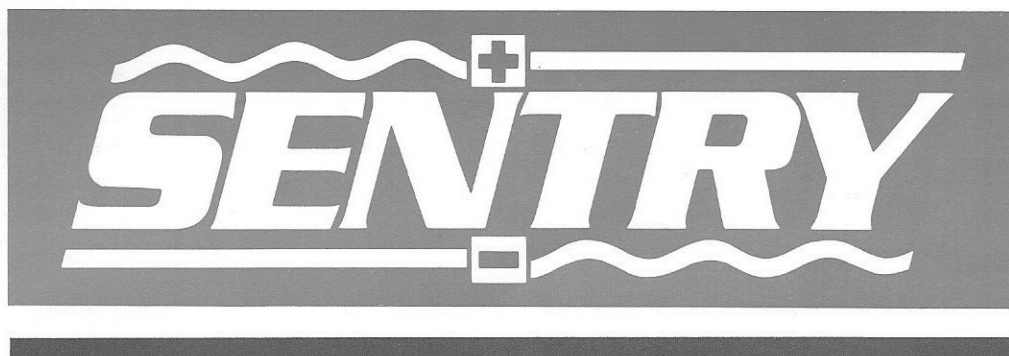


Operation

Maintenance

Installation



Marine Battery Chargers  
Series C/D

## **WARNING**

This manual contains essential safety information concerning the operation, installation and maintenance of Sentry Battery Chargers. It is vitally important that you read and understand the contents of this manual thoroughly before using the equipment, and it should be kept on board your vessel for future reference. If there are any statements in this manual that you do not understand, contact Marine Development Corporation for technical assistance before proceeding.

Improper installation or operation of Sentry Battery Chargers could produce hazardous conditions, which could result in serious injury or death of the occupants and damage or destruction of the vessel.

# Table Of Contents

Warning . . . . .	1
Operating Instructions . . . . .	4
Installation Instructions . . . . .	5
Your Sentry Battery Charger and How it Works . . . . .	7
Owner Maintenance . . . . .	10

# List of Illustrations

Figure 1. Series C Sentry Battery Charger . . . . .	3
Figure 2. How to Interpret your Sentry Model Number . . . . .	3
Figure 3. Series D Sentry Battery Charger . . . . .	3
Figure 4. Mounting your Sentry Charger . . . . .	5
Figure 5. Wiring Gauge and Grade . . . . .	5
Figure 6. AC and DC Connections (Drawing) . . . . .	5
Figure 7. AC and DC Connections (Photo) . . . . .	5
Figure 8. Ignition Cut-Off . . . . .	6
Figure 9. 12 V Remote Panel Connections . . . . .	6
Figure 10. 32 V Remote Panel Connections . . . . .	6
Figure 11. Simplified Block Diagram . . . . .	7
Figure 12. External Components . . . . .	7
Figure 13. Internal Components . . . . .	8
Figure 14. Typical Internal Wiring Diagram . . . . .	9
Figure 15. Fuse and Breaker Chart . . . . .	11
Figure 16. Control Circuit Calibration . . . . .	11
Figure 17. Schematic Drawings . . . . .	12

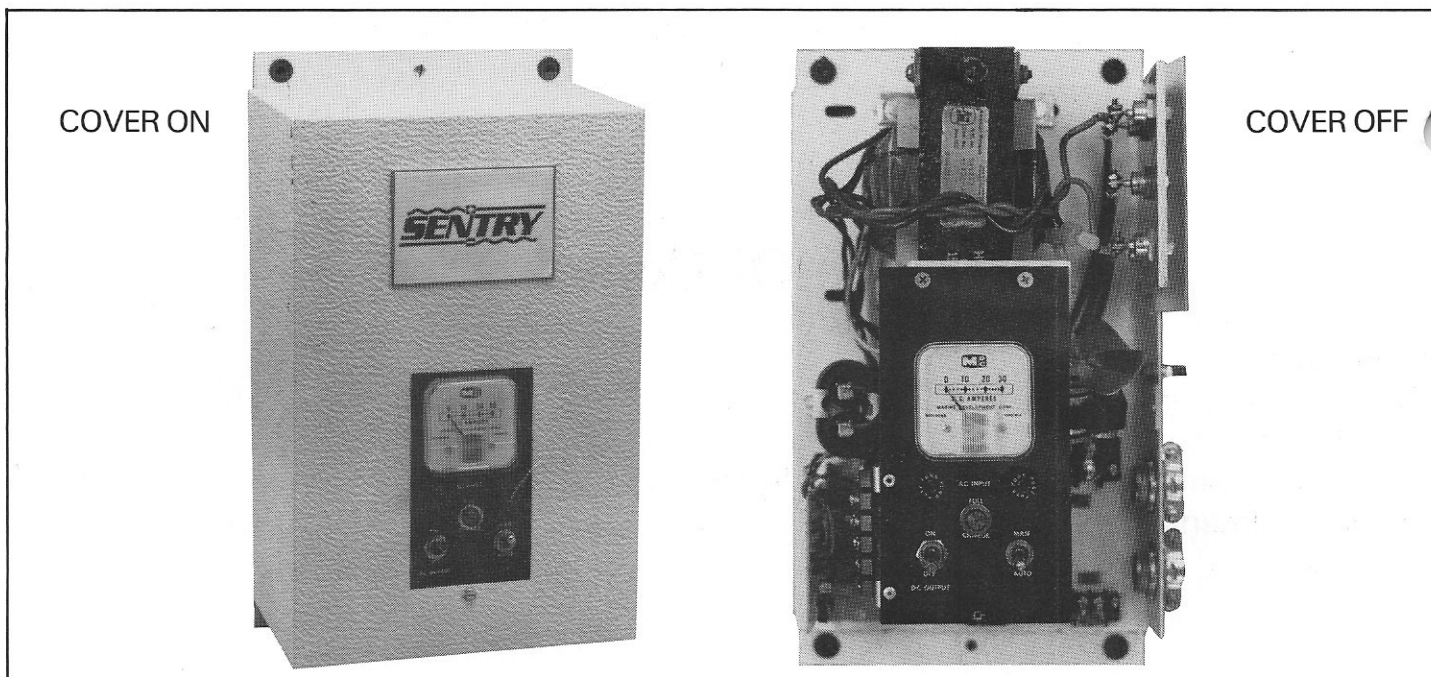


Figure 1. Series C Sentry Battery Charger.

Sentry model numbers provide important information about the type and configuration of each charger. The diagram below shows the meaning of this coded information.

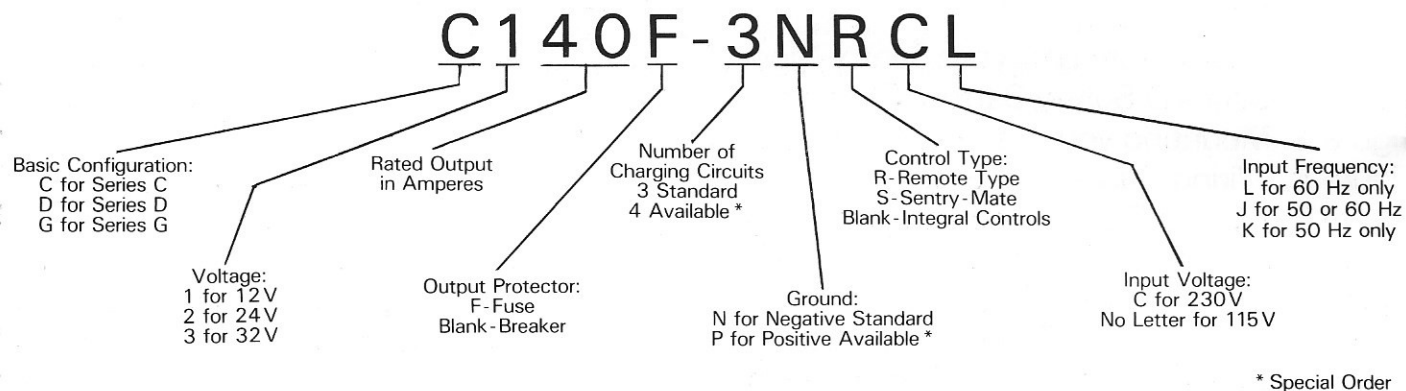


Figure 2. How to Interpret your Sentry Model Number.

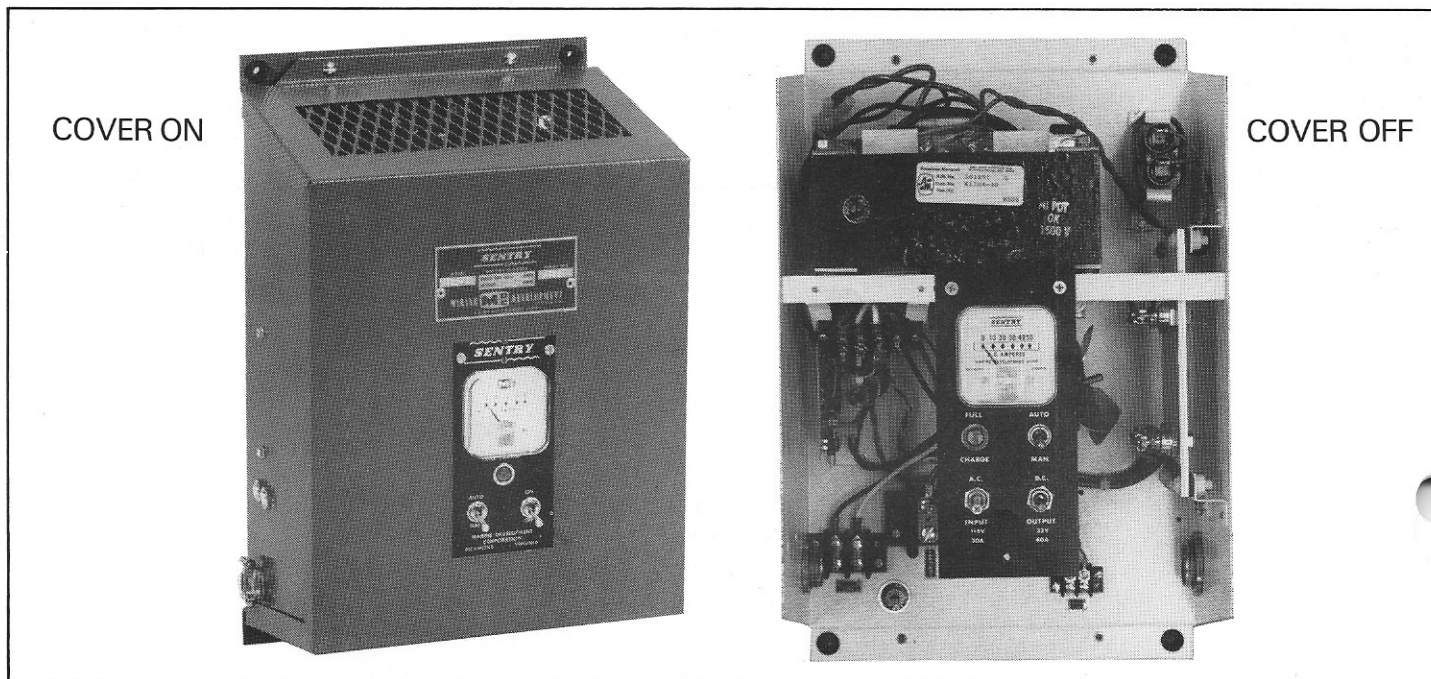


Figure 3. Series D Sentry Battery Charger.

# OPERATING INSTRUCTIONS

Sentry battery chargers are designed for fully automatic operation. Normally, once you have turned the charger on, you will not need to turn it off at all except for routine maintenance.

**The following is a step-by-step sequence of system operation.**

1. Turn on the vessel's circuit breaker for the line to which the Sentry charger is connected.
2. If your charger has a DC circuit breaker, make sure it is on. If not, reset. Note that some Series C and Series D chargers are equipped with fuses instead of DC circuit breakers.

## CAUTION

The DC circuit breaker on the face of your Sentry charger is not meant to be used as an "on-off" switch. If you wish to disconnect the power to the charger for any reason, this should be done on your AC circuit breaker panel.

3. Set the automatic/manual selector switch to "automatic".
4. Check the full-charge indicator light. If it is not lit, observe the ammeter, which should indicate the rate of charge to the batteries. If it is lit, the ammeter should read zero.
5. If your charger is a remote-panel model, the ammeter automatic/manual selector switch and the full-charge indicator light are located on the remote panel. Only the fuses or circuit breakers will be found on the main unit itself.
6. If your charger is a Sentry-Mate model, an automatic/manual selector switch is found both on the Sentry-Mate panel and the face of the charger. The Sentry-Mate panel also contains a voltmeter to indicate the condition of the batteries and a battery selector switch, which allows you to select which bank of batteries is monitored and used as control bank.

## CAUTION

Use of the "manual" setting is only recommended for short times, to give extra charge. The unit should remain in automatic at all other times. Overuse of the manual setting can result in overcharging and dehydrating your batteries.

# INSTALLATION INSTRUCTIONS

## WARNING

Owners should not attempt to install Sentry battery chargers without guidance from the factory. Whenever possible, the equipment should be installed by an authorized Sentry service representative.

1. Select a dry, well-ventilated area, near, but not above batteries. Mount in a vertical position, to create a natural ventilation for cooling the unit. Note that the wire connections are at the bottom of the unit. Leave at least three (3) inches clearance above and below the unit for proper ventilation. **See Figure 4.**

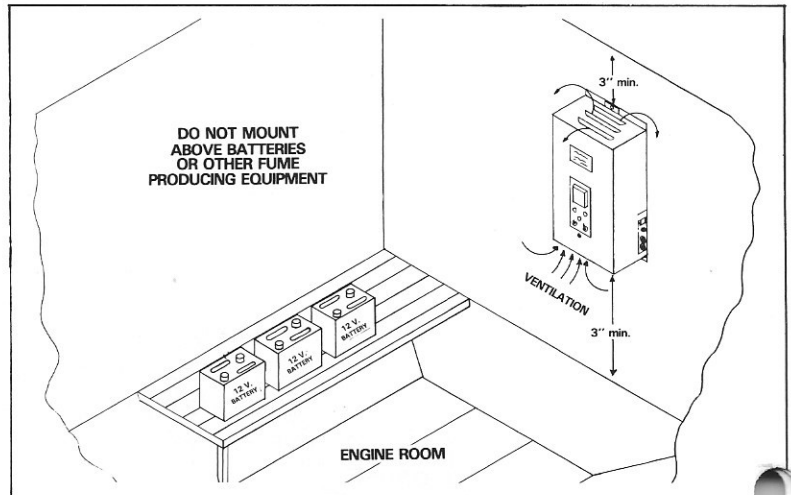


Figure 4. Mounting Your Sentry Charger.

2. Make AC connections. All Sentry chargers except 115V D330 models require #14 AWG wire with 105 °C insulation for use on AC connections and should be protected by a 15 AMP circuit breaker or time delay fuse. On 115V D330 models use #12 AWG wire with 105 °C insulation protected by a 20 AMP circuit breaker or time delay fuse. Wire terminations should be locking forks or ring terminals. **See Figures 6 and 7.**

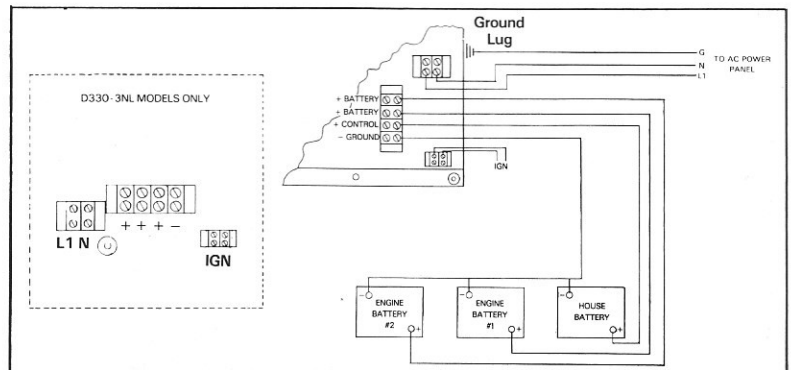


Figure 6. AC and DC Connections. (Drawing)

Distance From Sentry to Batteries	0-10 Feet	10-25 Feet
C120	#10 AWG	#8 AWG
C220	10	8
D330	8	6
C140	6	4

For distances over 25 feet consult factory.

Figure 5. Wiring Gauge & Grade.

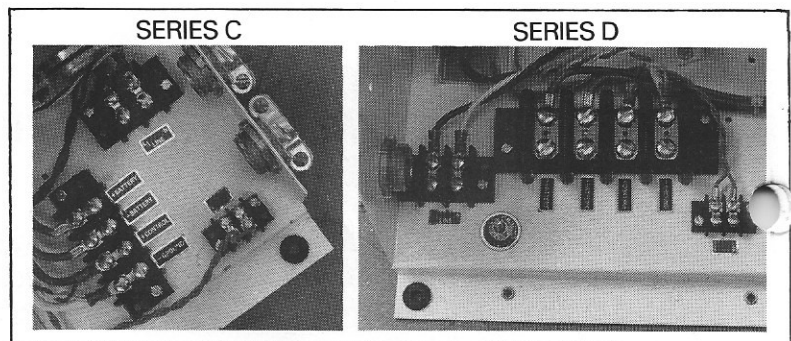


Figure 7. AC and DC Connections. (Photo)

## WARNING

Although Sentry chargers are designed to minimize the danger of the unit case and other metal components from becoming electrically charged, good safety practice demands that the unit case be grounded. Marine Development Corporation considers any ungrounded electrical equipment to be potentially hazardous and strongly recommends that you ground the case of the Sentry charger with 14 AWG or larger wire.

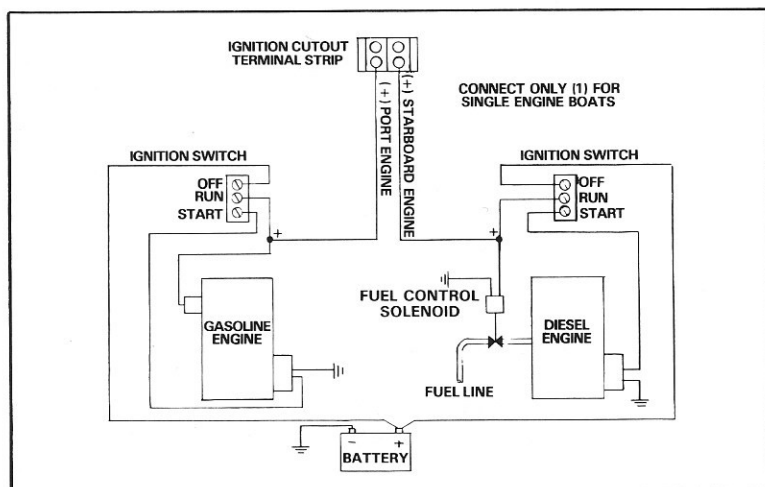


Figure 8. Ignition Cut-Off.

3. Make DC connections. Connect the positive terminal of the battery with the most load at dockside to the terminal labeled “+ CONTROL”. Connect negative terminals of all batteries to the common negative terminal labeled “- GROUND”.

4. Connect ignition cut-off, if desired. This is accomplished by connecting either or both of the ignition cut-off terminals to the positive output terminal of the ignition switch or the positive terminal of the fuel supply solenoid for the main engine. Use # 16 AWG or larger wire with 105° C insulation and terminate with locking forks or ring terminals. **See Figure 8.**

5. (Remote-Panel models only) Connect remote panel as shown in **Figure 9 or 10.**

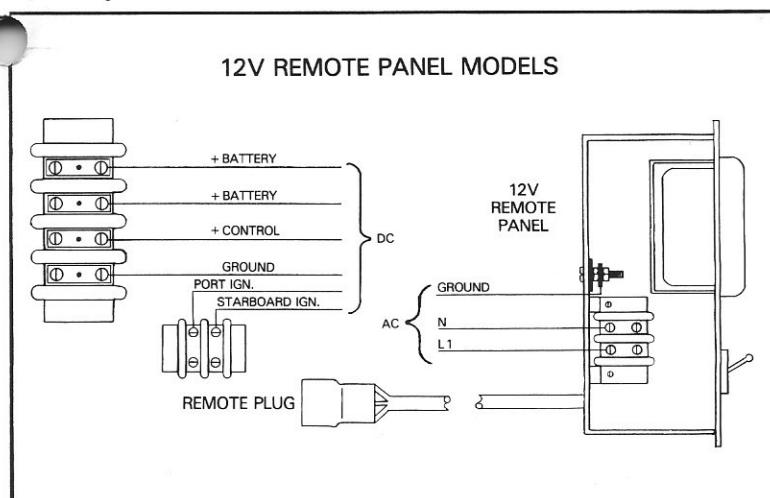


Figure 9. 12V Remote Panel Connections.

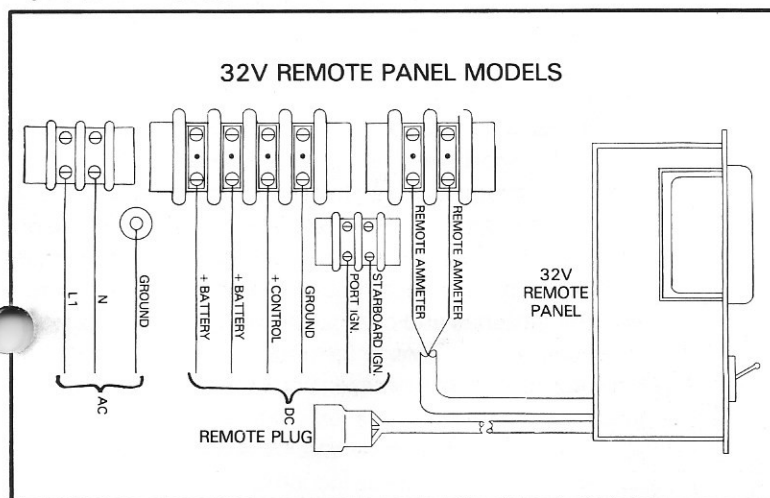


Figure 10. 32V Remote Panel Connections.

## IMPORTANT

Sentry Chargers are designed and calibrated specifically for marine grade deep cycle lead acid batteries. If you plan to use any other types of batteries, please contact the factory or an authorized Sentry representative first.

# YOUR SENTRY BATTERY CHARGER AND HOW IT WORKS

## FUNDAMENTALS OF BATTERY CHARGERS

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.

This is a two-step process. First, the 120 or 240 volt AC power is lowered to match the boat's DC voltage (typically 12, 24 or 32 volts). This is accomplished by a device called a transformer. Second, the reduced alternating current (AC) must be converted to direct current (DC). This is done by a device called a rectifier. See Figure 11.

Once the power source is reduced to a compatible voltage and rectified to the DC format, the power can be applied to the battery, allowing it to charge.

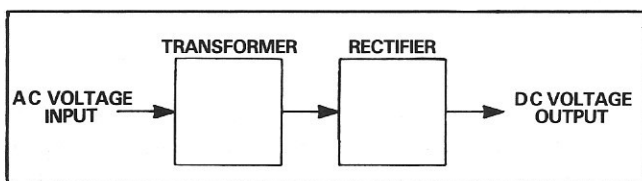


Figure 11. Simplified Block Diagram.

## EXTERNAL COMPONENTS

The following is a description of the functions of the switches, indicators and other external components of your Sentry battery charger. See Figure 12.

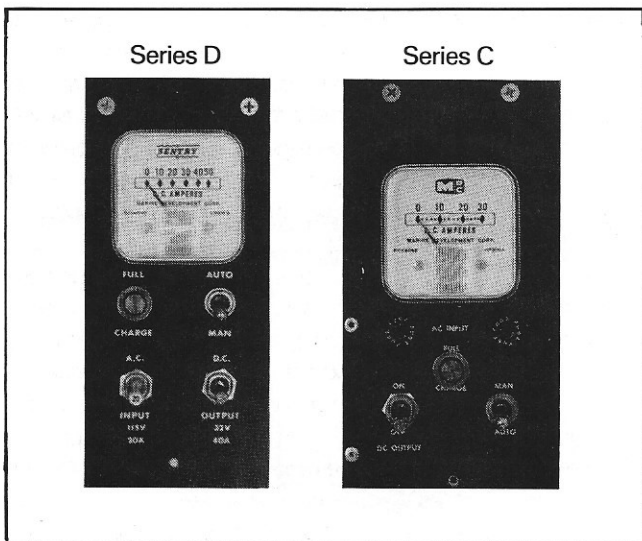


Figure 12. External Components.

**CONTROLS.** Since Sentry chargers are designed for fully automatic operation, the only user control on the face of the unit is the **automatic/manual** selector switch. This is normally placed in the "automatic" position and should only be switched to "manual" for brief periods

when continuous uninterrupted charging is desired. **CAUTION: DO NOT LEAVE IN MANUAL POSITION FOR LONG PERIODS OF TIME. THIS COULD DEHYDRATE AND DAMAGE YOUR BATTERIES.**

**INDICATORS.** There is one light and an ammeter on the front panel of the standard Sentry charger. The **ammeter** indicates total current flow to the batteries. The **full-charge** light is off when the unit is charging and on when the batteries reach full charge, as long as the **Automatic/Manual** selector switch is set in "automatic." Note that the **full-charge** light turns off when the charger is in the manual mode. The optional Sentry-Mate panel also has a **Battery Condition Indicator**, which shows the terminal voltage.

**FUSES AND CIRCUIT BREAKERS.** The **AC input fuses** protect the charger and wiring from AC overloads. Series C and D chargers use either **DC Circuit Breakers** or **DC Output Fuses** for protection against DC overloads. Note that fuses are required for these models to achieve full ignition protection.

**REMOTE PANELS (OPTIONAL).** Remote panels contain an ammeter, automatic/manual selector switch and full charge light. AC input and DC output breakers or fuses remain on the face of the charger itself. Remote panels must be specified at the time you order the basic charger, since special models are necessary to support the Remote-Panel option.

## INTERNAL COMPONENTS

The following is a description of the basic internal components of Sentry battery chargers. See Figure 13.

**TRANSFORMER.** Sentry battery chargers use a ferro-resonant transformer, which has two secondary coils, one of which is connected to a capacitor. The capacitor and the secondary coil "resonate" at a specific frequency, in much the same way a violin string and sounding box of the violin resonate together. When too much or too little voltage is applied, this resonance is upset, and the transformer corrects itself, thus leaving the secondary voltage stable. Thus, the transformer compensates for incorrect dock-side input voltages, thereby protecting the batteries and charger from high or low voltage. In addition, the Sentry ferro-resonant transformer inherently regulates its current output to the needs of its load.

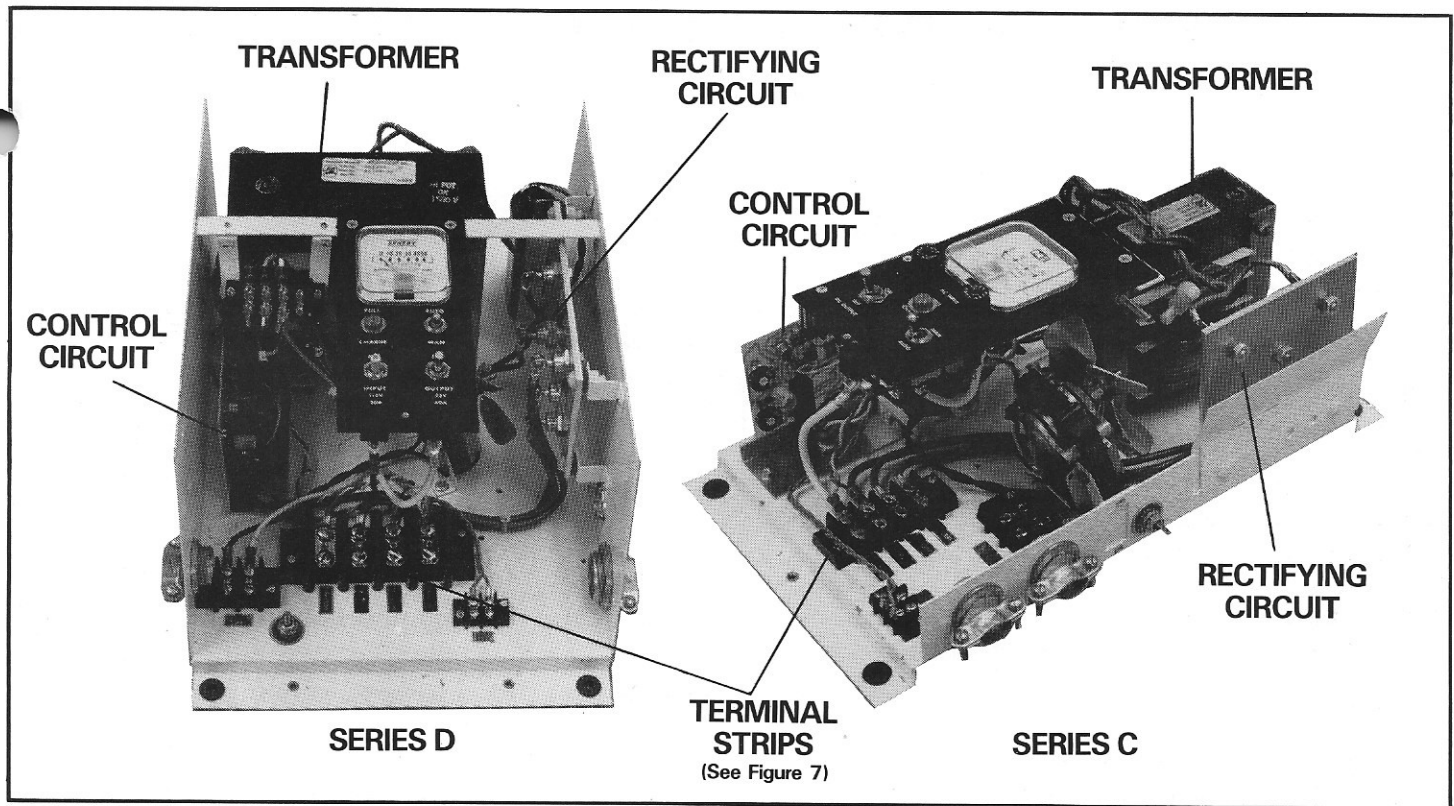


Figure 13. Internal Components.

**RECTIFYING CIRCUIT.** Sentry rectifying circuits convert AC power to DC power, and also supply current to up to three separate banks of batteries. This is accomplished by a series of blocking diodes and rectifying diodes. A heat sink is incorporated to dissipate heat from the diodes, and to serve as an output power divider.

**CONTROL CIRCUIT.** The control circuit monitors the voltage of one bank of batteries, normally the bank which carries the most load at dockside, and turns the charger on and off according to its requirements. The Sentry control circuit switches the output current completely off when the batteries reach full charge, provided that the automatic/manual switch is set for "automatic" operation. There is no output trickle to dehydrate or "boil" water out of the batteries.

**OTHER INTERNAL COMPONENTS.** Other components include a cooling fan, which bathes the heat sink and transformer with fresh air; terminal strips, which are used to make all electrical connections; an ignition cut-off circuit, which de-energizes the unit automatically when the engines are started to minimize the possibility of damage to the alternator or generator regulators.

#### FUNCTIONAL SEQUENCE

The internal wiring connections of your Sentry battery charger are illustrated in **Figure 14**. Also see the schematic drawings in **Figure 17**.

The AC input line voltage is fed first through a pair of fuses to the automatic/manual selector switch, as well as

to the ignition proof solid-state control circuit. The control circuit passes the AC power either to the transformer or to the full-charge indicator light. When the automatic/manual switch is in the "automatic" position, the switch is open, and the AC power is fed only to the control circuit, which feeds the AC power either to the transformer or to the full-charge indicator light. At the transformer, the line voltage AC power is reduced to a constant or stabilized low AC voltage and is then fed to the rectifying diodes in the heat sink. From there, full-wave rectified DC power is fed through an ammeter and through fuses or circuit breakers to the batteries to be charged. Blocking diodes are used to provide isolation between connected banks of batteries. The control circuit automatically responds to changes in terminal voltage to keep the battery at peak charge. When the control circuit senses a low terminal voltage, the transformer is energized and the full-charge indicator light switches off. This produces a DC output that starts to charge the battery at full output capacity. As the battery charges, the terminal voltage rises. This produces greater back EMF on the charger, and the charger output tapers back correspondingly. When the battery terminal voltage reaches the control circuit's "drop-out" or "turn-off" voltage, the charge rate is 5-15% of the rating of the charger. At this point, the electronic control circuit de-energizes the transformer, and the full-charge indicator light comes back on.

When the automatic/manual switch is in the "manual" position, the switch is closed. The control circuit is bypassed, and the AC power is fed directly and continuously to the primary coil of the transformer.

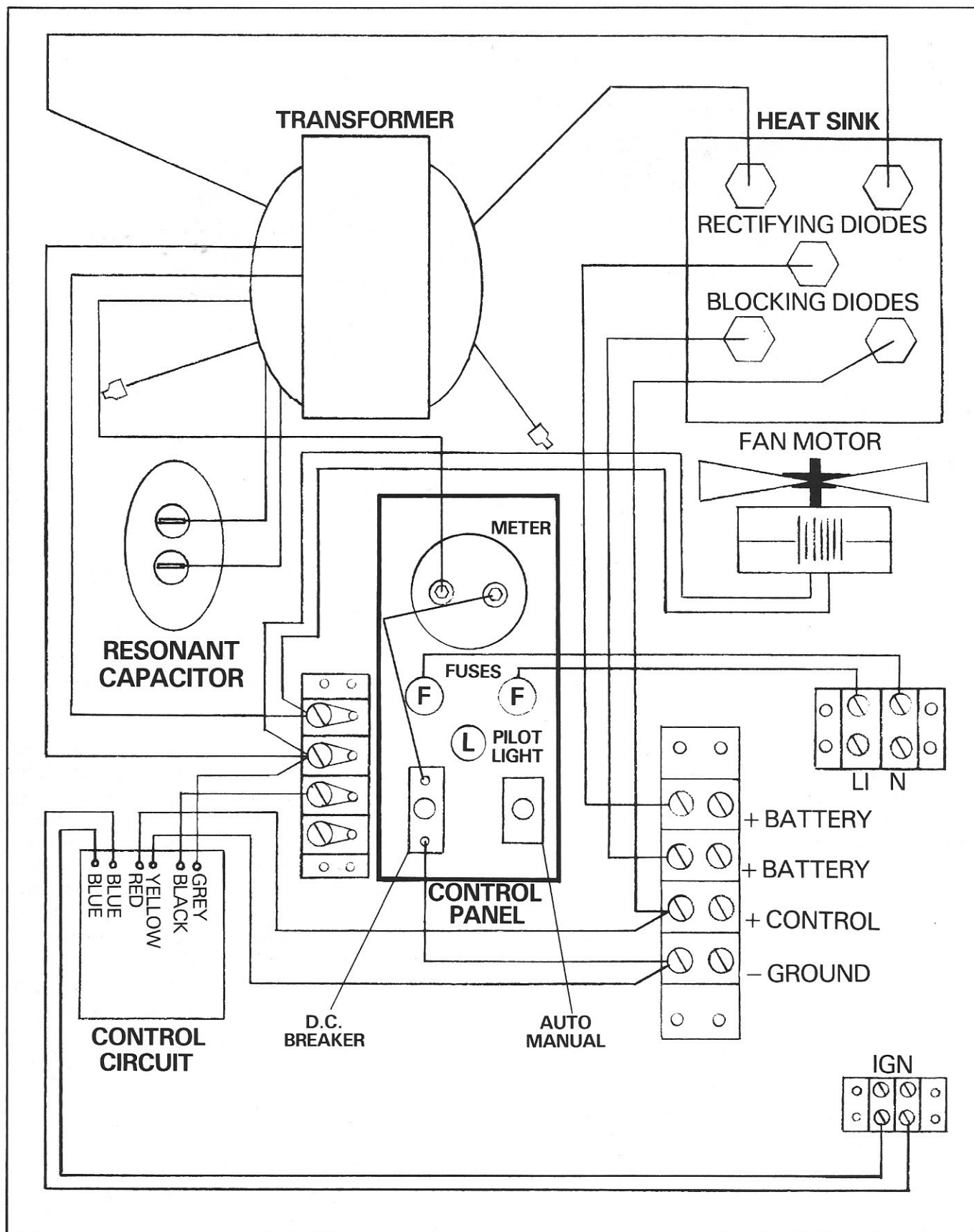


Figure 14. Typical Internal Wiring Diagram.

# OWNER MAINTENANCE

## WARNING

The following guidelines are given for various types of maintenance and repairs which can be performed by the owner. All other repairs should only be performed by an authorized Marine Development Corporation service representative.

**SYMPTOM :** The AC fuse is blown.

**ACTION:** Fuses may occasionally blow due to electrical overvoltage surges when other equipment is turned off and on or when shifting between ship and shore power. Fuses may be replaced as necessary. Refer to **Figure 15, Page 11**. If the problem persists, contact the factory or an authorized service representative for assistance.

**SYMPTOM:** The charger will not charge in the manual or automatic position, and the ammeter shows no current.

**ACTION:** The DC circuit breaker may be off, or the fuses may be blown. Check and reset or replace, as needed. Consult the fuse chart in **Figure 15, Page 11**, for replacement fuse sizes. If fuses continue blowing or the circuit breaker keeps tripping, contact the factory or an authorized service representative.

**SYMPTOM:** The charger turns on or off too soon or too late.

**ACTION:** The battery terminals may be loose or dirty. Clean and tighten terminals. The control circuit may be out of calibration, see calibration procedures, in **Figure 16, Page 11**. If this doesn't correct the problem, contact the factory or an authorized service representative for assistance.

**SYMPTOM:** The charger will not charge, but the transformer is humming.

**ACTION:** The battery terminals may be loose or dirty. Check and clean or tighten if necessary. The DC circuit breaker may be tripped. If so, reset. If these steps do not work, contact the factory or an authorized service representative.

**SYMPTOM:** The full-charge lamp will not light, but the charger turns off and on properly.

**ACTION:** The lamp is probably defective. Replace lamp.

**SYMPTOM:** The charger does not turn off, and the ammeter shows that it is still charging.

**ACTION:** You may have left the automatic/manual selector switch in the "manual" position. If so, switch it back to "automatic." Check the battery terminals for loose or dirty connections, and tighten or clean as necessary. Check for a dead or shorted cell in the battery, and replace the battery if needed. The control circuit may be out of calibration, see calibration procedures in **Figure 16, page 11**. If these steps do not solve the problem, contact the factory or an authorized service representative.

## WARNING

Always de-energize the charger by turning off its AC power supply at the boat's main circuit breaker panel before removing the charger cover or attempting to repair the charger.

## CAUTION

The listed fuses and breakers insure the safety and performance of the battery charger. Do not use any other without written authorization from MDC.

MODELS	AC INPUT FUSE	DC OUTPUT BREAKER	DC OUTPUT FUSE
C120-3NL	AGX10	30	
C120-3NRL	AGX10	30	
C120-3NSL	AGX10	30	
C120F-3NL	AGX10		30
C120F-3NSL	AGX10		30
C140-3NL	AGX10	50	
C140-3NCL	AGX10	50	
C140-4NL	AGX10	50	
C140-3NRL	AGX15	50	
C140-3NSL	AGX15	50	
C140F-3NL	AGX15		50
C140F-4NL	AGX15		50
C140F-3NRL	AGX15		50
C220-3NL	AGX15	30	
<b>AC BREAKER</b>			
C140-3NJ	20	50	
C140-3NCJ	7	50	
D330-3NL	20	40	
D330-4NJ	20	40	
D330-3NRL	20	40	
D330-3NRJ	20	40	

Figure 15. Fuse and Breaker Chart.

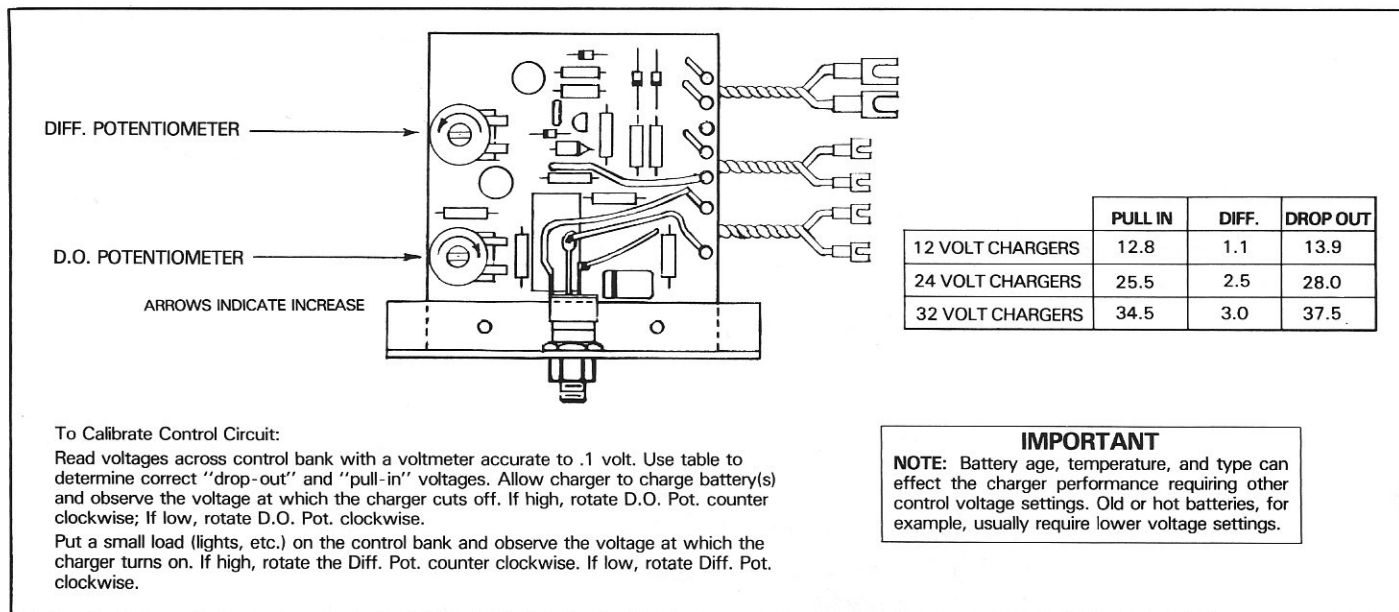


Figure 16. Control Circuit Calibration.

