



**Model SX100-1
Automatic Battery Charger**

User's Manual

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OPTIMIZER
THE EXTREME BATTERY CHARGER™

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IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS - This manual contains important safety and operating instructions for the Model SX100-1 Battery Charger (OPTIMIZER). Before using the battery charger, please read all instructions and cautionary markings on the battery charger, the battery, and the product using the battery.

CAUTION - To reduce the risk of electric shock:

- Do not expose unit to rain or moisture - use indoors only.
- Do not remove cover. There are no user serviceable parts inside. Refer service to qualified service personnel.
- Connect the battery charger directly to a grounding receptacle. An adaptor should not be used with this unit. This unit is equipped with a power cord having an equipment grounding conductor and a grounding plug (3-prong). The plug must be plugged into an outlet that has been properly installed and grounded in accordance with all local and national codes and ordinances.
- Disconnect charger from AC power and battery before attempting any maintenance or cleaning. Turning off controls may not reduce this risk.

WARNING

- Do not attempt to recharge non-rechargeable batteries. Charge only sealed or valve regulated, lead-acid, non-automotive, maintenance free rechargeable batteries. Attempting to charge other types of batteries may result in personal injury and battery damage.
- The enclosure will become hot during the charge cycle - DO NOT TOUCH!

DANGER - Never alter power cord or plug provided. If it will not fit the outlet, replace the power cord with one having the correct plug or have a proper outlet installed by an electrician. Improper connection will result in the risk of an electric shock or fire.

Make sure cords are located so that they will not be stepped on, tripped over, or otherwise subjected to damage or stress. Do not operate this unit with a damaged cord or plug - replace them immediately. To reduce the risk of damage to electric plug, pull by plug rather than cord when disconnecting unit.

Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way. Do not disassemble charger; incorrect reassembly will result in the risk of an electric shock or fire. Refer service to qualified service personnel.

Recharge batteries in well ventilated areas to prevent build-up of explosive gases.

Allow space around unit and adequate air circulation to reduce internal heat buildup. Do not place objects on top of the charger or restrict the airflow through the charger and do not operate in a small, enclosed space.

INTRODUCTION

The OPTIMIZER has the best interests of your battery in mind. It is a high quality charger designed with efficient and reliable switching technology for recharging Sealed Lead-Acid (SLA) batteries. It is a true constant current charger with precision constant voltage regulation.

With a custom programmed microcontroller, the charger is fully automatic with an adaptive charge algorithm that will prevent overcharging or undercharging your batteries. The most widely recommended charge algorithm by battery manufactures is the 3-stage charge algorithm. This algorithm has two-stage constant voltage and the current is limited to the maximum specified. The OPTIMIZER uses an adaptive 3-stage algorithm that scales the time spent in the absorption stage to the time spent in the bulk stage. This helps prevent the battery from being undercharged or overcharged. A major benefit of the 3-stage charging algorithm is that you don't have to worry about undercharging your battery if the application switches from stand by to cyclic; nor do you have to worry about overcharging your battery in standby applications. In standby applications the battery will be charged, topped-off, and maintained. In cyclic applications the absorption charge will help ensure a complete charge and prevent chronic undercharging, a leading cause of premature battery failure. The OPTIMIZER also implements a light conditioning charge to ensure the battery is in good condition and is able to accept a full current charge. There is also an optional equalize charge stage, entered after the bulk charge and absorption charge stages, that allows the battery to be more quickly charged in heavy-cyclic applications where there may not be enough time to complete a standard charge cycle.

Equipped with a heavy-duty extruded aluminum heat sink enclosure to ensure field reliability, this charger is designed to withstand rugged applications. Integral mounting holes are included in the enclosure for securely mounting to a wall. The output cable is heavy-duty parallel cable, size 16 AWG, 2-conductor, 6-feet long and is color coded red for positive and black for negative. It is terminated with a polarized connector for mating to a quick connect accessory harnesses. A harness with 6mm (1/4") ring terminals for connecting to ODYSSEY batteries is provided as standard equipment. Other harnesses with larger rings, boots & clips, or custom connectors are available. The unit is protected against reversed connection to a battery and shorted leads. The output is not activated until the charger is properly attached to a battery. When the output connector is detached from a battery, it may be live for 1 or 2 seconds until the output is deactivated. If the charger is accidentally connected to a battery in a reversed condition, the charger will not turn on and will not be damaged.



OPERATING INSTRUCTIONS

Before using this battery charger, make sure it is compatible with your battery. Refer to the ratings on the battery charger, the specifications in this manual, and your battery documentation. Charge only sealed or valve regulated, lead-acid, non-automotive, maintenance free rechargeable batteries. Attempting to charge other types of batteries may result in battery damage. If the battery is very hot or very cold, allow it to adjust to room temperature before starting the charge.

Installation

For the best performance, mount the charger to a hard, flat, vertical surface near a convenient power source and near the location of the battery to be charged (mounting screws are not provided). Confirm the mounting surface is strong enough to hold the charger in place using the screws you have selected. This charger should be located in a dry location. A vertical mounting allows cooling air to flow through the charger and over the heat sink fins. Do not operate the charger horizontally or it may over heat.

Battery Type Selection

A switch is provided for selecting between AGM (Odyssey) and Gel-Cell type batteries. This switch should be set to your battery type before connecting the battery. If you operate the switch during charge, if the charger is still in bulk mode (steady yellow LED), then both the charge and float voltages will be changed. If the charger is in absorption charge already (flashing yellow LED), or if it is already in float, then operating the switch will only change the float voltage for the current charge.

Charge Program Switch

A switch is provided for selecting between the standard charge program and a special program to be used in heavy-cyclic applications. The standard charge program is recommended for all battery types, capacities, and applications - given adequate recharge time. However, if you have a limited recharge time and the standard charge program is not getting the battery charged in the time available, then the heavy-cyclic charge program should be used. The charge mode should be selected before attaching the battery, or during the bulk charge (steady yellow LED). The heavy-cyclic charge program is not suitable for all battery types and capacities – consult your battery documentation.

Powering Up the Charger

Plug the charger into the proper power source as indicated on the unit. The charger does not have a “power on” indicator and will not give any indications until a battery is properly connected. To reduce sparks, the charger should be powered up before attaching a battery. Otherwise, there may be a spark as the battery charges up the high frequency capacitors inside the charger. In either case, the charger output remains off until a battery is properly attached.

Attaching the Battery

Determine the battery polarity. Most batteries identify the positive terminal with a “+” sign or the color red and identify the negative terminal with a “-” sign or the color black.

Attach the accessory harness to the battery noting the correct polarity. In some applications, this will be a short cable with ring terminals and an insulated polarized connector and may be permanently mounted to the battery. Connect the output cable to the battery harness. Hooking up the cables in this order will contain any possible spark within the insulated connector – not at the battery terminals. The output connector must be attached to the battery for 1 second, continuously, before the battery is detected and the charger turns on the output, lights the charge indicator, and begins charging the battery. If the battery voltage is too high or too low, the charger will assume that an incorrect voltage battery was installed and will display a fault. If the battery is attached in a reverse condition, the charger will not be damaged but it will not detect the battery and will not turn on.

Condition Charge Stage

Charging begins with a light conditioning charge, about 10% of the maximum charge current, until the battery reaches 10.5 volts. This qualifies the battery by ensuring that it is in proper condition to accept the full rated charge current before entering bulk charge.

Bulk Charge Stage

During bulk charge, the full rated current is delivered to the battery until the voltage rises to the absorption voltage. The current will not decrease as the battery voltage climbs above 12 volts. This offers a performance advantage over competitive products that reduce in current as the battery voltage rises. Approximately 80% of the battery capacity is returned during the bulk charge. The bulk charge ends when the charge voltage climbs to the absorption voltage and the battery begins to accept less current.

Absorption Charge Stage

During the absorption charge, the charge voltage is regulated at a constant high rate and the current drawn by the battery decreases as the battery becomes more charged. The charge indicator will begin to flash upon entering the absorption charge mode. The time spent during the absorption charge is proportional to the time spent during the bulk mode, based on 3 times the time spent in bulk (1.5 times in heavy-cycle mode), and has a minimum timer of 1 hour and a maximum timer of 8 hours (6 hours in heavy-cyclic mode). After 1 hour, the absorption charge will also end when a minimum charge current is detected. When the absorption charge ends the battery should be over 100% recharged. A small overcharge is required to prevent chronic undercharging – a leading cause of battery failure. At this point the charger will enter the float charge mode and the charge indicator will darken and the ready indicator will light.

Equalize Charge Stage (heavy-cyclic mode only)

If the heavy-cyclic charge program is selected, the absorption charge will be shortened by half and it will be supplemented with a constant current equalize charge lasting for 0.5 of the time spent in bulk, or 1 hour max. The charge current is limited to 10% of the maximum charge current. This charge program may not be appropriate for all battery types and capacities. Consult your battery documentation.

Rest Stage (heavy-cyclic mode only)

After the equalize charge, the charger will enter a rest period for 1 hour before entering float charge stage. During the rest period, the charger will indicate that the battery is ready for use.

Float Charge Stage

During float charge, the voltage is regulated at a lower rate and the battery draws whatever current is required to replace its standing losses. To maximize battery life, a negative charge temperature coefficient of approximately 3.5mV per cell per °C variation from 25°C is used. A precision temperature sensor monitors the temperature and as the temperature increases the float voltage is reduced, and vice-versa. The minimum charge voltage is limited to 13.2 volts during very warm conditions. Temperature compensation helps offset the impact of high temperatures on the float life of the battery. To help your battery keep its full capacity, we recommend the battery be left connected to the charger in float charge mode until ready to use. This will prevent chronic undercharging, a leading cause of premature battery failure. The float charge is low enough to prevent overcharging, but high enough to allow the battery to replace its standing losses and maintain a 100% state of charge. The battery may be left connected to the charger indefinitely, in float charge mode, without danger of overcharging.

Battery Disconnect

At anytime during the charge or fault modes (except charger fault), if the battery is disconnected the charger will reset the charge cycle and wait for a new battery to be attached. For best performance, the battery should not be disconnected before entering the ready mode. If it is necessary to pull a battery off of charge early, if possible wait for the charger to enter the absorption mode. Repeatedly ending the charge early will lead to premature battery failure very quickly due to chronic undercharging.

Attaching Loads to the Battery during Charge

When using parallel loads, allow the charger to cycle to ready before attaching the load. This will ensure that the proportional timing charge algorithm fully charges the battery. If heavy loads are attached to the battery during charge, the charger may not properly cycle out of the charge modes and may indicate a battery fault and turn off the charger. Light loads will have little effect other than robbing charge current and lengthening the charge cycle. During the float charge, if the parallel load causes the charger to deliver its full current, the charge indicator will light in addition to the ready light. In this condition, the battery is not being charged and is probably being discharged. This is OK as long as time is provided at a reduced load for the charger to replace the current drawn from the battery. Heavy loads permanently attached during float charge will cause the charger to warm and may affect the temperature reading and depress the float charge voltage. Use a larger charger with heavier loads.

Charger / Battery Fault Indications

Charger and battery faults are indicated by quickly and alternately flashing the charge and ready indicators. A charger fault occurs when the charger output is on when it should be turned off. A charger fault is permanent. To confirm a charger fault, with no battery

attached, unplug the charger, wait a few seconds until all lights are off, and plug the charger back into AC power. If the charger is damaged, it will indicate a fault after several seconds. Battery faults occur if the battery voltage is too high or too low, or if the charger spends more than 24 hours in bulk (indicating a possibly damaged battery). Battery faults are cleared by disconnecting the battery.

Temperature Fault Indication

Temperature faults are indicated by double flashing the charge indicator. While charging, if the internal charger temperature becomes excessively hot, it will pause charging and display a temperature fault. The charger will stop indicating a temperature fault when the charger temperature cools. During charge, temperature faults may be caused by the ambient temperature around the unit becoming very warm, if the charger vents are blocked, if the charger is operated in a horizontal orientation, and possibly if the charger is damaged. The charger will also display a temperature fault if the ambient temperature becomes too hot to safely maintain a battery on float charge.

Input Fuse

This charger is equipped with a non-user-replaceable fuse. If the charge indicator does not light when the battery is attached, first check to see that the output cable is not reversed on the battery and that the power source is not controlled by a light switch, etc. If the fuse is blown, the charger must be returned for service. The fuse value is selected to avoid nuisance trips and should only blow if the charger is damaged. The fuse may also blow due to high temperatures.

CUSTOM UNITS NOTE

Xenotronix/TLI can make custom units, or modify our existing units, to exactly match your charging needs. Call our sales department for technical information and pricing.

Following are *some* of the modifications we can perform:

- Reduce charge current to match your battery capacity
- Change the low rate current to match battery and charge rate
- Adjust float and charge voltages for special conditions or batteries
- Change charge times and timers
- Provide custom cables and connectors
- Private labeling

TROUBLESHOOTING

CHARGER DOES NOT START (no indicators) – Check to see if the receptacle is controlled by a light switch or power strip switch and verify the connection is good and the battery is not reversed. If the battery is below 1V it will not be detected by the charger and is probably damaged to accept a charge.

BATTERY FAULT WHEN 12V BATTERY IS ATTACHED – This occurs if the battery voltage is too low or too high. If you know you have a 12V battery, and not a 6V or 24V battery, check the battery voltage using a volt meter. If the battery has been so severely discharge that it remains below 8V even with the load removed, then the charger will assume it is a 6V battery and indicate a fault. A 12V battery that remains less than 8V is probably damaged and will not accept a charge. The battery may also be sulfated or have open cells. In this case the battery voltage will climb very high when current is applied. These batteries are damaged and can not be charged.

FORCING A CHARGE ON A LOW VOLTAGE BATTERY – The charger will not normally attempt to charge very low voltage batteries. When either the battery is so low in voltage that it can not be detected, or it is detected but the charger assumes it is an incorrect voltage battery, the charger will not start and may indicate a battery fault. If you wish to attempt a charge anyway, the battery must be brought to above 8V. They may be done using a simple automotive type battery charger or by temporarily attaching a good battery in parallel with the discharged battery (jumping). When the charger sees the correct voltage it will remove the fault and enter charge – the “jumping” battery or charger may be removed. It is likely that the battery has already been severely damaged, but some useful capacity may be recovered.

MAINTENANCE

Inspection

Periodically inspect the AC power cord and the DC output cable for visible signs of damage such as cuts and abrasions, or bent pins and damaged connectors. Do not operate the charger with damaged cables – replace them immediately.

Cleaning

Unplug the charger and disconnect the battery before attempting any cleaning. If it becomes necessary to clean the enclosure, wipe the enclosure exterior with a damp cloth. If necessary, use a mild detergent. Do not use an abrasive cleanser or spray cleaners directly onto the charger. Do not immerse unit in water.

OPTIONS

The OPTIMIZER may be ordered in a 230 VAC input version with a European “Schuko” plug and a switch selectable 115/230 VAC input version having the standard plug.

BATTERY CHARGER SPECIFICATIONS

General Conditions	Ambient Temperature = 25°C (77°F)
Operating Temperature	0 to 50°C (32 to 122°F)
Storage Temperature	-40 to 80°C (-40 to 176°F)
Input Power Requirements	110-127 VAC, 50-60Hz, 1.3A
Maximum Charge Current	7 A
Absorption Charge Voltage	14.70 Vdc (AGM) 14.10 Vdc (GEL)
Float Charge Voltage	13.62 Vdc (AGM) 13.50 Vdc (GEL)
Condition / Equalize Current	approx. 700 mA
Equalize Charge Voltage	15.60 Vdc
Battery	12-Volts, Sealed Lead-Acid
Input Cable	3/18 AWG, 6' long with NEMA 5-15P plug
Output Cable	2/16 AWG, 6' long with polarized connector, (harness with 6mm (1/4") ring terminals included)
Enclosure	extruded aluminum heat sinking chassis
Indicators	yellow LED = Charge; green LED = Ready
Dimensions (L x W x H)	6.50" (16.5 cm) x 6.40" (16.3 cm) x 2.00" (5.1 cm)
Weight (including cables)	2.65 lbs (1.2 kg)

DIMENSIONS