



PRIME™

SWITCH MODE INDUSTRIAL BATTERY CHARGER

USER'S MANUAL

*Important Safety,
Installation,
Operation, and
Maintenance
Instructions*







CHARGER RATINGS LABEL

The ratings label is located on the back of the charger. The label provides the model (MODEL), part number (PART NO), serial number (SERIAL NO), AC input ratings (INPUT), and DC output ratings (OUTPUT, CELLS, and AH) of the charger. The amp-hour (AH) rating indicates the full range of battery capacities that are recommended for use with this charger. Different battery profiles may be required to optimize the charging of specific battery capacities within this range. The BATTERY field indicates the factory-configured battery profile.

An example charger ratings label is provided below.

			
SERIAL NO	101303167		
PART NO	28480J83G1B1W1		
OUTPUT	24VDC	12A	MODEL
INPUT	100-230VAC	50-60Hz 1PH	28480
BATTERY	WET(18050)	12 CELLS	50-150AH

Please fill in the blank label that is provided below with the information from the ratings label on your charger for future reference.

			
SERIAL NO	_____		
PART NO	_____		
OUTPUT	____VDC	__A	MODEL
INPUT	_____	____Hz __PH	__A _____
BATTERY	_____	__CELLS	_____AH

Document any configuration or settings changes that are made by marking the ratings label on your charger or on an additional label or tag attached to your charger.

SAVE THIS MANUAL: Keep it in a location where it is available to anyone who may operate the charger.

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IMPORTANT SAFETY INSTRUCTIONS

1. **SAVE THESE INSTRUCTIONS** – This manual contains important safety and operating instructions.
2. Before using battery charger, read all instructions and cautionary markings on battery charger, battery, and product using battery.



LOOK FOR THIS SYMBOL TO POINT OUT SAFETY PRECAUTIONS. IT MEANS: *BE ALERT—YOUR SAFETY IS INVOLVED.* IF YOU DO NOT FOLLOW THESE SAFETY INSTRUCTIONS, INJURY OR PROPERTY DAMAGE CAN OCCUR.

3. **⚠ DANGER:** TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, CAREFULLY READ AND FOLLOW THESE IMPORTANT SAFETY AND OPERATING INSTRUCTIONS BEFORE INSTALLING OR OPERATING THE CHARGER.
4. **⚠ INSTRUCTIONS IMPORTANTES CONCERNANT LA SECURITÉ.**
5. **⚠ WARNING:** TO REDUCE THE RISK OF FIRE, INSTALL THIS BATTERY CHARGER ON A SURFACE OF NON-COMBUSTIBLE MATERIAL SUCH AS BRICK, CONCRETE, OR METAL.
6. **⚠ DANGER:** RISK OF ELECTRIC SHOCK. DISCONNECT CHARGER FROM BATTERY AND AC POWER BEFORE SERVICING. TURNING OFF THE CHARGER DOES NOT REDUCE THIS RISK.
7. **⚠ DANGER:** RISK OF ELECTRIC SHOCK. DO NOT TOUCH UNINSULATED PORTION OF AC OR DC CONNECTORS OR UNINSULATED BATTERY TERMINAL.
8. **⚠ DANGER:** RISQUE DE CHOCS ÉLECTRIQUES. NE PAS TOUCHER LES PARTIES NON ISOLÉES DU CONNECTEUR DE SORTI OU LES BORNES NON ISOLÉES DE L'ACCUMULATEUR.
9. **⚠ CAUTION:** CHARGE ONLY BATTERIES OF THE SAME TYPE, VOLTAGE, CELL NUMBER, AND AMP-HOUR CAPACITIES AS SHOWN ON THE LABEL. OTHER TYPES OF BATTERIES MAY BURST CAUSING PERSONAL INJURY AND DAMAGE. BEFORE CHARGING ANY OTHER TYPE OF RECHARGEABLE BATTERY, CHANGE THE CHARGER SETTINGS AS RECOMMENDED BY THAT BATTERY MANUFACTURER.
10. **⚠ ATTENTION:** UTILISER POUR CHARGER UNIQUEMENT LES ACCUMULATEURS AU PLOMB À ELECTROLYTE LIQUIDE. D'AUTRES TYPES D'ACCUMULATEURS POURRAIENT ÉCLATER ET CAUSER DES.
11. **⚠ DANGER:** TO PREVENT ELECTRICAL SHOCK, DO NOT TOUCH EITHER AC OR DC UNINSULATED PARTS. MAKE SURE ALL ELECTRICAL CONNECTORS ARE IN GOOD WORKING CONDITION. DO NOT USE CONNECTORS THAT ARE CRACKED, CORRODED OR DO NOT MAKE ADEQUATE ELECTRICAL CONTACT. USE OF A DAMAGED OR DEFECTIVE CONNECTOR MAY RESULT IN A RISK OF OVERHEATING OR ELECTRIC SHOCK.
12. **⚠ WARNING:** HAZARD OF ELECTRIC SHOCK.
13. **⚠ WARNING:** LEAD-ACID BATTERIES GENERATE EXPLOSIVE GASES. TO PREVENT ARCING OR BURNING NEAR BATTERIES, DO NOT DISCONNECT DC CHARGING CORD FROM BATTERIES

WHEN THE CHARGER IS OPERATING. KEEP SPARKS, FLAME, AND SMOKING MATERIALS AWAY FROM BATTERIES.

14. **⚠ WARNING:** ALWAYS SHIELD EYES WHEN WORKING NEAR BATTERIES. DO NOT PUT WRENCHES OR OTHER METAL OBJECTS ACROSS BATTERY TERMINAL OR BATTERY TOP. ARCING OR EXPLOSION OF THE BATTERY CAN RESULT.
15. **⚠ WARNING:** BATTERIES PRODUCE HYDROGEN GAS, WHICH CAN EXPLODE IF IGNITED. NEVER SMOKE, USE AN OPEN FLAME, OR CREATE SPARKS NEAR THE BATTERY. VENTILATE THE AREA WHEN THE BATTERY IS CHARGING IN AN ENCLOSED PLACE.
16. **⚠ WARNING:** LEAD-ACID BATTERIES CONTAIN SULFURIC ACID, WHICH MAY CAUSE BURNS. DO NOT GET ACID IN EYES, ON SKIN, OR CLOTHING. IF CONTACT WITH THE EYES OCCURS, FLUSH IMMEDIATELY WITH CLEAN WATER FOR 15 MINUTES AND OBTAIN MEDICAL ATTENTION.
17. **⚠ WARNING:** ONLY A QUALIFIED SERVICE TECHNICIAN SHOULD PROGRAM OR SERVICE THIS EQUIPMENT.
18. **⚠ CAUTION:** DO NOT OPERATE THE CHARGER IF IT HAS RECEIVED A SHARP BLOW, BEEN DROPPED, OR OTHERWISE DAMAGED. HAVE A QUALIFIED SERVICE TECHNICIAN EXAMINE AND REPAIR AS NEEDED.
19. **⚠ WARNING:** DO NOT DISASSEMBLE THE CHARGER. HAVE THE CHARGER EXAMINED BY A QUALIFIED SERVICE TECHNICIAN. INCORRECT RE-ASSEMBLY OF THE CHARGER MAY RESULT IN AN EXPLOSION, ELECTRIC SHOCK, OR FIRE.
20. **⚠ CAUTION:** MAKE SURE THE BATTERY SYSTEM HAS THE PROPERLY RATED VOLTAGE, AMP-HOURS, AND TYPE (“WET”, “AGM”, “GEL”, ETC.) FOR THIS CHARGING SYSTEM.

SAVE THESE INSTRUCTIONS

1. INTRODUCTION

This switch mode (high frequency) industrial battery charger features advanced charge and termination algorithms designed to optimize both daily battery capacity and overall battery life. The charger is convection cooled with no moving parts, sealed, and designed to provide maximum reliability. The universal AC input enables the charger to be used with a wide range of AC voltages and frequencies, and the charger includes high efficiency and power factor.

The charger was factory-configured with a charge profile intended for use with batteries of the same type, voltage, and number of cells as is listed on the ratings label (see the Charger Ratings Label section for additional details). The charger was also factory-configured for on-board or off-board use. Contact your dealer if you require a different configuration.

2. RECEIVING AND INSTALLING THE CHARGER

⚠ WARNING: DO NOT INSTALL THE CHARGER ON OR NEAR FLAMMABLE MATERIALS. POSITION THE CHARGER ON A FOUNDATION OF STONE, BRICK, CONCRETE OR GROUNDED METAL.

⚠ WARNING: CHARGERS CAN IGNITE FLAMMABLE MATERIALS AND VAPORS. DO NOT USE NEAR FUELS, GRAIN DUST, SOLVENTS, THINNERS, OR OTHER FLAMMABLES.

⚠ WARNING: REPLACE WORN, DAMAGED, OR CUT ELECTRICAL CORDS AND PLUGS IMMEDIATELY.

Unpack the charger and examine it for shipping damage. In the event that shipping damage is found, report it as a claim with the freight company.

Do not operate the charger with a damaged AC or DC cable or connector. Do not operate the charger if it has received a sharp blow, was dropped, or was otherwise damaged in any way. Contact your dealer.

Proper installation is important to achieve optimum performance and life from the charger and batteries. Allow as much free air space around the charger as possible. Please refer to the Specifications section for specific storage and operating environmental specifications.

The charger was factory-configured for mounting on-board a battery-powered vehicle/machine or off-board use in a shelf or portable application. Contact your dealer if you desire to use the charger in a non-factory-configured manner.

For on-board use, the most favorable way to mount the charger is with the charger base bolted to a metal plate (0.1 inch minimum). This provides both a strong structural mounting and good thermal conductive cooling. A poor thermal conductive mounting material such as plastic or wood would be less favorable for cooling.

The charger dimensions and mounting hole locations are shown in Figures 2-1 through 2-2.

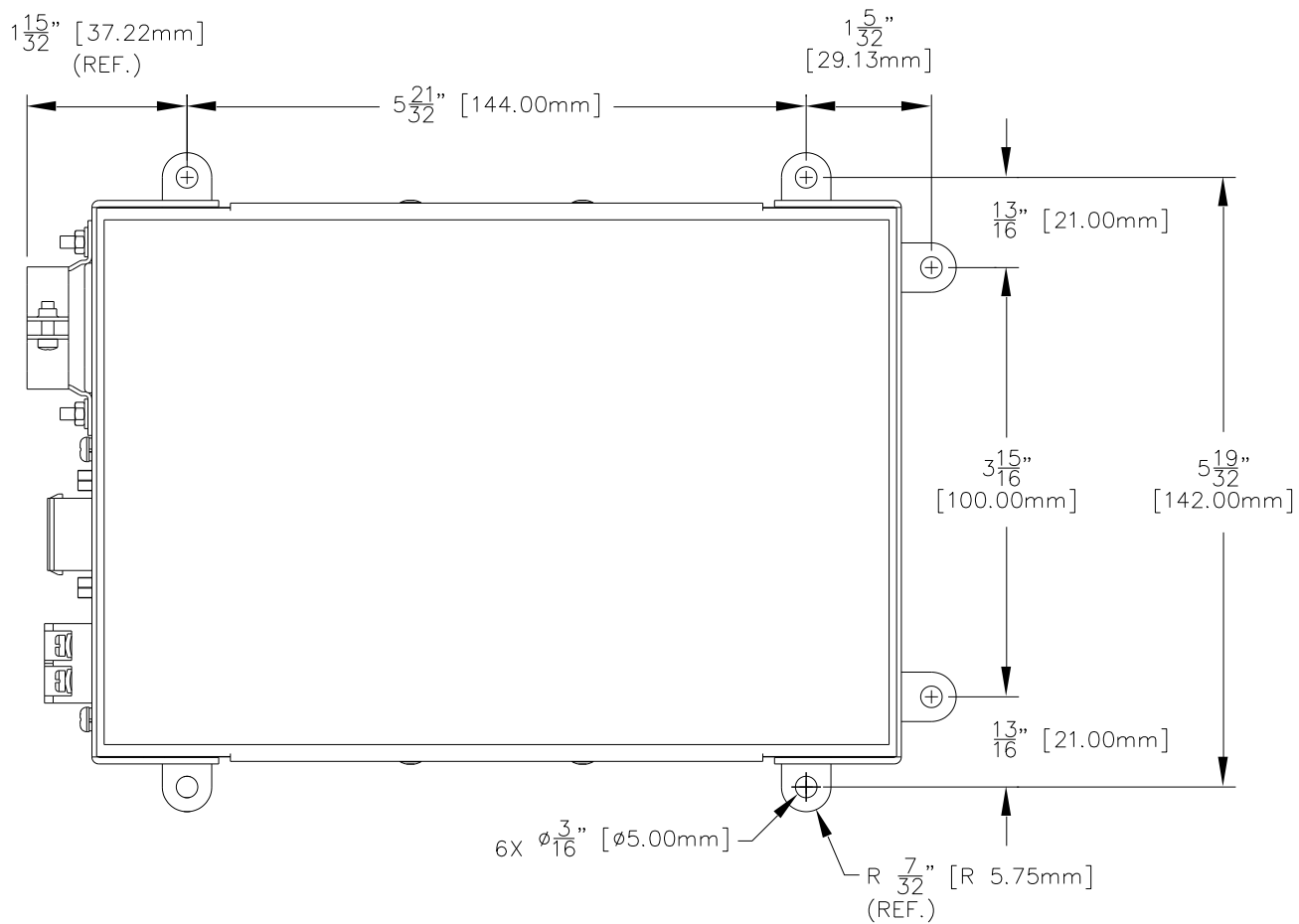


Figure 2-1: Charger Dimensions and Mounting hole Locations

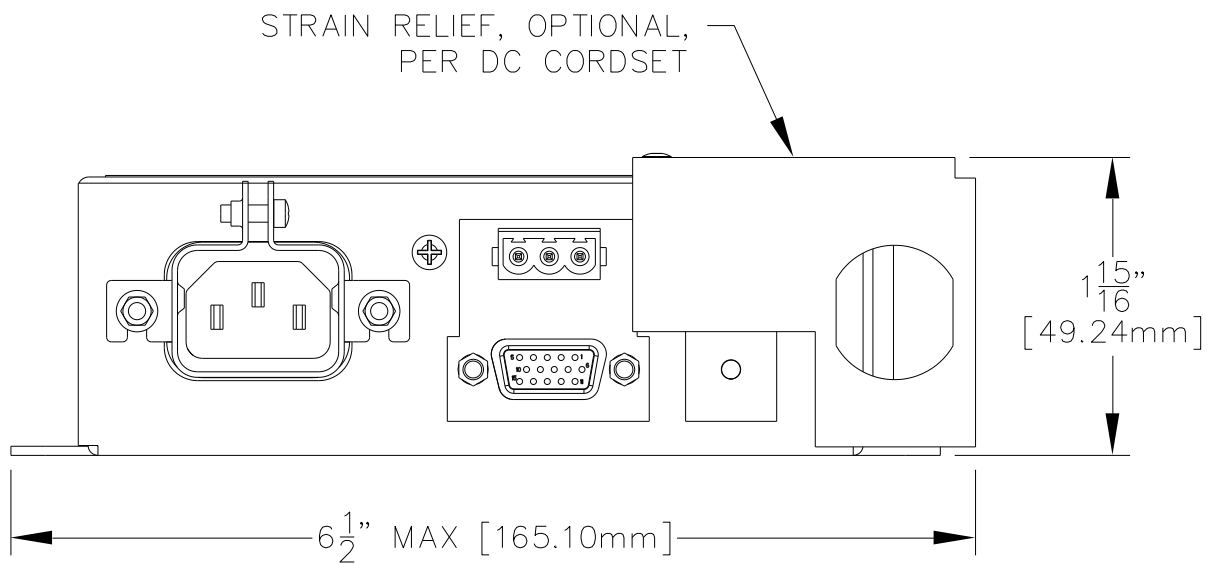


Figure 2-2: Charger Dimensions and Connector Locations

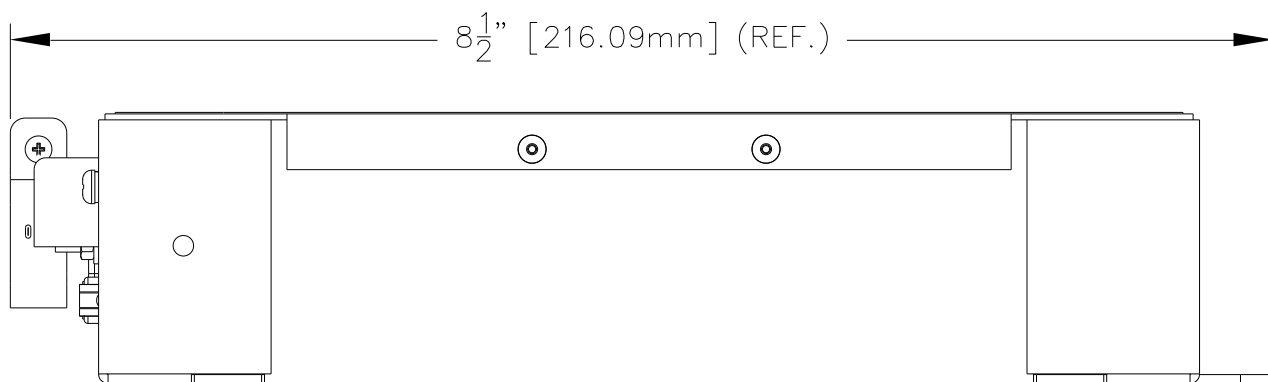


Figure 2-3: Charger Side View and Dimension

3. BATTERY TYPE

This charger was factory-configured to charge the type of battery indicated in the BATTERY field on the charger ratings label (for example, “Wet”). The 13th and 14th characters in the charger part number, available in the PART NO field on the charger ratings label, provide the charge profile code for the primary charge profile. For example, charger part number 28480J83A1B1W1 has a primary battery profile code of “W1” and charger part number 28480J83G1B1A1 has a primary battery profile code of “A1”. Figure 3-1 lists standard charge profile codes and their corresponding charge profiles. If the battery profile code for your charger is not listed in Figure 3-1, please contact your dealer for information. To change the active charge profile for this charger, please contact your dealer. If the active charge profile is changed, mark the charger ratings label and/or add an additional label or tag.

CAUTION: THIS CHARGER IS FOR USE ONLY WITH BATTERY SYSTEMS OF THE SAME TYPE AS THE ACTIVE BATTERY PROFILE. BATTERIES IMPROPERLY MATCHED WITH THE CHARGER MAY BURST CAUSING PERSONAL INJURY AND DAMAGE TO THE BATTERIES OR CHARGER.

Model	Rating	Part Number Battery Profile Code	Battery Profile
28480	24V/12A	W1	Wet, CC-CV-CC, 3A finish
		W2	Wet, CC-CV-CC, 3.5A finish
		W3	Wet, CC-CV-CC, 4A finish
		A1	AGM, CC-CV-CC, 1.8A finish
		A2	AGM, CC-CV
		A3	AGM, CC-CV- Float
		G2	Gel, CC-CV
		G3	Gel, CC-CV- Float

Figure 3-1: Standard Battery Profile Codes and Their Corresponding Battery Profiles

Battery manufacturers frequently use the same battery cases for different battery types. Wet/flooded batteries have removable cell caps. Water electrolyzed by discharging and charging the battery is replaced through these openings. Sealed batteries are generally distinguished by non-removable cell caps. The physical appearance of the battery case is frequently the same as a wet battery, though the cell caps are generally not removable. Refer to the battery manufacturer's information panel on the battery case to determine the type battery you have. If the information panel is missing or not legible, do not use the battery.

4. OFF-BOARD (SHELF) VERSUS ON-BOARD (BUILT-IN) CHARGERS

4.1 Off-Board Chargers

Off-board chargers are designed to be used in shelf or portable applications. If the AC input plug is connected to AC power, a new charge cycle automatically starts when the DC output is connected to a battery pack of the proper voltage. Disconnecting and reconnecting AC power while the DC output remains connected to a battery pack WILL NOT automatically start a new charge cycle. Disconnecting the DC output from the battery pack IS REQUIRED to automatically start a new charge cycle.

4.2 On-Board Chargers

On-board chargers are designed to be mounted on electric vehicles/equipment. If the DC output is connected to a battery pack of the proper voltage, a charge cycle automatically starts when the AC input plug is connected to AC power (unless a safety period of time has not passed since the successful completion of the previous charge cycle). Disconnecting the DC output from the battery pack is NOT REQUIRED to automatically start a new charge cycle.

5. USER INTERFACE

Figure 5-1 identifies the items found on the charger user interface.

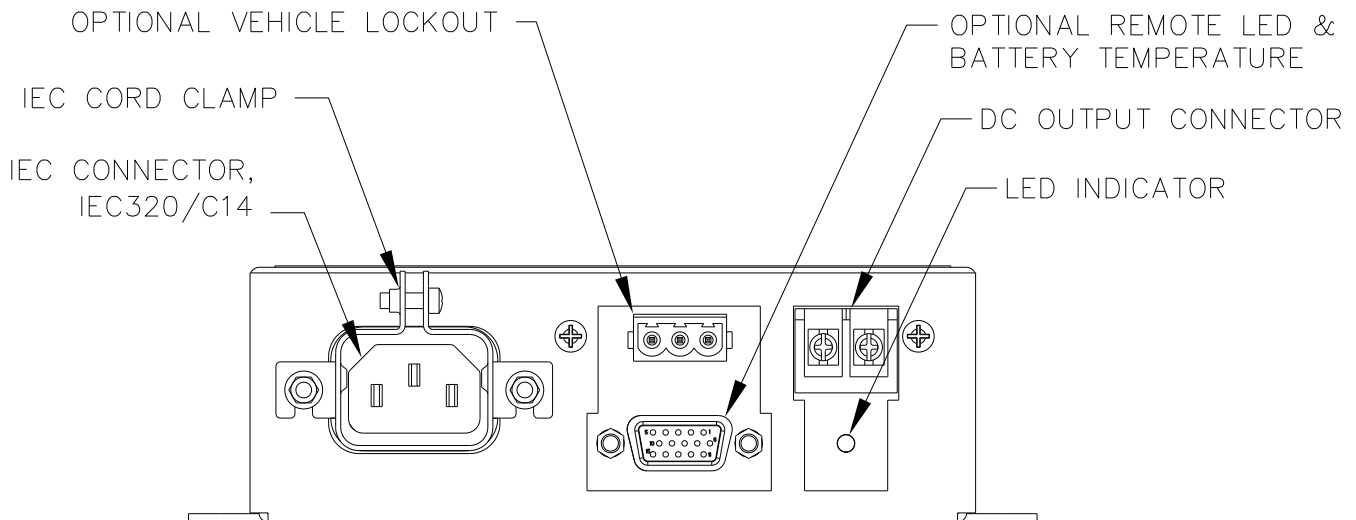


Figure 5-1 Charger User Interface

6. AC INPUT

The charger has an AC input rating of 100-230 volts, 50-60 hertz, single-phase. The charger has an AC operating range of 85-265 volts, 45-65 hertz. Below 100 volts, the charger may reduce output power.

The charger is equipped with an IEC inlet for the AC input power. This allows the AC power cord to be selected with a proper plug to be compatible with the local wall outlets. An optional AC cord clamp is available to retain the AC power cord.

The charger must be grounded to reduce the risk of electric shock and is equipped with an IEC inlet having an equipment-grounding conductor and a grounding socket. The installed AC power cord must be plugged into an outlet that is properly installed and grounded in accordance with all applicable electrical codes and ordinances.

If this charger includes the UL Listed symbol on its ratings label, it is provided with a cord set for connection to outlets operating at nominal 120 volts (or 240 volts as appropriate). If the input plug does not fit the power outlet, contact Lester Electrical for the proper cord set terminating in an attachment plug of the proper configuration for the power outlet.

⚠ CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK OR FIRE, DISCONNECT AC POWER FROM THE CHARGER BEFORE INSTALLING OR REMOVING UNIT.

⚠ DANGER: NEVER ALTER THE AC POWER CORD OR PLUG PROVIDED. IF IT WILL NOT FIT AN OUTLET, OBTAIN THE CORRECT CHARGER IEC AC CORDSET FOR THE OUTLET, OR HAVE A PROPER OUTLET INSTALLED BY A QUALIFIED ELECTRICIAN. IMPROPER CONNECTION CAN RESULT IN A RISK OF ELECTRIC SHOCK.

If an extension cord is necessary, it must be a 3-conductor, No. 14 AWG minimum, heavy-duty cord with ground. It must also be in good electrical condition and as short as possible, 50 ft (15m) maximum. Make sure that the pins on the plug of the extension cord are the same number, size, and shape as the AC power cord plug on the charger. The use of an improper extension cord could result in a risk of fire or electrical shock.

Locate all cords so that they will not be stepped on, tripped over, or otherwise subjected to damage, stress, or accidentally disconnected.

⚠ CAUTION: VERIFY THAT THE AC POWER CORD IS FULLY ENGAGED IN THE IEC INLET AND CANNOT BE PULLED LOOSE BEFORE USING THE CHARGER.

⚠ DANGER: RISK OF ELECTRIC SHOCK! CONNECT THE AC SUPPLY CORD DIRECTLY TO A GROUNDED, 3-WIRE OUTLET. DO NOT TOUCH UNINSULATED PORTION OF DC OUTPUT TERMINALS OR BATTERY TERMINALS. REPLACE DEFECTIVE CORDS, WIRES, OR CONNECTORS IMMEDIATELY.

7. DC OUTPUT

⚠ WARNING: LEAD-ACID BATTERIES GENERATE EXPLOSIVE GAS. CHARGE ONLY IN WELL VENTILATED AREAS. TO PREVENT ARCING OR BURNING NEAR BATTERIES, DO NOT DISCONNECT THE DC CHARGING CONNECTOR(S) FROM THE BATTERIES WHEN THE CHARGER IS OPERATING. IF THE CHARGE CYCLE MUST BE INTERRUPTED, UNPLUG THE AC POWER CORD BEFORE DISCONNECTING THE DC OUTPUT CONNECTOR(S) FROM THE BATTERIES. KEEP SPARKS, FLAME, AND SMOKING MATERIALS AWAY FROM BATTERIES. TO REDUCE THE RISK OF FIRE, DO NOT USE THE CHARGER NEAR FLAMMABLE MATERIALS OR VAPORS.

Only charge batteries of the same type, voltage, number of cells, and amp-hour capacities listed on the charger ratings label.

The charger includes externally accessible screw terminals for the DC output (see Figure 5-1). When connecting a cordset or wire assembly to the DC output screw terminals, ensure that the other end of the cordset or wire assembly is disconnected. The screw terminals should be torqued to 8.8 in-lbs. The “+” marked screw terminal must be connected to battery positive (+). The “-” marked screw terminal must be connected to battery negative (-). The charger will not operate if the polarity is reversed.

If the charger had a DC output cordset installed in the factory, the DC output cordset includes a commonly-used connector/plug. The polarity of the charger DC output connector/plug must be the same as the battery connector. The BLACK DC cable must be connected to the battery negative (-), and the WHITE or RED DC cable must be connected to the battery positive (+). The charger will not operate if the polarity is reversed.

8. VEHICLE LOCKOUT CONTROL (OPTIONAL)

The charger is equipped with a lockout/interlock relay to prevent vehicle/equipment operation while the charger is in use. If the charger is configured for on-board use, the lockout relay will be active while AC power is applied to the charger. If the charger is configured for off-board use, the lockout relay will be active while a valid battery is connected to the charger.

The charger lockout relay has normally closed (NC), common (COM) and normally open (NO) dry contacts. Connection to the relay is available through the green connector located on the charger. Please refer to Figure 8-1 to identify the lockout relays terminals.



Figure 8-1 charger lockout relay terminals. 1=NC, 2=COM, 3=NO

9. REMOTE LED (OPTIONAL)

An optional remote LED can be connected to the 15 pin communications port. The single LED can display three (3) colors to indicate charger status and fault information. It will indicate the same conditions as in sections 13 and 14 of this manual.

10. BATTERY TEMPERATURE SENSOR (OPTIONAL)

⚠ WARNING: IT IS IMPORTANT TO MOUNT THE TEMPERATURE SENSOR ON THE BATTERIES FOR PROPER TEMPERATURE COMPENSATION.

The temperature sensor (if present) should be attached to a battery post near the center of the battery pack. If the threaded stud is long enough above the battery jumper nut, attach the probe with another nut. Torque this nut to proper specifications. If the stud is too short, the nut holding the jumper wire will need to be removed. Open or remove the load and charging circuits to the batteries. Remove the nut and add the sensor, then torque the nut to the proper specifications. Then close or connect the load and charging circuits back to the batteries.

Securely fasten the temperature sensor cable to protect the sensor from being torn from the battery. Secure the sensor cable to a fixed object to ensure the probe will not be pulled loose. Use a cable tie mount on the battery or on the adjacent battery, if necessary.

11. PROPER CARE OF DEEP-CYCLE LEAD-ACID MOTIVE POWER BATTERIES

Motive power battery packs are subjected to severe deep-cycle duty on a daily basis. Although these batteries are designed to withstand such duty, the following precautions must be observed to obtain good performance and maximum cycle life.

⚠ CAUTION: ALWAYS WEAR PROTECTIVE EYE SHIELDS AND CLOTHING WHEN WORKING WITH BATTERIES. BATTERIES CONTAIN ACIDS WHICH CAN CAUSE BODILY HARM. DO NOT PUT WRENCHES OR OTHER METAL OBJECTS ACROSS THE BATTERY TERMINAL OR BATTERY TOP. ARCING OR EXPLOSION OF THE BATTERY CAN RESULT.

1. When installing new batteries, be sure the polarity of each battery and the overall battery pack is correct. Otherwise, battery and/or charger damage can result.
2. New batteries should be given a full charge before their first use because it is difficult to know how long the batteries have been stored.
3. New batteries and older batteries that have been in storage are not capable of their rated output until they have been discharged and charged a number of times. Consult the manufacturer of your batteries for more information.
4. **DO NOT EXCESSIVELY DISCHARGE THE BATTERIES.** Excessive discharge can cause polarity reversal of individual cells resulting in complete failure shortly thereafter.
5. Maintain the proper electrolyte level of wet (flooded) batteries by adding water when necessary. Distilled or deionized water is best for battery life. Never allow the electrolyte level to fall below the top of the battery plates. Electrolyte levels lower during discharge and rise during charge. Therefore, to prevent the overflow of electrolyte when charging, it is mandatory that water be added to cells **AFTER** they have been fully charged – do not overfill. Old batteries require more frequent additions of water than new batteries.
6. Hard crystalline sulfates form when batteries in storage are not maintained in a charged active state. Internal self discharge can bring about the start of this condition in as little as three days in warm temperatures. Batteries not maintained and allowed to sit in storage will self discharge, sulfate and lose capacity. Repeated charging without using the batteries between charges can recover some of the lost power, range, and life, but some permanent loss should be expected.
7. Cold batteries require more time to fully charge. When the temperature falls below 65°F, the batteries should be placed on charge as soon after use as possible.
8. The tops of batteries and battery hold downs must be kept clean and dry at all times to prevent excessive self discharge and the flow of current between the battery posts and frame. Electrolyte spilled on batteries never dries or evaporates.
9. All connections to batteries must be maintained clean and tight. Due to heating and discharge rates, bolted connections loosen over time. Re-tighten the connections twice yearly to the torques specified by the battery manufacturers.
10. Follow all operating instructions, cautions, and warnings as specified in this manual, on the charger, in the battery manuals, and in the vehicle manuals.

11.1 Personal Safety Precautions

1. Have someone within the range of your voice and close enough to quickly come to your aid when you work near a lead-acid battery.
2. Ensure that ample fresh water and soap are nearby in case battery acid contacts your skin, clothing, or eyes.
3. Wear complete eye and clothing protection. Avoid touching your eyes while working near a battery.
4. If battery acid contacts your skin or clothing, wash immediately with soap and water. If acid enters your eye, immediately flush your eye with running cold water for at least 10 minutes, and get medical attention immediately.
5. **NEVER** smoke or allow a spark or flame to be in the vicinity of a battery.
6. Be extra cautious to reduce the risk of dropping a metal tool onto a battery. It could spark or short circuit the battery or other electrical components that could cause an explosion.
7. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short-circuit current that is high enough to cause a severe burn.

8. NEVER charge a frozen battery.

12. CHARGER OPERATION

⚠ WARNING: TO REDUCE THE RISK OF AN ELECTRIC SHOCK, CONNECT ONLY TO A SINGLE-PHASE, PROPERLY GROUNDED (3-WIRE) OUTLET. REFER TO GROUNDING INSTRUCTIONS.

⚠ CAUTION: MAKE SURE THE BATTERY IS A RECHARGEABLE DEEP-CYCLE BATTERY WITH THE PROPER RATED VOLTAGE FOR THIS CHARGER.

⚠ DANGER: TO PREVENT ELECTRICAL SHOCK, DO NOT TOUCH UNINSULATED PARTS OF THE CHARGER DC OUTPUT CONNECTOR, BATTERY CONNECTOR, OR BATTERY TERMINALS. MAKE SURE ALL ELECTRICAL CONNECTORS ARE IN GOOD WORKING CONDITION. DO NOT USE CONNECTORS THAT ARE CRACKED, CORRODED, OR DO NOT MAKE ADEQUATE ELECTRICAL CONTACT. USE OF A DAMAGED OR DEFECTIVE CONNECTOR MAY RESULT IN A RISK OF OVERHEATING OR ELECTRIC SHOCK.

⚠ WARNING: CHARGER IS NOT TO BE USED WHILE THE BATTERY POWERED EQUIPMENT IS OPERATING.

⚠ ATTENTION: NE PAS UTILISER LE CHARGER PENDANT QUE L'EQUIPMENT EST EN MARCHÉ.

⚠ WARNING: LEAD-ACID BATTERIES GENERATE GASES WHICH CAN BE EXPLOSIVE. TO PREVENT ARCING OR BURNING NEAR BATTERIES, DO NOT DISCONNECT THE CHARGER DC OUTPUT FROM THE BATTERIES WHEN THE CHARGER IS OPERATING. KEEP SPARKS, FLAME, AND SMOKING MATERIALS AWAY FROM BATTERIES.

⚠ WARNING: ALWAYS SHIELD EYES WHEN WORKING NEAR BATTERIES. DO NOT PUT WRENCHES OR OTHER METAL OBJECTS ACROSS BATTERY TERMINALS OR THE BATTERY TOP. ARCING OR EXPLOSION OF THE BATTERY CAN RESULT!

⚠ WARNING: DO NOT DISCONNECT THE CHARGER DC OUTPUT CONNECTOR FROM THE BATTERY CONNECTOR WHILE A CHARGE CYCLE IS IN PROGRESS. THE RESULTING ARCING AND BURNING OF THE CONNECTORS COULD CAUSE THE BATTERIES TO EXPLODE.

⚠ CAUTION: TO AVOID DAMAGE TO THE CHARGER DC CABLE AND CONNECTOR AND BATTERY CONNECTOR, DISCONNECT BY GRASPING THE CHARGER CONNECTOR HANDLE OR BODY AND PULLING IT STRAIGHT OUT OF THE BATTERY CONNECTOR. DO NOT PULL ON THE CHARGER CABLE. DO NOT TWIST, ROCK, OR PULL THE CONNECTOR SIDEWAYS.

The instructions printed on the charger are for daily reference.

12.1 Off-Board Charger Operation

If the charger is factory-configured for off-board use, follow these operating instructions:

1. With the charger DC output connector/plug disconnected from the battery connector/receptacle, connect the charger AC power cord to an appropriate AC outlet (if not already connected).
2. Connect the charger DC output connector/plug to the battery connector/receptacle. The charger will start automatically, which is indicated by the LED beginning to blink amber slowly.

-
3. If the charger must be disconnected from the battery while a charge cycle is in progress, first disconnect the AC power cord from the AC outlet. Do not disconnect the charger DC output connector/plug from the battery while a charge cycle is in progress.
 4. The charge cycle 80% point is indicated by the amber LED beginning to blink quickly.
 5. The Finish charge cycle phase is indicated by the solid amber illumination of the LED. Not all charge profiles include a Finish phase.
 6. An extended Balance/Equalize charge cycle phase is indicated by the LED beginning to blink green quickly. Not all charge profiles include a Balance/Equalize phase.
 7. The charger automatically terminates the charge cycle when a battery reaches full charge, which is indicated by [1] the solid illumination of the LED or [2] the green LED beginning to blink slowly green indicating a post-charge phase. The required charge time is affected by numerous factors, including battery amp-hour capacity, depth of discharge, battery temperature, and battery age/usage.
 8. Leave the charger connected until the charge cycle is complete and your machine is going to be used
 9. Disconnect the charger DC output connector/plug from the battery connector/receptacle by firmly grasping both connectors and pulling them straight apart.

12.2 On-Board Charger Operation

If the charger is configured for on-board use, follow these operating instructions:

1. Ensure that the vehicle/equipment that the charger is mounted on is turned off.
2. With the charger AC power cord disconnected from the AC outlet, connect the charger DC output connector/plug to the battery connector/receptacle (most likely already connected or hard wired).
3. Connect the charger AC power cord to an appropriate AC outlet. The charger will start automatically, which is indicated by the LED beginning to blink amber slowly.
4. If the charger must be disconnected from the battery while a charge cycle is in progress, disconnect the AC power cord from the AC outlet. Do not disconnect the charger DC output connector/plug from the battery while a charge cycle is in progress.
5. The charge cycle 80% point is indicated by the amber LED beginning to blink amber quickly.
6. The Finish charge cycle phase is indicated by the solid amber illumination of the LED. Not all charge profiles include a Finish phase.
7. An extended Balance/Equalize charge cycle phase is indicated by the LED beginning to blink green quickly. Not all charge profiles include a Balance/Equalize phase.
8. The charger automatically terminates the charge cycle when a battery reaches full charge, which is indicated by [1] the solid green illumination of the LED or [2] the green LED beginning to blink green slowly indicating a post-charge phase. The required charge time is affected by numerous factors, including battery amp-hour capacity, depth of discharge, battery temperature, and battery age/usage.
9. Leave the charger AC power connected until the charge cycle is complete and machine is going to be used. Disconnect the AC power before operating the machine.

12.3 Storage Mode Operation

1. Storage Mode is designed to keep your battery maintained during storage periods that last a few weeks to several months at a time.
2. Depending on the battery type, a storage charge can be a continuous float or a periodic charge mode.
3. Do NOT disconnect the charger from the battery or from the AC power while your machine is not being used. Disconnecting and reconnecting the charger from the batteries or AC power may start a charge cycle, but disconnection disrupts the storage mode so optimum battery maintenance is not achieved.
4. After several months of storage your batteries should be serviced and the charger reset by disconnecting the DC for Off-Board or the AC for On-Board applications (disconnect AC for a minimum of 10 minutes) before continuing another storage season.

13. LED INDICATORS

The charger includes one (1) local LED that can display three (3) colors to indicate charger status and fault information (see Figure 5-1). The functionality of the LED is outlined below. If an optional remote LED is being used, it will provide the same functionality.

Amber (Charge Status)

Indicates charge cycle status. See Figure 13-1 for descriptions of the possible states.

Green (Charge Status)

Indicates when a charge cycle completes successfully, when an extended Balance/Equalize charge cycle phase is active, or when a post-charge phase is active. See Figure 13-1 for descriptions of the possible states.

Red (Fault)

Indicates when a charger or battery fault has occurred. See the FAULTS section.

Amber (Charge Status)	Green (Charge Complete)	Description
Slow Blink	Off	Bulk/Start charge cycle phase (constant power or constant current).
Fast Blink	Off	Absorption/Plateau charge cycle phase (constant voltage). Greater than 80% charged.
Solid On	Off	Finish charge cycle phase (constant current). Not all charge profiles include a Finish phase.
Off	Fast Blink	Balance/Equalize phase. An extended charge cycle is occurring because a trigger condition has been met (cycle count, etc). Not all charge profiles include a Balance/Equalize phase.
Off	Solid On	Charge cycle complete.
Off	Slow Blink	Charge cycle complete. Post Charge phase (constant voltage float, etc). Not all charge profiles include a Post Charge phase.

Figure 13-1: Charger LED States (Non-Fault)

14. FAULTS


	Red LED	Green LED	Amber LED	Description
Charger	Slow blink			AC voltage low fault - Slow blink Red LED
	Slow blink	Slow blink		Over temperature fault - Alternate between slow blink red and slow blink green
	Slow blink		Slow blink	Charger issue (not outputting current, relay didn't pull in, EEPROM error, internal supplies out of range, etc.) - Alternate between slow blink red and slow blink amber
Battery	Fast blink			Battery not present in On-board mode only (Ob=1) - Fast blink red only
	Fast blink	Fast blink		Under voltage fault - Alternated between fast blink red and fast blink green
	Fast blink	Slow blink		Over voltage fault - Alternated between fast blink red and slow blink green
	Fast blink		Fast blink	Overall charge maximum time - Alternated between fast blink red and fast blink amber
	Fast blink		Slow blink	Phase maximum time - Alternated between fast blink red and slow blink amber
Vehicle	Solid			Temperature probe or lockout error - Solid on red

Figure 14-1: Charger LED States (Faults)

Removing AC power from the charger always clears a fault. If the charger was factory-configured for off-board use, disconnecting the charger from the battery pack also clears a fault. If a fault cannot be cleared after taking appropriate corrective action, contact your dealer for troubleshooting and/or service.

15. TROUBLESHOOTING

The charger was fully tested and calibrated before leaving the factory. It was delivered ready to charge. If properly installed, the charger should require very little attention. If improper charger operation occurs, it will require repair by a qualified service technician.

 CAUTION: DO NOT OPERATE THE CHARGER IF IT IS DAMAGED OR APPEARS TO BE MALFUNCTIONING. PERSONAL INJURY OR DAMAGE TO THE CHARGER OR BATTERIES MAY RESULT. DO NOT DISASSEMBLE THE CHARGER. CONTACT YOUR DEALER. INCORRECT REASSEMBLY MAY RESULT IN RISK OF ELECTRIC SHOCK OR FIRE.

See Section 14 for information regarding faults indicated by the LED.

1. If the charger does not turn on, check for one of the following conditions.
 - a. The charger AC power cord is not plugged into a live and/or appropriate AC outlet.
 - b. The battery connections are incorrect – battery not connected, reverse polarity, or short circuit.
 - c. The battery voltage is too high.
 - d. The battery voltage is too low (below 3 volts).
2. If the charger turns off before a battery is fully charged, and a fault condition is not indicated by the LED, this indicates one of the following conditions.
 - a. The AC power was interrupted during the charge cycle.
 - b. The charger DC output connector was disconnected from the battery during the charge cycle.
 - c. The battery has been allowed to sulfate. Charge the battery at least once every three (3) days when the equipment is lightly used. Once sulfation is allowed to take place, it may be partially reduced by returning, temporarily, to daily charging.
3. A decrease in vehicle/equipment range where the battery loses power faster indicates one of the following conditions.
 - a. The electrolyte level in a wet lead-acid battery was allowed to drop below the top of the battery plates. If so, add distilled water to just cover the top of the plates immediately upon discovery, and then fill to the proper level with distilled water at the completion of the very next charge cycle.
 - b. Use of the vehicle/equipment before the battery has been fully charged and the charger automatically terminates the charge cycle. This shortens battery life and accelerates the onset of reduced daily range.
 - c. The normal wear-out pattern for the battery.
4. A charge cycle running longer than anticipated before terminating indicates one of the following conditions.
 - a. An overly-discharged battery.
 - b. The charger output may have been reduced due to low AC input voltage, high ambient temperature, or obstructions to cooling airflow.
 - c. The amp-hour capacity of the battery is greater than the charger can fully charge in the anticipated amount of time.

16. SPECIFICATIONS

AC Input

Voltage range, rated	100-230 Vac
Voltage range, operating	85-265 Vac (< 100 Vac: reduced power)
Frequency, rated	50-60 Hz
Frequency, operating	45-65 Hz
Phase	Single-phase
Current, maximum	4 A
Protection	Current limit, surge, transient, under voltage

DC Output

Voltage, nominal	24 Vdc
Voltage, maximum	36 Vdc
Voltage, minimum start-up	3 Vdc
Power	350 W
Current, rated	12 A
Current, maximum	12 A
Battery types	Wet/flooded, AGM, gel deep-cycle lead-acid; lithium-ion; custom. (See Section 3.)
Protection	Current limit, short circuit, reverse polarity, under voltage, over voltage, wrong battery voltage

LED

Single Multi-color LED,
Amber (charge status), Green (charge complete), Red (fault)

Lockout

SPDT dry-contact relay. 10 A continuous rating. See Section 8 for options and additional details.

Remote LED

Optional

Battery Temp Sensor

Optional

Mechanical

Dimensions & mounting pattern	See Figures 2-1 through 2-3
Weight (approximate)	5.5 pounds
Cooling	Natural convection (no fan)
AC connector	IEC 60320 C14 inlet with cord clamp
Mounting	Shelf, wall, bulkhead, See Figure 2-1 though 2-2 for additional details.

Environmental

Enclosure rating	IP66, NEMA 4
Operating temperature	-25 degrees C to 45 degrees C (-13 degrees F to 113 degrees F).
Storage temperature	-40 degrees C to 80 degrees C (-40 degrees F to 176 degrees F)

NOTES

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