

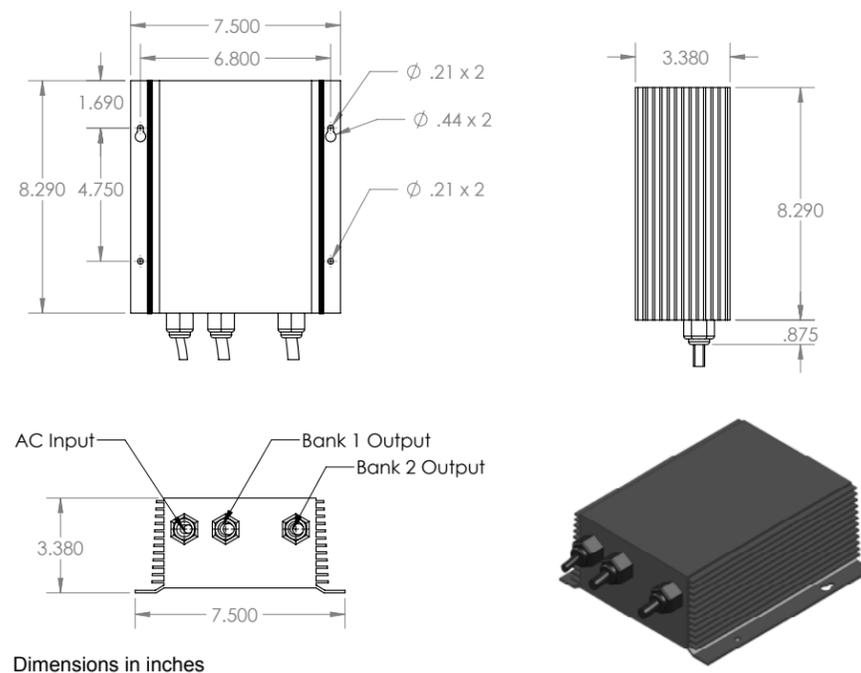
## Charger operation

The TPRO220-2 is fully automatic once installed properly. The LED indicator lights inform the user of the progress of the charging cycle, status of AC power and proper battery connections. The LED mode indicators will change state when the condition is true for both batteries. During a charging cycle and depending upon the state of charge of each battery, one battery or both batteries may be charging. Each battery will be checked independently for state of charge and the charger will respond accordingly. In float mode, continuous checking of each battery continues to insure full charge indefinitely.

Please review the table below for electrical specifications.

PARAMETER	DESCRIPTION / CONDITIONS	MIN	NOM	MAX	UNITS
$V_{FSTERM}$	Fast charge voltage, 25°C	14.4	14.5	14.6	VDC
$V_{FLOAT}$	Float voltage, $I_{OUT} < 1.0 A$ , 25°C	13.4	13.5	13.6	VDC
$I_{FS}$	Fast charge, $V_{BATTERY} = 12V$	20.0	21.0	22.0	Amps
$I_{FLTERM}$	Float charge termination current	4.5	5.0	5.5	Amps
$V_{AC}$	RMS AC voltage range	180	240	264	VAC
$I_{SBY}$	Standby current, AC off			0.5	ma

## Outline and mounting



## LED indicators

- Charging mode: Indicates the state of charge of the battery. The green Float light indicates the battery is fully charged.
- Charging current LEDs indicate amount of current.
- AC Power On LED indicates AC power is applied to the charger.
- Charging status LED indicates the output is connected properly to the battery and is being charged.

## Protection modes

**Over temperature:** The unit inhibits until it cools off and then restarts automatically. This is indicated by the AC Power and Float LEDs flashing. In very high ambient temperatures, it is possible for the non-auto reset thermal protection to activate. This is indicated by the AC Power on and 7-10 Amp Charging Current LEDs flashing. If this occurs, the AC power should be disconnected and reconnected once the charger has cooled off.

**Over voltage:** Activates in the event of a regulation malfunction and inhibits the charger. An over voltage condition is indicated by the AC Power On and Fast LEDs flashing. If the over voltage persists, the factory should be consulted.

### LIMITED WARRANTY

For two years from date of purchase, Chargetek Inc. will at its discretion repair or replace for the original consumer, free of charge, any part or parts found to be defective by Chargetek in workmanship or material. All shipping charges under this warranty must be paid by the consumer. Proof of purchase is required.

There is no other expressed warranty. Implied warranties, including those of merchantability and fitness for a particular purpose are limited to two years from the date of purchase. This is the exclusive remedy and consequential damages are excluded where permitted by law.



## TPRO220-2

## Installation Manual

Please read the entire installation manual before installing the battery charger. If there are any questions or concerns, please email us or call our toll-free number given below.

The TPRO220-2 is a rugged, waterproof and sophisticated three stage lead-acid chemistry battery charger. It can be configured in a multitude of dual battery system configurations and used as either an on-board or portable unit. With a wide operating temperature range and UL/CSA1236 certification, this product is especially suited for high end industrial applications and severe environments.

The charger is completely waterproof and sealed with UL

approved 94VO flame retardant epoxy. This sealing also provides extreme vibration and shock resistance since the encapsulated unit is effectively a brick.

The charging algorithm and LEDs indicators are controlled by an embedded microcontroller that contains software developed by and is proprietary to Chargetek. The TPRO220-2 precisely controls charging voltage and current to ensure a complete recharge every time. The charger may be left connected indefinitely to the batteries, maintaining full charge.

## CHARGETEK

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## Installation

### Location

- ❑ Do not mount directly over or under a battery or onto a carpeted, upholstered or varnished surface.
- ❑ Install in an area where all charger electrical cords will avoid hot surfaces such as exhaust pipes and moving parts such as fan wheels.
- ❑ Operating temperature is -10°C to 55°C (-14°F to 131°F). Storage temperature is -30°C to 80°C (-22°F to 176°F).
- ❑ Provide as much surrounding cooling clearance as possible for maximum efficiency, safety, and shortest recharge times. At a minimum, maintain a 3 inch clearance around the perimeter and the top side of the charger.
- ❑ Never mount in the vicinity of explosives, pressurized cans or other flammable material.

### Mounting

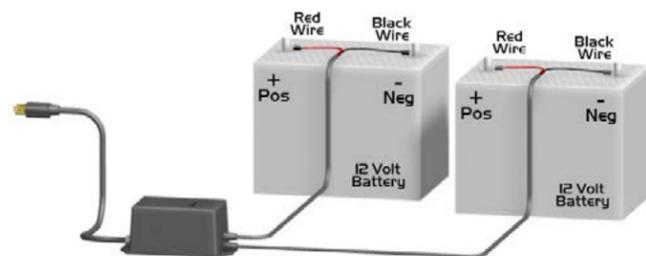
- ❑ Wear safety goggles, gloves and a long sleeve shirt when drilling mounting holes near a battery.
- ❑ In most cases, #10 stainless steel mounting bolts with aircraft nuts, nylocks, or #10 screws will provide for solid mounting.
- ❑ For extreme vibration conditions common in ATV and PWC applications, added security such as crossed shock cords are recommended.

### Electrical

#### AC wire connections

- ❑ The TPRO220-2 is equipped with a factory installed 6 foot AC cord with a ground connection. The ground connection is the round pin on the AC plug. **It is extremely important that only grounded electrical outlets or extension cords with a ground connection should be used when operating this charger.**
- ❑ Never connect the AC plug into an electrical outlet if you are wet or barefoot.
- ❑ Ensure that the AC cord cannot reach moving parts, lids, hoods, etc. Secure with a cable tie to solid anchor point if necessary.
- ❑ The charger will operate properly with either 120 volts 50 Hz or 120 volts 60 Hz AC input. Never use 220 volts AC with this unit.

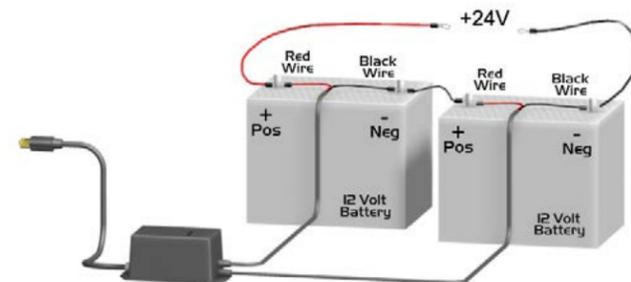
Two independent 12V battery connections



#### DC wire connections

- ❑ DC wire connections to the battery should be made before plugging in the AC cord.
- ❑ The charger should only be used with lead-acid type batteries such as AGM, SLA, flooded or maintenance free. If there is any question, please contact the factory.
- ❑ The charger will not operate until DC connections are made.
- ❑ When installing in the bilge of boats or any battery compartment, ensure that hatches are open and bilge blowers are operating for ten minutes to remove any fumes and hydrogen gas. Be certain the area is ventilated for personal health and safety.
- ❑ Keep wire routing from the charger to the battery neat and secure by anchoring with cable tie to a solid surface every few inches, not to exceed 18 inch intervals.
- ❑ Ensure that cables have sufficient clearance from moving parts and hot surfaces such as exhaust components.
- ❑ The TPRO220-2 is short circuit protected. Batteries are a high current source and additional protection is needed in the event of physical damage to the DC cables or electrical damage to the charger that may be externally induced. An in-line fuse (32 volts/5 amps rating) must be connected between the positive charger lead and the battery positive terminal. Also, an in-line fuse (32 volts/5 amps rating) must be connected between the negative charger lead and the negative battery terminal. This is required for each battery for maximum safety. The fuse's mechanical attributes are installation and environmentally specific. Consult the factory if selection assistance is required.
- ❑ For a 24 volt battery system comprised of two 12V batteries with a single inter-battery connection, the fusing is the same as above. Connect each DC cable to each battery as follows: the red lead is connected to the positive battery terminal and the black lead is connected to the negative battery terminal. All connections should be clean and tight. See installation diagram below.
- ❑ When connecting two batteries in series, it is imperative that the amount of charge and discharge be equal for both batteries. If there is an imbalance during charge or discharge, excessive battery voltage will occur. This results in an over-volted battery and will cause dangerous battery out gassing and destruction.

24V battery system connection



## Safety instructions

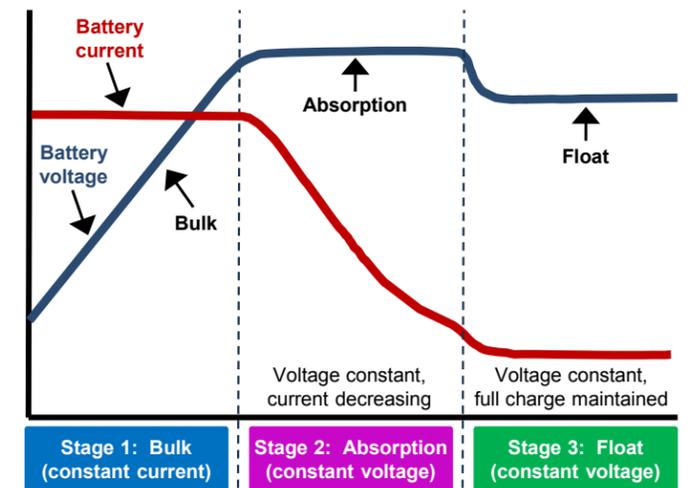
**CAUTION: The following are important safety instructions. Save these instructions.**

- ❑ Charge only lead acid, maintenance free, refillable, or "gel-cell" rechargeable batteries. Other types of batteries may burst causing personal injury or damage.
- ❑ Never smoke or allow sparks or flame in the vicinity of a battery.
- ❑ Someone should be within the range of your voice and close enough to come to your aid when you are working near a battery.
- ❑ Wear eye protection and clothing protection. Avoid touching your eyes while working near a battery.
- ❑ Have plenty of fresh water and soap nearby in case the battery acid contacts your skin, clothing or eyes.
- ❑ If the battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters your eyes, immediately flood them with cold running water for at least ten minutes and get immediate medical attention.
- ❑ Never operate a charger with a damaged cord or plug. Degradation of AC and DC cords, accidentally nicking or cutting the cords could result in sparking and cause injury.
- ❑ Never operate a charger that has been damaged in any way or try to disassemble it. Return it to the factory when service or replacement is required. Incorrect reassembly may result in an electrical shock or fire.
- ❑ Become familiar with all instructions and cautionary markings on chargers, batteries and equipment used. Only adults should install and operate the charger. The charger and batteries should be kept out of the reach of children.
- ❑ When using an extension cord, the TPRO220-2 requires a quality grounded extension cord of at least 18 awg wire size for cords up to 50 feet and a minimum of 16 awg for cords up to 150 feet.
- ❑ Never unplug a cord by pulling on the cord itself. Always grasp the plug when disconnecting the charger.
- ❑ The TPRO220-2 is waterproof and designed for harsh environments. It is not designed to be submerged. Please consult the factory if there are any questions.
- ❑ Never charge a frozen battery. If the battery has an odor or is visibly damaged, disconnect the charger and consult the factory.
- ❑ Study the battery manufacturer's precautions such as removing or not removing cell caps while charging.
- ❑ Keep batteries full. Add distilled water in each cell until it reaches the levels specified by the battery. Check the battery fluid levels regularly.
- ❑ Good battery maintenance procedures dictate that the battery fluid levels be checked on a regular basis, especially in high ambient temperatures.
- ❑ Keep the battery terminals clean. Always unplug the charger before cleaning. Keep corrosion from coming into contact with your eyes.
- ❑ Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a lead-acid battery. A lead-acid battery can produce a short circuit high enough to weld objects to metal, causing a severe burn.

## Three stage charge cycle

The TPRO220-2 employs a three stage charge routine. This is the charging procedure most lead-acid battery manufacturers recommend to return full capacity efficiently and extend battery life.

### Three stage charging curve



#### Stage 1: Constant current or bulk charge mode

Assuming that the battery is starting in a discharged state, the charger is operating in constant current mode. The charger current is maintained at a constant value and the battery voltage is allowed to rise as it is being recharged. Approximately 80% of battery capacity is returned in the constant current region.

#### Stage 2: Absorption mode

When the battery voltage reaches approximately 2.4 volts per cell, or 14.4 volts for a 12V battery, the charger voltage is held constant at this level and the battery current is allowed to reduce. This voltage is maintained until the charging current reduces substantially indicating a full charge. At this point, the battery is fully charged.

#### Stage 3: Float mode

Float mode is the final stage of the charging routine. During float mode, the voltage on the battery is maintained at approximately 2.25 volts per cell, or 13.5 volts for a 12V battery. This voltage will maintain the full charge condition of the battery without boiling out electrolyte or overcharging the battery.