

TESLA CHARGERS

Instruction Manual

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Published by
A&P Electronic Media
Spokane, Washington

Editors: Jeff Moe & Aaron Murakami

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Digital Edition Published by:

A&P Electronic Media

PO Box 10029

Spokane, WA 99209

<http://emediapress.com>

Digital Version 1.00 - Release Date: March, 2016

Digital version available at <http://teslachargers.com>

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Introduction

This introduction is reserved.

Battery and Electrical Safety Considerations

The following statements are included for safety considerations. Even though these statements may describe situations that seem extremely unlikely, they are possible under normal conditions. Therefore, please familiarize yourself with these risks and hazards for your safety and the safety of others.

Batteries generate hydrogen gas even during normal operations. Hydrogen gas can be explosive if ignited. This means that serious injury, including permanent disfigurement, scarring, and blindness can occur in the vicinity of a charging battery. People have been injured by battery parts flying in an explosion. People have been injured by battery acid spraying on them in an explosion. These are rare, but possible hazards of charging batteries.

A battery can explode under normal operations, such as starting your car. They can explode under abnormal conditions, such as jump starting a car, or if short circuited by a tool. They can explode in a parked car or sitting on a table.

To help reduce the risk of these dangers and the possibility of these injuries, it is extremely important that you read and understand this manual, as well as any warnings and instructions by the battery manufacturer. For your own safety, follow these instructions:

1. Wear Personal Protective Equipment

- a. Always wear complete eye protection that protects from all angles.
- b. Wear gloves to prevent exposure to battery acid.

2. Avoid flames and sparks near battery and fuel

- a. Always keep flames, matches, lighters, cigarettes, or ignition sources away from batteries.
- b. Do not put flammable material on or under charger.
- c. DO NOT use near gasoline vapors.
- d. Make sure charging clips make good, secure electrical contact with the battery terminals by twisting or rocking them back and forth several times.
- e. To avoid interference and/or prevent damage to vehicle electrical systems, ALWAYS disconnect battery from vehicle before charging a battery in a vehicle. Always remove grounded terminal (connected to vehicle frame) from battery first.
- f. A tool touching both battery posts or causing electrical conduction to be made between the battery posts is a short circuit and will spark. When using metal tools on or near battery, be extra cautious to reduce risk of a short circuit, possibly causing a burn, fire, or battery explosion. DO NOT drop a tool on the battery.

2. Reduce Explosive Gas (Hydrogen)

- a. Before connecting charger, add distilled water to each cell until battery acid covers plates to help purge extra gas from cells. DO NOT overfill. Battery acid expands during charging. After charging, fill to level specified by battery

manufacturer. For a battery without removable caps (maintenance-free battery), carefully follow manufacturer's instructions on charging.

- b. Some sealed, maintenance-free batteries have a battery condition indicator. A light or bright colored dot indicates low water. Such a battery may need to be replaced.
- c. Charge battery with caps in place. Most US batteries are made with flame arresting caps. DO NOT pry caps off sealed batteries.
- d. Be sure area around battery is well ventilated before and during the charging process. NEVER charge a battery in a closed-in or unventilated area. This may result in a fire and/or an explosion.

3. Stay Away from Battery when Possible

- a. Never put face near battery.

4. Avoid Contact with Battery Acid

- a. Battery posts may have acid corrosion. DO NOT get corrosion in your eyes. Avoid touching eyes while working near battery.
- b. Always use a battery carrier. Carrying a battery by hand may put pressure on its ends, causing acid to be forced out vent caps.
- c. Always have plenty of fresh water and soap nearby in case battery acid contacts eyes, skin, or clothing. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with cold

running water for at least 15 minutes and get medical help immediately.

- d. In very cold weather, a discharged battery may freeze. Never charge a frozen battery. Gases may form, cracking the case, and spray out battery acid.

5. Avoid Overcharging Batteries

- a. Battery chargers can overcharge a battery if left connected for an extended period of time, resulting in loss of water, creation of hydrogen gas, and excessive heating of the battery.

6. Follow Other Manufacturer's Recommendations

- a. Before using charger, read all instructions for, and caution markings on: (1) charger, (2) battery, and (3) related products. Follow their recommended rate of charge.

Electrical Warnings

This charger, like all electrical products, **MUST** be treated with respect. Follow these instructions to reduce electrical hazard risk.

Proper Grounding and AC Power Connection

Some charger models must be grounded to reduce risk of electric shock. If the charger is equipped with an electric cord having an equipment grounding conductor and a grounding plug, the plug **MUST** be plugged into an electrical outlet that is properly

installed and GROUNDED in accordance with all local codes and ordinances. If you ever feel even a slight shock from this or any electrical appliance, stop, walk away. Turn off electricity to outlet, and have it inspected by an electrician. You may have a dangerous, improperly wired outlet.

How to Test for a Shorted or Open Battery Cell

WARNING

Do not allow the battery charger to run in a continuous “overload” mode, this will void your warranty. Disconnect the battery and check it for an open or shorted cell.

The charger will not help batteries that have open or shorted cells. In order to tell if a battery as an open or shorted cell, simply perform the following tests. You will need a voltmeter and a hydrometer to perform both of these tests.

IMPORTANT: Please review our Safety Precautions before handling or testing any battery!

Safety First! Wear protective clothing, goggles and gloves when handling batteries.

Step 1: Physical and Mechanical Inspection

- a. A mechanical inspection is really important as it can save you from future battery trouble. Replace cracked or broken batteries, clean or replace rusted or broken connections. On flooded/wet cell batteries check the water levels. The water level should be high enough to just cover the plates. Use only distilled water and do not overfill as it can spill, which should be avoided since electrolyte is corrosive.

Step 2: Preparing the Tests

- a. Make sure you turn off any instruments or accessories that will drain the battery or battery system during testing.
- b. Charge the battery or battery system until it is fully charged.
- c. If the system has multiple batteries connected, we recommend to disconnect them from each other to get accurate readings. Let the batteries sit for 4 to 12 hours, the longer the better. This is important because if you measure the voltage immediately after charging, you will not be measuring the true voltage of the battery.

Step 3: Testing for a Shorted Cell

- a. With a voltmeter, measure the voltage of each individual battery.
- b. Reference the chart below to determine if a battery has a shorted cell.

<u>Battery</u>	<u>Voltage Reading of a Short Cell</u>
6-volts	4.3-volts or less
8-volts	6.5-volts or less
12-volts	10.6-volts or less

Example: If a 6-volt battery is reading below 4.3-volts, then it has a short cell.

Step 4: Testing for an Open Cell in a Flooded/Wet cell battery

- If you have sealed type batteries, this test method cannot be used.
- Use a temperature compensating battery hydrometer for this test.
- With the hydrometer, measure and record the specific gravity of each battery cell. (Example: Battery #1 — Cell 1 = 1.250, Cell 2 = 1.275, Cell 3 = 1.275). Fill & drain the hydrometer a few times before pulling a sample.
- Compare the specific gravity readings between each cell. If a battery has a difference of more than .05 between the cells, that battery has an open cell.

Example readings: Three 6-volt batteries:

	<u>Cell #1</u>	<u>Cell #2</u>	<u>Cell #3</u>	<u>Condition</u>
Battery A	1.250	1.225	1.250	Recoverable
Battery B	1.275	1.250	1.225	Recoverable
Battery C	1.200	1.250	1.275	Open Cell

Battery C has an Open Cell because the difference between Cell #1 and Cell #3 is .075 more than 0.05.

Any battery that has a Shorted or Open Cell needs to be replaced.

There are two methods you can use to check for a dead cell. One with a floating ball type hydrometer; if one or more cells show one or no balls floating, the cell is dead. The second test is with a volt meter. Place the negative lead on the negative post and the positive lead in the cell closest to the negative post and get a reading; it should be 1/6 of the battery voltage, or about 2-volts. Then check each cell down the line recording the readings. They should all be about the same. If you find a cell that is much lower than the others, that cell is dead.



BATTERY CHARGING NOTES

1. If a lead-acid battery is not completely recharged after each use, chemical buildup on the battery's plates increases slightly with each charge/load cycle and impedes the battery's ability to be charged and/or deliver power. If the battery is overcharged, the battery will heat, causing excessive thermal expansion and contraction. This causes damage to the internal structure of the battery, causing it to fail as well. Tesla chargers incorporate several innovative design techniques which minimize both undercharging and overcharging.
2. In many cases, the Tesla battery charger may be able to charge and even increase the capacity of batteries that are not able to be adequately charged with conventional battery charging techniques employed by the majority of battery chargers on the market today.
3. It is very important to choose the right charging rate for your application. For example, a small charger, such as the 1AU, charging at the 1amp rate would provide a fairly gentle charge to a 7Ah battery. However, if a 1Ah battery is substituted for the 7Ah battery, the charger will charge the battery much faster and more forcefully, because you have the same power going to a smaller battery. Although you can charge a smaller battery faster, a slower charge is recommended to get the longest life out of your battery.

See the charts below for properly matching the charger and battery.

Tesla Chargers Lead - Acid Battery Charger Line

Model	Input Values		Output Values		Battery AH Range	Fan
	VAC	HZ	Voltage	Peak Current		
1AU	100 - 240	50 - 60	1.5 - 24	1 Amp	2 - 10 Ah	No
2A12-4	100 - 240	50 - 60	15.2	2 Amps	20 - 80 Ah	No
10A12	100 - 240	50 - 60	15.2	10 Amps	80 - 225 Ah	YES
25A12	100 - 240	50 - 60	15.2	25 Amps	200 - 500 Ah	YES

Tesla Solar Tracker 5 Model Line

Model	Input Values			Output Values			Lead Acid Battery		Wire Size	Fan
	Voc	Vmp	Imp	Vmp	Imp	Wmp	Voltage	AH Range		
S3A12	22	18.5	3.0	15.1	3.0	45.0	12 volt	30 - 60	18 ga	No
S10A12	22	18.5	10.0	15.1	10.0	150.0	12 volt	100 - 200	12 ga	YES
S20A12	22	18.5	20.0	15.1	20.0	300.0	12 volt	200 - 400	8 ga	YES
S40A12	22	18.5	40.0	15.1	40.0	600.0	12 volt	400 - 800	6 ga	YES
S80A12	22	18.5	80.0	15.1	80.0	1200.0	12 volt	800 - 1600	4 ga	YES
S160A12	22	18.5	160.0	15.1	160.0	2400.0	12 volt	1600 - 3200	2 ga	YES
S40A24	44	37.0	40.0	30.2	40.0	1200.0	24 volt	400 - 800	6 ga	YES
S80A24	44	37.0	80.0	30.2	80.0	2400.0	24 volt	800 - 1600	4 ga	YES
S160A24	44	37.0	160.0	30.2	160.0	4800.0	24 volt	1600 - 3200	2 ga	YES

4. Tesla Chargers are designed to charge batteries within a recommended amp hour range. Charging batteries smaller than recommended may result in excessive heating or premature failure of the battery. Charging batteries larger than recommended may take an excessive amount of time during which the charger may prematurely end its automatic charging cycle and/or overheat. Do not use a charger smaller or larger than recommended since this will result in damage to the battery or the charger. Always follow the recommendations in the above chart.

5. Sealed/Maintenance Free/Gel Cell/AGM batteries are sealed (non-refillable) and, although these batteries have the inherent advantage of being spill-proof, the water inside these batteries cannot be replenished and the batteries eventually "dry out". When this happens, the battery's life is over. These batteries are particularly susceptible to being destroyed prematurely by overcharging which causes excessive off-gassing (water loss). In many cases, however, these batteries are rendered useless by undercharging, and, in many cases, conventional charging techniques are ineffective in charging them. Use the Tesla Charger to rejuvenate these batteries by breaking through the chemical layers and dendrite formation, when other chargers cannot, to amazingly restore capacity and extend battery life. The potent, rejuvenating power of the Tesla Charger has been found to be of tremendous advantage to battery longevity when used as part of a regularly scheduled maintenance charging routine (for example, 1 out of every 5-10 charge cycles).

1AU Battery Charger



OPERATING INSTRUCTIONS

Follow these three steps in this order.

STEP 1. BEFORE OPERATING CHARGER

- Place the charger and the battery away from any combustible material. Choose a location in accordance with the safety instructions in Section 1 of this manual.
- Connect charger to proper voltage AC power outlet (110-120V for Model 1AU-120, 220-240V for Model 1AU-240).
- Disconnect battery from any circuitry the battery may be powering.

STEP 2. TURNING THE CHARGER ON

1. Connect each of charger's output connectors to the corresponding battery terminal, making sure that the charger's positive '+' **RED** clip is connected to battery's positive '+' terminal and charger's negative '-' **BLACK** clip is connected to battery's negative '-' terminal. (See figure 1 below). If the battery's terminals are such that a mechanical clamping connection is not possible, use the magnets provided with the charger to secure the necessary electrical connections. (See Figure 2 below). If the battery terminals are unlabeled, connect one way and if charging doesn't begin reverse the connections. The charger is reverse polarity protected and will not be damaged if polarity is inadvertently reversed.

2.

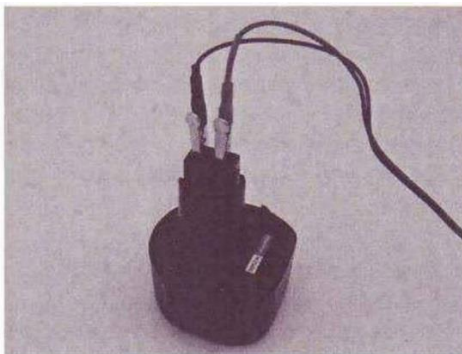


Figure 1

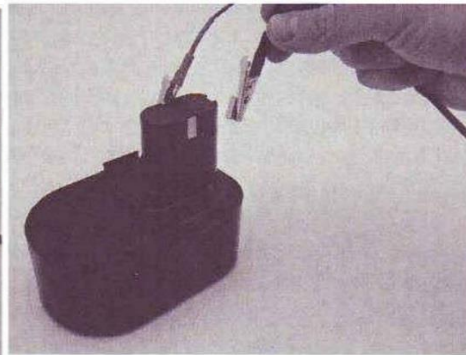


Figure 2

3. Choose the appropriate POWER LEVEL setting using the Power Level Switch, (See Figure 3), to match the battery to be charged. One may choose to deviate from the recommended power settings as marked on the top panel in order to increase or decrease the charge rate as desired (See Section 2, Part 3). However, attempting to charge a battery too fast, using a voltage setting higher than recommended, may cause the charger to operate outside of its specified electrical parameters. This will cause the DC circuit breaker on the back panel to trip (Figure 4). If this occurs, lower the voltage setting, wait for the breaker to cool, then reset the breaker by pressing its button, and restart the charging process.
4. Turn on the power switch (Figure 4). If either the polarity is reversed or the battery voltage is too low, LED will flash RED. If charging does not begin, battery voltage may be too low. See Section 4.2 BEFORE operating the voltage detection bypass (VDB) button. During the charging process, the LED indicator will show solid (non-flashing) RED.
5. Make sure the battery does not become disconnected from the charger while the charger is charging the battery. This can make a dangerous spark which can cause an explosion. Note also that if the battery gets disconnected and reconnected while under charge, the automatic charge cycle will be reset, possibly causing the charging process to take longer than necessary.
6. See CHARGING TIMES below for length of charge:

Fully discharged 1AH (1,000mAH) battery- approx. 2-4 HRS.

Fully discharged 3AH (3,000mAH) battery- approx. 4-8 HRS.

Fully discharged 7AH (7,000mAH) battery - approx. 8-14 HRS

IMPORTANT NOTE ON CHARGE TIMES

Charging times for your battery may be different from these depending on brand and condition. If your battery is half charged you will need only half the time to charge. Some old batteries may not accept a charge and will heat up on charging. It is common for a battery's first few charge cycles on the Tesla charger to take longer than normal as a result of the charger's rejuvenating characteristics.

CAUTION

If at any time the battery:

- 1) Gets hot (above 140°F or 60°C) or
- 2) Stays warm (above 100°F or 38°C) for more than 4 hours,

STOP CHARGING.

7. This charger is not intended nor designed to supply power for applications other than battery charging. Never charge a battery while the battery is powering another appliance or load.

STEP 3. TURNING THE CHARGER OFF

1. After the battery is charged, the LED indicator will turn to solid (non-flashing) green, indicating that the charging cycle is

finished. After the charging cycle is over, the charger will continue to perform a maintenance (float) type charge, flashing the LED green from time to time.

2. After the battery is charged, the LED indicator will turn to solid (non-flashing) **GREEN**, indicating that the charging cycle is finished. The charger should then be disconnected from the battery. If the charger is left connected after the charging cycle is finished, the battery voltage could drop allowing the **RED** LED to come back on and charge the battery until the solid **Green** LED is lit. The charge cycle may be stopped at any time by turning the power switch off from the rear panel of the charger.

Troubleshooting

1. Charger will not come on (no LED)
 - a. Charger is not plugged into an AC receptacle.
 - b. There is no power to the AC wall receptacle.
 - c. The AC circuit breaker in the power (rocker) switch on the rear panel is tripped. Reset the breaker by rocking the switch to the ON position. If the breaker trips again, **DO NOT** attempt to operate charger. Have the charger serviced by the manufacturer.
2. Charge cycle will not begin (flashing LED)
 - a. Battery is not connected to charger. Check to make sure good electrical contact is made.
 - b. Charger polarity is reversed. Battery '+' is not connected to charger '+', '-' to '-' , etc. Reverse battery connections and try again.

- c. DC circuit breaker has tripped. Lower the voltage setting, allow circuit breaker to cool, press circuit breaker button to reset, and attempt to restart charging process.
- d. Battery resting voltage is below 0.5-volts. **Before going further, be sure to establish that battery connections are made with proper polarity.** Push and hold voltage detection bypass (VDB) button in upper right corner of back panel to activate charge cycle until battery voltage comes up. **Important note: bypassing the voltage detection circuitry may allow one to inadvertently reverse charge the battery. Again, check to make sure polarity is correct before pressing VDB button.** If after holding VDB button pressed for 60 seconds, the charger reverts back into error mode (flashing **RED** LED) upon release of button (assuming electrical connections are secure) battery may be internally physically damaged and unable to take a charge. Check battery connections and try again. **BE SURE POLARITY IS CORRECT BEFORE PRESSING VDB BUTTON, OR DAMAGE TO THE CHARGER MAY RESULT.** DO NOT, however, operate charger longer than 60 seconds with VDB button depressed. NEVER mechanically secure VDB button in depressed position. DO NOT attempt to charge batteries that will not charge under the normal procedures outlined in this manual. Dispose properly and immediately of all batteries that will not take a charge.
- e. The battery connections may have become corroded or tarnished, preventing the charger from detecting the presence of the battery. If this is the case, clean the battery clips and/or battery terminals and try again.

3. Battery becomes too hot (greater than 140° F or 60° C
 - a. Battery is too small for charger. See Section 2.
 - b. Battery is in poor condition. If one area of the battery is excessively hotter than another area while battery is under charge or load, this may indicate a failed cell. Replace battery.
4. Charging cycle doesn't end (GREEN light never comes on).
 - a. Interrupted power source. If the line voltage is interrupted, surged, or erratic (i.e. a brownout, blackout, etc.), the circuitry in the charger may cause the charger to act erratically. Disconnect the charger from the power source, disconnect the battery from the charger, and check to see that the battery is charged. If not, then repeat the charging process as normal after correcting any abnormal line voltage condition(s).
 - b. Battery connections are not secure. A poor electrical connection can cause intermittent electrical contact, causing the charge cycle to keep repeating. Correct as necessary.

CONTROL PANEL LAYOUT

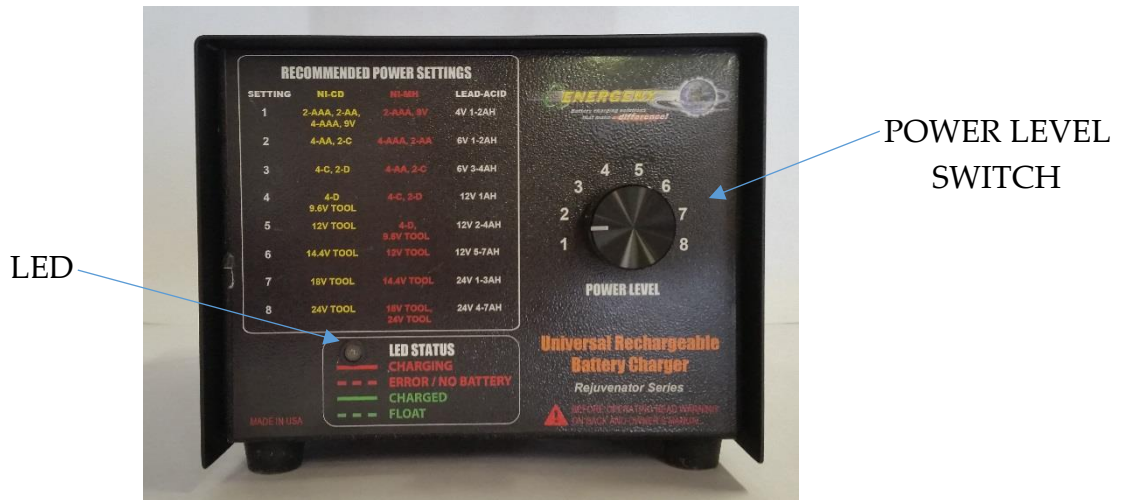


Figure 3

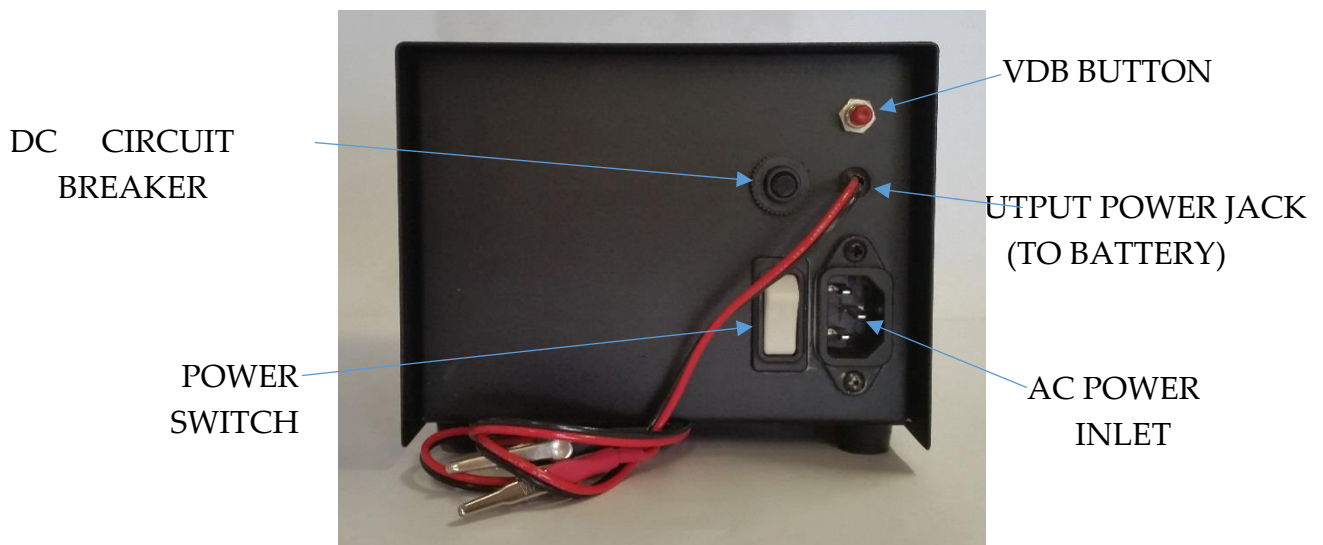


Figure 4

Section 6: SPECIFICATIONS

1AU -120 Universal Rechargeable Battery Charger

- INPUT: 110 – 120V AC, 1A, 50-60HZ
- OUTPUT: 1.2 – 24 VDC, 1.25A

1AU-240 Universal Rechargeable Battery Charger

- INPUT: 220 – 240V AC, 0.5A, 50-60HZ
- OUTPUT: 1.2 – 24 VDC, 1.25A

2.5A12-EX Battery Charger



Setting Up Your Charger

The 2.5A12-EX is a 2.5 amp charger designed to charge 12 volt batteries, hence the name "2.5A12-EX". The charger unit runs on 24-volts DC, which is supplied by the Universal Power Supply that is included with the charger.

The Universal Power Supply will run on ALL household power, anywhere in the world. In countries other than USA and Canada you will

need to acquire a universal AC cord as used for computers with the proper plug for your country. This power supply can be safely plugged into any ordinary AC power system that supplies power for home appliances. This includes:

1. 120 VAC 60Hz systems in North America.
2. 240 VAC 50Hz systems in Europe, Asia, South America, and elsewhere.
3. 100 VAC 50Hz systems in Japan.

When plugged into any of these AC systems, the Universal Power Supply will produce the 24-volts DC @ 2.5 Amperes that the 2.5A12-EX charger requires.

Step One: Find a location where you plan to charge your battery and bring the battery, charger, and its power supply together in that location.

Step Two: Find the nearest AC power receptacle to where you want to charge your battery. If it is close enough, simply plug the Universal Power Supply into the receptacle and place it near the battery. If the receptacle is too far away for the supplied cord to reach, then use an extension cord of appropriate length to span the distance.

Step Three: Place the 2.5A12-EX charger between the power supply and the battery you wish to charge. Lay out the cords from the charger and prepare to attach them to the battery terminals, and prepare to plug the power supply into the charger.

Operating Instructions

Your 2.5A12-EX has one indicator light, which can be either **RED** or **GREEN**. It has NO ON/OFF switch. The unit is turned ON by plugging it into the power supply and turned OFF by unplugging it from the power supply.

Step One: Things to do Before Operating the Charger

1. For flooded-cell batteries, check to make sure that the water levels of the battery to be charged are at the level specified by the manufacturer. If any of the cells are too low, add DISTILLED WATER ONLY according to the battery manufacturer's specifications. Do not overfill the cells as charging may raise the level slightly.
2. **IMPORTANT** - Disconnect the battery from any circuitry the battery may be powering. If the battery is in a vehicle, disconnect the battery from the vehicle's wiring. **The charger may damage other devices designed to operate at the battery voltage.** We are not responsible for any damage to your vehicle's on-board computers or associated components, which may occur if this step is not followed.

Step Two: The Charging Process

1. **Make sure the battery is at least 6 volts or the charger will not charge the battery.** Batteries under a 6 volt resting voltage are normally in too poor of shape to be brought back. Connect both of the charger's output connectors to the corresponding battery terminals. Make sure that the charger's **RED** (+) clip is connected

to the battery's positive (+) terminal post, and the charger's BLACK (-) clip is connected to the battery's negative (-) terminal post. After this is done, the **RED** light should come ON and stay **SOLID**, if the battery has at least 6 volts, which is necessary for the charger to start.

2. Plug the Universal Power Supply's AC plug into a suitable household (single phase) wall receptacle (See Safety Instructions).
3. Connect the DC power output of the Universal Power Supply to the DC power input jack of the 2.5A12-EX charger. At this point, the light remains RED for the duration of the charging cycle. You may also hear a rapid clicking noise, which is the capacitor in the charger discharging to the battery.
4. As the battery charges, the **RED** light remains solid until the very end at which time the GREEN light comes on solid. When the GREEN light is on, the battery is charged and the charger can be disconnected from the battery and the power supply plug can be removed from the wall.

NOTE: *Due to the condition of some batteries, the **GREEN** light will never come on. This is perfectly normal for badly worn batteries that are not able to be brought back to optimum conditions. We recommend using a volt meter to monitor the charging voltage of the battery. In a highly sulphated battery, it is normal for the voltage to climb to the high 16 volt range and over a period of time, the voltage will drop in small increments. This voltage drop means the sulphation is successfully dissolving back into the solution making the electrolyte solution conductive again. As the conductivity increases, the voltage will continue to drop. If the sulphation has not crystallized too hard, the battery can normally come back to an optimum condition and the*

GREEN light will come on. Watch this segment of this video to learn more about the above stated concept:

<https://youtu.be/0hLI2W17W8?t=7m18s>

5. Below are APPROXIMATE CHARGING TIMES for the batteries listed:

To calculate these approximations, we take the amp hour rating for the battery and divide it by the amp rating of the charger. The 2.5A12-EX is a 2.5 amp charger, so to fully charge a 20 amp hour battery we divide 20 amp hours by 2.5 amps, which equals 8 hours. This is based on a deep cycle battery in good condition and is only discharged down to 10.5 volts, which is the lowest a deep cycle battery should be discharged to keep it in good condition.

Fully discharged 20Ah or 200 CCA* Battery – Approx. 8 Hours

Fully discharged 40Ah or 400 CCA* Battery – Approx. 16 Hours

Fully discharged 80Ah or 800 CCA* Battery – Approx. 32 Hours

**Cold Cranking Amp rating for starter batteries is only a rough estimate to compare them to a deep cycle battery's amp hour rating.*

NOTES ON CHARGING TIMES

Charging times for your battery may be different from those listed, depending on their condition. If your battery is only half discharged, you will need only half as much time to charge. Some old batteries may not accept a charge and will heat up on charging, which means the battery is damaged and should be properly discarded, because it will not accept a charge.

Charging times for “deep cycle” batteries are based on their amp hour ratings (Ah). Charging times for “engine starting” batteries are rated in cold cranking amps (CCA). These may vary widely, depending on the size of the battery and its state of discharge.

Charging for longer times may damage the battery. **CAUTION:** If at any time the battery gets hot (above 120°F or 49°C) during the charging process, **STOP CHARGING**. Your battery most likely has a shorted cell and cannot be repaired.

Step Three: Turning the charger OFF

After the battery is disconnected from the charger, unplug the charger from the power supply, unplug the power supply from the wall socket, and put the charger and power supply away in a safe place.

Battery Charging Recommendations

1. Tesla Chargers incorporate several innovative design techniques which minimize both undercharging and overcharging.
2. The technology incorporated in the design of this battery charger is of particular advantage in charging heavily or partially sulfated batteries. In many cases, the Tesla Charger may be able to charge and even increase the capacity of batteries that are not able to be charged or rejuvenated with conventional battery chargers on the market today.
3. It is very important to choose the right charger for your application. For example, a small charger such as the 2.5A12-EX that charges at a 2.5 amp rate would be an ideal trickle charger to a 80Ah battery. And of course, this charger will charge a 20Ah battery much faster.
4. This charger is designed to charge flooded cell type lead-acid batteries rated between 20-80 Ah or 200-800 CCA. Charging batteries smaller than this with this charger will damage the battery.
5. Sealed lead-acid batteries (Gel Cell or Absorbed Glass Mat, AGM) have the inherent advantage of being spill proof, however, because the water inside these batteries cannot be replenished, the batteries eventually dry out. When this happens, the battery's life is over. These batteries are particularly susceptible to being destroyed prematurely by overcharging which causes excessive off-gassing (water loss). These batteries are also rendered useless by undercharging, and in these cases, conventional charging techniques are ineffective to charge them. For this type of battery, the 2.5A12 should be used only for occasional charge topping, and should not be used on a regular basis to avoid battery damage.

6. If the battery you wish to charge is in a vehicle, disconnect the battery from the vehicle's electrical system before connecting the charger to the battery.

2A12 Battery Charger



Setting Up Your Charger

The 2A12 is a 2 amp charger designed to charge 12 volt batteries, hence the name “2A12”. The charger unit runs on 24-volts DC, which is supplied by the Universal Power Supply that is included with the charger.

The Universal Power Supply will run on ALL household power, anywhere in the world. In all other countries but USA and Canada you will need to find a suitable AC cord as used for computers. This power supply can be safely plugged into any ordinary AC power system that supplies power for home appliances. This includes:

4. 120 VAC 60Hz systems in North America.

5. 240 VAC 50Hz systems in Europe, Asia, South America, and elsewhere.
6. 100 VAC 50Hz systems in Japan.

When plugged into any of these AC systems, the Universal Power Supply will produce the 24-volts DC @ 2.5 Amperes that the 2A12 charger requires.

Step One: Find a location where you plan to charge your battery and bring the battery, charger, and its power supply together in that location.

Step Two: Find the nearest AC power receptacle to where you want to charge your battery. If it is close enough, simply plug the Universal Power Supply into the receptacle and place it near the battery. If the receptacle is too far away for the supplied cord to reach, then use an extension cord of appropriate length to span the distance.

Step Three: Place the 2A12 charger between the power supply and the battery you wish to charge. Lay out the cords from the charger and prepare to attach them to the battery terminals, and prepare to plug the power supply into the charger.

Operating Instructions

Your 2A12 has two indicator lights, one **RED** and one **GREEN**. It has NO ON/OFF switch. The unit is turned ON by plugging it into the power supply and turned OFF by unplugging it from the power supply.

Step One: Things to do Before Operating the Charger

3. For flooded-cell batteries, check to make sure that the water levels of the battery to be charged are at the level specified by the manufacturer. If any of the cells are too low, add DISTILLED WATER ONLY according to the battery manufacturer's specifications. Do not overfill the cells as charging may raise the level slightly.
4. **IMPORTANT** - Disconnect the battery from any circuitry the battery may be powering. If the battery is in a vehicle, disconnect the battery from the vehicle's wiring. **The charger may damage other devices designed to operate at the battery voltage.** We are not responsible for any damage to your vehicle's on-board computers or associated components, which may occur if this step is not followed.

Step Two: The Charging Process

6. Plug the Universal Power Supply's AC plug into a suitable household (single phase) wall receptacle (See Safety Instructions).
7. Connect the DC power output of the Universal Power Supply to the DC power input jack of the 2A12 charger. At this point, both the **RED** and **Green** indicator lights should FLASH at the same time.
8. Connect both of the charger's output connectors to the corresponding battery terminals. Make sure that the charger's **RED** (+) clip is connected to the battery's positive (+) terminal post, and the charger's **BLACK** (-) clip is connected to the

battery's negative (-) terminal post. After this is done, the **RED** light should come ON and stay ON SOLID.

9. As the battery charges, the **RED** light will stay on solid until near the end of the charging process. As the charge nears the end, the **GREEN** and **RED** lights will begin to FLASH alternately, which means float mode, and at this time the battery is sufficiently charged and can be used. It is not necessary for the solid **GREEN** LED to come on, although it is recommended to wait for the solid **GREEN**. Note: due to the condition of some batteries, they will not ever reach the solid **GREEN** condition. You can, however, leave the charger connected from 48-72 hours after which if the charger has not gone to solid **GREEN**, the battery is not capable.
10. When the battery is finished charging, the **GREEN** light will come on SOLID. At this point, the battery should be disconnected from the charger.
11. Below are APPROXIMATE CHARGING TIMES for the batteries listed:

To calculate these approximations, we take the amp hour rating for the battery and divide it by the amp rating of the charger. The 2A12 is a 2 amp charger, so to fully charge a 20 amp hour battery we divide 20 amp hours by 2 amps, which equals 10 hours. This is based on a deep cycle battery in good condition and is only discharged down to 10.5 volts, which is the lowest a deep cycle battery should be discharged to keep it in good condition.

Fully discharged 20 AH or 200 CCA* Battery – Approx. 10 Hours

Fully discharged 40 AH or 400 CCA* Battery – Approx. 20 Hours

Fully discharged 80 AH or 800 CCA* Battery – Approx. 40 Hours

**Cold Cranking Amp rating for starter batteries is only a rough estimate to compare them to a deep cycle battery's amp hour rating.*

NOTES ON CHARGING TIMES

Charging times for your battery may be different from those listed, depending on their condition. If your battery is only half discharged, you will need only half as much time to charge. Some old batteries may not accept a charge and will heat up on charging, which means the battery is damaged and should be properly discarded, because it will not accept a charge.

Charging times for “deep cycle” batteries are based on their amp hour ratings (Ah). Charging times for “engine starting” batteries are rated in cold cranking amps (CCA). These may vary widely, depending on the size of the battery and its state of discharge.

Charging for longer times may damage the battery. **CAUTION:** If at any time the battery gets hot (above 120°F or 49°C) during the charging process, **STOP CHARGING**. Your battery most likely has a shorted cell and cannot be repaired.

Step Three: Turning the charger OFF

After the battery is disconnected from the charger, unplug the charger from the power supply, unplug the power supply from the wall socket, and put the charger and power supply away in a safe place.

Battery Charging Recommendations

7. Tesla Chargers incorporate several innovative design techniques which minimize both undercharging and overcharging.
8. The technology incorporated in the design of this battery charger is of particular advantage in charging heavily or partially sulfated batteries. In many cases, the Tesla Chargers may be able to charge and even increase the capacity of batteries that are not able to be charged or rejuvenated with conventional battery chargers on the market today.
9. It is very important to choose the right charger for your application. For example, a small charger such as the 2A12 that charges at a 2 amp rate would be an ideal trickle charger to a 80Ah battery. And of course, this charger will charge a 20Ah battery much faster.
10. This charger is designed to charge flooded cell type lead-acid starter batteries rated between 20-80 Ah or 200-800 CCA. Charging batteries smaller than this with this charger may damage the battery from excess heat.
11. Sealed lead-acid batteries (Gel Cell or Absorbed Glass Mat, AGM) have the inherent advantage of being spill proof, however, because the water inside these batteries cannot be replenished, the batteries eventually dry out. When this happens, the battery's

life is over. These batteries are particularly susceptible to being destroyed prematurely by overcharging which causes excessive off-gassing (water loss). These batteries are also rendered useless by undercharging, and in these cases, conventional charging techniques are ineffective in charging them.

12. If the battery you wish to charge is in a vehicle, disconnect the battery from the vehicle's electrical system before connecting the charger to the battery.

Troubleshooting

The 2A12 has two indicator lights on it; one **RED** and the other **GREEN**. These indicator lights will always tell you the condition of the charger according to the following 6 possibilities. If the charger is doing something you don't understand, look at what the two indicator lights are doing and refer to this list.

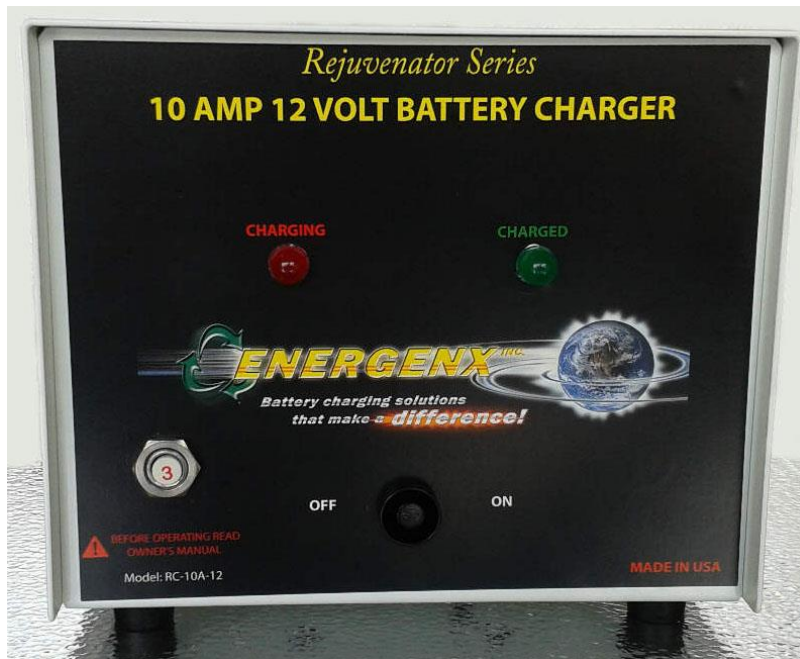
1. Both lights are off
 - a. Charger is not receiving any power from the power supply AND it is not connected to a battery to be charged.
 - b. If the Universal Power Supply is plugged into an AC wall receptacle AND the charger is plugged into the power supply, THEN there is no power at the AC wall receptacle. Verify that the AC wall receptacle works.
 - c. If the AC wall receptacle works, THEN check to see if the Universal Power Supply connections are secure. Check to make sure that the AC power cord is seated firmly in the wall receptacle and that the DC power jack is inserted

completely into the charger. Check also the AC power cord as well.

2. **RED** and **GREEN** lights are flashing simultaneously
 - a. The power supply is plugged into the wall receptacle and the charger is plugged into the power supply, but the charger is NOT connected to a battery.
 - b. IF the battery charger IS connected to a battery, check the connections for corrosion, or a broken wire, as the charger does not recognize the battery connection being present.
3. **RED** light is flashing quickly
 - a. The charger is receiving power from the power supply, but its output wires are connected to a DANGEROUS CONDITION.
 - b. The charger is connected to the battery in reverse. Disconnect and reconnect while observing the proper polarity. (Black clip must connect to the Negative Battery Terminal and the **RED** clip must connect to the Positive Battery Terminal).
 - c. The battery is deeply damaged and is producing a “short circuit” condition. The battery may not be able to be charged. Disconnect immediately.
 - d. The two clips that are supposed to be connected to the battery are directly touching each other. Disconnect them immediately.
 - e. DO NOT LET THE CHARGER REMAIN IN THIS CONDITION!
4. **RED** light is ON Solid
 - a. The battery voltage is LOW.

- b. WHEN the power supply is connected to the charger and the charger is connected to the battery, the Solid RED means the battery is being charged.
 - c. WHEN the power supply is NOT connected to the charger, but the charger is connected to the battery, the Solid RED light means the battery is low, but is NOT being charged.
5. RED and GREEN lights flashing alternately
- a. The battery is being charged AND is approaching the end of the charging cycle.
 - b. The battery is already fully charged and is cycling in the “float” mode.
6. GREEN light is ON Solid
- a. The battery is fully charged and should be disconnected from the charger.
7. If the RED and GREEN LEDs flash alternately when the battery is discharged and first connected to the charger
- a. This indicates a highly sulfated battery with high impedance. This causes the voltage to rise making the GREEN LED flash from time to time. It is recommended to use a volt meter and measure the voltage at the battery terminals. Monitor the voltage over the next few days and you should see the voltage drop as the battery is desulfated. After desulfation, the voltage should then begin to rise to a fully charged condition.

10A12 Battery Charger



Unpacking Your 10A12

Carefully unpack all of the parts to your 10A12 and inspect them for damage during shipping. If there is any damage, contact the shipping agent and immediately file a claim. As you unpack your unit, take an inventory of the parts to make sure you have received a complete unit. You should have:

1. One 10A12 Charger Unit
2. 6 ft. Grounded Power Cord (USA & Canada)
3. One Owner's Manual

Keep all of the packing materials as they will be needed if you wish to store the unit, travel with the unit, or if you need to return for

repair. If any of these items are missing, contact the manufacturer at once and report the packing error.

Setting up your Charger

The 10A12 is a 10 amp charger designed to charge 12 volt batteries, hence the name 10A12. The charger unit runs on standard voltage (120-volts AC or can be purchased in the 240-volts AC version).

The 10A12 is supplied with a power cord in the USA and Canada. In all other countries you must acquire a suitable AC cord with the plug type specific to your country. This cord is the type commonly used on computers.

Step One: Find a location where you plan to charge your battery and bring the battery, the charger, and its power supply together to that location.

Step Two: Find the nearest AC power receptacle to where you want to charge your battery. If it is close enough, simply plug the charger into the receptacle and place it near the battery. If the receptacle is too far away for the supplied cord to reach, then use an extension cord of appropriate length to span the distance.

Step Three: Place the 10A12 charger between the power supply and the battery you wish to charge. Lay out the cords from the charger and prepare to attach them to the battery terminals, and prepare to plug the

power supply into the charger.

- Special Note: Your charger is equipped with an internal reset-able circuit breaker. Your charger will not operate on a shorted battery.

Operating Instructions

Your 10A12 has two indicator lights, one **RED** and one **GREEN**. It has an ON/OFF switch located on the front of the charger.

Step One: Things to do Before Operating the Charger

1. For flooded-cell batteries, check to make sure that the water levels of the battery to be charged are at the level specified by the manufacturer. If any of the cells are too low, add DISTILLED WATER ONLY according to the battery manufacturer's specifications. Do not overfill the cells as charging may raise the level slightly.
2. **IMPORTANT** - Disconnect the battery from any circuitry the battery may be powering. If the battery is in a vehicle, disconnect the battery from the vehicle's wiring. **The charger may damage other devices designed to operate at the battery voltage.** We are not responsible for any damage to your vehicle's on-board computers or associated components, which may occur if this step is not followed.

Step Two: The Charging Process

1. Connect the output of the Power Supply cord to the power input receptacle on the back of the charger.
2. Plug the Power Supply's AC plug into a suitable household (single phase) wall receptacle (See Safety Instructions). At this point, both the **RED** and **Green** indicator lights should FLASH at the same time. Connect both of the charger's output connectors to the corresponding battery terminals. Make sure that the charger's **RED** (+) clip is connected to the battery's positive (+) terminal post, and the charger's **BLACK** (-) clip is connected to the battery's negative (-) terminal post. After this is done, the **RED** light should come ON and stay ON SOLID.
3. As the battery charges, the **RED** light will stay on solid until near the end of the charging process. As the charge nears the end, the **GREEN** and **RED** lights will begin to flash alternately, which means float mode, and at this time the battery is sufficiently charged and can be used. It is not necessary for the solid **GREEN** LED to come on, although it is recommended to wait for the solid **GREEN**. Note: due to the condition of some batteries, they will not ever reach the solid **GREEN** condition. You can, however, leave the charger connected from 48-72 hours after which if the charger has not gone to solid **GREEN**, the battery is not capable.
4. When the battery is finished charging, the **GREEN** light will come on solid. At this point, the battery should be disconnected from the charger.
5. Below are APPROXIMATE CHARGING TIMES for the batteries listed:

To calculate these approximations, we take the amp hour rating

for the battery and divide it by the amp rating of the charger. The 10A12 is a 10 amp charger, so to fully charge a 225 amp hour battery we divide 225 amp hours by 10 amps, which equals 22.5 hours. This is based on a deep cycle battery in good condition and is only discharged down to 10.5 volts, which is the lowest a deep cycle battery should be discharged to keep it in good condition.

Fully discharged 80 AH or 800 CCA* Battery – Approx. 8 Hours

Fully discharged 225 AH Battery – Approx. 22.5 Hours

**Cold Cranking Amp rating for starter batteries is only a rough estimate to compare them to a deep cycle battery's amp hour rating.*

NOTES ON CHARGING TIMES

Charging times for your battery may be different from those listed, depending on their condition. If your battery is only half discharged, you will need only half as much time to charge. Some old batteries may not accept a charge and will heat up on charging, which means the battery is damaged and should be properly discarded, because it will not accept a charge.

Charging times for “deep cycle” batteries are based on their amp hour ratings (Ah). Charging times for “engine starting” batteries are rated in cold cranking amps (CCA). These may vary widely, depending on the size of the battery and its state of discharge.

Charging for longer times may damage the battery. **CAUTION:** If at any time the battery gets hot (above 120°F or 49°C) during the charging process, **STOP CHARGING**. Your battery most likely has a shorted cell and cannot be repaired.

Step Three: Turning the charger OFF

Turn off the power switch on the front of the charger. After the battery is disconnected from the charger, unplug the power supply cord from the wall socket, and put the charger away in a safe place.

Battery Charging Recommendations

1. Tesla Chargers incorporate several innovative design techniques which minimize both undercharging and overcharging.
2. The technology incorporated in the design of this battery charger is of particular advantage in charging heavily or partially sulfated batteries. In many cases, the Tesla Chargers may be able to charge and even increase the capacity of batteries that are not able to be charged or rejuvenated with conventional battery chargers on the market today.
3. It is very important to choose the right charger for your application. For example, a charger such as the 10A12 that charges at a 10 amp rate would be an ideal slow charger for a 225 Ah battery and charge an 80Ah battery much faster.
4. This charger is designed to charge flooded cell type lead-acid starter batteries rated between 80-225 Ah or 800-2250 CCA.

Charging batteries smaller than this with this charger may damage the battery from excess heat.

5. Sealed lead-acid batteries (Gel Cell or Absorbed Glass Mat, AGM) have the inherent advantage of being spill proof, however, because the water inside these batteries cannot be replenished, the batteries eventually dry out. When this happens, the battery's life is over. These batteries are particularly susceptible to being destroyed prematurely by overcharging which causes excessive off-gassing (water loss). These batteries are also rendered useless by undercharging, and in these cases, conventional charging techniques are ineffective in charging them.
6. If the battery you wish to charge is in a vehicle, disconnect the battery from the vehicle's electrical system before connecting the charger to the battery.

Troubleshooting

The 10A12 has two indicator lights on it; one **RED** and the other **GREEN**. These indicator lights will always tell you the condition of the charger according to the following 6 possibilities. If the charger is doing something you don't understand, look at what the two indicator lights are doing and refer to this list.

1. Both lights are off
 - a. Charger is not receiving any power from the power supply AND it is not connected to a battery to be charged.
 - b. If the Power Supply cord is plugged into an AC wall receptacle AND the charger is plugged into the power

supply, THEN there is no power at the AC wall receptacle. Verify that the AC wall receptacle works.

- c. If the AC wall receptacle works, THEN check to see if the power supply cord connection is secure. Check to make sure that the AC power cord is seated firmly in the wall receptacle and that the receptacle end is inserted completely into the charger.
2. **RED** and **GREEN** lights are flashing simultaneously
 - a. The power supply cord is plugged into the wall receptacle and also into the charger, but the charger is NOT connected to a battery.
 - b. IF the battery charger IS connected to a battery, check the connections for corrosion, or a broken wire, as the charger does not recognize the battery connection being present.
3. **RED** light is flashing quickly
 - a. The charger is receiving power from the power supply, but its output wires are connected to a DANGEROUS CONDITION.
 - b. The charger is connected to the battery in reverse. Disconnect and reconnect while observing the proper polarity. (Black clip must connect to the Negative Battery Terminal and the **RED** clip must connect to the Positive Battery Terminal).
 - c. The battery is deeply damaged and is producing a "short circuit" condition. The battery may not be able to be charged. Disconnect immediately.
 - d. The two clips that are supposed to be connected to the battery are directly touching each other. Disconnect them immediately.

- e. DO NOT LET THE CHARGER REMAIN IN THIS CONDITION!
4. **RED** light is ON Solid
 - a. The battery voltage is LOW.
 - b. WHEN the power supply is connected to the charger and the charger is connected to the battery, the Solid **RED** means the battery is being charged.
 - c. WHEN power is NOT connected to the charger, but the charger is connected to the battery, the Solid **RED** light means the battery is low, but is NOT being charged.
 5. **RED** and **GREEN** lights flashing alternately
 - a. The battery is being charged AND is approaching the end of the charging cycle.
 - b. The battery is already fully charged and is cycling in the “float” mode.
 6. **GREEN** light is ON Solid
 - a. The battery is fully charged and should be disconnected from the charger.
 7. If the **RED** and **GREEN** LEDs flash alternately when the battery is discharged and first connected to the charger
 - a. This indicates a highly sulfated battery with high impedance. This causes the voltage to rise making the **GREEN** LED flash from time to time. It is recommended to use a volt meter and measure the voltage at the battery terminals. Monitor the voltage over the next few days and you should see the voltage drop as the battery is desulfated. After desulfation, the voltage should then begin to rise to a fully charged condition.

25A12 Battery Charger



Unpacking Your 25A12

Carefully unpack all of the parts to your 25A12 and inspect them for damage during shipping. If there is any damage, contact the shipping agent and immediately file a claim. As you unpack your unit, take an inventory of the parts to make sure you have received a complete unit. You should have:

1. One 25A12 Charger Unit
2. 6 ft. Grounded Power Cord
3. One Owner's Manual

Keep all of the packing materials as they will be needed if you wish to

store the unit, travel with the unit, or if you need to send it back for repair. If any of these parts are missing, contact the manufacturer at once and report the packing error.

Setting up your Charger

The 25A12 is a 25 amp charger designed to charge 12 volt batteries, hence the name 25A12. The charger unit runs on standard voltage (120-volts AC or can be purchased in the 240-volts AC version).

The 25A12 is supplied with a power cord in the USA and Canada. In all other countries you must acquire a suitable AC cord with the plug type specific to your country. This cord is the type commonly used on computers.

Step One: Find a location where you plan to charge your battery and bring the battery, the charger, and its power supply together to that location.

Step Two: Find the nearest AC power receptacle to where you want to charge your battery. If it is close enough, simply plug the charger into the receptacle and place it near the battery. If the receptacle is too far away for the supplied cord to reach, then use an extension cord of appropriate length to span the distance.

Step Three: Place the 25A12 charger between the power supply and the battery you wish to charge. Lay out the cords from the charger and

prepare to attach them to the battery terminals, and prepare to plug the power supply into the charger.

- Special Note: Your charger is equipped with an internal reset-able circuit breaker. Your charger will not operate on a shorted battery.

Operating Instructions

Your 25A12 has two indicator lights, one **RED** and one **GREEN**. It has an ON/OFF switch located on the front of the charger.

Step One: Things to do Before Operating the Charger

1. For flooded-cell batteries, check to make sure that the water levels of the battery to be charged are at the level specified by the manufacturer. If any of the cells are too low, add **DISTILLED WATER ONLY** according to the battery manufacturer's specifications. Do not overfill the cells as charging may raise the level slightly.
2. **IMPORTANT** - Disconnect the battery from any circuitry the battery may be powering. If the battery is in a vehicle, disconnect the battery from the vehicle's wiring. **The charger may damage other devices designed to operate at the battery voltage.** We are not responsible for any damage to your vehicle's on-board computers or associated components, which may occur if this step is not followed.

Step Two: The Charging Process

1. Connect the output of the Power Supply cord to the power input receptacle on the back of the charger.
2. Plug the Power Supply's AC plug into a suitable household (single phase) wall receptacle (See Safety Instructions). At this point, both the **RED** and **Green** indicator lights should FLASH at the same time. Connect both of the charger's output connectors to the corresponding battery terminals. Make sure that the charger's **RED** (+) clip is connected to the battery's positive (+) terminal post, and the charger's **BLACK** (-) clip is connected to the battery's negative (-) terminal post. After this is done, the **RED** light should come ON and stay ON SOLID.
3. As the battery charges, the **RED** light will stay on solid until near the end of the charging process. As the charge nears the end, the **GREEN** and **RED** lights will begin to flash alternately, which means float mode, and at this time the battery is sufficiently charged and can be used. It is not necessary for the solid **GREEN** LED to come on, although it is recommended to wait for the solid **GREEN**. Note: due to the condition of some batteries, they will not ever reach the solid **GREEN** condition. You can, however, leave the charger connected from 48-72 hours after which if the charger has not gone to solid **GREEN**, the battery is not capable.
4. When the battery is finished charging, the **GREEN** light will come on solid. At this point, the battery should be disconnected from the charger.

5. Below are APPROXIMATE CHARGING TIMES for the batteries listed:

To calculate these approximations, we take the amp hour rating for the battery and divide it by the amp rating of the charger. The 25A12 is a 25 amp charger, so to fully charge a 225 amp hour battery we divide 225 amp hours by 25 amps, which equals 9 hours. This is based on a deep cycle battery in good condition and is only discharged down to 10.5 volts, which is the lowest a deep cycle battery should be discharged to keep it in good condition.

Fully discharged 200 AH Battery – Approx. 8 Hours

Fully discharged 500 AH Battery – Approx. 20 Hours

NOTES ON CHARGING TIMES

Charging times for your battery may be different from those listed, depending on their condition. If your battery is only half discharged, you will need only half as much time to charge. Some old batteries may not accept a charge and will heat up on charging, which means the battery is damaged and should be properly discarded, because it will not accept a charge.

Charging times for “deep cycle” batteries are based on their amp hour ratings (Ah). Charging times for “engine starting” batteries are rated in cold cranking amps (CCA). These may vary widely, depending on the size of the battery and its state of discharge.

Charging for longer times may damage the battery. **CAUTION:** If at any time the battery gets hot (above 120°F or 49°C) during the charging process, **STOP CHARGING**. Your battery most likely has a shorted cell and cannot be repaired.

Step Three: Turning the charger OFF

Turn off the power switch on the front of the charger. After the battery is disconnected from the charger, unplug the power supply cord from the wall socket, and put the charger away in a safe place.

Battery Charging Recommendations

1. Tesla Chargers incorporate several innovative design techniques which minimize both undercharging and overcharging.
2. The technology incorporated in the design of this battery charger is of particular advantage in charging heavily or partially sulfated batteries. In many cases, the Tesla Chargers may be able to charge and even increase the capacity of batteries that are not able to be charged or rejuvenated with conventional battery chargers on the market today.
3. It is very important to choose the right charger for your application. For example, a charger such as the 25A12 that charges at a 25 amp rate would be an ideal slow charger for a 500 Ah battery and charge an 200Ah battery much faster.
4. This charger is designed to charge flooded cell type lead-acid starter batteries rated between 200-500 Ah. Charging batteries smaller than this with this charger may damage the battery from excess heat.

5. Sealed lead-acid batteries (Gel Cell or Absorbed Glass Mat, AGM) have the inherent advantage of being spill proof, however, because the water inside these batteries cannot be replenished, the batteries eventually dry out. When this happens, the battery's life is over. These batteries are particularly susceptible to being destroyed prematurely by overcharging which causes excessive off-gassing (water loss). These batteries are also rendered useless by undercharging, and in these cases, conventional charging techniques are ineffective in charging them.
6. If the battery you wish to charge is in a vehicle, disconnect the battery from the vehicle's electrical system before connecting the charger to the battery.

Troubleshooting

The 25A12 has two indicator lights on it; one **RED** and the other **GREEN**. These indicator lights will always tell you the condition of the charger according to the following 6 possibilities. If the charger is doing something you don't understand, look at what the two indicator lights are doing and refer to this list.

1. Both lights are off
 - a. Charger is not receiving any power from the power supply AND it is not connected to a battery to be charged.
 - b. If the Power Supply cord is plugged into an AC wall receptacle AND the charger is plugged into the power supply, THEN there is no power at the AC wall receptacle. Verify that the AC wall receptacle works.

- c. If the AC wall receptacle works, THEN check to see if the power supply cord connection is secure. Check to make sure that the AC power cord is seated firmly in the wall receptacle and that the receptacle end is inserted completely into the charger.
- 2. **RED** and **GREEN** lights are flashing simultaneously
 - a. The power supply cord is plugged into the wall receptacle and also into the charger, but the charger is NOT connected to a battery.
 - b. IF the battery charger IS connected to a battery, check the connections for corrosion, or a broken wire, as the charger does not recognize the battery connection being present.
- 3. **RED** light is flashing quickly
 - a. The charger is receiving power from the power supply, but its output wires are connected to a DANGEROUS CONDITION.
 - b. The charger is connected to the battery in reverse. Disconnect and reconnect while observing the proper polarity. (Black clip must connect to the Negative Battery Terminal and the **RED** clip must connect to the Positive Battery Terminal).
 - c. The battery is deeply damaged and is producing a “short circuit” condition. The battery may not be able to be charged. Disconnect immediately.
 - d. The two clips that are supposed to be connected to the battery are directly touching each other. Disconnect them immediately.
 - e. DO NOT LET THE CHARGER REMAIN IN THIS CONDITION!

4. **RED** light is ON Solid
 - a. The battery voltage is LOW.
 - b. WHEN the power supply is connected to the charger and the charger is connected to the battery, the Solid **RED** means the battery is being charged.
 - c. WHEN power is NOT connected to the charger, but the charger is connected to the battery, the Solid **RED** light means the battery is low, but is NOT being charged.
5. **RED** and **GREEN** lights flashing alternately
 - a. The battery is being charged AND is approaching the end of the charging cycle.
 - b. The battery is already fully charged and is cycling in the "float" mode.
6. **GREEN** light is ON Solid
 - a. The battery is fully charged and should be disconnected from the charger.
7. If the **RED** and **GREEN** LEDs flash alternately when the battery is discharged and first connected to the charger
 - b. This indicates a highly sulfated battery with high impedance. This causes the voltage to rise making the **GREEN** LED flash from time to time. It is recommended to use a volt meter and measure the voltage at the battery terminals. Monitor the voltage over the next few days and you should see the voltage drop as the battery is desulfated. After desulfation, the voltage should then begin to rise to a fully charged condition.

Solar Tracker 5 Charge Controllers

Models:



S3A12/S3A12-LiFePO4



S7.5 LiFePO4



S10A12 & S20A12



S40A12/24 & S80A12/24



S160A12/24

These charge controllers are designed to charge flooded cell lead acid batteries and can be configured for charging Lithium Iron Phosphate batteries (LiFePO₄).

The Solar Tracker 5 solar charge controllers incorporate new features and protections using highly advanced technology. The patented charging algorithm has also been further optimized for longer battery life and improved system performance.

Many functions of the Solar Tracker 5 are unique. Although the Solar Tracker 5 is very simple to use, please take the time to read this operator's manual and become familiar with the controller.

Always Put Safety First

- Be very careful when working with batteries. Wear eye protection and have fresh water available to wash and clean any contact with battery acid.
- Charge only batteries that are properly sized for the system.
- Explosive battery gasses can be present during charging. Be certain there is enough ventilation to release the gasses.
- Use insulated tools and avoid metal objects near the batteries.
- Carefully read the battery manuals and other equipment manuals before installing the solar charging system. Observe ALL precautions when working with batteries and power electronics.
- Fuses or DC disconnects may be required in the system. These protective devices are not part of the Solar Tracker 5 controller.
- Avoid large voltage drops in the battery wires.
- Do not allow water to enter the controller.
- Install the controller in a horizontal position with adequate ventilation.
- Save these instructions for future reference.

Quick Start Instructions

This section provides a brief overview of how to get started using the Solar Tracker controller. However, please preview the entire manual to ensure best performance and years of trouble-free service.

1. Mount the Solar Tracker to a horizontal surface. Allow space above and below the controller for air flow.

2. Make sure the solar panel output will not exceed the ratings of the Solar Tracker 5 being installed (See Solar Tracker Input Specifications).
3. Before connecting your batteries or solar panels, be sure that all circuit breakers or switches on the Solar Tracker 5 are in the OFF position.
4. Connect the Batteries first. Torque all of the Solar Tracker terminals tightly, but do not exceed 35 in-lb.
5. 40 amp and larger Solar Tracker 5 charge controllers are available for 12v and 24v systems only.
6. Observe LEDs to confirm normal operation.
7. It is recommended that the system be properly grounded.

Tesla Solar Tracker Specifications

It is very important to follow the input specifications for the Solar Tracker charge controllers. Input values too low will give unsatisfactory charging performance, or no charging at all. Input values too high will damage the charge controller and void the warranty. Be very careful to match the output specifications of the solar panel(s) used with the required input values of the charge controller. See the specification chart in the Appendix.

LED Indicators

The LEDs in the upper label indicate system status and various functions. These functions are described below.

Charging - LED 1 – RED)

The RED LED will always stay on when connected to partially charged batteries, and will go off when batteries are charged.

Solar Tracking - LED 2 – BLUE (S10, S20, S40, S80, S160 models)

ON: Battery charging during sunlight (always on during sunlight)

OFF: Normal during no sunlight conditions.

Battery Status - LED 3 – GREEN

Indicates battery is at or near full charge and also in desulfating mode (self-regulating). Normally OFF in no sunlight conditions.

General Installation Notes

- The Solar Tracker 5 uses only the finest materials and fasteners, and a durable powder coating to protect from harsh conditions. However, for acceptable service life, extreme temperatures and marine conditions should be avoided.
- The Solar Tracker 5 prevents reverse current leakage at night, so a blocking diode is not required in the system.
- The Solar Tracker 5 is designed to regulate ONLY solar (photovoltaic) power. Do not connect it to any other type of power generator, i.e. wind turbine. However, other power sources can be connected directly to the batteries.
- The connector terminals will accept a maximum wire size of AWG #6/16mm (solid/multi-strand) or AWG #8/10mm (fine strand). Use a 7/16" insulated wrench, and torque tightly up to 35 in-lb.

Solar Tracker 5 Charging Method

The Solar Tracker 5 uses 3 stages of charging for rapid, efficient, and safe battery charging. These are listed below:

1. Recharging with 100% of available solar energy.
2. Constant-voltage regulation prevents heating and excessive battery gassing.
3. Specialized pulse charging restores full battery capacity.
4. Float: After battery is fully charged, the Solar Tracker 5 reduces to a float, or desulfating, charge as indicated by the **GREEN** LED. This brings uneven cells into balance and extends battery life.

Cautions

1. Troubleshooting should be done by qualified personnel.
2. A battery can cause serious damage if shorted.
3. There are no user serviceable parts, fuses, or circuit breakers inside the Solar Tracker 5.
4. Observe all normal precautions when working with energized circuitry.

Troubleshooting

The Solar Tracker 5 is assembled with automated equipment, tested with computers, and is protected from faults. It is usually worthwhile to troubleshoot the entire solar charging system for faults, since the

Solar Tracker will generally not be the cause of a problem. Most problems will be caused by wiring connections, batteries unable to hold a charge, or faulty loads.

Battery is not charging

- Check the **BLUE** charging LED above the solar input. With sunlight on the solar array, the **BLUE** LED should be ON (S10, S20, S40, S80, S160 models).
- Check that the proper battery type has been selected.
- Check that all wire connections in the system are correct and tight. Check the polarity (+/-) of the connections.
- Measure the solar array open circuit voltage (disconnected from the controller) and confirm it is normal. If the array voltage is low or zero, repair the fault in the array.
- Confirm that the load is not drawing more energy than the solar array can provide.
- If the battery terminals are corroded, there may be excessive voltage drops between the Solar Tracker 5 and the battery. This is a common cause of undercharging batteries.
- Check the condition of the battery. Determine if the battery voltage falls at night with no load. If the battery is unable to maintain its voltage, it may be failing.
- Measure the solar input voltage (during daytime) and battery voltage at the Solar Tracker 5 terminals. If the voltages at the terminals are the same (within about 0.5-volts), the solar array is charging the battery. If the solar voltage is close to open circuit (about 20-volts), and the battery voltage is low, the controller is not charging the battery and may be defective.

- Check that the load is connected and turned on. Confirm that no fuses or circuit breakers in the system are tripped (there are fuses or circuit breakers in the front or back of the Solar Tracker 5).
- Check all connections to the load, and battery connections. Make sure voltage drops in the system are not too high (a voltage drop to the load will reduce the voltage at the load).
- Check the LED indicators on the Solar Tracker 5. If no **BLUE** status LED is on, the solar array may have been disconnected.

Appendix

Tesla Chargers Lead - Acid Battery Charger Line

Model	Input Values		Output Values		Battery AH Range	Fan
	VAC	HZ	Voltage	Peak Current		
1AU	100 - 240	50 - 60	1.5 - 24	1 Amp	2 - 10 Ah	No
2A12-4	100 - 240	50 - 60	15.2	2 Amps	20 - 80 Ah	No
10A12	100 - 240	50 - 60	15.2	10 Amps	80 - 225 Ah	YES
25A12	100 - 240	50 - 60	15.2	25 Amps	200 - 500 Ah	YES

Tesla Solar Tracker 5 Model Line

Model	Input Values			Output Values			Lead Acid Battery		Wire Size	Fan
	Voc	Vmp	Imp	Vmp	Imp	Wmp	Voltage	AH Range		
S3A12	22	18.5	3.0	15.1	3.0	45.0	12 volt	30 - 60	18 ga	No
S10A12	22	18.5	10.0	15.1	10.0	150.0	12 volt	100 - 200	12 ga	YES
S20A12	22	18.5	20.0	15.1	20.0	300.0	12 volt	200 - 400	8 ga	YES
S40A12	22	18.5	40.0	15.1	40.0	600.0	12 volt	400 - 800	6 ga	YES
S80A12	22	18.5	80.0	15.1	80.0	1200.0	12 volt	800 - 1600	4 ga	YES
S160A12	22	18.5	160.0	15.1	160.0	2400.0	12 volt	1600 - 3200	2 ga	YES
S40A24	44	37.0	40.0	30.2	40.0	1200.0	24 volt	400 - 800	6 ga	YES
S80A24	44	37.0	80.0	30.2	80.0	2400.0	24 volt	800 - 1600	4 ga	YES
S160A24	44	37.0	160.0	30.2	160.0	4800.0	24 volt	1600 - 3200	2 ga	YES

Warranty & Guarantee

Limited Warranty Repair of Defective Parts: This equipment is guaranteed to be free from manufacturing defects for a period of one (1) year from the date of purchase. Any defective parts will be repaired or replaced “free of charge” during that one year period. This limited warranty does not cover shipping and handling costs, or damage caused by purchaser’s misuse or accident, or damage caused by fire, flood, or any other natural disaster.

This guarantee does not apply to units that have been subjected to misuse, abuse, neglect, or accidental damage, or to units that have been used in violation of the operating instructions. Equipment that, in our judgment, shows evidence of having been altered, modified, or serviced without our authorization, will not be eligible for service under this guarantee.

Money Back Guarantee: The manufacturer and seller of this product promise to take back any single unit, purchased at the full retail price, in exchange for a full refund (***less any shipping charges and a 20% restocking fee***) as long as the unit so returned is undamaged with regard to physical appearance and functional operation within 60 days of its purchase. Any damage to the unit or discount of the purchase price voids this offer

Disclaimer: Except as provided in paragraph one above, the purchaser acknowledges that he or she is purchasing this equipment “as is”. The manufacturer and seller specifically disclaim all warranties, express or implied, including warranties of merchantability, or of fitness for a particular purpose or use. The manufacturer and seller assume no liability for injury, damage, or loss from the use or misuse of this equipment, either by the purchaser or by any other third party. The purchaser agrees to use this equipment at his or her own risk.

Limited Liability: This limited warranty extends only to the original purchaser, is not transferable, and is limited to the purchase price of the equipment. In no event and under no circumstances will the manufacturer or it’s agents be liable for any incidental or consequential damages resulting from either the use or misuse of this equipment, regardless of its operating condition.

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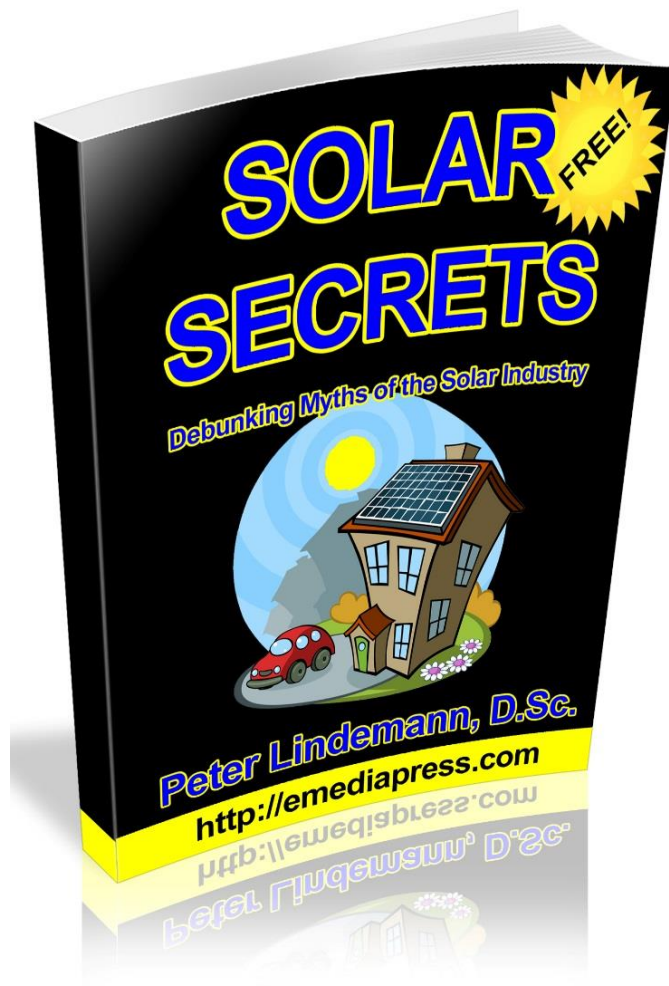
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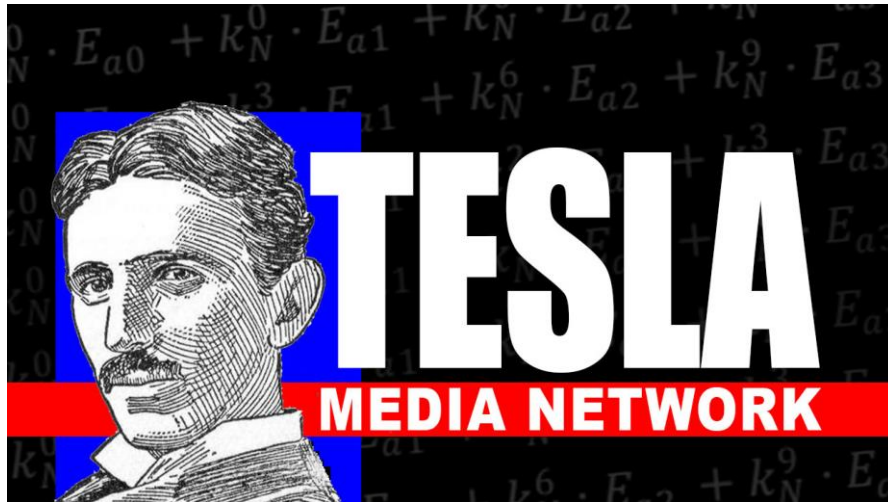
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