

# EVtricity Prototype Fast Charging Kit

## User Manual v1.5c

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## 1. Important Safety Instructions

### 1.1.AC Input Voltages

**DANGER!** This system operates from AC input voltage capable of producing fatal electrical shock.

### 1.2.DC Output Voltages

**DANGER!** This system produces DC power and may have a battery source connected to it. The DC voltage is high (up to 116V) and the rectifiers used in the charging kit and/or battery can deliver large amounts of current. Exercise extreme caution not to inadvertently contact or have any tool inadvertently contact an output terminal or battery terminal or exposed wire connected to an

**output terminal or battery terminal. NEVER allow a metal object, such as a tool, to contact more than one termination or battery terminal at a time, or to simultaneously contact a termination or battery terminal and a grounded object. Even a momentary short circuit can cause sparking, explosion, and injury.**

### **1.3.Disassembly**

DANGER! The charging kit should not be disassembled for any reason. Removal of the back cover or rectifiers exposes a person to potentially hazardous and lethal AC and Dc currents. Do not attempt to service the charging kit in any way. Contact our support email address if you have concerns around the performance of your charging kit.

### **1.4.Electrical Compliance**

This fast charging kit uses Emerson R48-2000e3 rectifiers which meet a number of standards including UL 60950-1; EN 60950-1 and IEC 60950 and have CE certification.

### **1.5.High Moisture and Dust environments**

**These charging kits should not be used in environments where there is high moisture or dust.**

### **1.6.Attachment/Transport of Charging Kit**

The charging kits may be carried in a pannier bag, tank bag, top box or back pack. To avoid excess vibration and damage to the charger through movement within bike luggage, it is recommended that the charging kit be wrapped in a soft material such as a towel or jumper.

The charging kits are not waterproof and dustproof and should not be fixed to the motorcycle in any way. **Fitting of the chargers directly to the motorcycle will void the warranty.**

### **1.7.Enclosure of Chargers**

**The charging kits require ventilation to avoid overheating and subsequent reduction in charging performance.** The charging kits generate significant heat and should never be utilised in enclosed environments such as pannier bags, top boxes or tank bags. Use of the charging kit without adequate ventilation may result in melting or other damage to materials enclosing the charging kit.

## **2. Introduction**

This kit has been developed to assist people to build their own fast charger for use to charge electric vehicles such as a Zero motorcycle.

The kit comes in two forms- a single or double charging kit.

### **2.1.Kit Contents**

**The single charge kit specification is:**

- AC input voltage = 85-300V
- Default AC current = 15A
- Maximum AC current = 20A @ 230V
- Standard DC output = 3.4kW (using 15A @ 240V AC)
- Maximum DC output = 4kW (on request)

- AC input socket = 1 x IEC C20
- DC output socket = 1 x Anderson SB50
- Dimensions = 29cm x 18cm x 5cm (excl. cable glands and cables)
- Weight = 3kg

Charging time from empty with onboard (useable 10kWh capacity) = ~ 2 hours

#### **Accessories – Single Charger**

Included: Single DC fast charger cable included (1 x SB50 to SBS75XBRN)

Not Included: IEC20 16/20A cable for your country

#### **The Double charger specification is:**

Two chargers in one case with separate AC input and DC output

- AC input voltage = 85-300V
- Default AC current = 2 x 15A
- Maximum AC current = 2 x 20A @ 230V
- Standard DC output (one module) = 3.4kW (using 15A @ 240V AC)
- Maximum DC output (one module) = 4kW (on request)
- Standard DC output (both modules) = 6.8kW (using 30A @ 240V AC)
- Maximum DC output (both modules) = 8kW (on request)
- AC input socket = 2 x IEC C20
- DC output socket = 2 x Anderson SB50
- Dimensions = 29cm x 18cm x 10cm (excl. cable glands and cables)
- Weight = 6kg

Charging time from empty with onboard (useable 10kWh capacity) = <1.5 hours

#### **Accessories – Double Charger**

Included: Double DC fast charger cable included (2 x SB50 to SB120 + SB120 to SBS75XBRN)

Not Included: 2 x IEC20 16/20A cables for your country

*Note: The kits do not include the necessary AC cables to connect the chargers to an electrical supply. The kits have one IEC C20 socket which is capable of supporting up to 250V and 20A. The chargers are defaulted to a limit of 15A AC current. The maximum that these chargers can use is 20A AC current. **These current limits must be strictly observed when connecting to any electrical supply.***

## **2.2.Charger Components**

The chargers have been built using the following components:

- 2 x Emerson R48-2000e3 rectifiers
- Custom PCB that connects the two rectifiers in series
- Turnigy AWG 10 DC cables

- Turnigy or similar AWG14 AC cables
- IEC C20 AC input cables
- Phoenix Contact AC and DC connectors
- Anderson SB50 DC connectors
- Anderson SB120 DC connectors (double charger)
- Anderson SBS75X connector and handle
- 1m x 6mm<sup>2</sup> DC cable (single charger)
- 1m x 16mm<sup>2</sup> DC cable (double charger)
- Black aluminium case inc stainless steel back cover

## 2.3.Charger Programming

### Default Configuration

The chargers are based on high quality Emerson rectifiers which have been configured to the following settings:

Voltage = 116V

AC Input Current Limit = 15A

Rectifier walk-in (delay to 116V) = 12 seconds

### Custom Configuration

These settings can be changed prior to shipping to different settings within the limits of the rectifiers. The combined rectifier limits are as follows:

DC output voltage = 84-116V

AC Input current limit (single charger) = 2A to 20A (note that a single chargers will not deliver more than 4kW DC)

AC Input current limit (double charger) = 4A to 40A (note that a double charger will not deliver more than 8kW DC)

Rectifier walk-in (delay to 116V) = 0-60 seconds

The charger kits do not support owners modifying these settings themselves. Any kits that have their settings changed from the original delivered specification will have their warranty void.

## 2.4.Double Charger – modular nature

The double charger unit is effectively two single chargers integrated into one aluminium case. Each module has its own dedicated AC input and Dc output which allows either one module or both modules to be used at the same time depending on available power. The AC input and DC outputs are colour coded - yellow for the lower unit and blue for the upper unit. When you are using just one module, then we recommend only connecting that module into the DC Y adaptor and only providing power to the module that is charging i.e. only connect the AC input and DC output of the modules you are using. The default configuration of each module is 15A (USA/Oceania) and 16A Europe.

Using two modules will require 30A and 32A respectively. If the charging station or power circuits do not provide sufficient power to run both modules, but at least 15A/16A then use one module only.

## 2.5. Instructions for Use with Zero Motorcycles

Charging of a Zero Motorcycle via the Fast Charging Connector should follow the sequence below. Failure to follow this sequence may void the warranty on the charger or cause the Zero fast charge fuse to blow.

1. Locate the charger away from water (including rain) and dirt and close enough to the motorcycle for the DC cable to reach the fast charge port but **do not plug in the DC cable yet**
2. **Check the maximum continuous current rating of the circuit/s or charging station/s to understand the available power and ensure the combination of chargers to be used is less than that maximum continuous current rating.** The default current limits are 15A/16A for a single charger, 2 x 15A/16A for a double charger. If you are also plugging in the Zero SR/S/DSR/DS onboard charger it's limit is ~6A/12A (110v and 220v circuit respectively). If a charging station has a 30A limit you can plug in any combination of fast and onboard chargers as long as the total draw does not exceed 30A. Current is additive so that two 15A single chargers will draw 30A, a double charger (2x15A) and onboard (6A) will draw 36A.
3. Connect the AC and DC cables to the charger but **do not power it on.**
4. Key on / turn on the motorcycle
5. Wait until you hear the click of the contactor closing (approximately 10 seconds after keying on the motorcycle)
6. Connect the chargers to an AC Supply
7. Turn on the AC supply
8. Connect the charger's DC cable to the Zero fast charge connector
9. The bike's display should show you the time remaining eg. 1:10 (1h10m) and continue to update for 10-20 seconds until the bike has ascertained the charging current at which time the charge time remaining will stabilise
10. If the time remaining is above 0:00 and there is a flashing green display light, the bike is charging
  - The bike can now be keyed off. The time remaining should continue to display and the bike continue to charge. Charging can be monitored via the Zero mobile app or the time remaining or charge state on the bike's dash/display.
  - The onboard charger may be powered on to provide additional charging
  - The bike will continue to charge until it reaches its maximum state of charge and charge current drops to ~2A DC at which time the Zero BMS will trigger the contactor to open, the charger will go into idle state and the bike will no longer receive charge
  - At this time, or at any time after the initial charging has commenced the chargers can be first switched off / disconnected from the AC supply and subsequently the DC cable can be removed from the fast charge port.
  - **The charging kit is designed to be used for fast charging and should not be left on for extended periods of time (>1 hour) after charging has stopped**

- **It is recommended that you monitor the fast charging process to ascertain the time remaining and to ensure that once the charging has completed that the charger is turned off**
  - The recommendation to turn off the charger is aligned with Zero Motorcycles announcement in May 2017 that “Zero is now recommending that owners do not keep their motorcycles plugged into an AC power source once charged. This will ensure maximum performance and power pack life”.
11. If the time remaining is 0:00, then the charger is not able to charge the motorcycle. In this case the chargers should be turned off at the AC source and disconnected from the AC supply and the DC cable disconnected from the fast charge port. The bike should then be keyed off. **Refer to the troubleshooting section if this occurs.**

## 2.6.Charging limits for use with Zero Motorcycles

Zero motorcycles have a fast charge connector (located above the motor on Zero S/SR/DS/DSR models). For 2014-2017 models this connector has a fuse with a 100A limit. It is recommended that any charging occur at less than 90A DC including the onboard charger to ensure that the fuse limit is not exceeded. This equates to <9kW AC charging.

Other Zero models – specifically the FX and FXS motorcycles and 2013 or earlier models have lower fuse limits. These limits should be ascertained before using the charging kits. It is the owners responsibility to understand the fuse limits of their motorcycle and ensure the charging rate is below that limit.

The double charger with its default 15A AC setting and running on a 240V AC source along with the onboard charger will utilise 8.5kW => under 90 Amps DC.

### **Use of charger on 2013 or earlier Zero models or 2018+ models**

The chargers provide a maximum of 116V DC and should only be used on vehicles that have batteries that support that voltage. It is the owner’s responsibility to confirm the maximum voltage of Zero motorcycles built outside 2013-2017 and the suitability for the use of this charging kit with those models.

2013 models have a limited charge fuse of 30A. Unless the fuse and associated cabling have been updated (as has happened with some battery replacement/recalls) our chargers would exceed that fuse limit and therefore these charging kits are not suitable for use with stock 2013 models.

## 2.7.Limits for use on electrical supply

Charge current limits should be supported by the sockets and circuits they are being connected to. Chargers should not exceed the continuous current rating of a circuit including any other appliances that may be using the same circuit eg. a charger with 15A limit should only be run on a circuit capable of continuously supplying 15A or more.

Note that the onboard charger uses ~6A at 220v and ~12A at 110V. Bear that in mind when plugging in the onboard charger to the same charging station or circuit as the single or double chargers to ensure you do not exceed the station or circuit capacity.

## 2.8.Troubleshooting

If you are having issues with charging the following troubleshooting guide may help.

### Issue #1: Yellow flashing light

This alarm is for a loss of communication for the rectifier with a separate controller. Our chargers are pre-configured with voltage and current limits and do not require a separate controller. This does not in anyway impact the performance of the charging kit.

### Issue #2: Charger not charging

Potential Causes	Action	Resolution
DC cable not connected to fast charge port	Check DC cables are all connected and pushed firmly into the Zero fast charge port	The time remaining should show on the bike's dash after DC cable is connected to the fast charge port
Bike not keyed on	Check if the bike is keyed on	Turn the bike on and wait for the contactor to close (audible click or at least 10 seconds) before attempting to connect the DC cable to the fast charge port
Contactor has not closed	Listen for the contactor to click closed	Wait for the contactor to close before connecting DC cable to the fast charge port
Rectifier power issue	Check there is a solid green light on each rectifier	If green light is not showing on all rectifiers, do not use the charger and contact support

## 2.9.Warranty

The charging kit comes with a one year warranty from date of purchase. This warranty covers repair or replacement of the charging kit and its components including shipping to/from the owner if it does not perform. If we are unable to repair or replace the charging kit or its components we will provide a refund of the original purchase price. In the event that a replacement or refund is provided, the faulty item will become the property of EVtricity.

If you believe you have a warranty claim for your charging kit please contact us using the support details at the end of this manual.

### Warranty Exclusions

The charging kit is not waterproof or dustproof and should not be used in environments where it is exposed to moisture or dust. For this reason, the charging kit should also not be fitted directly to the motorcycle where it may be exposed to high moisture or dust. Charging kits that have been used in high moisture or dust environments or fitted to the motorcycle will not be warrantied.

## **2.10. Support**

Free 12 months support for your Fast Charging Kit is available via contacting us [support@evtricity.com.au](mailto:support@evtricity.com.au). If you have any questions or issues with your charging kit please contact us at this address.