

# Lear 3.3kW High Voltage Charger

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# INTRODUCTION

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This manual describes the Lear 3.3kW high voltage battery charger. The Lear 3.3kW is used on a number of major automotive manufacturer electric automobiles, most notably the Chevrolet Volt and the CODA.

The Lear 3.3kW is a Controller Area Network (CAN) controlled charger suitable for charging battery packs of 200 to 420 vdc from single-phase 120vac or 240vac split phase power.

The charger will produce a maximum of about 11 amps charging current at voltages up to 420vdc. Maximum input power is 3300 watts with efficiencies of up to 96%.

Notably, this charger has a remarkably clean power factor correction leaving your power lines squeaky clean.

Two Lear 3.3kW chargers can be configured with an optional cable for Master/Slave operation to produce 6.6 kW power.

High quality Delphi automotive grade connectors allow safe and reliable connections to your electric vehicle.

The Lear 3.3kW charger also features a 35 ampere 12vdc aux output. At this point, it is not known how to turn on this output or set its voltage.

The Lear charger is water cooled and we recommend a 50% mixture of glycol and water to prevent corrosion.

The charger weighs 21 lbs.

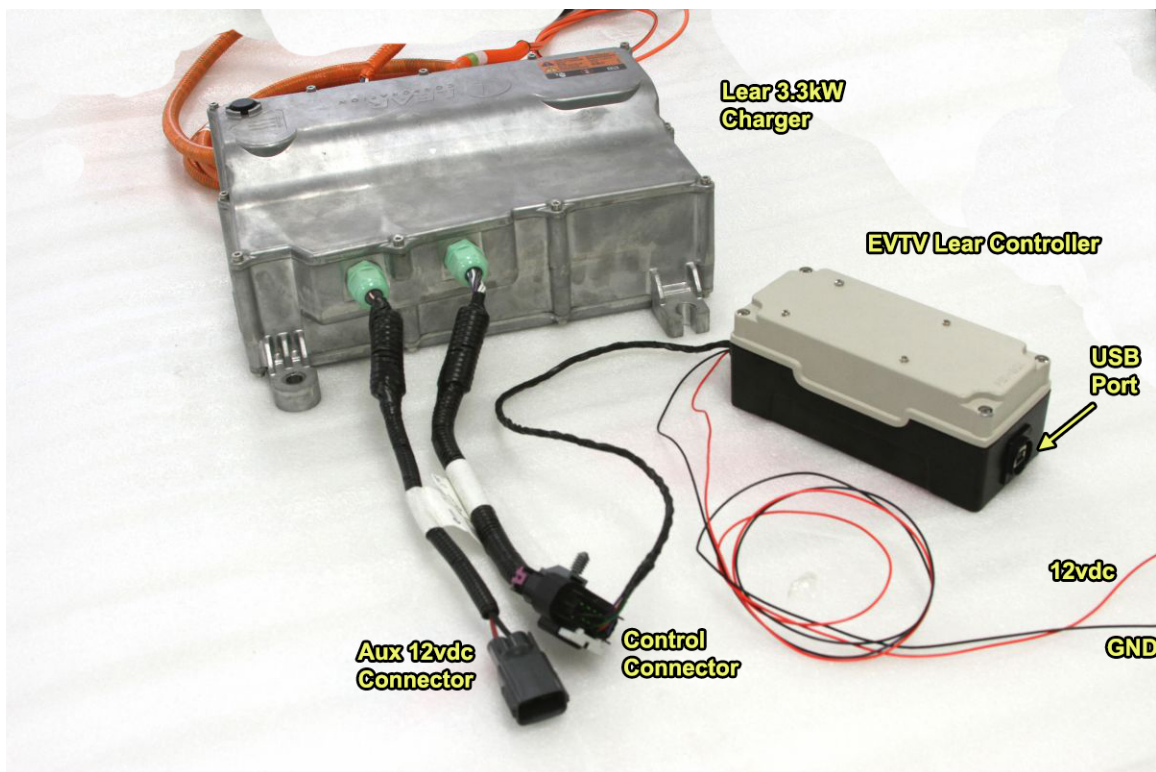
Dimensions are 12 x 8 x 5 inches.

# CONNECTIONS

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To connect the Lear 3.3kW charger to your electric vehicle systems, you must make the following connections.

1. 12vdc power.
2. EVTV Lear Charger Controller Module
3. High Voltage Battery Pack
4. 120vac or 240 vac AC Power



## 12V POWER

Both the Lear Controller Module and the Lear 3.3kW charger require 12vdc power from the vehicle to operate. This has been consolidated into a single connection to the Lear Controller via a red wire (+12vdc) and black wire (12v rtn/frame ground).

This is normal automotive 9-15vdc at less than 2 amperes.

It is important that this 12v power ONLY be applied when charging is desired. This ensures the controller module is reset at the beginning of charge.



## EVTV CONTROLLER MODULE

The EVTV Lear Controller Module must be connected to the Lear 3.3 kW charger via the 12 pin black Delphi GT150 connector.

This connector is wired as shown below.

Signal	Color	Pin
12vdc	RED	A and F
12v rtn	BLK	G
CANHI	ORN	B
CANLO	GRN	C

## HIGH VOLTAGE BATTERY PACK

High voltage output is provided via the Delphi HV280 Series Part Number 13861585 Connector. This connector features two wires.

- SOLID ORANGE
- ORANGE/BLACK STRIPE

We have found these to VARY dramatically and are very easy to confuse. HV+ (positive) is the right-hand pin on the charger connector when facing the charger while HV- is the left-hand pin. Do NOT rely on the wire color code. Confirm with ohmmeter before using.

## AC POWER

AC Power input is provided via the Delphi 13861587 connector. The other end of the provided cable has a connector you may use, but generally would be removed to connect the three wires to your J1772 inputs as follows:

- **WHITE**      **L1**
- **GREEN**     **Neutral**
- **BLUE**       **L2**

This should be connected to 240vac 60 Hz split phase power. The connection MAY be made to 120vac single-phase power but output power will be reduced.

# OPERATION

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In normal operation, when 12vdc is applied to the controller module, CAN communications is established between the module and the Lear charger. As soon as AC power is applied, the charger will begin charging the battery pack. It does not matter whether AC power or 12vdc is applied first, but no charging occurs before both are present.

The charger will charge at roughly the commanded current until the SetVDC voltage is reached. It will then quite accurately hold that voltage by gradually decreasing the provided charger current. At the point where the charge current falls below the designated END current value, the charge will terminate.

If at any time during the charge process, either the AC power or 12v power are removed, charging will terminate. It will resume if AC power and 12vdc later become available. In this way, you can also use other devices to monitor and control charging by interrupting the 12vdc supply to the Lear Charger Controller, if desired.

# SETTING CHARGE VALUES

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The EVTV Charge Controller Module sends Controller Area Network (CAN) messages to the Lear charger to control all charge operations. The important values it uses include:

- **Charger Voltage**
- **AC Current Limit**
- **End Current.**

These values are contained in Electrically Erasable Programmable Read Only Memory. And so anytime 12v is applied, the module initializes operation, retrieves the configuration items from EEPROM, and controls the charge process.

The only time user intervention is necessary in this automatic process, is to change the values used. This can be done with any laptop computer with a serial terminal program such as Hyperterm for Windoze or CoolTerm for Mac OSX.

The EVTV Lear Charger Controller Module features a Universal Serial Bus (USB) B type connector on one end. This should be connected to a laptop or other personal computer with a serial USB connection cable and serial port WITH terminal program software.

The terminal program **MUST** be set to a data rate of 115,200 bits per second and a serial specification of 8 data bits, no parity, and 1 stop bit (8N1).

Once this is performed, the screen below should appear and a regular line of ASCII text will print each second showing the SetVDC, the Actual VDC, the ACamps, Actual Amps, the End current, ampere hours, kiloWatthours, and charging time.

```
Startup successful. EVTV Motor Werks - Lear Charger Version 1.17
```

```
===== LEAR Charger CAN Controller Version 1.17 =====
***** List of Available Commands *****
```

```
? or h - Print this menu
a - set desired AC input current limit ie a9.5
c - sets CAN port ie c0 or c1
d - toggles DISPLAY FRAMES off/on to print recieved and sent CAN data traffic

e - set current level to terminate charge ie e4.2
i - set interval in ms between CAN frames i550
k - set data rate in kbps ie k500
v - set target charging voltage CV ie v325.9
x - set 12volt Aux output voltage ie x13.37
z - Zero amphours and kilowatt hours
```

```
*****
=====
```

```
Using CAN1 - initialization completed.
```

```
LEARCHARGER: SetVDC:335.0v Actual:310.2vdc ACLimit:20.0A DC Amps:12.75A End:3.50A
20.15Ah 6.75kWh Temp:39C Time: 00:00:00.612
```

```
LEARCHARGER: SetVDC:335.0v Actual:310.2vdc ACLimit:20.0A DC Amps:12.75A End:3.50A
20.17Ah 6.75kWh Temp:39C Time: 00:00:01.112
```

```
LEARCHARGER: SetVDC:335.0v Actual:310.2vdc ACLimit:20.0A DC Amps:12.75A End:3.50A
20.19Ah 6.76kWh Temp:39C Time: 00:00:01.612
```

## SETTING VOLTAGE

The most important setting is the charge voltage. This is the voltage the charger will charge your battery pack to. This appears in the printout at SetVDC. The charger will apply maximum current until this value is reached, and then gradually decrease the applied energy to maintain that voltage.

The command for changing this is **V** or **v** for voltage. Your terminal program should be set to send a carriage return and line feed with each line. Entering **V335.4** and pressing return would change the SetVDC voltage to 335.4 and this should immediately begin appearing in the transmitted lines.

## AC CURRENT LIMIT.

In most chargers, you set the amount of current you want delivered when charging. The Lear charger is somewhat different. It allows you to modify the maximum AC current the device will use.

This is really provided for the rare occasion where you want to limit the amount of power you take from a small current circuit to avoid blowing circuit breakers. For example, you could enter **A5** to charge at ROUGHLY 5 amps, limiting the amount of AC current IN to the charger.

However, a little experimentation reveals that you easily adjust the output current to any value you like using this setting to throttle the output.

## SETTING CHARGE TERMINATION CURRENT

The command **E** allows you to set the termination current i.e. **E2.8**. This would set the termination current to 2.8 amperes. For most battery chemistries, this is normally set at C/20 or 0.05C. For example, if you had a 65 Ah pack, you might set this to 0.05 x 65 or 3.2 amps.

At the point where the charge VOLTAGE is reached, the charger will automatically begin decreasing the applied charge current to maintain that voltage. At the point where it decreases to 3.2 amperes, in this case, the charge controller sends a disable signal to the charger.

The charger reports the actual voltage measured which in most cases will be a lower value than SetVDC. The ACLimit you provided is displayed but we also display actual DC amps going to the pack.

You may clear the ampere-hour Ah and kiloWatt-hour kwh counters with the character **Z** for Zero.