Electric Mountain Drive™

Installation and Assembly Instructions, Type 3

http://www.ecospeed.com/docs/emtnd3_assy

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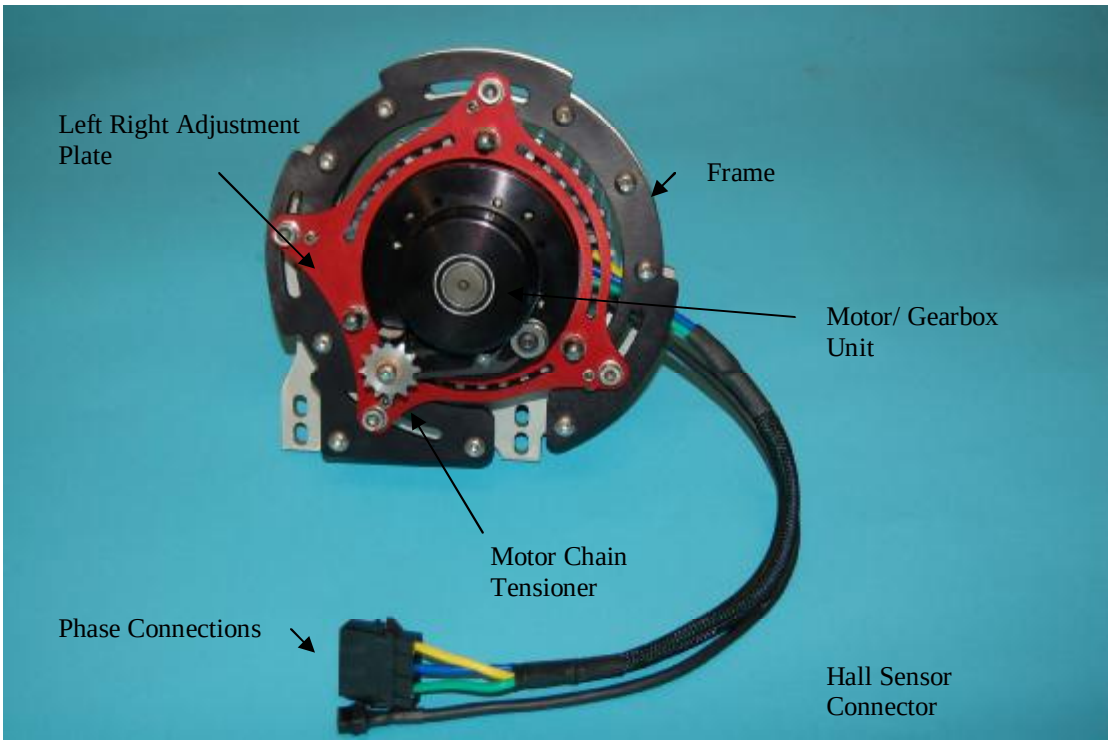
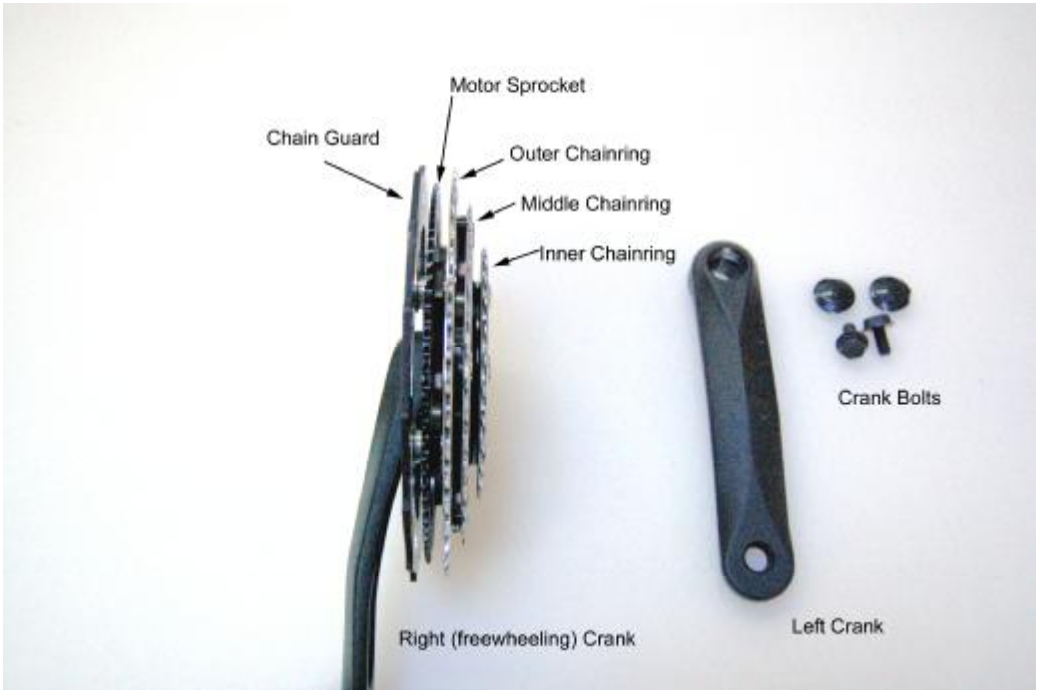
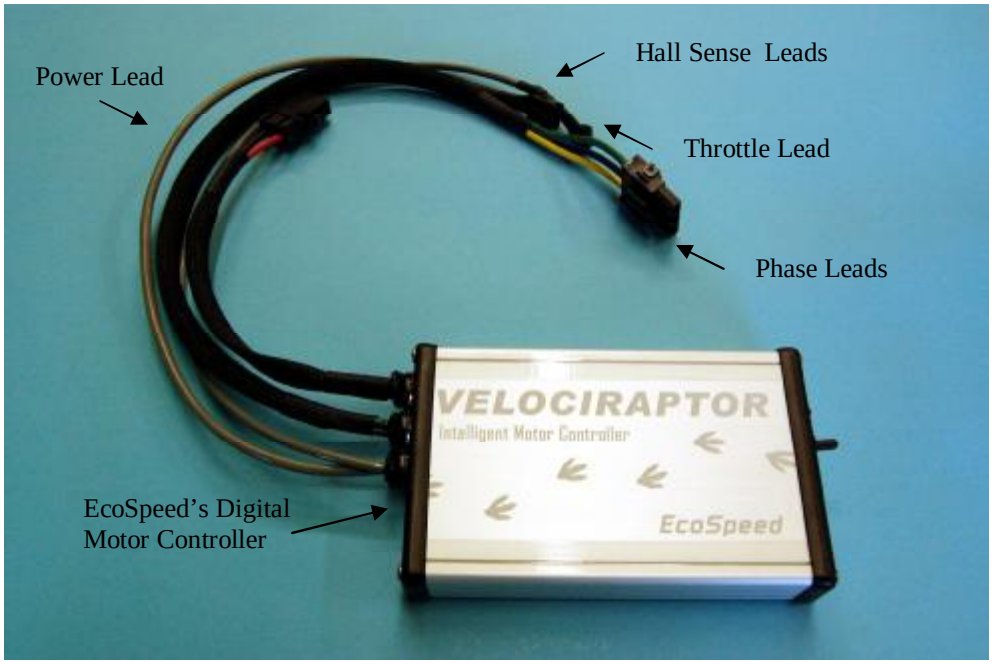


Drive Unit
(connectors may differ depending on motor)



Freewheeling Crankset
(triple shown)

Electric Mountain Drive Components



Velociraptor Motor Controller

Other Parts,

Electric Mountain Drive Components

Congratulations on your purchase of EcoSpeed's Electric Mountain Drive, Type 3. The Type 3 Electric Mountain Drive is the world's best multi-speed, throttle operated, electric-assist conversion and the only electric-assist designed specifically for the power needs of Cargo bikes.

These instructions will guide you step by step through what we hope will be a simple and painless installation of your EMtnD. The mechanical skills involved are modest and, we give you hints and tips at every step that reflect what a professional mechanic knows. If at any time you have problems, call us at 1-866-EcoSpeed (866-326-7733) for friendly technical assistance or e-mail us at support@ecospeed.com.

A word on how these instructions are organized. Each step is under a major heading – Step 1:, Step 2:, etc. If you've installed an EMtnD before you can just read the major headings and ignore the explanatory text. Below each major heading is a list of sub-steps. The important information in each sub-step is in bold text. If you're a competent bike mechanic, you can just read the bold text and safely ignore the rest. The remaining text is there to clarify things for non-mechanics. *We've also included tips and hints in Italics.*

Before getting started check that all the pieces needed were included in your shipment:

Check the packing list included with your shipment.

You will also need the following tools:

1) 2.5mm, 3mm, 4mm, 5mm, and 8mm hex (or Allen) wrenches. (*The standard "L" shaped hex wrenches sold at bike shops and hardware stores. Get long handled versions if possible.)*

2) 10mm box or open end wrench.

3) 8mm and 10mm nut drivers or sockets. Also 14mm if your bottom bracket uses this size bolt.

4) Wire clippers or scissors.

5) Small screwdriver. *(For adjusting front derailleur.)*

6) Needle nose pliers.

7) Crank puller tool. The Park Tool CWP-6 would be an example of this *(Standard bike repair tool. Available from almost any bike shop.)*

8) Bottom bracket tool. Such as Shimano TL-UN74. *(Standard bike repair tool. Available from almost any bike shop.)*

9) 15mm pedal wrench. The Park Tool PW-5 would be an example of this *(Standard bike repair tool. Available from almost any bike shop.)*

10) Torque wrench (optional). A small one reading in inch-pounds.

If your frame tube is larger than 1.75" in diameter, you have a cargo bike with a rectangular main tube, or for any other reason you are using our quarter brackets, you will also need the following tools.

11) Drill with 3/32" *(or 2.5mm),* **3/16"** *(or 5mm)* **and 19/64"** *(or 7.5mm)* **bits.**

12) Machinists transfer punch (included with brackets).

13) 5mm rivet nut tool. *(A somewhat less common bike tool. Most bike shops should have them, or we can sell you one)*

14) **Dremel tool**
Once you have all the parts and tools you need, it's time to clear a nice space to work, find several of hours time, and get to it.

Step 0: Make sure that your bike is in good condition.

If you haven't had your bike tuned up by your local bike shop in a while, now would be a good time. Installing the EMtnD will place extra stress on your bike so it's important that it be in top condition.

Step 1: Find a way to secure your bike while working. (photo 1)

A bike repair stand such as bike shops use is ideal. You can also just leave the bike on it's kick-stand, as a cargo bike should be stable on its own.

(1) Bike up on Stand

Step 2: Remove crankset.

Remove left and right cranks. Leave chain hanging.

The cranks are held in place by bolts, sometimes concealed under caps. Remove using a socket or hex wrench. *(Trick: The bolts can be very tight. Tie one of the crank arms to your bike frame using a rope or strap. That frees both hands to turn the wrench.)*

(2) Removing Crank with Crank Puller

Once the bolts are out, use your crank puller tool to pull the cranks off of the bottom bracket axle (photo 2).

Step 3: Remove Bottom Bracket

There are different bottom bracket tools, so you will need to use the one appropriate for your bike. Photo 3 shows the tool used for Shimano cartridge bottom bracket nuts such as the one supplied with the EMtnD.

(3) Removing Bottom Bracket

Note the *right* nut is left-hand threaded, i.e. it tightens by turning left and loosens by turning to the right (clockwise). The *left* nut uses standard right hand threads (loosens counterclockwise).

Remove the left nut first. The cartridge will come out along with the right nut.

Step 4: Position MtnD3.on the main frame, as close to the bottom bracket and crankset as possible (while staying on the flat portion of the main tube).
(Photo 4)
The mounting system will differ between bike models. Some will use rivet nuts (Installation Instructions 5A) and some will use clamps (Installation Instruction 5B).

(4) Positioned close to bottom bracket

Step 5A : Rivet nut installation.

If the bike's main tube has a diameter of more than 45mm or 1.75 inches the installation will utilize quarter clamp brackets and if it is a rectangular tube, such as the Bullitt, the installation would use side brackets. *In either case, it is important to follow the steps outlined below as rivet nut installation is difficult to do with precision. This procedure ensures correct alignment.*

(5A) Marking Position to Drill

Side Brackets (Bullitt Kit) Once the position is set, tighten the side brackets onto the kit with the top 2 bolts on each bracket so that the kit is sitting flush with the frame tube and the and the bracket bolts are in the center of the adjustment slots. Sight down the main tube of the bike and make sure the motor plate is vertically aligned. You may want to have someone help you with this. It would be as though you tied a string from the seat tube and the steer tube, the motor plate should be directly under this string.

Marking the rivet nut position.
Once you have the kit in alignment use the supplied transfer punch and mark the position (by inserting the pointed end into the hole and tapping the other end with a hammer) of one hole only (it doesn't matter which one) and slide the kit off the main tube. (Photo 5A)

(5B) Drilling with consecutively larger bits

Installing the first rivet nut.

Note that you are drilling holes in your frame so take your time and be extremely careful. If you're concerned about weakening your frame by drilling the holes, don't be. Small holes such as these don't reduce strength at all. Once the rivet nuts and brackets are installed, the whole assembly is actually stronger than the frame was before.

Drill a small pilot hole at the location of a mark you made in step 2A-2 Use a small bit *(a small bit is easier to precisely align with the indentation)* **such as a 3/32" (2.5mm).**

Expand the hole size using a bit of approximately 3/16" (5mm).

Expand the hole to its final size using a 19/64" (7.5mm) bit (photo 11). *Getting to the final hole size in two steps allows the drills to penetrate more smoothly reducing the chance of paint chipping, or getting off-center. (Photo 5B)*

Install the first rivet nut using the instructions that came with your tool. Photo 5C shows installation using a wrench type rivet nut tool. *When using wrench type tool, be sure to not over tighten the tool. Doing so will strip the threads from inside the rivet nut.*

(5C)Wrench Type Rivet Nut Tool

The way to avoid over tightening is to grip the wrenches close to the rivet nut tool and carefully note the effort you're exerting. When the effort starts to increase, stop turning the tool. The nut is fully installed at that point.

(5D) Lever Type Rivet Nut Tool

Photo 5D shows a lever type tool similar to what we can supply. It must be adjusted so that it can properly crimp the rivet nut inside the frame. *The rivet nut is threaded onto the tool as shown in Photo 13, with the flange of the rivet nut against the adjustable knurled nut on the tool. When the handle of the tool is squeezed, the nut is compressed and grips the sides of the holes in the frame. The tool should be adjusted so that it has about 1/4" of travel to insure that the rivet nut is firmly in place. Install as shown in Photo 14. You may need help squeezing the handles of the tool. It takes quite a bit of force to crimp the rivet nut in place.*

Thread one of the M5 x 20mm into each rivet nut after installation. Photo 15. Tighten the bolt slightly to make sure the rivet nut doesn't turn.

If it does turn, reattach the rivet nut tool and tighten the tool another eighth turn if it's a wrench type, or squeeze the handle harder if it's a lever type. Repeat until the rivet nut doesn't turn when the bolt is moderately tightened.

(5E) Setting Additional Rivet Nuts

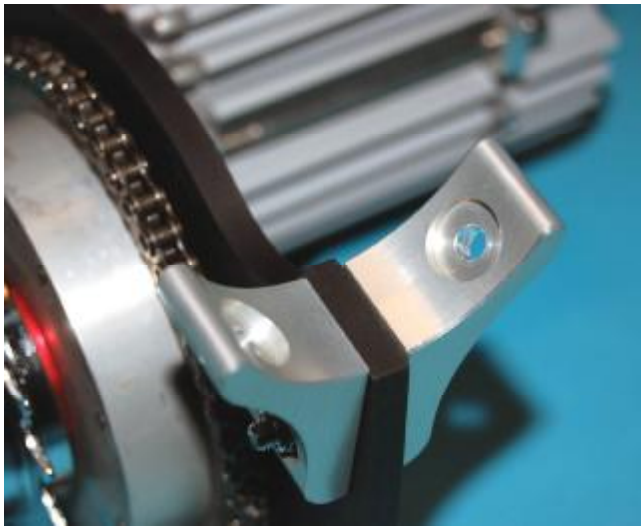
Additional Rivet Nut Installation, Photo 5E

Now that the rivet nut is installed slide the kit back on, bolt it into the rivet nut
Use 2 M5 x 20mm socket head bolts. Place a lock washer followed by a flat washer under the head of each bolt. Pass through quarter brackets and thread into Riv-nuts. Tighten to approx 25 in-lb (2.8 N-m).

You don't want to over tighten these bolts and risk turning the Riv-nut. The lock washers will prevent them vibrating loose if moderately tightened.

After bolting kit into nut, re-align it vertically, making sure everything is true. Once it is again in correct vertical alignment repeat step 4A-2 and 4A-3 with one rivet nut on the opposite side of the frame tube. Now it should be in correct vertical alignment.
Now that you have a bolt holding the kit to both sides of the bike, do one on each side of the remaining bracket. Repeat the process of the first ones, doing one at a time to ensure proper line up of the brackets. Once these are done and you have a bolt in all four of these holes, use the transfer punch and mark all four of the remaining ones. These can now all be drilled, and have their rivet nuts installed all at once.

For Quarter Brackets, rather than 2 holes on each bracket there is only one but the process is similar in that you find correct alignment, tap and drill one hole, then attach kit to that hole, re-align, and mark the second hole in the other half of the bracket pair. Repeat this process for the other bracket set. (See photo 5F+G)



(5F) Quarter Bracket Alignment

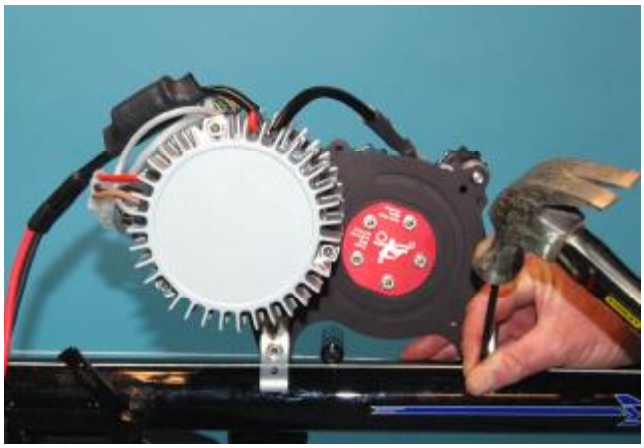
Step 5B: Clamp Installation:

If your EMTND3 uses round tubes under 1.75inches or 45mm then your kit will contact round clamps.

Position Clamps
Set kit on the frame tube with the kit flush and in contact with the top of the tube, and as close as possible to the seat tube. Bolt the clamps onto the motor plate, while in place on the bike. Slowly tighten all bolts while keeping the kit in the correct vertical alignment. Using the punch, mark where holes need to go through the rib below the main tube.

Remove the kit and drill holes using previous drilling instructions, stepping up drill bit sizes each time.

With the M6 holes drilled through the rib, put the kit back on the frame, re-bolting the clamps, this time with M6 bolts through the holes you just drilled as well.
Small differences in the width of the rib and the width of the motor plate are accounted for so don't worry about slight differences in size.



(5G) Marking Attach Bolt Location (EMD shown, EMtnD is similar)

Step 6: Install the new bottom bracket

Use anti-seize lubricant and thread the BB into the right side turning left to tighten (counter clockwise).

(Trick: to avoid cross threading, gently press the nut into the bike frame while turning clock-wise. You will feel a periodic click as the end of the thread drops into the groove in the frame threads. When you feel the click, stop turning clockwise and turn counterclockwise to engage the threads.)

Next, thread the left side cup into the frame around the bottom bracket spindle. Turn right to get it tight (clockwise).

The EMtnD is designed to work with frames that take standard 1.37" x 24tpi, 68mm wide bottom brackets. If yours is not, you will need to find a compatible width bottom bracket to use with the EMtnD. The supplied one for a single crankset uses a 122.5mm square taper spindle and a triple uses a 127mm. There is quite a bit of adjustability built into the EMtnD3, so a 127 one should work fine for the single if needed.

Make sure all clamp or quarter bracket nuts and bolts are tight.

Tighten both bottom bracket nuts.

Step 7: Install the freewheeling crankset. (photo) and bike chain.

Install the left side crank arm and the freewheeling crank and chain-ring assembly on the right. Tighten bolts firmly so that both arms are pressed onto the bottom bracket axle as far as they will go.

Wrap the bike's chain around one of the bike sprockets on the assembly.

It's important that the right side crank arm is firmly seated onto the BB axle for correct alignment of the motor drive chain. (Photo 7)

(7) Install EcoSpeed Crankset

Step 8: Align the gearbox sprocket to the chain-ring motor sprocket.

Thread the motor chain around the motor chain-ring on the crank, through the gearbox, through the tensioner, and back to itself. (Photo 8) Because of the variability in bikes and chain length needed, you will need to cut the motor chain to make it as short as possible. When you have the chain threaded through, pull it tight and mark the link that will need to be broken. To break a link requires grinding both outer pins completely down to the plate, and then using a punch to knock out the link. If you have a dermal tool, use a regular cut off wheel for this job while its still in place, otherwise remove chain and utilize a bench grinder, make sure not to loose

(8) Installing the Motor Chain

track of your mark and cut the wrong pin. Now re-thread, and use the supplied master link to connect the ends. (photo 8A+B)

To account for the variable angle that a bottom bracket will have with the motor gearbox, the red tertiary plate holding the gearbox is meant to be rotated to optimize the best path for the motor chain.
With the chain installed, rotate the red tertiary plate until the chain is fairly centered where it enters and leaves the gearbox. Make sure the chain is as tight as possible, The tensioner should not be taking up an overly large amount of slack, if it is, take off another link. (Photo 8C)
Sight down the line of the motor chain, and use the tertiary plates' set screws and adjustment bolts to straighten out the line, where it is not going to rub against either chain-ring guards, and will give the best power transfer possible. You may want to use a thin straight edge, such as a metal ruler, to help you sight down the chain-line to check alignment of the gearbox sprocket with the chain-ring motor sprocket. (Photo 8D)
If the misalignment is less than about 0.7mm or .025" that is good enough.
Once the gearbox is aligned, place the Eco-Speed logo decal on the motor face. As the orientation of the motor varies, the logo must be put on after adjustment.

(8A) Adjusting Length and Pulling Chain Ends Together

(8B) Installing Master Link (clockwise from top left)

Step 9: Install all wiring

While wiring up the system, do not secure any of the wires to the frame until everything is in place and tested. This will insure that everything is working and routed most efficiently before using the included zip ties.

Install the throttle

1) If your bike has twist shifters: Remove right side grip and shifter and install the thumb throttle between shifter and brake as shown in photo 9A.

You may need to move the right brake lever to the left to make room for the throttle. The throttle slides onto your handlebar and locks in place with a set screw visible on the bottom of the throttle body.

Reinstall the twist shifter making sure there is enough clearance to allow free movement of the throttle lever.

(8C) Proper Chain Tension

If your bike has thumb shifters: Install accessory mount on left hand side, and place the throttle on it so it is above the bars. Photo 9B

If you don't have the correct throttle to work with your bar and shifter setup, contact EcoSpeed for advice and/or a different throttle.

Right side mounting is the usual but, left hand mounting is possible and allows you to shift and operate the throttle simultaneously, which some prefer.

2) Route the throttle wire so that is doesn't impair turning the bars, won't snag on anything, and reaches the throttle connector on the motor.

(8D) Using Set Screws to Align Motor Chain

<u>If you have a Cycle Analyst for your kit, Install it Now</u>

The Cycle Analyst will have a wheel sensor and a connection between the battery and controller. It is a good idea to mount it now, as the throttle and analyst wires will follow some of the same paths

<u>Mount the Controller</u>

Attach the controller to your bike using the included adhesive foam and cable ties. Photo 25 shows one possible mounting location.

The controller is an electronic device that regulates motor speed and power levels in response to a signal from the throttle. It is small and light and so may be mounted in any number of places. The important considerations are cooling — the controller should be in open air and not enclosed, and locating it so that cables from the motor and throttle will reach.

(9A) Right Hand Throttle Location

(9B) Left Hand Throttle Install

<u>Mount your Battery</u>
See the included separate instructions for your type of battery system.

<u>Connect all cables</u>

Connect the following cables:

1) **Throttle.** Black 4-circuit JST connector on throttle plugs into matching connector on throttle. Be careful when plugging in to avoid bending connector pins.
2) **3 Motor phase wires.** These can have various connector types depending on the motor and controller combination. The phase wires are the three heavy colored wires coming out of the motor. Connect them to the matching connector on the controller. If the phase wires have individual connectors, match them according to color.
3) **Motor Hall Sense Cable.** A gray cable coming out of the motor ending in a black JST connector with 5 or 6 circuits. Plug into the corresponding connector on the controller. Be careful when plugging in to avoid bending connector pins.
4) **Main Power Connection.** The heavy cable from the battery to the controller terminating in a gray 2-circuit MiniFit Sr connector.

With a box bike, it is easy to hide all the wiring under the main deck. Place connectors where they will not be crushed by the kick stand, and where they will not be in the spray path. If you choose to place the controller or battery under the deck, it is your responsibility to make sure they will not be continuously catching road spray, which could cause damage to them. We recommend placing the battery in the box if possible. If items are placed under the deck, they should be protected from the road by metal plate, or something that will shield them from water and debris.

WARNING: Do not route the phase wires (2 above) and the Hall sense cable (3 above) next to each other over their entire length. Space them at least an inch (25mm) apart over most of their length. The high currents in the phase wires can interfere with the low voltage signals in the Hall cable and destroy the controller.

Possible Controller Location

Wiring wrapped in Optional Velcro enclosure

Main Power Connector

Step 10: Check front Derailleur Adjustment

(10) Adjusting Inner and Outer Limits

Triple chainring version only: Test front derailleur adjustment and adjust as needed. It's especially important to adjust the derailleur so it doesn't over shift on the big ring and drop the bike chain onto the motor chain.

If you don't know how to adjust your derailleur you can ask your local bike shop to do it, or go to:

http://www.parktool.com/repair/readhowto.asp?id=75

on the Park Tool Company web site for an excellent how-to article on front derailleur adjustment.

Single chainring version only: If switching from a triple chainring to a single chainring, leave the front derailleur in place and adjust it so that the bike chain is centered in the cage.

This will provide extra protection to keep the chain from coming off the front sprocket on sharp bumps.

Step 11: Finish up and Test.

1) With the rear wheel suspended off of the ground, turn on the battery pack switch and press the throttle to test the system. Run the bike through all of the gears to make sure the derailleur is properly adjusted. Look at the motor chain and verify that it is running smoothly. Make sure that all wires are out of the way of all moving parts. Make sure axle bolts or skewers are tight

2) Once you're satisfied that everything is operating correctly, neatly tie all wires out of the way of moving parts using the included cable ties.

Proper adjustment of the gears and making sure that the rear cassette and bearings are in good shape is especially critical given the extra load the drive train will be subjected to. Also, check that the rear axle skewer or bolts are fully tightened. Axle bolts should be torque to about 20 ft-lbs (28 Nm). Skewers should be as tight as you can comfortably make them. It is possible for the motor to pull the axle right out of the dropouts if they are loose.

3) Road test. Run through all the gears making sure they are shifting smoothly. Use full throttle in each gear to check for skipping of the drive chain. Keep speeds low at first until you're sure that everything is functioning properly and you become familiar with riding with the motor assist.

Congratulations On Your Successful Install, Enjoy The Ride!