



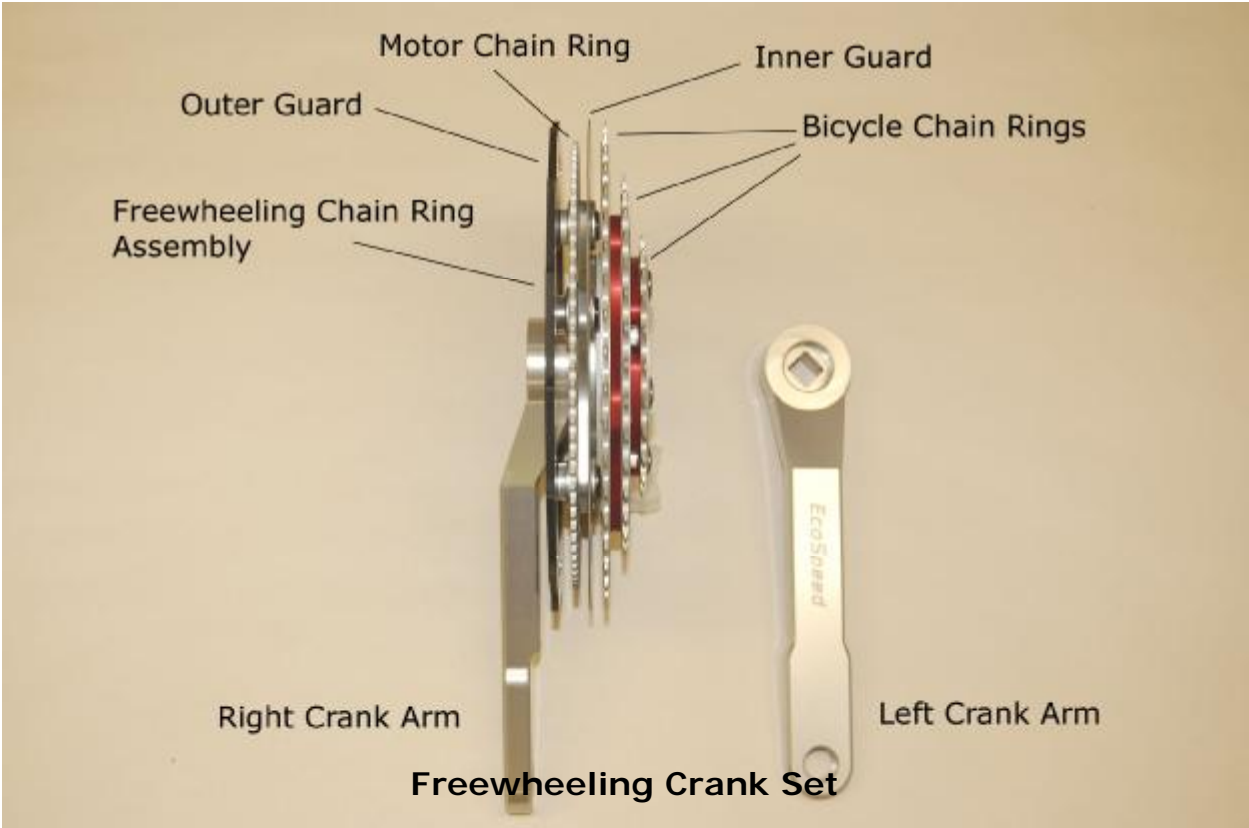
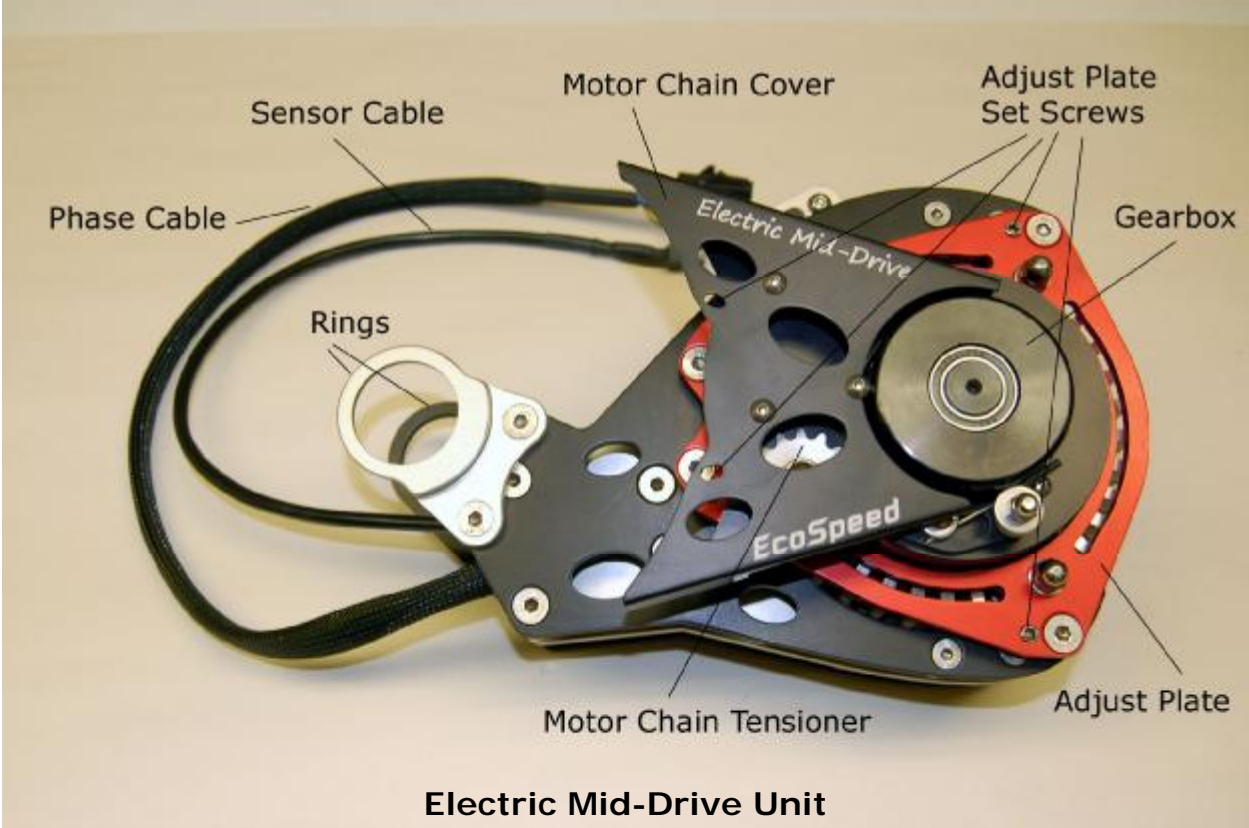
Electric Mid Drive™

Installation and Assembly Instructions
Crankset Drive System, Type 1

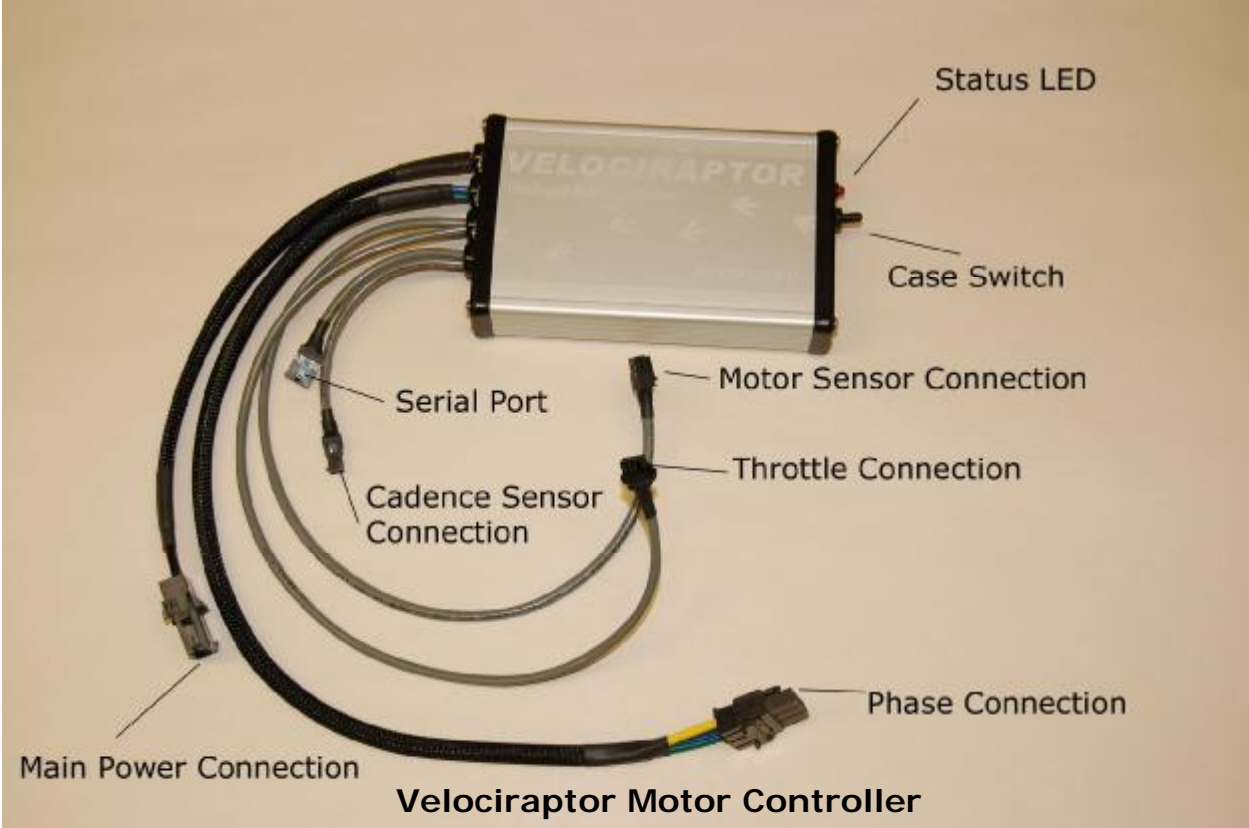
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http://www.ecospeed.com/docs/emdc1_assy_rev_1.0.pdf

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Electric Mid Drive Components



Electric Mid Drive Components

Congratulations on your purchase of EcoSpeed's Electric Mid Drive™ Electric Assist System, the world's best multi-speed, throttle operated, electric-assist conversion kit. It is the only electric-assist designed specifically for the high power needs of Mountain and Cargo bikes.

These instructions will guide you step by step through what we hope will be a simple and painless installation of your Electric Mid-Drive. 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.

Special Note for Bike Shops. If your customer has requested that you install our electric assist system on their bike, know that no tools or skills are required beyond those normally needed for bike maintenance and repair. You can be confident that the knowledge you already have plus these instructions are all you will need to perform a professional quality installation of EcoSpeed's EMD assist system.

A word on how these instructions are organized. Each step is under a major heading. If you're an experienced bike mechanic this may be all you need to look at to remind you of the sequence of installation steps.

CHECK YOUR SHIPMENT

Check the packing list included with your shipment to see that everything has been included.

GET YOUR TOOLS TOGETHER

You will 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) Pin Spanner SPA-1 or Pin Spanner SPA-2. *(Standard bike repair tools. Available from almost any bike shop. The larger SPA-1 is best. The other will work. The -1 is usually green and the -2 is red.)*

10) 15mm pedal wrench. The Park Tool PW-5 would be an example of this *(Standard bike repair tool. Available from almost any bike shop.)*

11) Crank and bottom bracket wrench. Used for installing and removing lock rings. *(Park Tool HCW-5 is such a tool.)*

12) Phil Wood bottom bracket tool. Included if your kit has a Phil Wood bottom bracket.

13) Grease or anti-seize lubricant will be needed for threading bottom bracket cups.

CHECK THE CONDITION OF YOUR BIKE

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 EMD will place extra stress on your bike so it's important that it be in top condition.

SET UP YOUR BIKE TO BE WORKED ON

A bike repair stand such as bike shops use is ideal. The next best thing is to turn the bike upside down resting on the saddle and handlebar ends.

REMOVE THE PEDALS AND CRANK SET

You won't need the crank set — the kit supplies a new one. The pedals will be re-installed on the new part.

STEP 1: Remove both pedals.

Use your 15mm pedal wrench. Note that the right pedal loosens by turning to the left and the left pedal loosens by turning to the right.



(1) Bike on Repair Stand



(2) Removing Crank with Crank Puller

Set the pedals aside. You will reinstall them on the new crank set supplied with your kit.

STEP 2: Remove the left and right cranks and chainrings.

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.*)

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



(3) Removing Bottom Bracket

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.

Your local bike shop can probably sell you the necessary tool, or they can just take the bottom bracket off for you.

Note the 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.



(4) Phil Wood Bottom Bracket Cup

INSTALL THE NEW BOTTOM BRACKET INCLUDED WITH YOUR KIT.

Most kits ship with the ultra high quality Phil Wood™ bottom bracket. This design uses separate left and right cups and lock rings. This allows the left-right position of the bottom bracket to be adjusted slightly.



(5) Fully seated Phil Wood Bottom Bracket Cup

STEP 1: Install the right side bottom bracket cup. Note that it is left hand threaded. Use anti-seize compound on the threads inside your frame.

STEP 2: Insert the bottom bracket cartridge from the left side. Note that some are not symmetric. If so, insert so that the side with the longer axle is on the right of the bike.

STEP 3: Install the left side bottom bracket cup. This is the one that tightens to the right.

STEP 4: Tighten both cups. The Phil Wood cartridge is an extremely tight fit in the cups so you'll want to tighten carefully. You can use a flashlight to look inside the cups to see if they are fully seated. They are seated when the tool grooves are against the bearing as shown in photo 5.

STEP 5: Adjust cups so that the left one has about 3/8" (9.5mm) of threads showing outside the frame.

PREPARE THE EMD UNIT FOR MOUNTING

The EMD unit has two rings that attach to the left and right bottom bracket cups. The right one must be removed and then reinstalled once the unit is attached by the left side ring.

STEP 1: Remove the two bolts and associated nuts and washers that attach the right ring to the rest of the EMD frame. See photo 6.

ATTACH THE EMD UNIT TO THE BOTTOM BRACKET

STEP 1: Hang the unit from the left side ring as shown in photo 7. This assumes you are working with the bike on a stand. If not, you may need to use a free hand to support the unit while you do the next step.

STEP 2: Install the left side locking nut. This threads onto the exposed threads of the left bottom bracket cup and holds the unit in place. See photo 5. Do not fully tighten yet.

STEP 3: Slip the right side ring over the right bottom bracket cup and install the right side lock ring. See photo 8. Do not fully tighten yet.



(6) Right Side Ring Removed



(7) Unit Hanging from Left Ring. Installing Left Lock Nut



(8) Installing Right Lock Nut . Preparing to Re-attach Right Ring.

STEP 4: Re-attach the right side ring to the EMD frame using the bolts, nuts, and washers removed at step 1 in the previous section. Tighten bolts and nuts securely.

ATTACH EMD UNIT TO FRAME

A two piece bracket bolted to the top of the EMD unit's middle plate is held to the frame by a band clamp. See photo 9.

STEP 1: Swing the unit up against the frame and check the the top edges of the bracket are parallel to the frame tube surface. If not you can loosen the bolt and nut holding the bracket to the EMD and adjust its position.

You can also attach the bracket to the EMD middle plate using the other pair of holes for even more adjustability.

STEP 2: Slip the worm screw housing of the band clamp into the openings in the bracket. Insert the free end of the band into the housing and tighten as shown in photo 9. You can slip the end of the band into the plastic tube that surrounds the band as you tighten it for a neat appearance.

STEP 3: Tighten the left and right lock rings. The right ring tightens by turning to the left using an HCW5 bottom bracket tool. The left right tightens by turning right.

Some kits will have an aluminum ring on the left that is turned with a pin spanner such as the one shown in Photo 5. Others will have a steel lock ring that turns using the HCW-5.

INSTALL THE CADENCE SENSOR

The cadence sensor sends crank speed information to the controller. The system will operate without it, but only at reduced power. Installing it unlocks the full power potential of the drive and, together with the speed sensor, enables the cruise control feature.



(9) Installing Band Clamp



(10) Cable Ties for Cadence Sensor



(11) Installing Cadence Sensor



(12) Cadence Sensor Installed



(13) Installing Crank Set

STEP 1: Thread two small cable ties through the small oval holes in the cadence sensor backing plate on the left side of the unit as shown in Photo 10. The heads of the cable ties should be behind the plate.

STEP 2: Thread the cable ties through the base of the cadence sensor as shown in Photo 11. Pass the ties back underneath the bottom edge of the backing plate and secure.

Photo 12 shows the installed sensor.



(14) Installing Motor Chain

INSTALL THE CRANK SET

Install the left crank arm and the right crank arm/chain ring assembly. Tighten the nuts securely. Wrap the bike chain around one of the sprockets. Photo 13.

INSTALL THE MOTOR CHAIN

The motor/gearbox unit drives the crank set using a 1/4" (6.35mm) drive chain.

STEP 1: Lay the motor chain over the outermost crank set sprocket and pass it through the gear box from the top as shown in Photo 14. You can reach into the bottom of the gear box nose and turn the small sprocket by hand to pull the chain through the gear box.



(15A) Installing Master Link (clockwise from top left)

STEP 2: Join the ends of the chain using the included master link. Photo 15A. *The master link consists of a pin assembly, a side plate, and a spring clip. Join the chain ends with the pin*

assembly, slip the side plate over the ends of the pins then snap the clip into place in the grooves on the ends of the pins using needle nose pliers.

STEP 3: Move the chain above the spring loaded motor chain tensioner . Photo 15B.

ALIGN THE MOTOR CHAIN

Correct motor chain alignment insures quiet running and long chain life. The red adjust plate surrounding the gearbox has 4 set screws that allow it to be moved left or right and tilted in any direction. The tilt is not normally needed but is there to allow precision alignment.

STEP 1: Sight along the top of the chain to see if it goes straight from the gearbox to the crank set. Turn the cranks by hand to check that the chain is straight. If it is, no adjustment is necessary. If not, go to step 2.

STEP 2: Loosen the four bolts and nuts at the corners of the adjust plate. The nuts for the two bolts closest to the crank set can be accessed from the rear through holes in the frame plates using a 10mm socket driver.

STEP 3: Turn the set screws next to each of the four attach bolts to move the adjust plate left or right. Turn each screw the same amount to keep the adjust plate parallel to the EMD frame. If necessary the screws can be turned slightly different amounts to adjust the tilt of the plate. *Since the attach bolts are loose you will need to press the motor/gearbox/adjust plate assembly against the frame by hand to check alignment.*

STEP 4: Once you are satisfied with the alignment, tighten the four attach bolts and associated nuts. Tighten each one a turn or two at a time so that the adjust plate settles evenly onto the set screws.



(15B) Motor Chain Installed



(16) Loosening Adjust Plate Bolts

INSTALL THE MOTOR CHAIN COVER

STEP 1: Install the motor chain cover using three M4 x 6mm button head screws. Before tightening the screws adjust the cover position so that the gap between the cover and the chain ring guard is the same at the top and the bottom.

This completes the mechanical installation of the drive unit. What remains is to install the motor controller, the handlebar mounted throttle, the optional e-bike computer/display, and the battery. You may want to congratulate yourself, have a beer or an iced tea, and get ready to do that last few steps before you ride.

MOUNT THE CONTROLLER

The controller contains the sophisticated electronics and software at the heart of your EMD system. It is relatively small and light and can be mounted anywhere that it can get air flow for cooling.

The unit comes with a bracket that allows the controller to be mounted to a standard water bottle mount as shown on Photo 18.

EcoSpeed also makes a different bracket that can be used to mount the controller to one of our battery cradles or to any flat surface. Contact EcoSpeed if you would like one of those instead.

STEP 1: Attach the included bracket to a free water bottle mount.

STEP 2: Look at the back of your controller and you will see 5 screws. Orient the controller so that the text is upright and remove the two screws on the bottom and the single center screw.

STEP 3: Rest the controller on the bracket and attach it with the three screws removed in step 2. Photo 19.



(17) Motor Chain Cover Installed



(18) Bracket for Attaching Controller to a Water Bottle Mount



(19) Mounting Controller on Bracket

MOUNT THE THROTTLE

The EMD kits come standard with a thumb operated throttle that mounts on the right side of the handlebars between the twist shifter and brake lever. If your bike has a thumb shifter, you will probably want to use a twist throttle instead. Contact EcoSpeed to swap throttles. It is also possible to mount the thumb throttle on the left side of the handlebars using a bar extension. Contact EcoSpeed for details.

STEP 1: (Thumb Throttle) Remove the right side grip and twist shifter. Loosen the right brake lever so that you can slide it inboard on the bar to make room for the throttle.



(20) Thumb Throttle

STEP 2: (Thumb Throttle) Slide the throttle onto the bar. Find a good location that's comfortable to reach with your thumb. Tighten the set screw on the throttle to lock it in place. Reinstall the gear shifter and grip.

STEP 1: (TwistThrottle) The twist throttle mounts on the right end of the handle bar and replaces the grip. Remove the grip. Slide the throttle on to the bar. Tighten set screw. *Some twist throttles are short and are installed with a short piece of grip outboard of the throttle. Some replace the grip entirely.*

INSTALL OPTIONAL E-BIKE COMPUTER DISPLAY

See instructions that came with your display. Normally the display is mounted near the middle of the handlebar .



(20) Optional Cycle Analyst E-Bike Computer

INSTALL BATTERY SYSTEM

If you purchased a battery system from EcoSpeed, see the instructions that came with your battery.

If you have a battery from another source, see the instructions that came with the battery and contact EcoSpeed to get a wire pigtail with the correct connector.



(21) EcoSpeed Lithium Tri-metal Battery in Fabric Covered Aluminum Case

CONNECT THE SYSTEM TOGETHER

Connect all of the matching connectors in the system. The connectors are designed so that you can't get it wrong. Each connector has a unique mate and will only plug into that one.

STEP 1: It's a good idea to connect all of the connectors without worrying about routing the cables and do a quick check to see that the system is working. Do this by momentarily and gently pressing the throttle with the system on, all cables away from rotating components, and the rear wheel off the ground.

STEP 2: This step requires a bit of craftsmanship to get a neat installation. Unplug the connectors from step 1. Then carefully route each cable so that it does not interfere with any mechanical component and gives a neat appearance. Your kit includes a bundle of cable ties for this purpose. Once you're satisfied with the cable routing, re-plug the connectors.

STEP 3: At the end you will likely have a bundle of extra loose wire and connectors. These can be pressed against your frame and secured with cable ties as shown in Photo 22.

STEP 4: Your kit comes with a fabric wrap that can be used to cover the cable bundle. Photo 23.

Below is a list of all of the connections in the system. If you want, you can go through the list and connect each connector in sequence.

Motor Phases. Heavy three wire cable from the motor. Connects to matching connector on the controller.

Motor Sensors. Small connector coming out of the motor housing with six terminals. Connects to matching connector on controller. It's important that this cable not be within 1/2" (12mm) of the motor phases cable above for more than a short distance (6" or 150mm). To do otherwise may cause incorrect operation due to signal interference.

Main Power. Heavy two wire cable from battery. Connects to matching connector on controller. If the optional Cycle Analyst is installed, it connects between these two connectors.

Throttle. Small connector with three signal terminals in a 4 terminal housing. Connects to matching connector on controller.

Cadence Sensor. Small connector with two rows of two terminals each. Connects to matching connector on controller.



(22) Cable Bundle



(23) Cable Bundle Cover

Speed Sensor. Two terminals in a flat three terminal shell. Connects to matching connector on the cadence sensor cable.

Serial Port Interface. Flat 4 terminal connector coming out of controller. Normally unconnected. This is where you can plug in a laptop computer or other device having a serial port and modify controller settings.

There may be other connectors coming out of your controller as well. These are for future use and may be safely ignored.

CHECK FRONT DERAILLEUR ADJUSTMENT

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. The inner guard provides some protection against this, but adjust properly anyway.

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.

FINISH UP AND TEST

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

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 torqued 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.

Road test. Run through all the gears making sure they are shifting smoothly. Test 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. Be sure to always start off in a reasonably low gear ("low" means easy to pedal without the motor being on). Starting in a high gear strains the controller and may cause its stall detection feature to shut it off for self protection.

