Razor Ecosmart Metro increase power, speed, and range mods

I recently modified my Razor Ecosmart Metro using parts and forum advice from ElectricScooterParts.com. Specifically I referenced this post from a few years back: https://support.electricscooterparts.com/support/discussions/topics/1000088437

Along the way I encountered a few differences, noted some areas that could use more description, and I found a way to mount the new motor *without* changing the factory motor mount.

The parts I ordered:
36 Volt 1000 Watt Currie Electric Scooter Motor with 11 Tooth Sprocket
MOT-SD361000

36 Volt 1000 Watt SPD-CT660B9 Controller and THR-86 Throttle Kit
KIT-CT660B9

15Ah Extended Range Battery Pack with Wiring Harness for Razor EcoSmart Metro Electric Scooter, Includes 12 Month Warranty
ESM-BATTERYPACK-XR15

55 Tooth Rear Wheel Sprocket for #25 Chain
SPR-2555

36 Volt 3 Amp Automatic Battery Charger with 3-Pin XLR Plug
CHR-36V3AXLR

Swpeet 700Pcs Automotive Electrical Wire Connectors Kit, 2.8mm 2 3 4 6 9 Pin Automotive Electrical Wire Connectors Pin Header Crimp Wire Terminals and 30 Kits 4mm Car Motorcycle Bullet Terminal Wire
[Ordered from major online retailer]

#10-24 x 1 in. Phillips Flat Head Stainless Steel Machine Screw (3-Pack)
#8 Stainless Steel Flat Washer (12-Pack)
#10-24 Stainless Steel Nylon Lock Nut (4-Pack)
[Ordered from orange home improvement store]

The tools I used:
Flathead and phillips screwdrivers w/ magnetic end
Miniature flathead “thumb” screwdriver (like what you’d used to repair glasses)
Rotary cutting (dremel) tool
1/8" Tungsten carbide metal cutting bit for rotary tool
1/4" and 1/2" drive socket wrenches

8mm, 10mm, 3/8", 15 or 16mm (don't recall) sockets
Wrench with 8mm on one end and 10mm on the other
Wire strippers
Bench vice
Electrical tape
Safety glasses

Why I did this mod:
I live in a hilly neighborhood and wanted a way to give my metro more power and more range. Speed came as a byproduct of the modifications I made (22 mph now, and could be even faster if the rear wheel sprocket was changed - more on that later). I was motivated to do the mod work because my Razor had stopped working after I found a foul smell one morning when I went to disconnect the charger. It's a great scooter, but not great enough to ride without power!

What I did to prepare:
I spent a lot of time researching forums for inspiration, instruction, and recommendation on parts, then ordered a new 1000 watt controller and throttle kit, a 1000 watt motor, a 15Ah extended range battery pack, a 55 tooth rear wheel sprocket, and a new charger off of ElectricScooterParts.com. I decided to keep my scooter 36 volts as it seemed a bit more achievable. I also ordered a connector kit after I got a ways into the project and found that I needed to get some connector parts I didn't already have, and I wound up getting some hardware to mount the motor.

I put my scooter up on my garage work bench so I could get at it, and started by taking pictures of all of the parts of the scooter that I thought I might have trouble with later remembering how it went together. Specifically I took pictures of how cables were routed around and through the scooter, pictures of where unique or difficult to reach parts were located, and especially pictures of the rear wheel assembly - the chain routing, the tensioner pulley and spring, how the brake attaches, etc

Uninstall factory parts:
I then began "tearing down" the scooter, disconnecting and removing the internals. The scooter disassembled easily, and I put all the hardware I took out into a pile and kept it together. It was easy at the end to reassemble using hardware from the pile as different areas of the scooter used different sizes, colors, and types of hardware so it was easy not to mix them up.

I pulled the factory throttle and cabling, battery packs, controller, and motor off of the scooter and put them in one of the boxes that my new parts were shipped in. Never know when you may need them again! I messed up just a little during this step with the controller, as it was confusing how the controller was attached. There are screws off each end of the controller holding it into the bottom of the plastic 'tub'. That's how it's removed. I found this out after accidentally taking the controller apart undoing some other screws in the metal housing.

For a tip while inside the plastic tub, when you undo the cable holders (there are a couple in there), leave one of the two screws in and just rotate it out of the way so you can reuse it later. That way there's no concern over which orientation they go in, and it's a little easier to put them back in.

Installing the Controller:
There wasn't much to installing the controller. I set the new 36 Volt 1000 Watt SPD-CT660B9 controller down in the plastic tub in the same location as the old factory controller. For now, I let it sit in there without attaching it to the tub. At the very end of the build, just before the motor work, I ran some screws in to attach it. It's in roughly the same spot as where the old one is, but it doesn't fit the same holes. If I recall correctly, I used one of the existing holes from the old controller (whichever one worked best to give the cables the most room), then drilled a new hole for the other end and reused the same screws.

Installing the Throttle and Battery Pack:
Onto the real work now. I started by installing and wiring up the new THR-86 throttle. It slides right on the front handlebar in the same location where you removed the factory one (loosen the clamp if you need to first) and is easy to fix in place by tightening up the clamp on the grip. I routed the cable from the new throttle in exactly the same way as the old factory one was - together with the brake cables, wrapped in the spiral cable holders, and threaded through the front rubber grommet into the plastic tub. I don't recall at this point if you had to take the rubber grommet out to fit the new cable in, or if mine accidentally came out. Either way, mine came out and it was a bear to get back into the hole in the tub. I used screwdrivers to push it back into the plastic hole and then slowly worked the edges to get it properly seated.

I routed the new throttle cable through the same internal path as the old one, laying it inside the cable holder and tightening it down to hold it in place along with the brake cables. I read in another post that the new cable was short - they must have remedied this as mine was plenty long enough.

It gets tricky wiring in the new throttle cable. On the old factory controller, the throttle and brake cables separately plugged into their own connections. On the new 1000 watt controller they go together into the same coupler. I stripped the end of the brake cable (the one that tells the controller to stop the motor, NOT the one that connects to the rear wheel), crimped on a new metal spade connector, and used the controller wiring directions to push the new metal spade connector into the existing plastic coupler on the end of the throttle cable in the location noted.

The miniature flathead thumb screwdriver mentioned in my tools list was perfect for depressing the metal tabs on the spade connectors to remove them from their plastic coupler. When you look at them, it will make sense. For crimping on a new spade connector.. I didn't have the right tool. I just used my wire strippers which also had some crimping capabilities and carefully lined up where I wanted things crimped while trying to replicate the crimps on the factory wires. I messed up a few times, bending some irreversibly out of shape. With focus and patience I was

eventually able to get them all. I bought a kit with several of the connectors needed (in the parts list above) so it was okay to lose a few.


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MID
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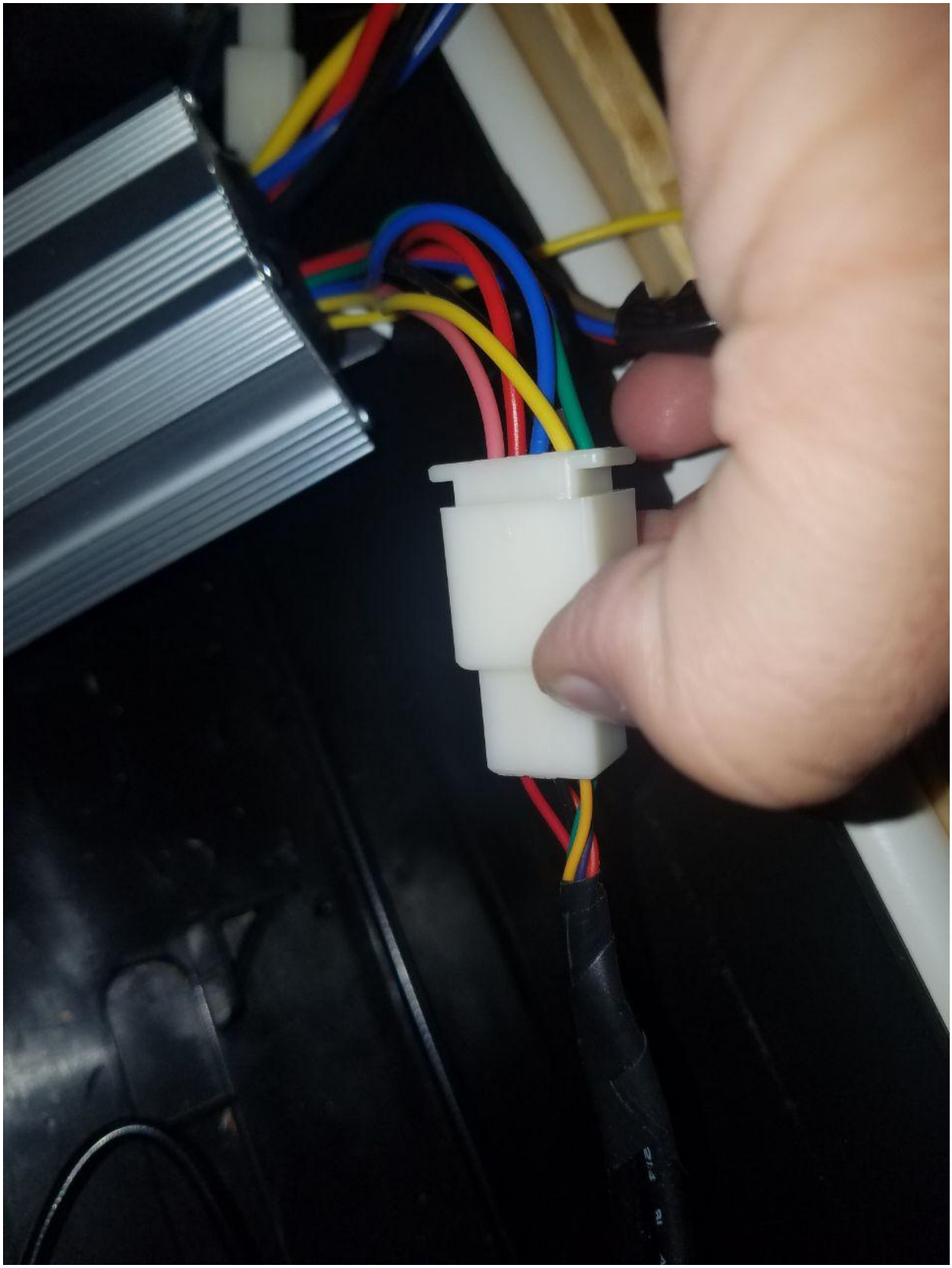
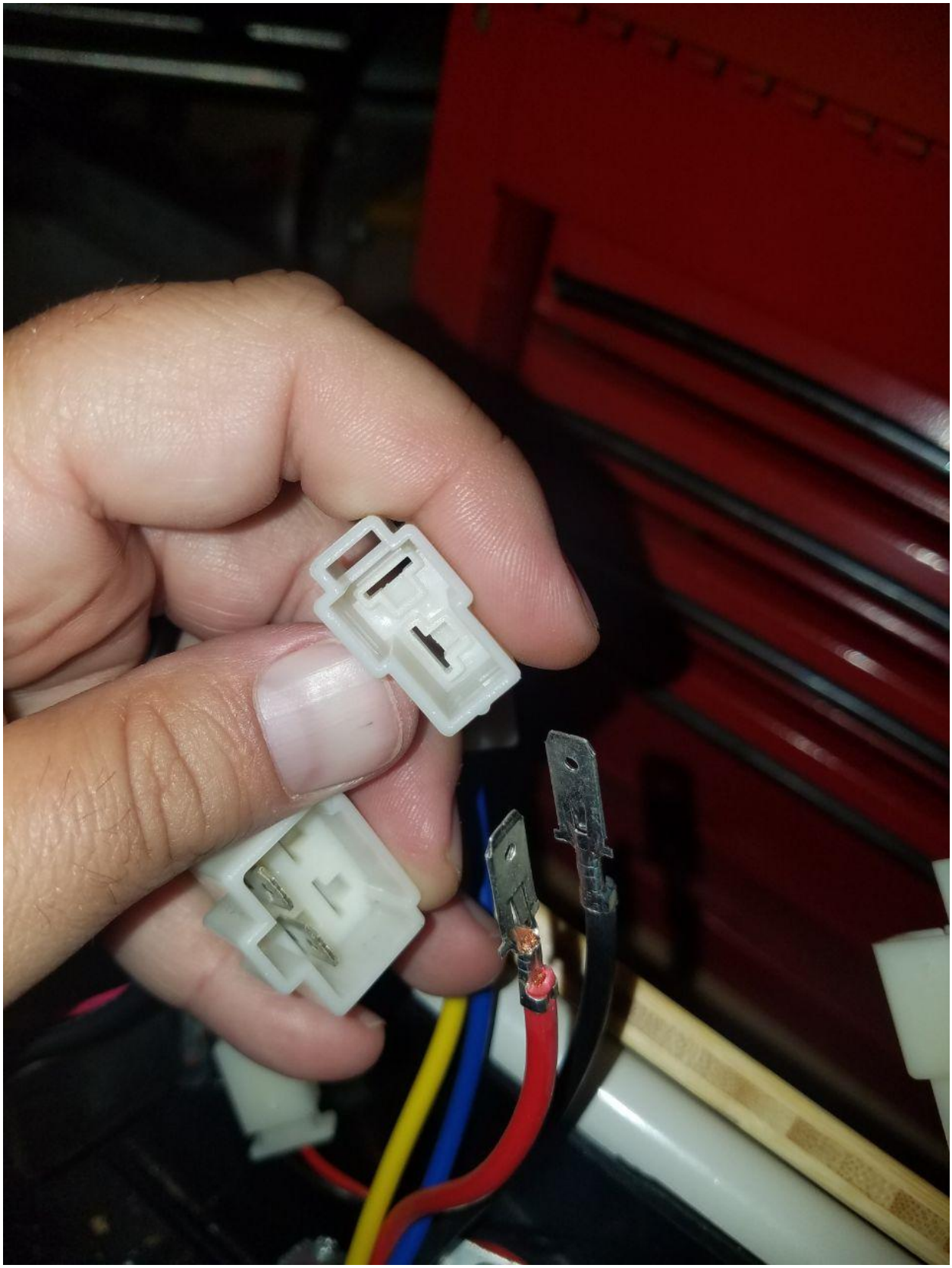
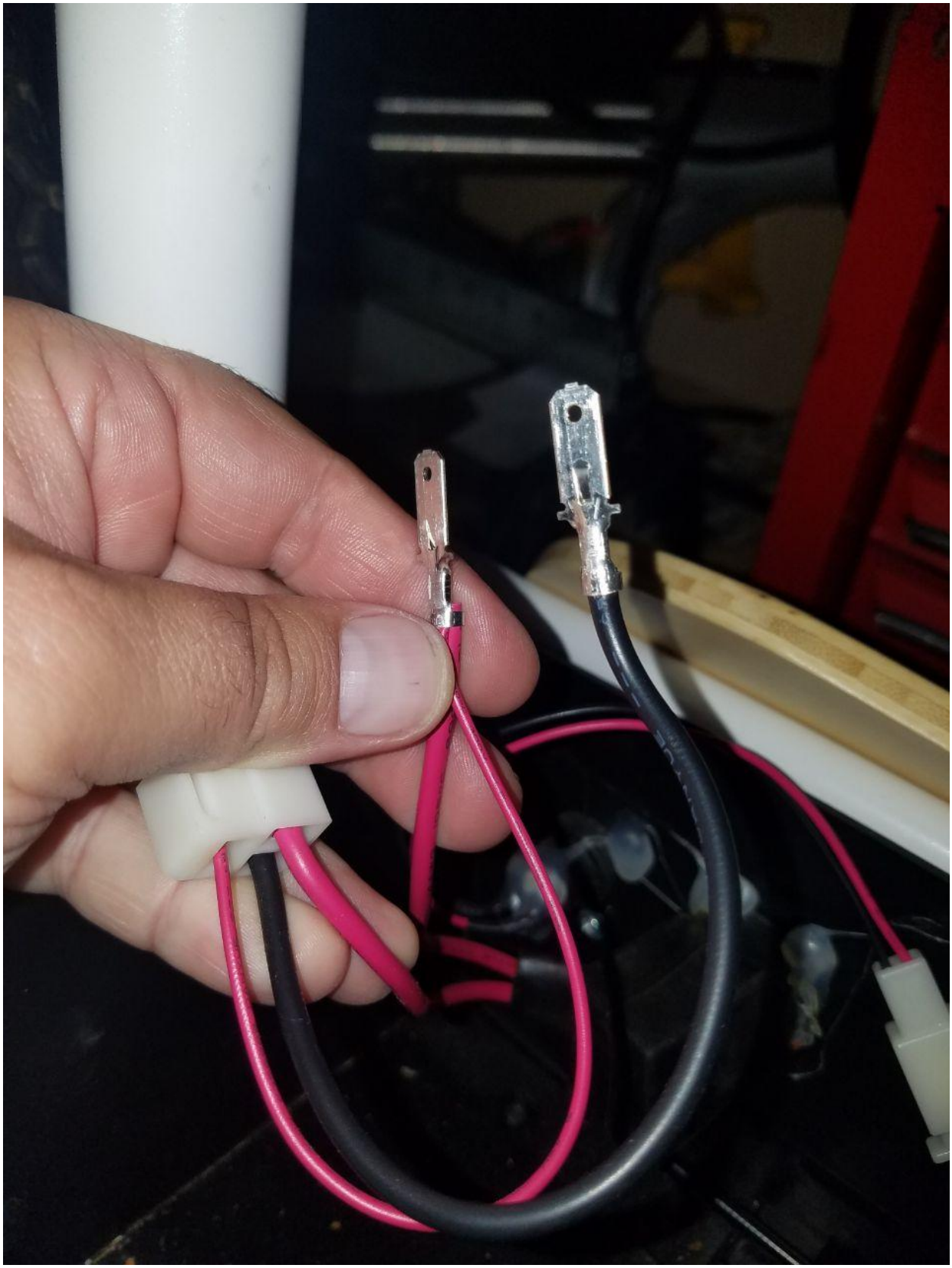


Next up was the new 15Ah extended range battery pack. The throttle and brake cables are the only things in the tub that occupy the same space as the batteries (they go underneath them), so after they were done, it was time to put the batteries in. I carefully lowered the battery pack into the tub doing my best to line things up so nothing was pinched or smashed and the end with the connections was near where the controller would go. They drop in nicely and have a snug fit. I had to put a different plastic coupler on the controller power wires to connect to the battery. I don't remember if I reused one that was already on the metro (but no longer being used), or if it came out of the connector kit I purchased; but, either way it was the simplest coupler change I made in the whole project - pulling the metal spade connectors out of the original coupler and then just pushing them into the new one.



(Re)Wiring the Power Switch, and Connecting the Charging Port:

After the battery pack, I had to address the wiring set from the power switch to the controller. On the old factory controller, the battery connected in through the power switch. With the new parts, everything runs directly to the controller. Using the controller wiring directions, I simplified the wire harness coming off of the power switch to be just one single plastic coupler that plugs into the controller. To do that, I eliminated all wires after the first plastic coupler, eliminated the one smaller wire that remained (leaving just the two larger wires), and then replaced the plastic coupler so that it fit the receiving end on the controller. I got the new plastic coupler out of the connector kit, above. I followed the same stripping and crimping process for this that I followed with the throttle wire above. One notable difference here is that I had a really hard time crimping the new metal spade connectors on. Thankfully the connector pack I ordered had plenty of them, because they were a lot more difficult to shape and crimp on the larger gauge wire. Again, though, I was able to get it done. To help make sure the metal spade connectors stayed on the ends of the wires, I wrapped them in electrical tape (enough to hold it firm, but not so much that it wouldn't fit into the plastic coupler).



The charging port connected right up to the controller without issue, if I recall correctly.

Mounting the Motor:
At this point in the process, everything was connected but the motor. I decided that before I went any further, it would be a good idea to verify that all of the components work. I connected the motor while it was just sitting on the bench next to the metro - but touching the metro frame in case it needed to be grounded - turned on the power switch, and slowly twisted the throttle to verify things worked and that the motor turned in the correct direction (counter-clockwise).

After that was successful, it was time for the toughest part of the modifications for me - figuring out how to mount the motor. If things just bolted up, we would be done here.

I was prepared to cut off the factory mounting plate, fabricate a new one, and weld it on. As it turns out, I was able to make the existing factory motor mount work using some creative processes.

I noted that the mounting pattern of the new 36 Volt 1000 Watt Currie Electric Scooter Motor was similar to the factory Razor motor, but the holes were farther away from center. I used a rotary tool and the 1/8" tungsten carbide metal bit to elongate the existing motor mount holes until I could put a screw through each of the currie motor mount holes into the factory razor motor mount. This process was almost entirely guess-and-check. I frequently stopped to make sure I didn't make the holes in the motor mount plate too long, and to make sure they were lining up (make sure I was elongating them in the right direction). I would periodically stop, put my mini flathead thumb screwdriver through the bottom mount hole of the motor and the mount, and then visually check the top two holes for alignment - yes, I used the mini screwdriver as a temporary screw.

I was initially worried about using a slotted hole for motor mounts until I realized that the shape of the holes would prevent the motor from moving around, especially so while bolted down.

For a tip while making the holes larger - this process produces a lot of metal shavings. I used the two magnetic screwdrivers to catch the shavings and clean them off the working surfaces and bench. It worked really well. A larger/stronger magnet would probably work even better.

Once the slots in the motor mount were long enough, I carefully mounted the new 1000w motor using 1” stainless steel machine screws and several #8 stainless steel washers. I noted that the actual mount location on the factory plate was recessed, but the housing on the new 1000w motor was so big that it didn’t fit into the recess. So, I put 3 washers on each screw in between the motor and the factory motor mount to make it nearly a flush mounting surface. Combined with 1 washer on the end of the screw and finished off with a stainless steel nylon locking nut, everything was rock solid once mounted and tightened up.

I specifically used the smallest washers I could find that would fit the screws because there’s not a lot of space around the hole in the recess. Regular sized washers would not sit flat against the plate.

There’s no concern about the length of the screws or size of the hardware as the chain routing easily clears this setup. The motor is rock solid on the mount, with nothing flexing or moving as far as I can tell. I have considered using other things to improve the mount - jb weld to hold things in place if needed, or cable ties to attach the mount plate to other areas of the frame as a safety - but thus far it doesn’t seem like they’re needed.

Wiring the Motor:
Then I had some more problems to solve. I needed to solve the new alignment issues with the chain. The new 1000w currie motor has a shorter shaft and the front and rear sprockets don't align as-is, and I needed to figure out how to get the plastic coupler on the end of the motor wire through the rubber grommet and into the plastic tub.

I solved the wire problem by digging out all the hot glue in the plastic coupler, using the flathead thumb screwdriver to depress the metal tabs, and pulling the metal spades temporarily out of the plastic coupler. I then threaded the motor cable through the oval slot on the mounting plate, through the grommet into the tub, reinserted the metal spade connectors into the plastic coupler and finally connected it to the controller. The grommet came out when I did this, twice unfortunately, but I was again able to use two flathead screwdrivers to put it back both times.

I was careful when I routed the wiring so nothing pinched or bent too far, and was also careful to keep the cable sheathing away from the side of the motor where it can get hot. I am considering going back and putting some cable ties on it to move it even further if it seems like it's still getting hot.

Aligning and (Re)Installing the Factory Chain:
The real challenge was going to be the chain. With the new motor having such a short shaft, the new motor drive sprocket didn't align with the factory rear wheel sprocket.

I had an idea though. I had ordered a 55 tooth rear wheel sprocket to make the scooter faster. While I was doing the build, I decided I was going to keep the original factory 65 tooth rear wheel sprocket in place because I wanted to retain the final drive ratio to improve hill climbing power, but I still had that 55 tooth sprocket that I purchased.

I set the rear end of the scooter up on blocks of wood to get the tire up off the bench, then I took the rear wheel assembly apart, being careful to note where each screw, bolt, washer, locking ring, and nut went. Next I removed the factory 65 tooth sprocket, then wound up using the new 55 tooth sprocket as a spacer to move the factory sprocket out closer to the new motor. There is *just* enough length on the screws holding the sprocket in to add the 55 tooth sprocket behind the 65 tooth, and then put the screws and nuts back in.

This was exactly what I needed to line them up! I needed a way to move the rear wheel sprocket out, and I was otherwise going to waste the new sprocket I ordered. I still can't believe it worked out so well.

The last problem to solve was the chain tensioner. It was misaligned with the new chain path. I used my bench vice to take out some of the bend in the metal bar holding the pulley. To do this, I centered each bend in the vice head and cranked the vice closed to flatten out the bends. I'd do one a little ways, then flip it around and put the other end in, bending it just enough so the pulley and the collar on the other end of the metal bar were parallel. I took my time and used guess and check. I wound up bending it a few times until it was slightly too much and rubbed on the inside of the motor mount, then I put it back in the vice and re-bent it with a hammer until it was just right.

Then I powered the scooter on and slowly twisted the throttle to watch the chain move and see if it looked like it would stay put. It did, so I called it finished!

Final Thoughts:
After reassembling everything and thoroughly testing, I am extremely pleased with the new parts. The scooter has noticeably more power and now even accelerates going uphill. I've let friends ride it who have then remarked about its power and speed. I've given the kids a ride along with me and they enjoy it of course. I haven't had a chance to test out the battery duration yet, but I feel confident it will be acceptable. This is all with a 230lb rider.

It's fair to say there are some things that could maybe cause problems down the road - having wire terminals taped, eyeballing the chain alignment, letting cables rest on top of the controller, etc. If something goes wrong at this point, though, I feel confident after this process in my ability to fix it.

Thank you ElectricScooterParts for the parts and the forums! Thank you to the original poster of the above post for your problem solving and inspiration!

Anyone can do this!


RAZOR