2018 JK Ebike Restoration

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INTRODUCTION

On 17 May 2016 our son purchased from eBikeAdventure here in Ventura, CA an electric bicycle custom built on a 28-inch Huffy Premier frame. For some two months, our son rode this bike all over the county with good results.

In July 2016 our son suffered a severe ischemic stroke which limited his ability to ride any bicycle. During his recuperation we arranged with eBikeAdventure to add dynamic braking of the rear wheel and a rear kickstand to make the eBike easier to use for him. Adding dynamic braking required a different controller and required beefing up the frame area around the rear axle to better withstand the torque of the rear motor (to keep the rear axle from rotating). The conventional side kickstand was inadequate to keep the bike stable when parked.

For a total of 18 months the bicycle was heavily ridden around Ventura County and to Santa Paula and Ojai, about 20 miles distant from our home in Ventura, CA. The battery was recharged many, many times as needed.

FIRE!

On 9 December 2017, our son's electric bicycle (ebike) was badly burned in a fire in a beat up travel trailer on a ranch west of Moorpark, CA. The trailer and all of our son's other belongings in the trailer were destroyed in that fire. Our son was outside at the time and no one was injured. The Fire Department was called and they put out the fire.

On 12 December I went with our son to retrieve the damaged ebike and whatever else was salvageable. The ebike sat in our yard while we came to grips with what happened.

The battery, controller and rear wiring were destroyed. The rear tire and tube were partially missing. The rear rim was badly distorted. The motor was not tested but was presumed lost due to the heat.

Later investigation disclosed the throttle was heat damaged as well. In addition, the hydraulic front brake master cylinder and the headlight on-off switch were damaged from old age and heavy use and needed replacing anyway.

DECISIONS

After long thought it was decided to rebuild the bike keeping most of its original features while making a few changes:

1. Reduce wheel size from the original 28” to 26” for easier mount and dismount, and for easier and cheaper tire and tube replacement.
2. Use Schrader valves instead of the original Presta valves on the inner tubes.
3. Retain the original regenerative braking/dynamic braking and single brake lever (brake lever master cylinder activates the front-wheel hydraulic disk brake, and the brake lever switch deactivates the motor and activates rear-wheel dynamic braking) to accommodate our son 's physical limitations.
4. Separate the battery, controller and 48 to 12 volt converter for better cooling. Original build had all these in one bag on the rear rack and occasionally something would shut down due to over-heating.
5. Use larger wire sizes (roughly 18 AWG) than original for easier wiring and longer life from vibration and rough handling.
6. Retain the new bright front LED headlight just installed two days before the fire.
7. Install a brighter than original LED rear red light for good visibility at night.
8. Purchase a larger battery (48V, 20AH) from a US supplier (ebay).

ACTIONS

1. Bought new 26” 1,000 watt rear wheel, new 26” front wheel, controller and thorn proof inner tubes from eBikeAdventure.
2. Bought remaining needed components from various sources (mostly ebay).
3. Custom made a dual female 0.187 spade connector for the brake switch.
4. Designed the installation and installed the battery, controller and DC converter on the existing rear rack. Nylon insert lock nuts and 3/8-inch Adel clamps keep items secure and quiet. The controller and most connections are inside an old ABS box from a propane torch kit. Further details depend on the exact items being installed.
5. Added a post on the battery rack so the battery would stop at the locking position.

RESULTS

1. On 9 January 2018 I test rode the bike as a 1-speed 26” pedal-only bike with good results. Waiting on electrical parts.
2. On 29 January 2018 all ordered components were on hand. Physical installation started.
3. On 31 January 2018 front and back lights, switch and DC converter were wired and tested with battery.
4. On 1 February 2018 the controller was mounted and all remaining components connected. It runs again! The test drive quickly failed with a freak spill in the driveway due to an over-eager test pilot (me) ! Only minor bruises and a bent ego. The ebike still ran fine on its stand!
5. As of August 2019, our son has ridden the bike regularly for many, many miles and commented on how smooth and quiet it runs. The lighting, he says, is excellent.

PHOTO GALLERY

May 2016 Original Build

December 2017 Fire Damaged

January 2018 Pedal Only

February 2018 It Runs Again!

New Headlight

New Rear Light

Aweking 48 to 12 Volt Converter

(Behind Rear Light – Yellow Arrow)

Final Assembly March 2018

Rear Fender and Skirts

LESSONS LEARNED

This electric bicycle has been ridden often and sometimes up to 20-miles one-way over city streets full of potholes, heavy traffic and other hazards. The bike has crashed several times with injuries to itself and its rider. In the year and a half since this bike was rebuilt after the fire it has required significant maintenance and redesign. Some of them are listed below for your information and enjoyment!

1. The heavy Pilot headlight works wonderfully well for riding at night. It was bolted to the front fender with a single ¼-20 bolt and hardware. Metal fatigue from vibration created a large hole in the fender where the headlight used to mount. Now, a much beefier mount attached to the fender mounting struts is hopefully going to last longer.

2. Tires, on the rear wheel powered by its hub motor, wear out quickly! Price and manufacturer do not seem to matter much. And replacing a tire on that wheel is made complicated by the motor wiring. Yes, we are using a Mr. Tuffy band and thick-walled inner tubes. For our fourth tire in 18 months, we are now trying a “ThickSlick” tire which claims to have twice the rubber thickness of ordinary tires.

3. We are now on our third throttle. They all work well, but they are so cheaply made that they will not stand up to emergency maneuvers with the brakes and handlebars. The thin plastic just falls apart when gripped in panic! Keep a spare throttle handy.

4. The listed battery (48 volts, 20 amp-hours) is still going strong after 18 months. The cells, that is. Otherwise:

- The bike fell over and landed on the key which broke off while still in the lock. That's when our locksmith told us the key blank is a Honda motorcycle format. Keep a couple spare keys handy.
- One day the battery refused to charge. The RCA charge connector mounting hardware had vibrated loose. Now the nut, washer, negative wire and connector barrel are all soldered together.
- The key switch stopped working. We could not turn the power off! Investigation showed the high current in the wires inside the battery had melted the insulation on the wires to the key switch and they were shorting out the switch. New wire with better insulation is working well.
- The key switch is mounted to thin black plastic with two short flat-head M5 bolts. Stress on the key switch caused the bolt heads to pull through the plastic, recessing the switch and its anti-theft pin. No, the black plastic is not ABS! I custom made a thin aluminum “washer” which covers the whole recessed area where the key switch mounts including the two bolts and the anti-theft pin. Slightly longer mounting bolts were then required.
- The RCA style charger port has the full force of the battery behind it. After a momentary short there (by me) melted the center pin of the charger jack I replaced the damaged original jack with an audio RCA female jack mounted in a new hole just beside the former hole. Also, I

added a 1N5408 diode (1,000 volts, 3 amps) in series with the center pin (anode to the connector, cathode to the battery) so energy can go into the battery but not come out of the battery at the charger port.

- NOTE: While an audio RCA male plug will fit and work with the battery's charger port, the “RCA style” male charger connector with its short center pin WILL NOT successfully connect with an audio female RCA jack! The original charger connector with its short center pin was replaced with a Switchcraft 3507 metal RCA male audio connector which is working well for us.

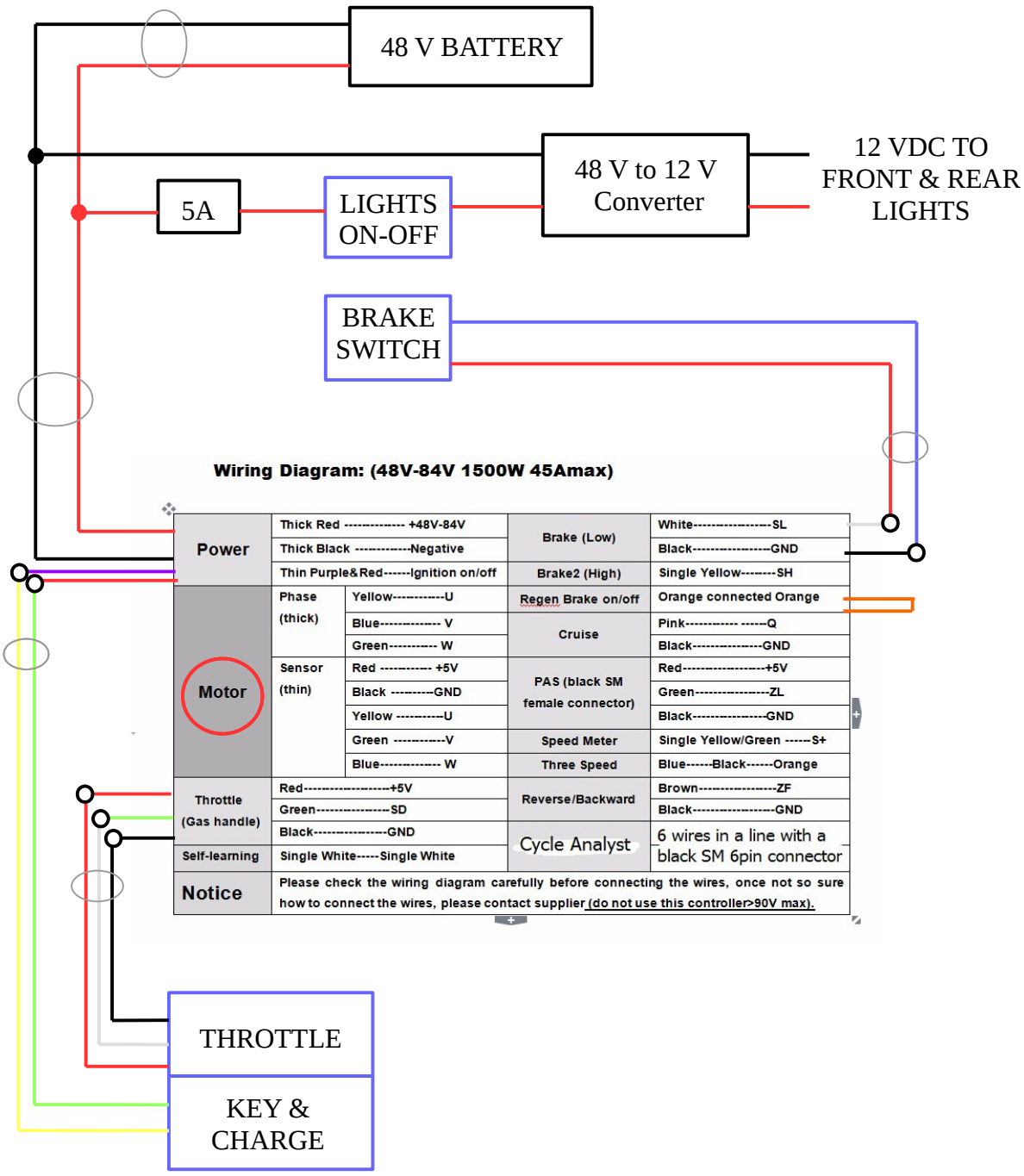
There is more, but you get the idea. Electric bikes require frequent maintenance, especially when ridden over potholes in heavy traffic by a rider who is a stroke victim!

EPILOGUE

1. On 7 June 2020 this ebike was stolen. Ventura, CA police report 2020-500461 applies.

2. On 24 July 2020 our son who rode this ebike passed away after a long illness.

2018 JK EBIKE REBUILD DIAGRAM



Wiring Diagram: (48V-84V 1500W 45Amax)

Power	Thick Red ---------- +48V-84V		Brake (Low)	White----------SL	
	Thick Black ----------Negative			Black----------GND	
	Thin Purple&Red------Ignition on/off		Brake2 (High)	Single Yellow--------SH	
Motor	Phase (thick)	Yellow----------U	Regen Brake on/off	Orange connected Orange	
		Blue---------- V	Cruise	Pink---------- -----Q	
		Green---------- W		Black----------GND	
	Sensor (thin)	Red ---------- +5V	PAS (black SM female connector)	Red----------+5V	
		Black ---------GND		Green----------ZL	
		Yellow ----------U		Black----------GND	
		Green ----------V	Speed Meter	Single Yellow/Green -----S+	
		Blue---------- W	Three Speed	Blue------Black------Orange	
Throttle (Gas handle)	Red----------+5V		Reverse/Backward	Brown----------ZF	
	Green----------SD			Black----------GND	
	Black----------GND		Cycle Analyst	6 wires in a line with a black SM 6pin connector	
Self-learning	Single White-----Single White				
Notice	Please check the wiring diagram carefully before connecting the wires, once not so sure how to connect the wires, please contact supplier (do not use this controller>90V max).				

NOTES:

1. Blue boxes indicate components mounted on handlebars.
2. Motor wiring not shown for clarity, but connected as indicated.
3. Three Speed: Blue to Black = 50%. No connection = 100%. Orange to black = 120%.

2018 JK EBIKE REBUILD INFO

1. CONTROLLER: Bought from eBike Adventures.
https://de.aliexpress.com/item/High-Quality-GREENTIME-15-Mosfets-48-84V-1500W-Dual-mode-Sensor-Sensorless-Brushless-DC-Motor-Controller/32218294528.html?spm=a2g0x.10010108.1000016.1.4378e669xvBYQ8

Greentime, Batch No: GT20160528-15G100
Size 8” x 3.5” x 2”, Rack bars O.D. 13/32” (3/8” + 1/32”)
White blade locking connectors on controller: Type see below.
Black blade locking connectors on controller: Type unknown.

Wiring Diagram: (48V-84V 1500W 45Amax)

Power	Thick Red ---------- +48V-84V		Brake (Low)	White----------SL
	Thick Black ----------Negative			Black----------GND
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		Green---------- W		Black----------GND
	Sensor (thin)	Red ---------- +5V	PAS (black SM female connector)	Red----------+5V
		Black ---------GND		Green----------ZL
		Yellow ----------U		Black----------GND
		Green ----------V	Speed Meter	Single Yellow/Green ------S+
		Blue---------- W	Three Speed	Blue------Black------Orange
Throttle (Gas handle)	Red----------+5V		Reverse/Backward	Brown----------ZF
	Green----------SD			Black----------GND
	Black----------GND		Cycle Analyst	6 wires in a line with a black SM 6pin connector
Self-learning	Single White-----Single White			
Notice	Please check the wiring diagram carefully before connecting the wires, once not so sure how to connect the wires, please contact supplier (do not use this controller>90V max).			

50% 120%

Round screw lugs on controller: 5mm hole, 3/16” hole.

2. CONNECTORS:
Screw terminals. Molex Euro Style connector strip. 10mm (large) and 8mm (small).
White locking flat blade connectors. China. No brand. https://www.ebay.com/itm/380pcs-Motorcycle-Car-Electrical-2-8mm-2-3-4-6-Pin-Wire-Connectors-Terminal-Kit-/302588671524?_trksid=p2385738.m4383.l4275.c10

3. WHEELS & TIRES: Bought from eBike Adventures.
US 26-inch wheels. Tires & tubes 26” x 1.75”, Schrader valve, Pressure 350 kPa / 50.7 PSI

Chain goes on center sprocket of 7. No dérailleur.

4. HYDRAULIC FRONT DISK BRAKE:
When the lever is released, the spring-loaded piston in the master cylinder slides back past openings called port-timing holes. These allow excess brake fluid to flow into a reservoir adjacent to the master cylinder. An elastic membrane within the reservoir, the bladder, expands as excess fluid enters the reservoir and contracts as it cools, maintaining consistent pressure within the brake system. At the caliper, the pistons are held in place by a seal that flexes as the brakes are engaged and aids in retracting them from the rotor when the brakes are released. All disc brake systems require a rider to fully release the lever to prevent pump. On long downhill runs, the rider should get on and off the brakes as much as possible.

BRAKE SWITCH: Switch itself is normally closed, but the untouched brake lever holds the switch open. During normal riding, the brake lever is released, the switch is open and the motor can be powered. To stop, pulling the brake handle just a little closes the brake switch, stops the motor and (optional) engages regeneration (dynamic braking of the rear wheel). Pulling the brake handle further activates the hydraulic front disk brake. Electrical contacts are two male 0.187-inch spades.

MASTER CYLINDER: Handlebars 7/8-inches measured.
https://www.ebay.com/itm/Front-Brake-Master-Cylinder-Handle-Bar-For-Honda-GL1000-GL1100-GL1200-GL1500/121871238081?ssPageName=STRK%3AMEBIDX%3AIT&_trksid=p2060353.m2749.l2649 Mfg. KOSIN. Fits Honda GL1000 GL1100 GL1200 GL1500

5. 48 TO 12 VOLT CONVERTER: Allows use of 12-volt lights from the 48-volt battery.
Aweking Waterproof DC/DC 48V Step Down to 12V 10A 120W Voltage Buck Converter Regulator Transformer Power Supply for Car Truck Vehicle CE listed

6. HEADLIGHT: 12-volt, 18-watt, 1.5A, 4 LEDs, 8-degree spotlight.
http://www.pilotautomotive.com/lighting/PL-9702P.html

7. TAIL LIGHT: 12-volt, 1.2-watt, 0.1A, 10 LEDs.
NEW SUN Trailer Boat RV Red LED Lights Surface Mount 10 Diodes Bullseye Clearance Side Marker Light 2-Pack

8. LIGHT SWITCH: SPST LIGHT SWITCH FOR 7/8” HANDLEBAR MOUNTING
We wanted a switch that did not hang down below the handlebars making it easy to damage. This $1.84 switch, shipped directly from Singapore, hugs the handlebars and works well for us. No specifications are given but for us it switches 48 volts at up to 2 amperes.
https://www.ebay.com/itm/Motorcycle-ATV-Bike-Handlebar-Switch-Headlight-Lamp-ON-OFF/252821831327?hash=item3add5afe9f:g:rxoAAOSwc-tY4fgs:rk:4:pf:0

9. BATTERY: 48-volt, 20 amp-hour. Uses Honda motorcycle key format/blank.
Size: 360 x 150 x 80 mm, 14 1/4” x 6” x 3 1/4”
Key Switch turns power on/off & locks battery in rack. Anderson 50A 600V connector with 7-inch pigtails. RCA lotus head female charge port. 2A charger with red/green charge light.
https://www.ebay.com/itm/48V-Volt-Ebike-Electric-Bicycle-Conversion-Rechargeable-Battery-Pack-20Ah-1500kw/221917940676?_trkparms=ao%3D1%26asc%3D20140725133649%26meid%3D117bf85a88634bc39340aa95ab8ac580%26pid%3D100276%26mehot%3Dpp%26&_trksid=p2060778.c100276.m3476

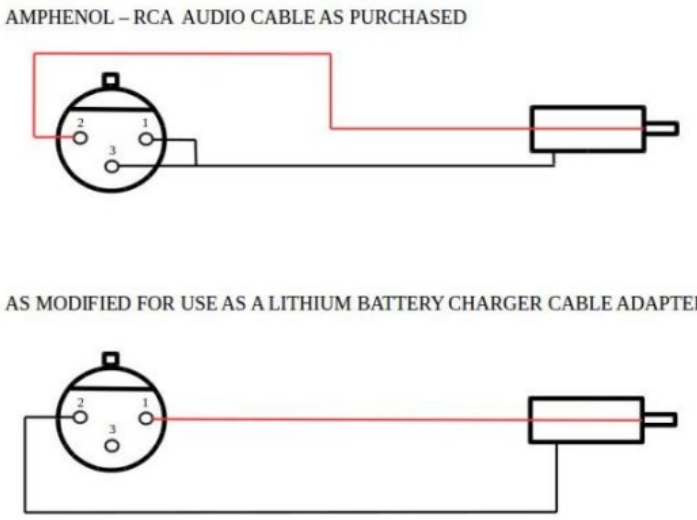
In 2019 the high current draw melted the insulation on the wires to the key switch, shorting the switch so power could not be shut off. Wiring was replaced and dressed to not touch.

10. BATTERY CHARGER CONNECTOR ADAPTER: This new battery offers a “Lotus-Head” RCA style female connector for plugging in its charger. Photo shows charger connector. No source has yet been found to purchase another of these connectors.

The previous battery and charger used an Amphenol XLR 3-pin audio connector, female at the battery and male from the charger. Pin-1 is positive and Pin-2 is negative. Pin-3 is not used. A 6-foot audio shielded wire adapter cable, XLR female to RCA male was purchased from https://www.mycablemart.com/store/cart.php?m=product_detail&p=6380 .

The adapter's wiring at the XLR connector was changed to provide positive on the RCA center pin and negative on the RCA shell. As originally wired for audio use, the polarities would be reversed (incorrect). Diagram below. This allows using the previous spare charger to charge the new battery.

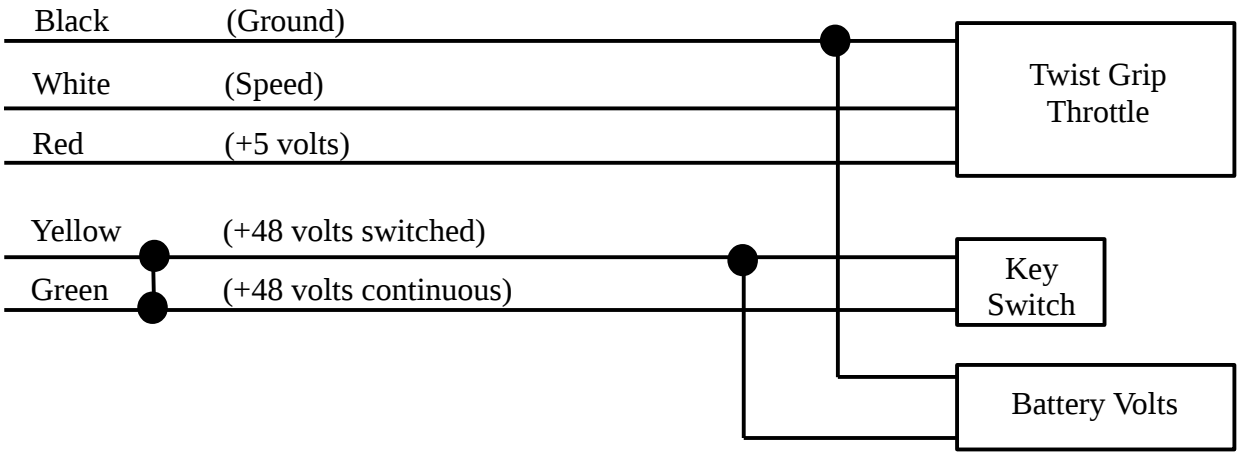
The audio RCA male plug fits well (goes fully into the socket) into the battery's charger port and now the previous spare charger is available for use with the new battery.



11. THROTTLE: Twist-grip with 5-level battery charge monitor and key switch.
Handlebars 7/8-inch diameter measured.
https://www.ebay.com/itm/E-Bike-Electric-Scooter-Throttle-with-Key-48v-US-SELLER/141979538576?hash=item210ea3d490:g:rPwAAOxy2d9SZaGD

Hall effect sensor. Red: +5 volts, Black Ground, White 0 > 5 VDC to controller as twist grip is operated. Working throttles have a voltage output between 0.8-4.3 Volts DC. The output voltage can be as low as 0.5 Volts and as high as 5 Volts on a good working throttle.

Switch (or key), Yellow and Green at throttle. Red & Purple at controller. 48 VDC.



NOTE: Throttle key switch not used. Battery key turns power ON/OFF.
Yellow and Green wires are shorted together by the controller connector to simulate throttle key switch always ON.

MEASURED VOLTS TO LIGHT

LIGHT	VOLTS DC
RED	18
YELLOW	46.9
GREEN 1	47.9
GREEN 2	48.9
GREEN 3	49.6

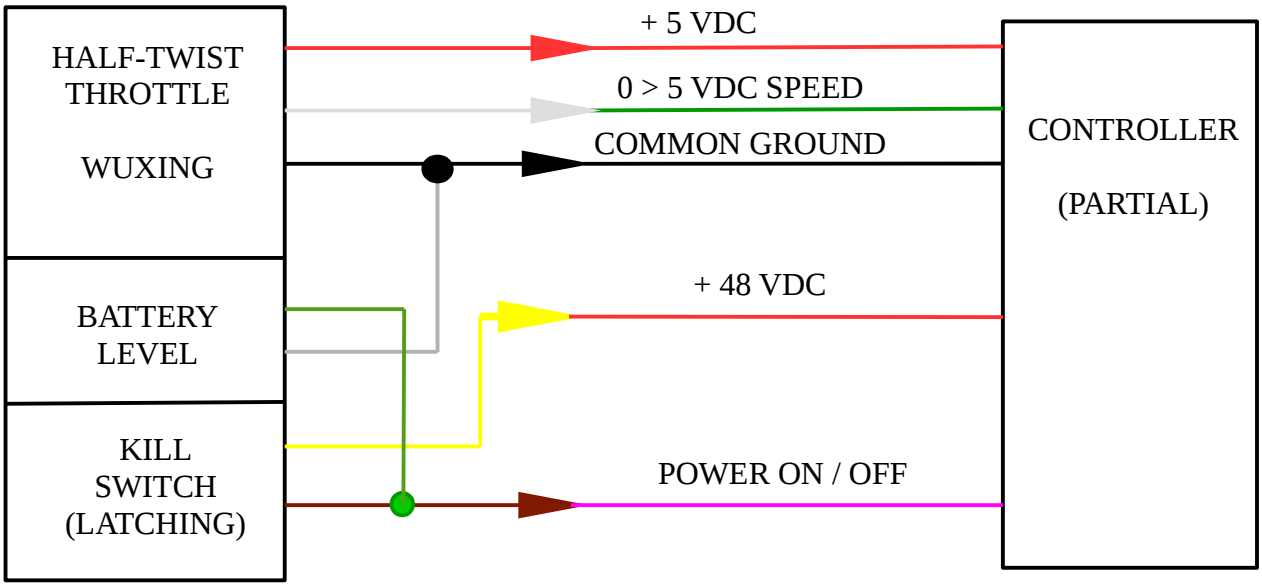
12. ALTERNATE THROTTLE: Half-Twist Grip with 3-level battery monitor and “kill switch”.

https://www.ebay.com/itm/322385783454

WUXING, No Model Number, 48-VOLT

Red pushbutton “kill switch” is SPST (single pole, single throw) latching switch.

Diagram corrected 4 Nov 19 so kill switch turns off power to the controller AND the battery monitor.



13. 12-VOLT ACCESSORY OUTLET

In May 2019 a “cigarette lighter” 12-volt power outlet was added. It is connected across the 12-volt feed to the headlight, protected by a 7.5 amp fuse. This allows using a 12-volt air compressor to pump up the tires, or a 5-volt USB adapter for recharging smartphones.

2018 JK EBIKE REBUILD PARTS ORDERS

ITEM	DETAILS	SOURCE	NOTES	COST
Front Wheel	26”	EBIKE ADV.	Disk Brake	$400 4-items
Rear Wheel	26”	EBIKE ADV.	1,000 Watt Brushless Hub Motor	Included
Tire Band	26” Rear	AMAZON	Mr. Tuffy	$53 3-items
2-Tubes	26” thick	EBIKE ADV.	Thorn-proof, Schrader valve	Included
Controller	Same w/Regen	EBIKE ADV.	Same as previous controller	Included
Rear Light	Red LED	AMAZON	Side Marker Light	Included
Front Light	LED	Pep Boys	Previously installed	$40
48 to 12 Conv.	12V, 10A	AMAZON	For 12-volt lights	Included
Throttle	Same	EBAY	Same as previous throttle	$36
Battery	48V, 20AH	EBAY	LiPO / Lithium Ion, 13s / 8p	$550
Light Switch	Latching	EBAY	Rated 60V, 1A	$2
Master Cylinder	GL1000	EBAY	KOSIN	$32
Connector Kit	2.8 mm	EBAY	To match controller connectors	$12
Metric Hdw.	Assorted	LOWE'S	To mount components	$30
Chain Guard	#56725CG	HUFFY	Replacement for original	$7
TOTAL	APPROX.	ALL		$1,162