Technical Manual

BESV CF1

V. 1.0, Sep. 2015

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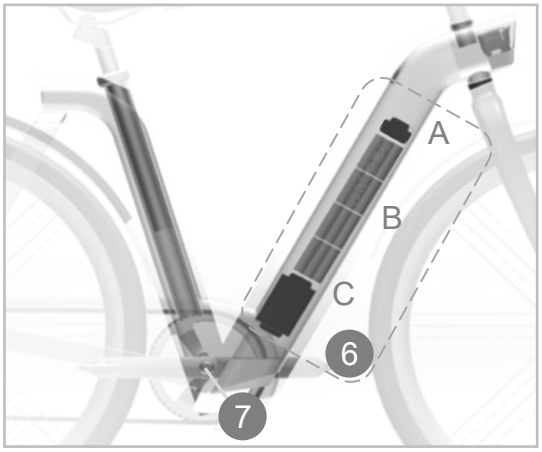

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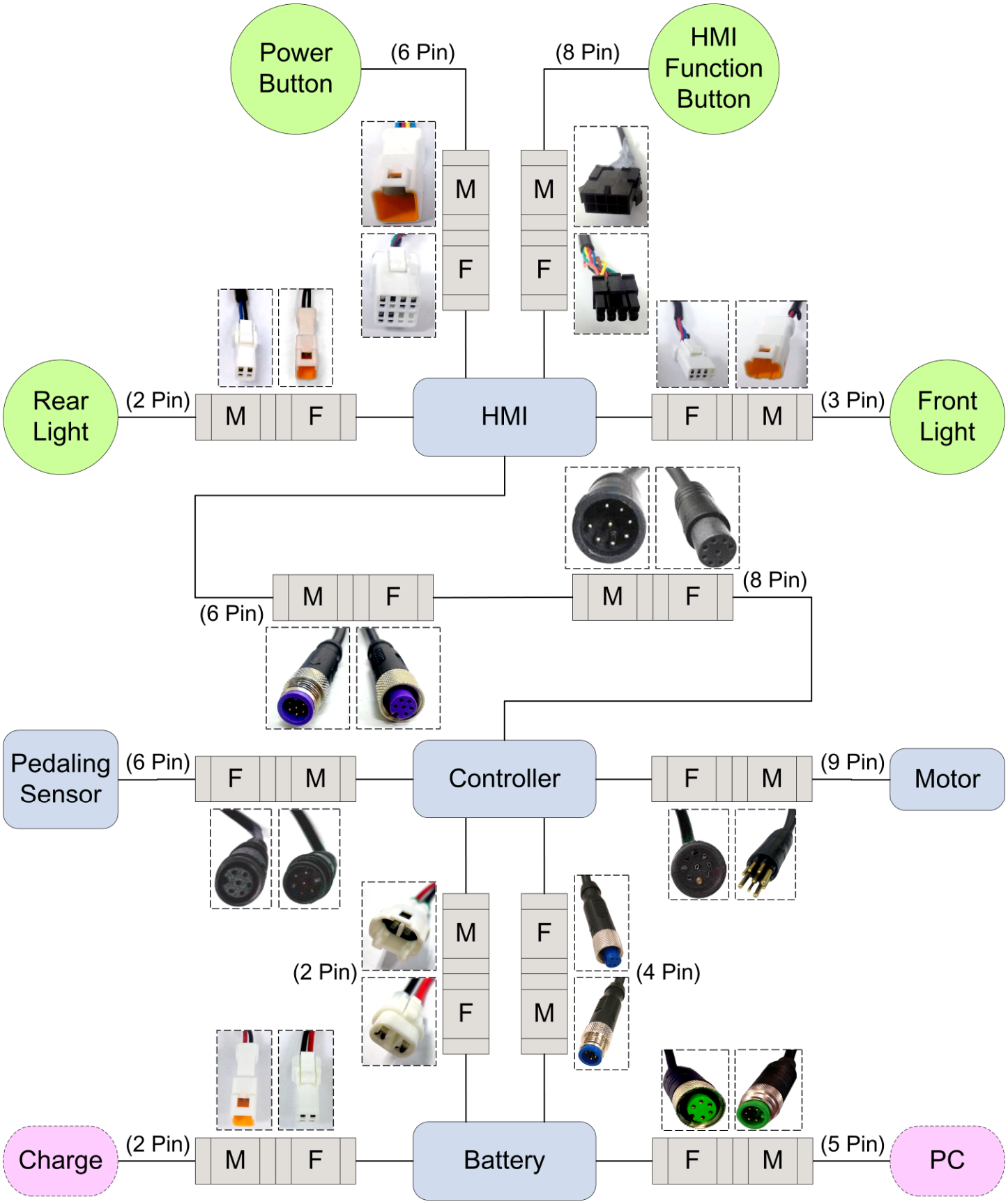

Power Button
(6 Pin)
(8 Pin)
HMI Function Button
M
F
M
F
Rear Light
(2 Pin)
M
F
HMI
F
M
(3 Pin)
Front Light
M
F
(8 Pin)
(6 Pin)
M
F
Pedaling Sensor
(6 Pin)
F
M
Controller
F
M
(9 Pin)
Motor
M
F
F
M
(2 Pin)
(4 Pin)
Charge
(2 Pin)
M
F
Battery
F
M
(5 Pin)
PC

1.1 Specification

1.1.1 Controller

Model	A-Type
Operating Temp.	-15°C ~ 50°C (5°F ~ 122°F)
Storage Temp.	-15°C ~ 100°C (5°F~ 212°F)
Storage Humidity	10% ~ 85%
ROHS	Confirms the ROHS of PTC
Function	1. Over voltage protection 2. Over current protection 3. Stall protection 4. Speed limitation 5. UART communication 6. BLDC driver with hall 7. Battery Communication
Output Power	250W (Peak 380W)
Operating Voltage	36V Regular (Range: 30 to 42V)
Efficiency	92%

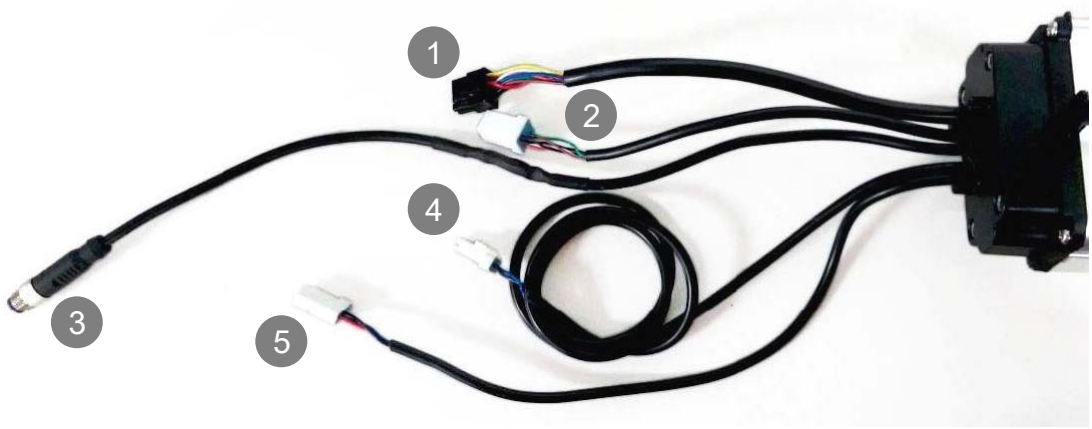
1.1.2 Motor

Model	250W Front Gear
Operating Temp.	-15°C ~ 80°C (5°F ~ 176°F)
Storage Temp.	-15°C ~ 100°C (5°F ~ 212°F)
Storage Humidity	10% ~ 90%
Fork Size	36 H
Weight	2 kg
ROHS	< 45 db
Noise	120 ~ 450 RPM
Max RPM	40 Nm
Max Torque	180 ~ 300W
Max Output	36 V Regular (Range: 24 to 48V)
Operating Voltage	> 80%

1.1.3 Pedaling Sensor

Model	Kingmeter RPM
RPM Resolution	12 Impulses / Rotation
Weight	43 g
Operating Voltage	5 V
Clockwise	Yes
Counterclockwise	No
Direction	Yes

1.1.4 HMI



Model	BESV HMI
Operating Temp.	-15°C ~ 70°C (5°F ~ 158°F)
Storage Temp.	-15°C ~ 80°C (5°F~ 176°F)
Storage Humidity	20% ~ 80%
Display Type	Handlebar Switch and Power Button LED Indicator
Lighting Control	Integrated PWM Headlight + Taillight control
I/O Cable Connector	1 → 8 Pin Handlebar Switch 2 → 6 Pin Power Button 3 → 6 Pin Power + UART communication cable to motor controller 4 → 2 Pin Rear Light 5 → 3 Pin Front Light
Information	Battery Capacity, Assistance Level, Version Query
Assistant Level	3 Assistance Level

1.1.5 Battery

Model	CF1 Battery
Cell	LG - 2750 mAh
Typical Capacity	7550 mAh ± 5%
Nominal Voltage	37 V
Max Charge Voltage	42.5 V
Voltage at End Discharge	29.03 V
Max. charging current	4 A
Max. Discharge current	12 A
Continuous Discharge Current	10.8 A
Capacity Led Display	No
Communication Type	UART
Operating Temp.	Charge：0°C ~ 40°C (32°F ~ 104°F) Discharge：-10°C ~ 40°C (14°F ~ 104°F)
Storage Temp.	-20°C ~ 60°C (-4°F ~ 140°F)
Power Consumption	Sleep Mode：≦50mA Shutdown Mode：≦1mA

2. Operation

2.1 Battery

2.1.1 Charge

1. Connect the battery charger

Connect the battery charge as illustrated. Connect the charger to the charge port on bike and the red indicator light on the power button indicates the charging is underway. It takes approximately 5 hours to fully charge the battery. Once the battery is charged, the battery indicator will turn blue.

If you are done charging, disconnect the charger from the battery before removing the power plug from power socket.

Hook toward to front light

Blue light : full power

Red-breathing light : in charging

2. Charging time

The charging time depends on the remaining energy in the battery and the charger current. The acceptable charger input voltage is AC 100 - 240 V ~ 2A (50 / 60Hz).

If the battery is completely discharged, you can estimate the charging time by the following calculation example :

The estimated charging time is the battery's capacity divided by the charger current. The standard CF1 battery is 8.8 Ah and the standard CF1 charger is 2A.

Estimated charging time = 8.8 / 2 = 4.4 hours

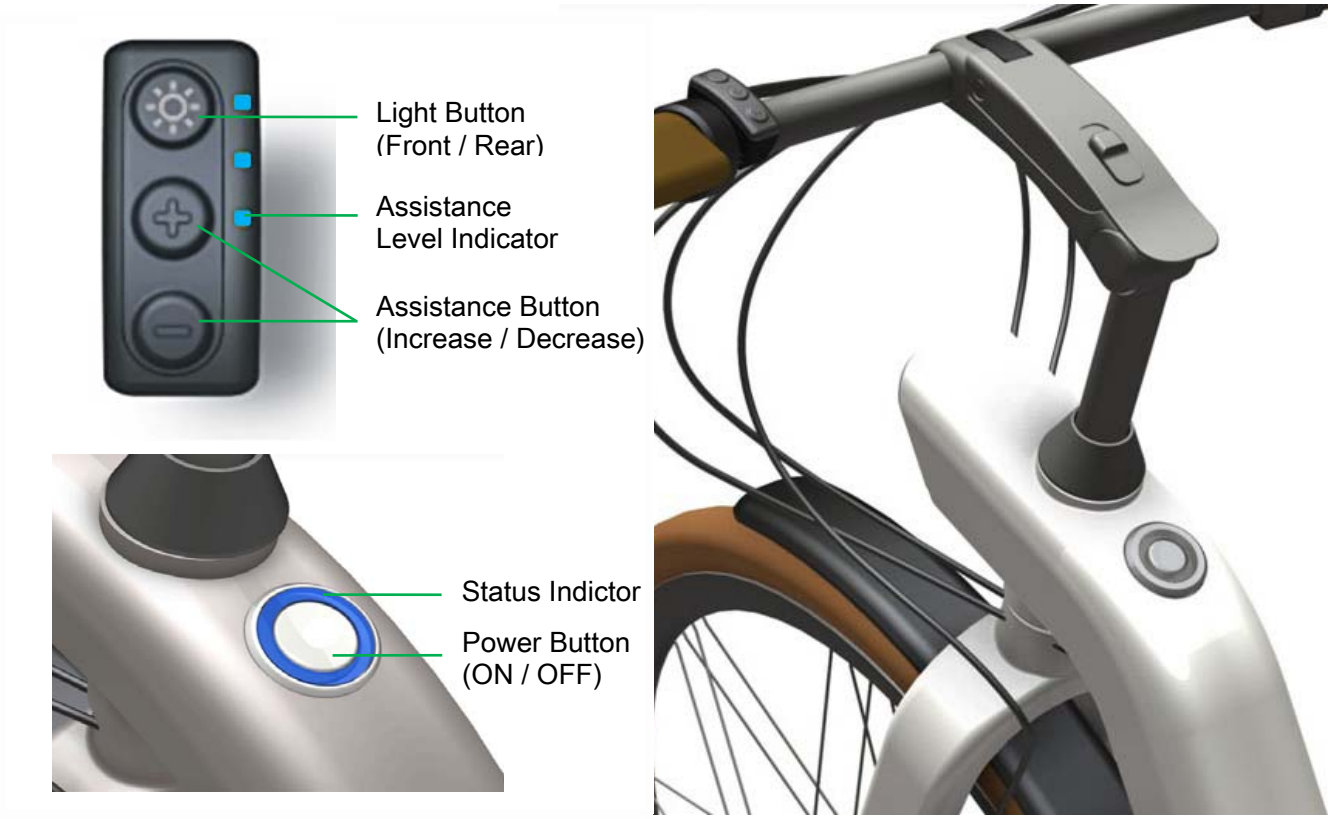
2.1.2 Important Safety Notes for Battery Charging

- Use only the battery charger delivered with the product.
- Use only dry charger, undamaged power cable and charger.
- Replace damaged power cable and charger immediately.
- Remove any possible foreign object from the charging socket, such as dusts, ice or snow before plugging in.
- Using any battery charger other than the one delivered with the product may cause overheating of the batter y or even a risk of explosion.
- Deep discharging of battery may result in internal damage.
- There is a fire risk if the temperature of batter y rises up to a dangerous level.
- Avoid deep discharging of battery while in use or storage.
- If not in use, the battery should be charged fully at least every 3 months.
- Do not expose the bike in a storage temperature lower than -20°C (-4°F) or higher than 60°C (140°F). Please note that the internal structure of battery may be overheated to damage due to high temperature greater than 60°C, particularly exposed to direct sunlight.
- Do not use the charger at a humid place or an ambient temperature lower than -10°C (14°F) or higher than 40°C (104°F).
- The battery and charger are maintenance-free. Do not attempt to disassemble or modify the battery or charger.
- Do not expose the battery to high voltage.
- It is advised not use battery with damaged casing.
- Do not cover the battery or the charger while charging is in progress.

2.2 HMI

2.2.1 Information

HMI is separated into two parts, one is power button/status indictor another is assistance button / assistance level indicator.



- Power button LED indicator

(1) Discharge status

Capacity Display	Description
	Blue light : battery power > 50%
	Red light : 50% > battery power > 20%
	Red light flash : 20% > battery power > 10% Please change assistant to level 1.
	Red light fast flash : battery power < 10% Please charge it immediately.

(2) Charge status : Assistant level can't adjust when the bike is charging.

Capacity Display	Description
	Blue light : battery power > 95% The battery is charged near to full capacity.
	Red-breathing light : battery power < 95% The battery is charging.

- Assistant Level Suggestion

Level	Assistance Display	Riding condition
0		Riding without assistance.
1		Riding on a leveled surface.
2		Riding uphill or against the winds.
3		Riding up steep hill or against strong winds.

2.2.2 Operation

- Turn on/off system

  One click the power button and then the system will be turned on immediately.
  When power is on, push the power button for 3 seconds and the system will turn off.

  Note 1 : Start action is blue-breathing led on status indictor and marquee led on assistance level indictor.

  Note 2 : The system turns off automatically after no operation for 3 minutes.

- Turn on/off front and rear light

  Using front/rear light button can turn on/off the light on bike. Front light has two intensities, adjust it to full or half by pressing the light button again and again.

- Assistance level setting

  There are 3 different assistance levels can be chose by user. According different conditions on road, press [+] or [-] button to adjust assistant.
  ※ [**+**] : Increase [**–**] : Decrease

- Firmware version in HMI\Controller requiring

  The system will enter function mode after pressing [+] and [-] button for 3 seconds. Please press [+] or [-] button to select the firmware version in which device you want to know. Then press light button to enter the relative mode.

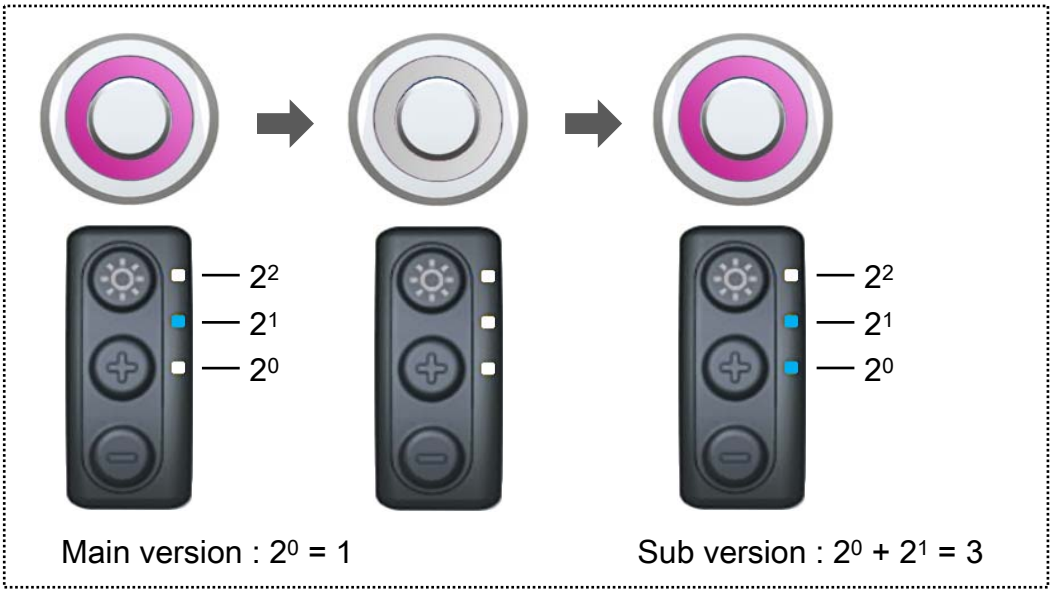
  Function page

Display	Function page	Description
	1	Require firmware version in HMI.
	2	Require firmware version in controller.

Firmware version information

After entering "version information", the "status indicator" will keep flashing with purple color. At the same time, "assistance indicator" will show main version and sub version sequentially.

For example : firmware version is 1.003

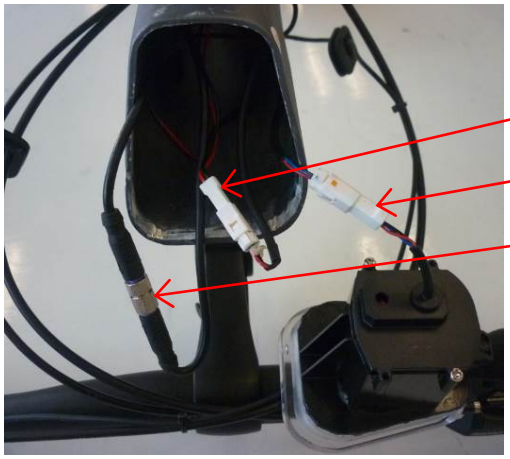


3. Disassembling Components

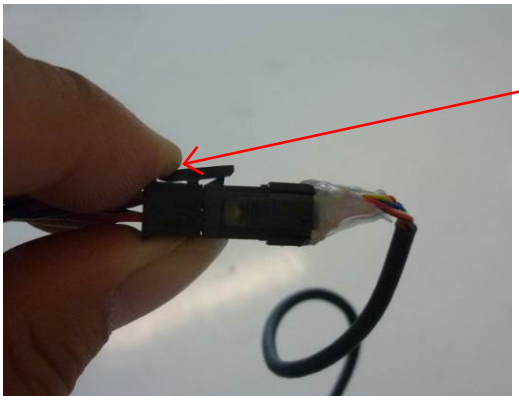
3.1 EMS (Electrical Manager System)

1. Turn off the power and place the bike upside down.

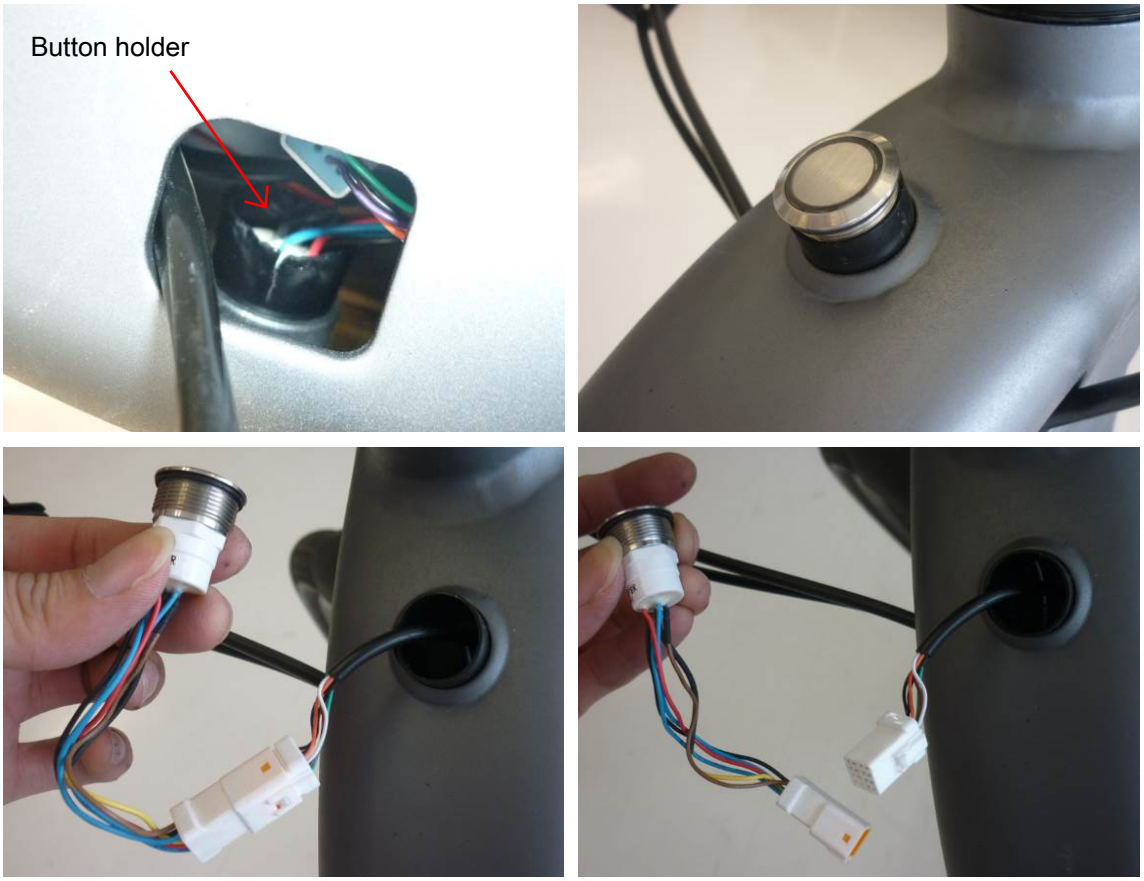
2. Loosen the front light screw, take off the front light and then disconnect front light, charger and main cables.



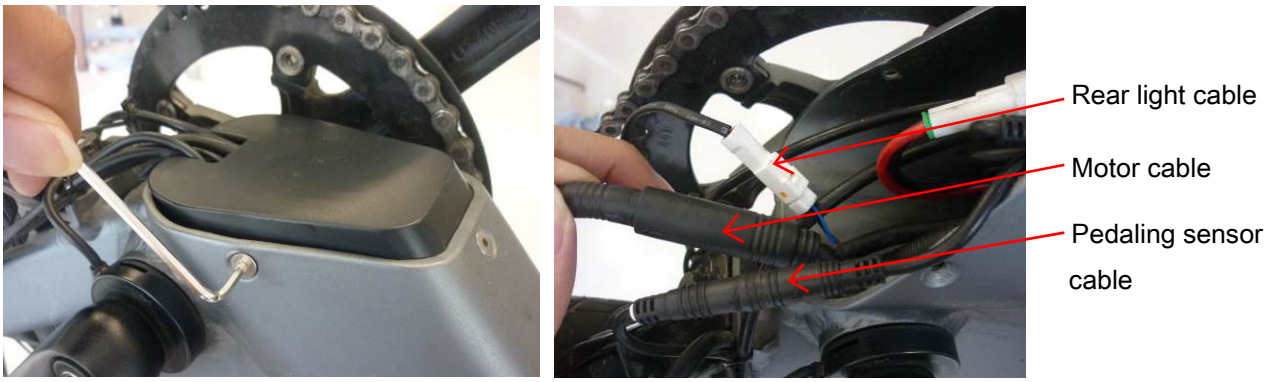
3. Remove the right side wire cover carefully, pull out the switch connector and disconnect it.



4. Remove both side wire cover, push the power button holder up by finger. Then pull the button connector and disconnect it.

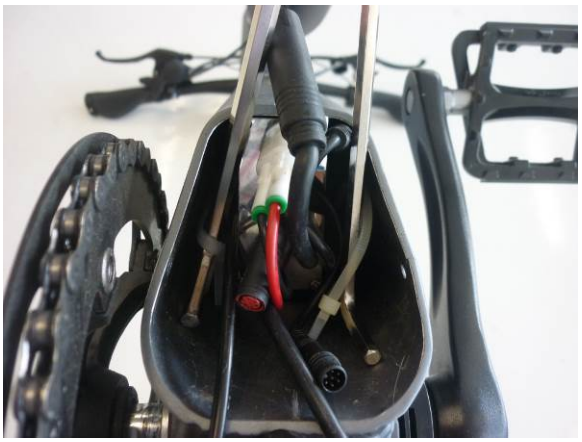


5. Loosen the bottom cover screw, and remove the bottom cover. And then disconnect motor, pedaling sensor and rear light cables.

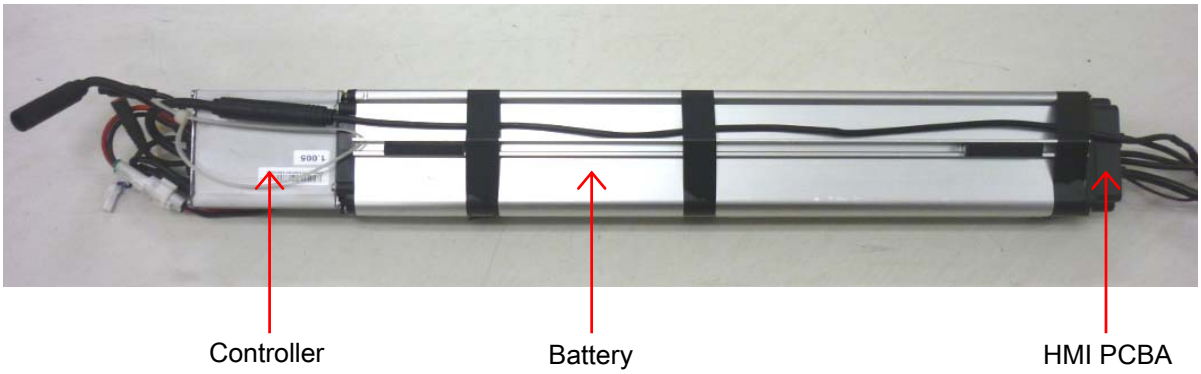


6. Lossen two battery screw.


7. Find the cable ties inside the down tube, hook the cable ties and then pull out the power kit very carefully. Check if any cable stuck during the whole procedure.

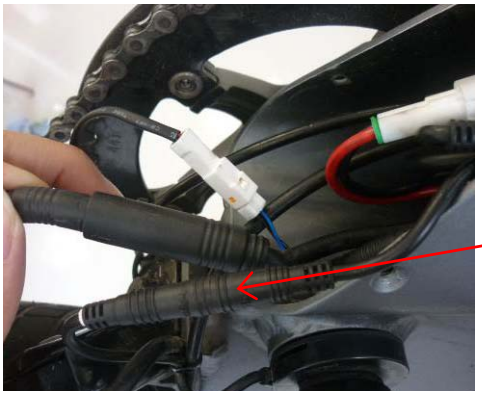



8. Power kit disassemble finished.



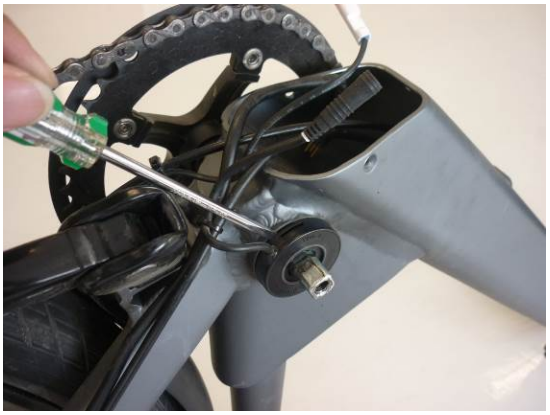
3.2 Pedaling Sensor

1. Place the bike upside down, remove the bottom cover, and then disconnect pedaling sensor cable.



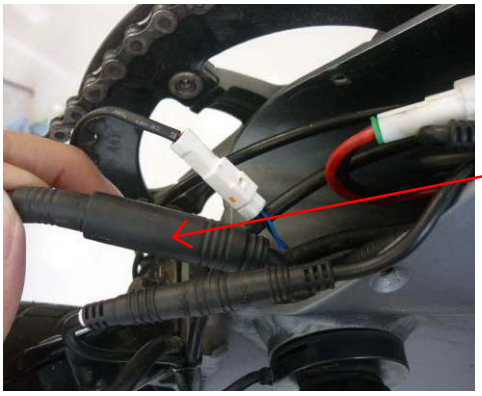
2. Loosen the left crank screw and then remove left crank.

3. Take apart the pedaling sensor with screw driver.



3.3 Motor

1. Place the bike upside down, remove the bottom cover, and then disconnect motor cable.



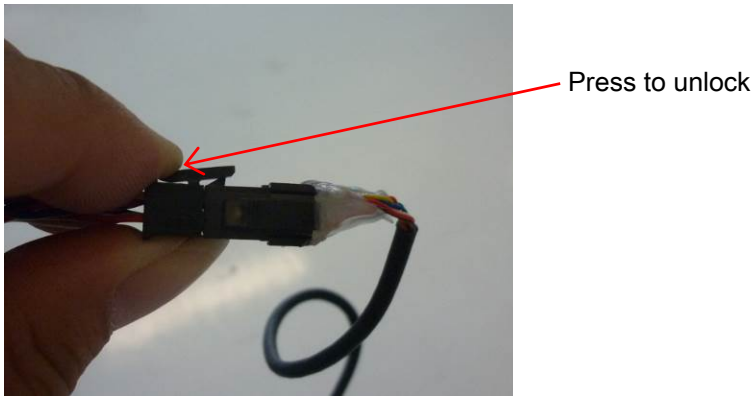
2. Remove the both side rubber cap and the flange nut.

3. Shift the derailleur to the highest speed.

4. Bend the derailleur back and remove the rear wheel.

3.4 Switch

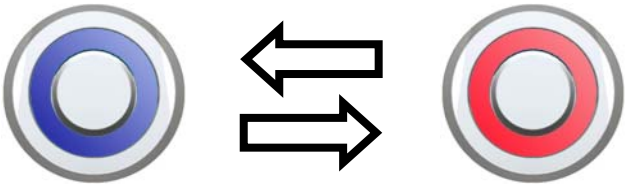
1. Remove the right side wire cover carefully, pull out the switch connector and disconnect it.



2. Loosen the screws on the switch and remove it.

4. Trouble shooting

4.1 Error or warning alert



The system has some error or warning when user see the display of capacity show the blue and red led flash alternately. Error or warning can be decided by the assistance light flash automatically. If yes, it represents error and no assistant. If not, it represents warning. The following table shows the mean of this message.

- Warning message : Please press [light] and [-] button for 3 seconds. Then, hold two buttons to know the warning code. If you release this buttons, the e-bike can adjust assistance level as a normal status.

Display	Warning code	Mean
	1	G-Sensor Communication Fail
	2	Battery Communication Fail
	3	Battery Status Fail

- Error message : Please recode the error code when you see the assistance light flash automatically.

Display	Error code	Mean
	1	The motor is stalled and unable to go forward.
	2	The motor is driving hard.
	3	The signal arrangement of hall sensors is wrong.
	7	The connection between HMI and controller fails.

4.2 Basic

Symptom possible	Possible cause	Consequence and solution
System is not on.	Battery is low.	Connect charger to charge port. The battery indicator will be red to show charging is persisting. If the battery indicator is red and blue alternative flash, please have a check with authorized distributor.
	Instrument is not installed correctly, causing the electric connection to come loose.	Check that the instrument, buttons, electric connectors on the handle bar, and the cables/wires around the motor and controller are connected correctly.
Battery indicator keeps blue/red flashing.	Malfunction of power system.	Have an authorized distributor to check the bike.
The assistance system isn't consisting when pedaling.	Incorrect version of program	Have an authorized distributor upgrade the program.
	Interference between brake and wheels.	Adjust the brake system or find the service of authorized distributor.
	Tire pressure inappropriate or problematic.	Inflate the tire or replace if it is flat.
The assistance level goes back to 0 when pedaling.	Poor connection between wire and controller.	Reconnect or have an authorized distributor check the power controller system.
	Motor is damaged.	Have an authorized distributor check the power controller system.
The lights are not working.	Battery is low.	If the battery indicator shows red fast flash or no light indicate, please go to charge if available.
	Internal electric connection of lighting system comes loose or abnormal in system.	Have an authorized distributor check.

Symptom possible	Possible cause	Consequence and solution
The battery does not charge.	The battery may be poorly connected.	Make sure the batter y is connected correctly before repeating the charging cycle.
	The indicator on the charger is not on.	Have an authorized distributor to check the charger.
	The battery is damaged.	Have an authorized distributor to check the battery.
Poor braking performance	The brakes are not inserted.	Insert the brakes There is grease stain on the brake disc or shoes. If the brake disc or shoes are covered in grease, the braking distance will be longer and the risk of accident and injury increases. When this happens, please go to an authorized distributor immediately. • Clean the brake disc with alcohol. • Change the brake shoes. • Bring the dirty disc or shoes to an authorized distributor for examination.
	Poor braking performance and not distinctive braking action.	Bring the bike to an authorized distributor to correct the leak.
Metallic noises come out of brakes and it is rough to decelerate.	Worn brake shoes will lead to longer braking distance and the risk of accident increases. When the brake shoes are worn beyond the minimum thickness, the shoe supports will grind into the friction ring on the brake disc.	Have the brake shoes and brake disc, if necessary, changed by an authorized distributor.

4.3 Advanced

4.3.1 Battery

The following progress is strongly recommended to be executed by technicians.

Issue	Step	Check step	Action
Unable to discharge	1	Check if the system turns on with procedure on user manual or not.	If yes, progress the next step. If no, turn on the system.
	2	Check if the connectors between battery and system connect steadily or not.	If yes, progress the next step. If no, tune off and then reconnect the connectors steadily.
	3	Measure the output voltage and check the value is lower than 30V or not.	If yes, please charge the battery. If no, progress the next step.
	4	Use the electronic thermometer to measure the temperature of battery's surface, and check if the value is larger than 68'c or not.	If yes, please stay the battery as cool as room temperature. If no, progress the next step.
	4.1	Open the battery case and check the fuse is broken or not.	If yes, please replace with a new fuse. If no, progress the next step.
	5	Open the battery case and get the circuit board out, Check if there is short circuit on output pin or not.	If yes, please remove any possible loading which causes short circuit. If no, please contact with the manufacturer.

Issue	Step	Check step	Action
Unable to charge	1	Check if the connectors between battery and charger connect steadily or not.	If yes, progress the next step. If no, tune off and then reconnect the connectors steadily.
	2	Use the electronic thermometer to measure the temperature of battery's surface, and check if the value is larger than 68'c or not.	If yes, please stay the battery as cool as room temperature. If no, progress the next step.
	2.1	Open the battery case and check the fuse is broken or not.	If yes, please replace with a new fuse. If no, progress the next step.
	3	Open the battery case and get the circuit board out, Check if there is short circuit on output pin or not.	If yes, please remove any possible loading which causes short circuit. If no, please contact with the manufacturer.

4.3.2 Motor

Issue	Step	Check step	Action
Unable to work	1	Check if the connectors between motor and controller connect well or not.	If yes, please turn off the system and reconnect the motor's cable. If no, please progress the next step.
	2	Check the metal pins inside the connector of motor are bended or not.	If yes, please progress the next step. If no, please fix the metal pins or replace the connector.
	3	Check if the skin of connector and cable near axle is damaged, or core is exposed.	If yes, please replace the cable. If no, please progress the next step.
	4	Use meter to measure the signal of hall sensor (by 3 thin cables inside, yellow, blue, green). With rotating the motor backwards manually, the voltage of signals should be 0V or 5V.	If yes, please progress the next step. If no, please replace the hall sensors and re-check again.
	5	Use meter to measure the resistance of hall sensor. Check if the value is infinite or not.	If yes, please contact with the manufacturer. If no, please replace the hall sensors and re-check again.
No speed information	1	Use meter to measure the resistance of speed sensor. Check if the value is infinite or not.	If yes, please contact with the manufacturer. If no, please replace the speed sensors and re-check again.

Issue	Step	Check step	Action
Abnormal vibration	1	Check if the connectors between motor and controller connect well or not.	If yes, please turn off the system and reconnect the connectors. If no, please progress the next step.
	2	Check the metal pins inside the connector of motor are bended or not.	If yes, please progress the next step. If no, please fix the metal pins or replace the connector.
	3	Check if the housing of motor is out of shape.	If yes, please replace the housing. If no, please progress the next step.
	4	Check if there is any abnormal noise from bearing while rotating the motor manually.	If yes, please replace the bearing. If no, please progress the next step.
	5	Check the axle of motor is rusty, or if there is any wiggle while rotating the motor manually.	If yes, please replace the axle. If no, please progress the next step.
	6	Use meter to measure the signal of hall sensor (by 3 thin cables inside, yellow, blue, green). With rotating the motor backwards manually, the voltage of signals should be 0V or 5V.	If yes, please contact with the manufacturer. If no, please replace the hall sensors and re-check again.

Issue	Step	Check step	Action
The motion resistance is heavier while motor is rotating.	1	Use meter to check if the cable of motor is short in circuit.	If yes, please replace the motor. If no, please progress the next step.
	2	Please contact the manufacturer for the criterion of inductance, and measure the inductance with LRC meter, and then check if the value exceeds the criterion.	If yes, please replace the motor. If no, please progress the next step.
	3	Use scope to measure the EMF of motor and check if the signal is correct or not.	If yes, please progress the next step. If no, please replace the motor.
	4	Open the housing of motor, and use meter to confirm any short circuit between silicon steel and any cable.	If yes, please replace the motor. If no, please contact with the manufacturer.

4.3.3 Whole Bike

Issue	Step	Check step	Action
No assistance while pedaling.	1	Check if the assistant level is 0 or not.	If yes, please adjust the assistant level >=1. If no, please progress the next step.
	2	Check if the connectors between motor and controller connect well or not.	If yes, please progress the next step. If no, please turn off the system and reconnect the motor's cable.
	3	Use diagnosis tool to check the e-brake signal without braking lever.	If yes, please replace the brake. If no, please progress the next step.
	4	Connect the diagnosis tool to system. Rotate the wheel backwards manually and monitor the "U Hall", "V Hall", "W Hall". All of the hall sensors shouldn't be ON or OFF at the same time, and should keep changing while rotating.	If yes, please progress the step 6. If no, please progress the next step.
	5	Replace the standard controller, and check the result again after repeating the progress of step 4.	If yes, please replace the controller. If no, please replace the motor.
	6	Connect the diagnosis tool to system. Rotate the pedal forwards manually, and the "pedal 1" signal should keep changed, and "RPM" should show value.	If yes, please contact with the manufacturer. If no, please progress the next step.
	7	Replace the standard controller, and check the result again after repeating the progress of step 6.	If yes, please replace the controller. If no, please replace the pedaling sensor.

Issue	Step	Check step	Action
After turning on system, the HMI is on but can't be operated	1	Replace the standard HMI and check the normality again.	If yes, please replace the HMI. If no, please replace the controller.
The assistance level resets to 0 while pedaling.	1	Check if the connectors between motor and controller connect well or not.	If yes, please progress the next step. If yes, please turn off the system and reconnect the motor's cable.
	2	Check if there any damage in motor cable.	If yes, please replace the motor. If no, please progress the next step.
	3	Connect the diagnosis tool to system. Rotate the wheel backwards manually and monitor the "U Hall", "V Hall", "W Hall". All of the hall sensors shouldn't be ON or OFF at the same time, and should keep changing while rotating.	If yes, please progress the next step. If no, please replace the motor.
	4	Replace the standard motor and check the normality again.	If yes, please progress the next step. If no, please replace the motor.
	5	Replace the standard controller and check the normality again.	If yes, please contact with the manufacturer. If no, please replace the controller.
The HMI immediately turns off after turning on.	1	Replace the standard HMI and check the normality again.	If yes, please replace the HMI If no, please contact with the manufacturer.

Issue	Step	Check step	Action
The assistance is not smooth and discontinuous while pedaling.	1	Connect the diagnosis tool to system. Check the firmware version is correct or not.	If yes, please progress the next step. If no, please upgrade the firmware of controller.
	2	Connect the diagnosis tool to system. Rotate the pedal forwards manually, and the "pedal 1" signal should keep changed, and "RPM" should show value.	If yes, please progress the step 4. If no, please progress the next step.
	3	Replace the standard controller and check the normality again.	If yes, please replace the controller. If no, please replace the pedaling sensor.
	4	Connect the diagnosis tool to system. The initial value of "pedal sensor" should be 0 or 1. Rotate the pedal forwards manually for 2 circles, and check if the "pedal signal" is 23 ~ 25 or not.	If yes, please progress the next step. If no, please replace the pedaling sensor.
The system can't be turned on or HMI can't be on.	1	Remove the battery. Measure the voltage with meter and check it is lower than 30V or not.	If yes, please progress the next step. If no, please progress the step 3.
	2	Charge the battery with charger and the led indicator on charger should work normally.	If yes, please charge the battery fully then test again. If no, please replace the battery.
	3	Replace the standard battery and check the normality again.	If yes, please replace the battery If no, please progress the next step.
	4	Replace the standard HMI and check the normality again.	If yes, please replace the HMI If no, please contact with the manufacturer.

Issue	Step	Check step	Action
Power outputs while pedaling backwards.	1	Connect the diagnosis tool to system. Rotate the pedal backwards manually, and check if the "pedal signal" increase or not.	If yes, please contact with the manufacturer. If no, please replace the pedaling sensor.
	2	Replace the standard controller, and check the result again after repeating the progress of step 1.	If yes, please replace the controller. If no, please replace the pedaling sensor.