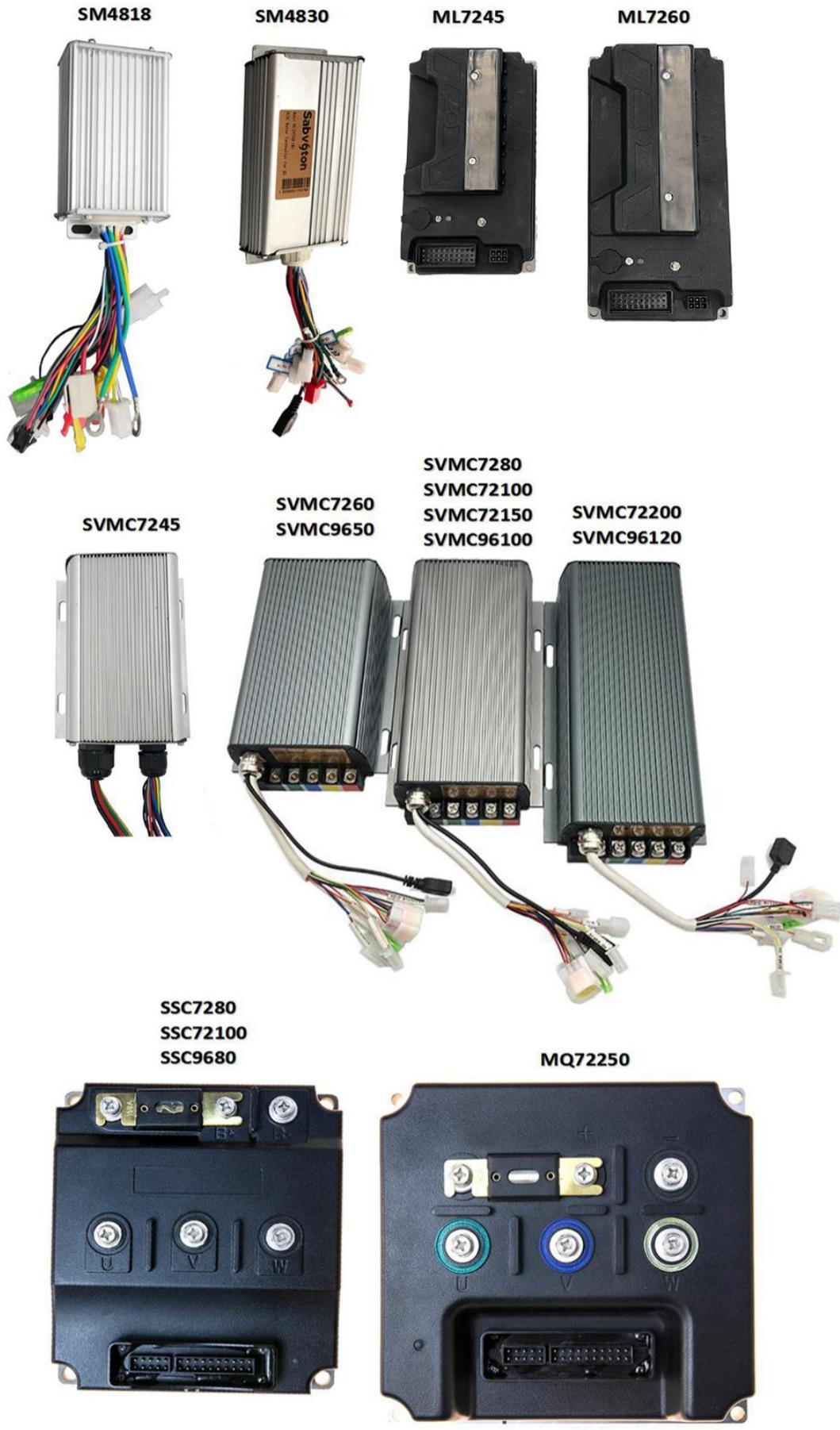


MQ/Sabvoton Brushless DC Motor Controller User' s Manual

Devices Supported:

SM4818
SM4830
ML7245
ML7260
SVMC7245
SVMC7260 SVMC9650
SVMC7280 SVMC72100 SVMC72150 SVMC96100
SVMC72200 SVMC96120
SSC7280 SSC72100 SSC96080
MQ72250



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Chapter 1 Introduction

Sabvoton sine wave controller is designed to drive DC brushless motors, which is applied on high power electric motorcycle, mini e-car and so on.

MQCON(Sabvoton) SVMC/SSC programmable sine-wave motor controller works with high efficiency, less noise, and lower energy consumption, which makes your electric vehicles or electric motorcycles more comfortable and easier to control. Our designed friendly interface of the programmable motor controller makes you set the parameters, conduct the tests and obtain the diagnostic info easily and quickly.

Chapter 2 Features and Specifications

2.1 General Functions

- Basic functions: Hall, electric lock, high brake, throttle
- Optional functions: temp sensor KTY83-122, 0-5v e-brake, low brake, three speed(switch / button), Hall speedometer, reverse, cruise, anti-theft, CAN, ebs for SVMC models.
- Accessories: shunt, fuse, USB cable for programmable PC, bluetooth adapter, watercooling sink, LCD-SW900.

2.2 Key Features

Sabvoton motor controller is designed for brushless dc motor control, which is applied for high power electric bicycle, electric scooter, mini electric car and so on.

- FOC sine-wave controller applied to BLDC or PMSM
- The controller match one motor to get best electric angle no more than 3 minutes for the first time.
- minimizing the torque pulsation, achieving non-noise, on-vibration run with great Comfort
- The precise current ring can provide accurate torque input to meet the requirement Of large torque output during vehicle starting and climbing.
- work efficiently, reducing the heat consumption and extending the mileage
- built-in protection: block protection, over-current protection, over-heat protection, over-voltage protection and so on, guaranteeing the system and driver safety
- status and fault intelligence management provide the information including the run-mode, fault type and so on, LED also twinkle in different way to indicate the fault type, all these make the diagnosis and repair easily
- convenient external interface: reversing, cruise, ebs, anti-theft and so on
- parameters and functions can be configurable by computer or mobile phone
- CAN bus is optional for meter or BMS application

2.3 Name Regulation

SM 48 30

- SM is serial model, this serial support two version, V1 support meter programmable, V2 support PC programmable.
- 48 is battery voltage
- 30 is battery current

ML 72 45

- ML is serial model, this serial is unprogrammable.
- 72 is battery voltage
- 45 is battery current

SVMC 72 150

- SVMC is serial model, this serial is programmable.
- 72 is battery voltage
- 150 is battery current

【 HOT PRODUCTS 】



SM



ML



SVMC



SSC/MQ



LCD-SW900



SSC Watercooling Board



Shunt



USB Cable



Plug In



Bluetooth

MQ Controller Brushless Motor Controller

Model	Size	Rated Volt	DC	Phase	Matched motor	Note
SM4818	103*65*35	24v-48v	18A	50A	350w	It can be programmable by LCD meter or PC.
SM4830	155*80*43	24v-48v	30A	90A	600w	
ML7245	190*110*50	48v-72v	45A	130A	800w	Unprogrammable.
ML7260	220*110*50	48v-72v	60A	150A	1-1.5kw	
SVMC7245	164*120*62	48v-72v	45A	135A	0.8-1kw	Programmable by PC and Phone, can be support LCD-SW900 meter and ebs.
SVMC7260	215*147*62	48v-72v	60A	165A	1-1.5kw	
SVMC9650		48v-96v	50A	150A	1-1.5kw	
SVMC7280	249*147*62	48v-72v	80A	200A	1.5-2kw	
SVMC72100		48v-72v	100A	250A	2-3kw	
SVMC72150		48v-72v	150A	350A	3-4kw	
SVMC96100		48v-96v	100A	250A	2-3kw	
SVMC72200	283*147*62	48v-72v	200A	450A	4-5kw	
SVMC96120		48v-96v	120A	300A	4-5kw	
SSC7280	186*165*70	48v-72v	80A	200A	1.5-2kw	
SSC72100		48v-72v	100A	250A	2-3kw	
SSC96080		48v-96v	80A	200A	2kw	
MQ72250	200*145*65	48v-72v	250A	450A	5kw	Programmable by PC and Phone

1.48V model: range of the batteries voltage is 24V-60V.
 2.72V model: range of the batteries voltage is 48V-90V.
 4.96V model: range of the batteries voltage is 48V-120V.

Other Accessories

Bluetooth Adapter	SSC Watercooling board
Fuse	LCD-SW900 Meter / TFT H6 Display



MQ CONTROLLER

Chapter 3 Wiring and Installation

3.1 Mounting the Controller

The controller can be oriented in any position which should be as clean and dry as possible, and if necessary, shielded with a cover to protect it from water and contaminants. To ensure full rated output power, the controller should be fastened to a clean, flat metal surface with four screws. Applying silicon grease or some other thermal conductive material to contact surface will enhance thermal performance. Proper heat sinking and airflow are vital to achieve the full power capability of the controller. The case outline and mounting holes' dimensions are shown in Figure 1,2,3,4,5,6,7,8,9,10.

TBD

Figure 1: SM4818 mounting holes' dimensions
 103mm*65mm*35mm(dimensions in millimeters)

TBD

Figure 2: SM4830 mounting holes' dimensions
 155mm*80mm*43mm(dimensions in millimeters)

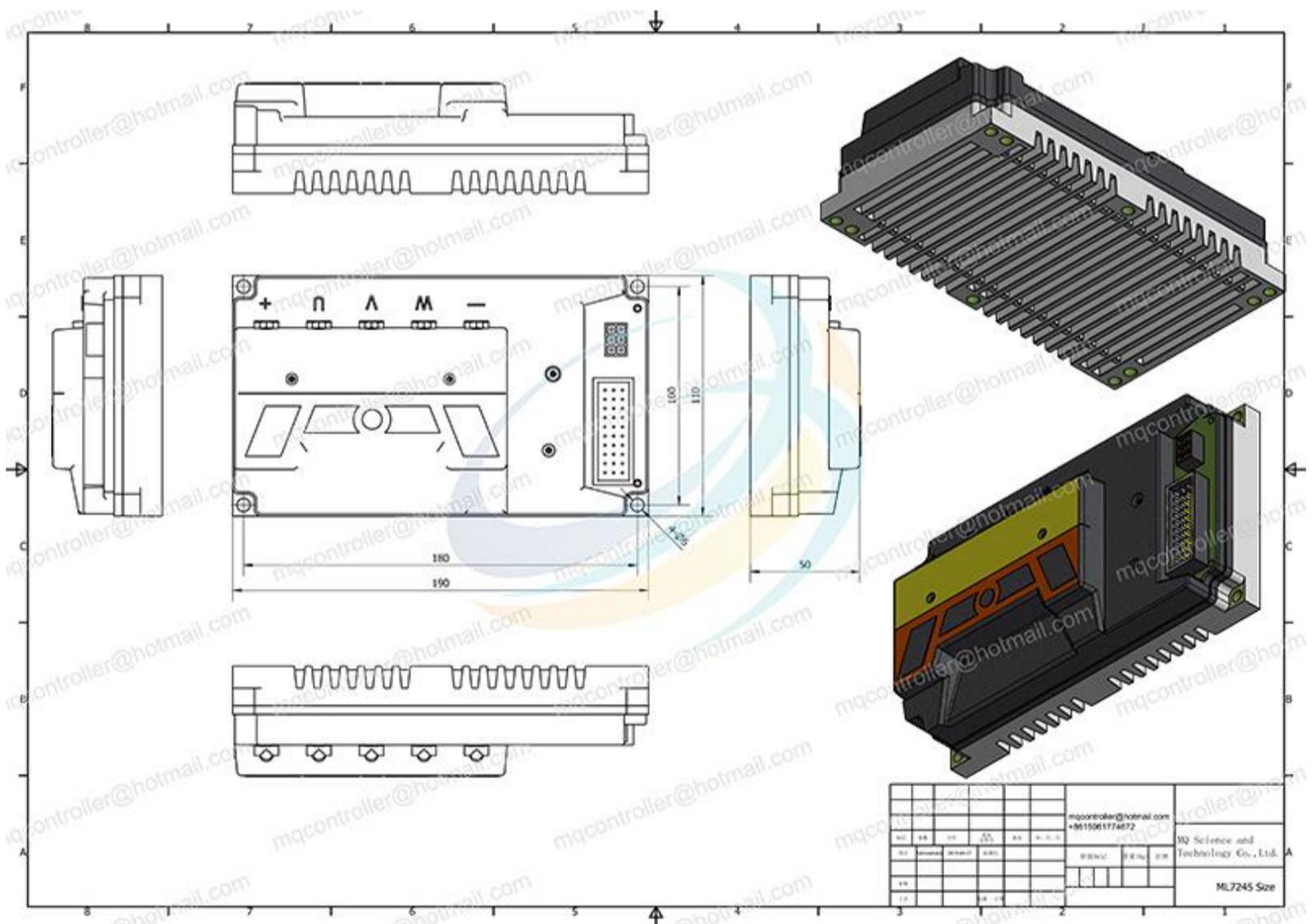


Figure 3: ML7245 mounting holes' dimensions
 190mm*110mm*50mm(dimensions in millimeters)

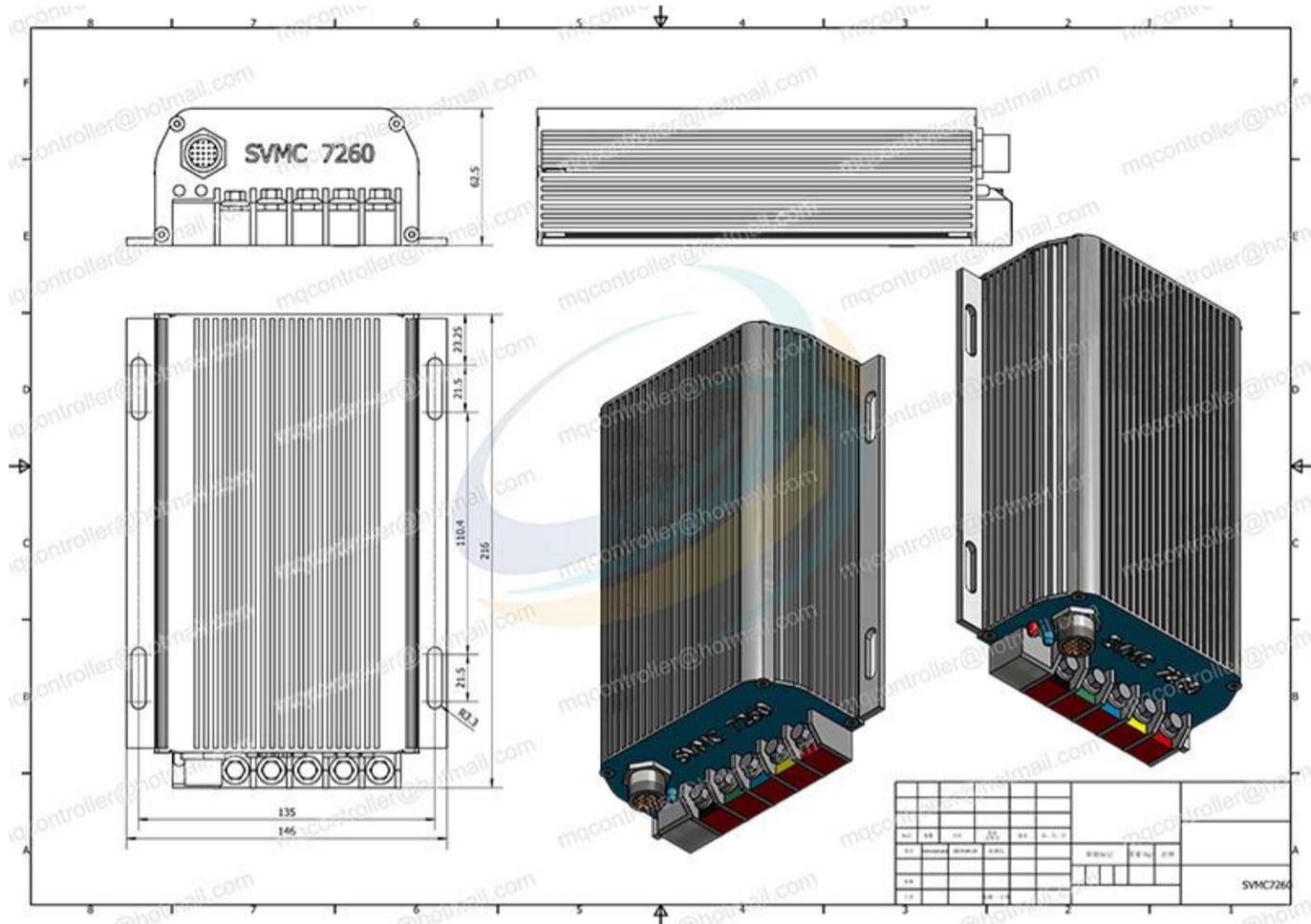


Figure 6: SMC7260, SMC9650 mounting holes' dimensions
 215mm*147mm*62mm(dimensions in millimeters)

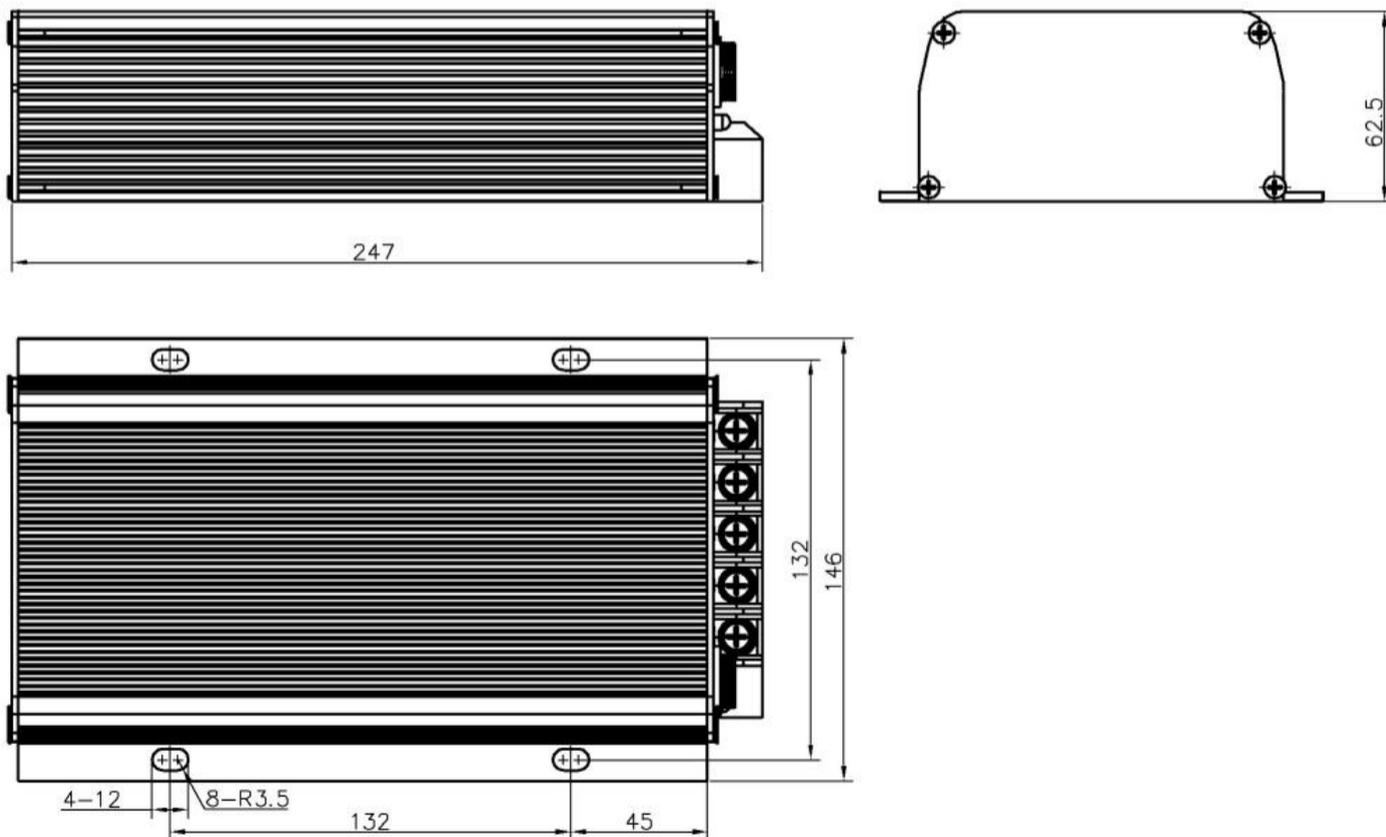


Figure 7: SMC7280, SMC72100, SMC72150 mounting holes' dimensions
 249mm*147mm*62mm(dimensions in millimeters)

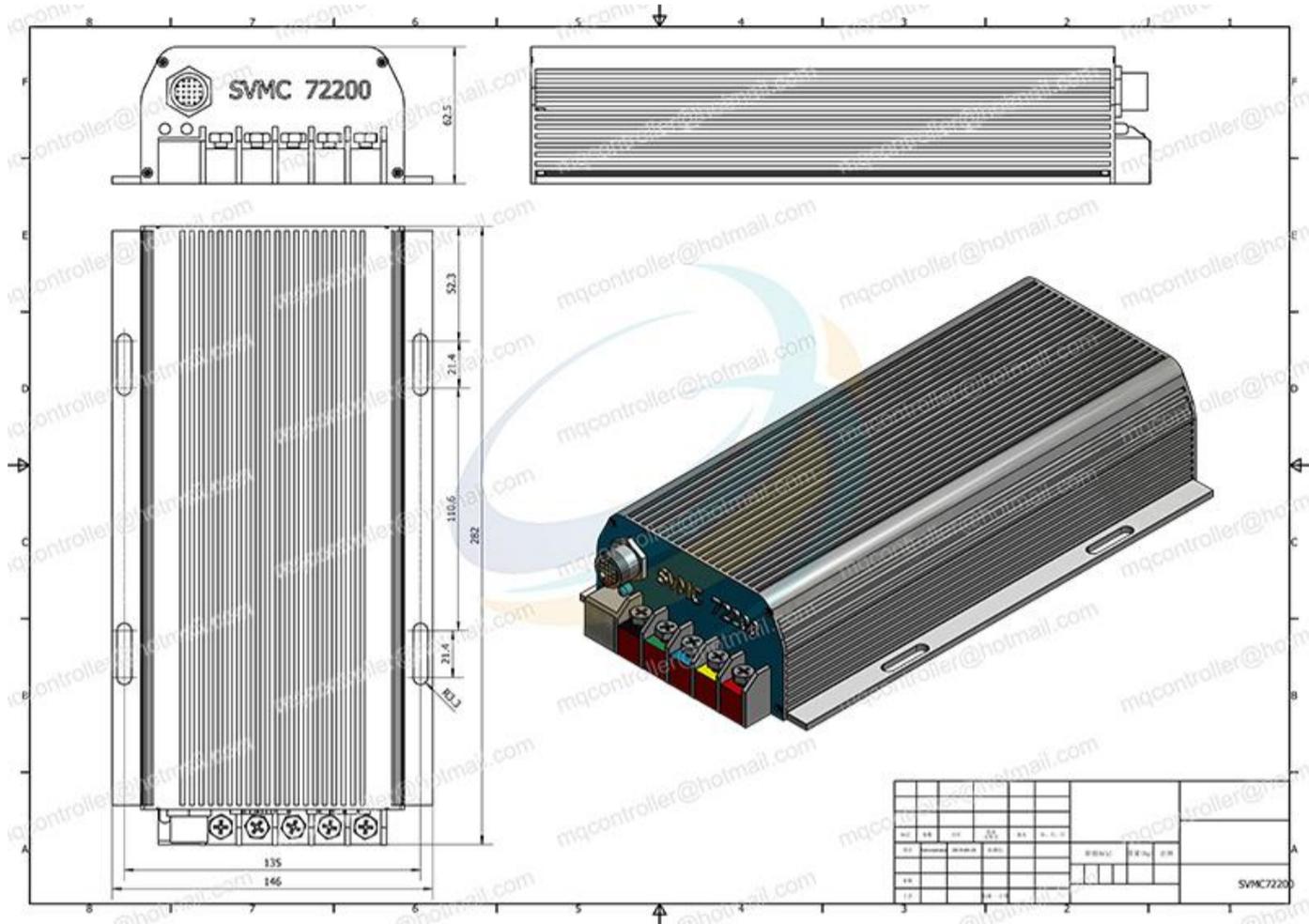


Figure 8: SVMC72200, SVMC96120 mounting holes' dimensions
 283mm*147mm*62mm(dimensions in millimeters)

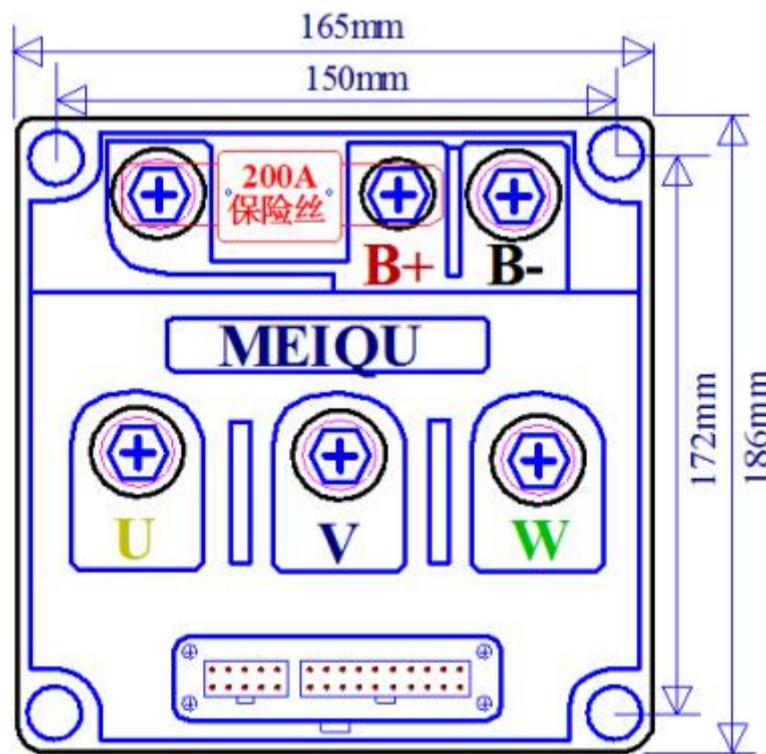
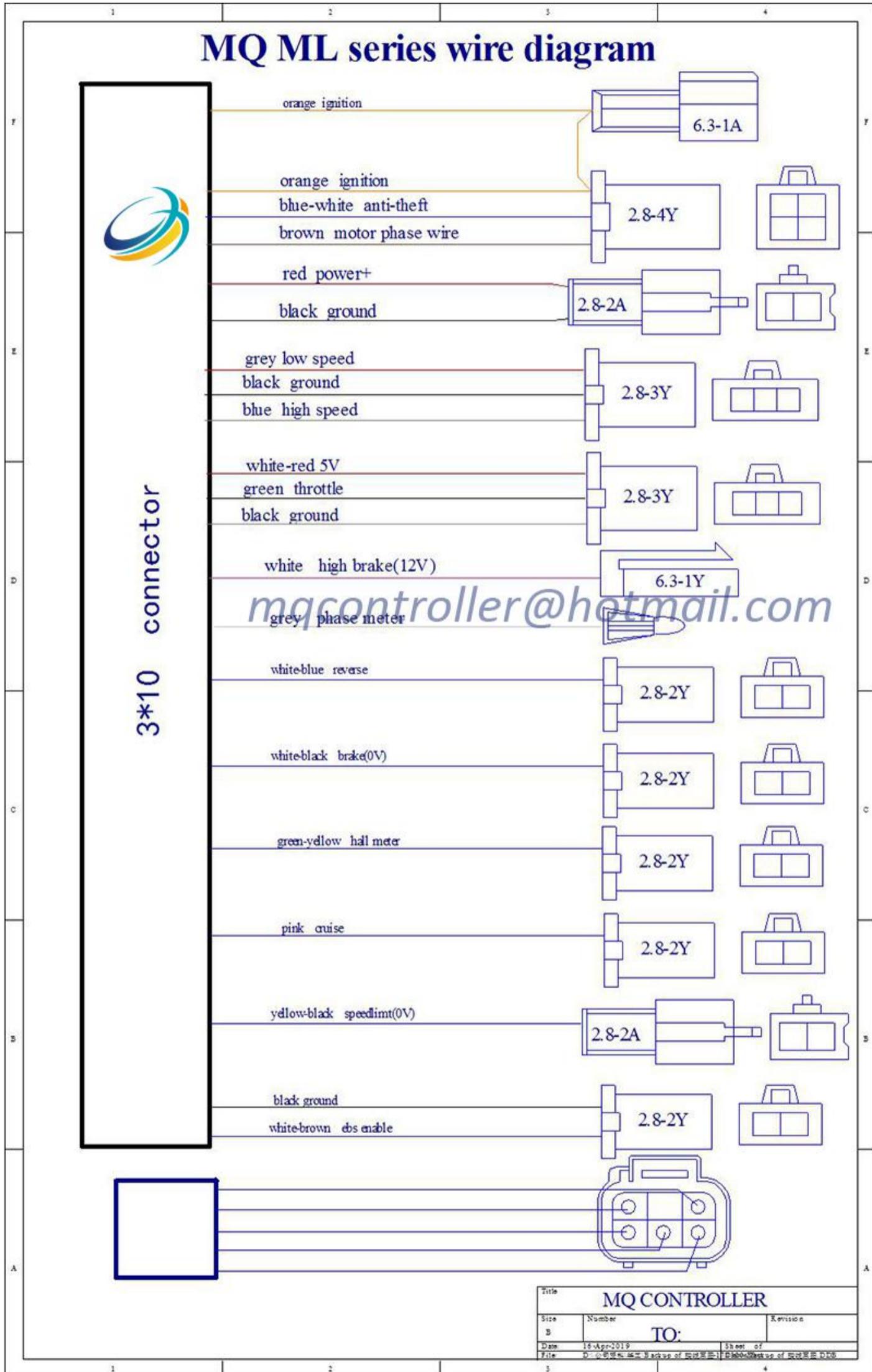


Figure 9: SSC7280, SSC72100, SSC72150, SSC96100 mounting holes' dimensions
 186mm*165mm*70mm (dimensions in millimeters)

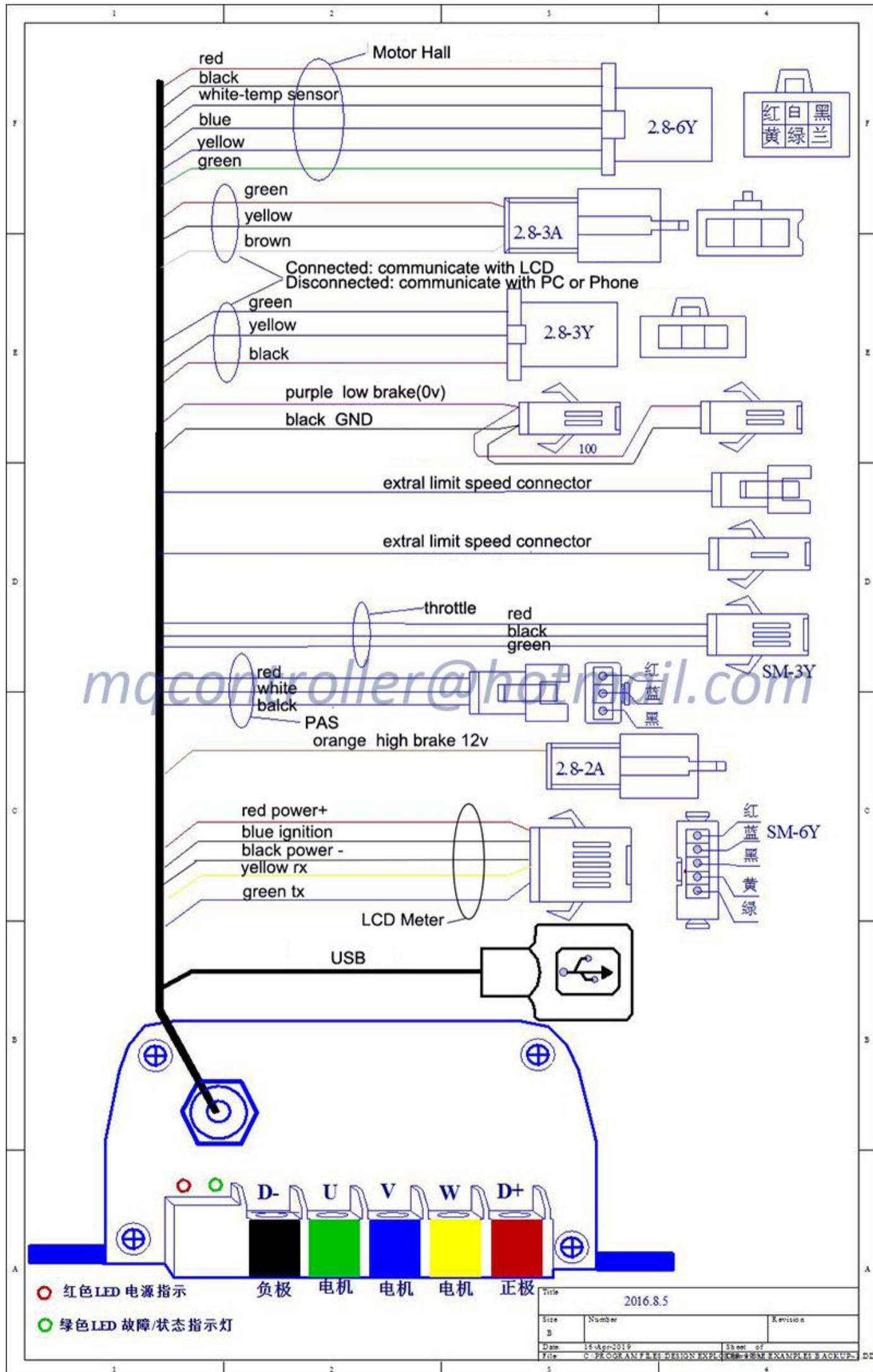
3.2.2 Pin definition of ML Controller(default & Optional)

Default functions: Hall, throttle, ignition, hall speed signal, high brake, low brake, three speed switch, reverse, anti-theft, cruise, EBS. (support regen braking, but cannot adjust the regen power.) Unprogrammable type.



3.2.4 Pin definition of SVMC Controller(with LCD meter function)

Default functions: Hall, throttle, high brake, temp sensor, reverse, low brake, PAS, LCD function. (support regen braking, can adjust the regen power by software.)

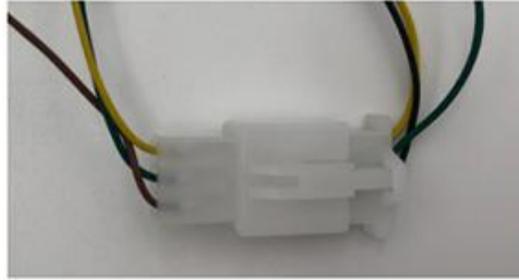


3.2.5 Pin definition of SVMC Controller(with TFT H6 Display function)

Default functions: Hall, throttle, high brake, temp sensor, reverse, low brake, 0-5v e-brake, PAS, H6 display function.
(support regen braking, can adjust the regen power by software.)



a. Hall Plug
Red - Hall positive
Black - Hall negative
White - Temp sensor
Yellow - Hall signal
Blue - Hall signal
Green - Hall Signal



b.
Brown
Green
Yellow
c.
Black
Green
Yellow
Connected: communicate with TFT
Disconnected: communicate with PC or Phone



d. PAS(5 gear speed)
Red - Positive
Green - PAS
Black - Negative



e. reverse / low brake
White - Reverse
Yellow - Low brake 0v



f. 0-5v throttle
Red - Throttle positive
Grey - 0-5v throttle
Black - Throttle negative



g. 0-5v e-brake
Red - Throttle positive
Brown - 0-5v e-brake throttle
Black - Throttle negative



f. high brake 12v
Purple - high brake 12v



g. H6 display(with ignition)
plug to new H6 display
with ignition function

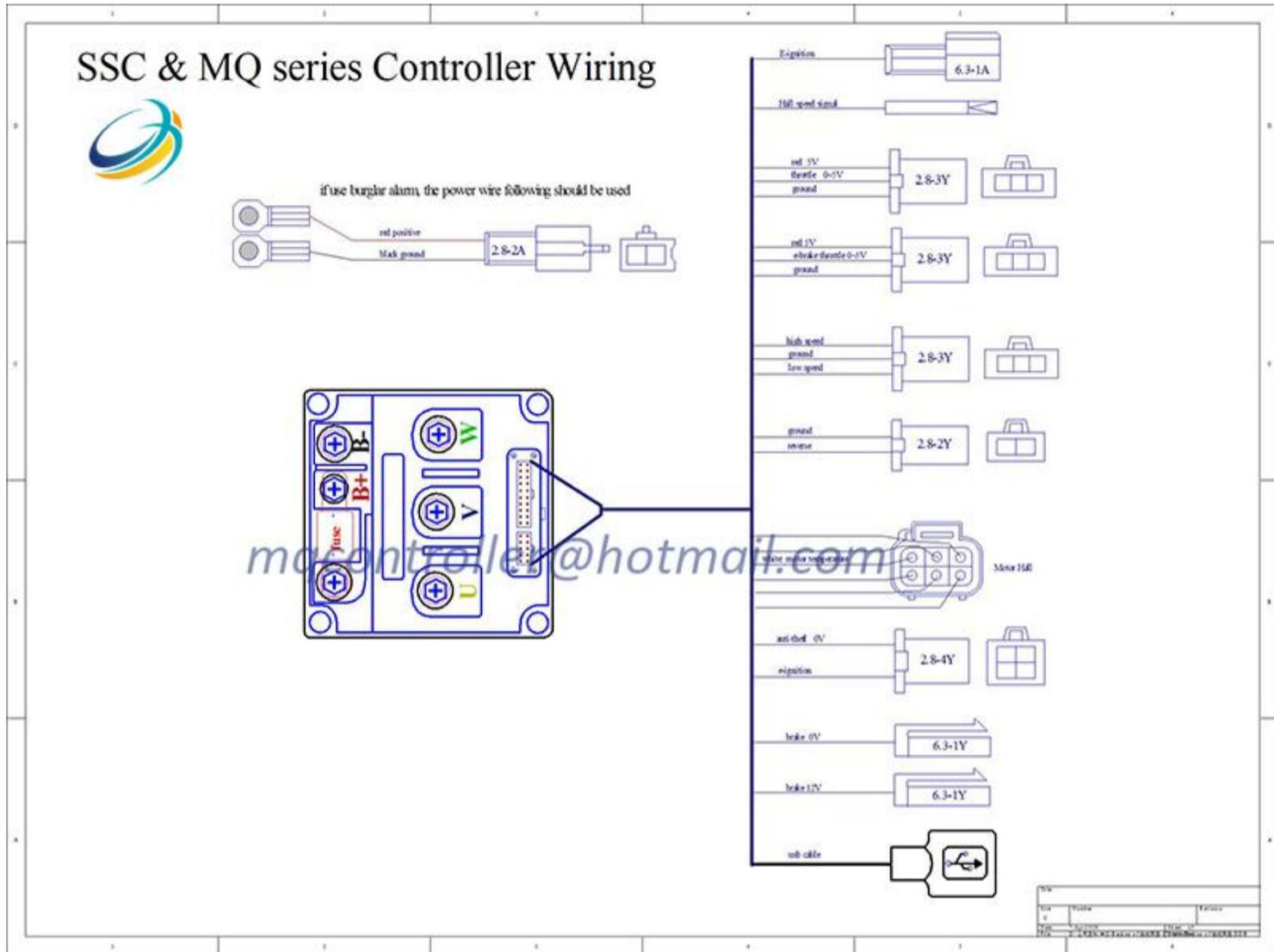


h. USB cable
for PC connect

Wiring for SVMC controller with TFT H6 display and PAS

3.2.6 Pin definition of SSC and MQ Controller(default & Optional)

Default functions: The default function for SSC/MQ controller: Hall, throttle, ignition, hall speed signal, high brake, 0-5v e-brake, three speed switch, temp sensor, reverse, low brake. (support regen braking, can adjust the regen power by software.)



3.2.7 Controller Functions Description

- **Hall:** it's connect with motor Hall, five wires with hall positive, hall negative and three hall signal wires. Normally, it's color to color with motor hall to plug in, some brand motor may need exchange the color of three hall signal to match with.
- **Throttle:** it's connect with your hall type 0-5v throttle.
- **Ignition:** The wire should connect to battery positive.
- **Hall Speed Signal:** This wiring is just one same wiring of the motor hall. It should be connected to hall meter ,if it is connected to battery positive or other high voltage incautiously. the motor hall and controller circuit will be broken .
- **High brake 12v:** it's e-brake activated by 12v.
- **Low brake 0v:** it's e-brake activated by ground. You can choose high brake, or low brake, or 0-5v e-brake for using, while it cannot used together.
- **0-5v e-brake:** it's the function to adjust the brake strength. For new controllers from the year of 2019, it's achieved by throttle.
- **three speed switch:** when the pink wire connect to ground(ground = battery negative) ,the controller will enter high speed mode. when the transparent wiring connect to ground, the controller enter to low speed mode. When the pink and transparent both disconnect with ground ,the controller enter middle speed mode.
- **Reverse:** it's activated by ground.
- **Temp Sensor:** we use KTY83-122 model. Pls. make sure your motor with same model.

- LCD Meter: it's the function to match with LCD-SW900, the display with ignition function. it's different with TFT H6 display. Support for SVMC models 48v-72v controllers. When this function included in the controller, hall signal speed wire will be removed from controller, it cannot used together.
- TFT H6 display: it's the function to match with TFT H6 display. The display with ignition function. Support for SVMC models 48v-72v controllers. When this function included in the controller, hall signal speed wire will be removed from controller, it cannot used together.
- PAS function: SVMC model controllers can be customized with PAS(5 gear speed). If with PAS function, the three speed function will removed from controller, it cannot used together.

3.3 Installation Check List

3.3.1 Cautions before using

Before operating the vehicle, complete the following checkout procedure. Use buzzer code as a reference as listed in Table.

Caution:

Put the vehicle up on blocks to get the drive wheels off the ground before beginning these tests.

- Do not allow anyone to stand directly in front of or behind the vehicle during the checkout.
- Make sure the PWR switch and the brake is off
- Use well-insulated tools.
- Positive and negative poles cannot be reversed. B+ is the positive pole, and B- is the negative pole. The corresponding phase lines of UVW are yellow, green and blue lines. All the binding posts need be insulation, or the controller will be burned by them.
- Pls. adjust the controller parameters according to motor configuration and confirm phase wire/hall wire setting before install the controller in your vehicle.
- The E-lock and brake H wires of harness wires should connect with positive wires, and other function wires (like low brake, reverse, cruise, three speed etc.) should connect with negative wires. **Pls. note: the wrong connect way will lead a damage for controller, in that case you have to bearing all maintenance costs by yourself!**
- Twist throttle lightly after installed controller in the vehicle, avoid to using EBS function.
- When you want to disassembly controller, closed the battery air switch first, then open e-lock to discharge, then disassembly the controller after closed e-lock. Pls. note: don't short the positive and negative poles to discharge before disassembly controller.

The controller installation should consider the heat dissipation and ventilation to void Water spatter. And the connect wring is as followings.

- please check the diagram when begin your controller connection carefully
- the power switch and the main contactor must be shut off during the connecting
- when power on, the read led should be always on

3.3.2 Easy damage condition for controller

- Wrong connect with positive and negative poles
- Flooding water.
- Metal port of USB cable connect with high voltage.
- The torque of electric drew driver less than 10N, otherwise, it will cause binding post, fall off or bolt broken in binding post.
- The motor's insulating layer of phase lines peels off due to aging, which causes the phase lines short circuit, then the controller will be burned directly.

Chapter 4 Programmable Parameters

MQ Configuration program allow users to set parameters according to the vehicle actual

working environment so as to be at its best. The default parameters of the controller are not recommended for all applications. Make sure set the proper parameters before making any test to avoid danger. Customers can do program on PC software or Android App. The Android Tablet is preferred.

PC software compatible for XP, Win 7, Win 8, Win10, not available for Mac OS system.

Please download the manuals and software from our website.

<http://www.mqcon.com/menu/downloads.html>

4.1 Overview steps for using controller

- ① Download wiring diagram & manuals & software
- ② Read manual carefully
- ③ install software & USB driver
- ④ connect wiring follow manuals
- ⑤ adjust parameters of controller
- ⑥ test in the vehicle

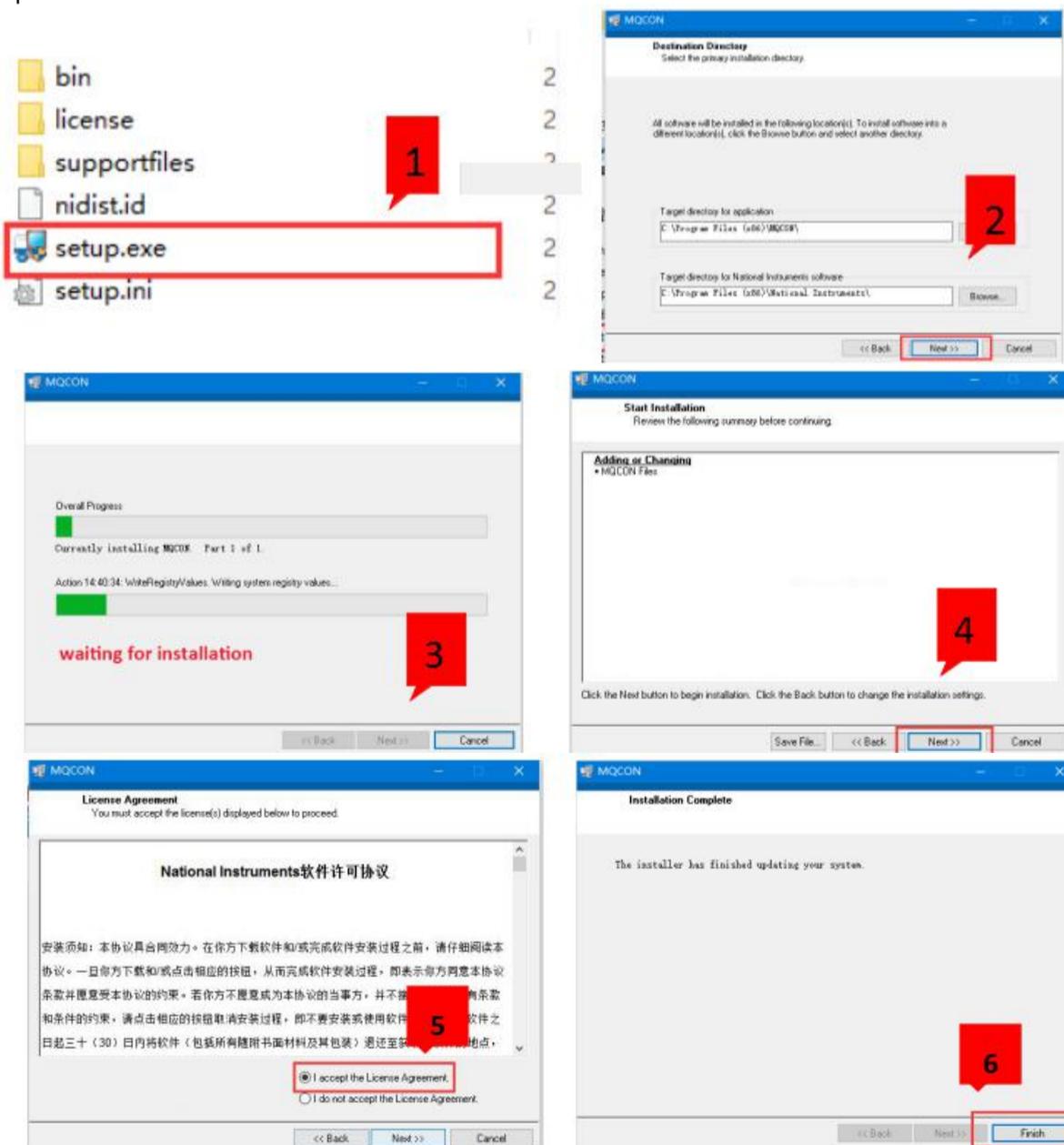
If any questions, pls. contact with us immediately. Email: mqcontroller@hotmail.com

4.2 Software Installation

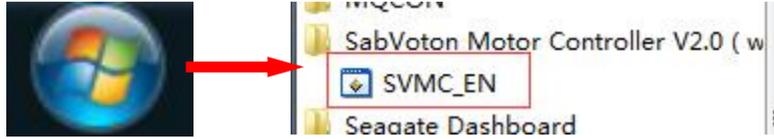
The software is compatible for XP, Win 7, Win 8, Win10, not available for Mac OS system.

4.2.1 Installation of software and USB driver

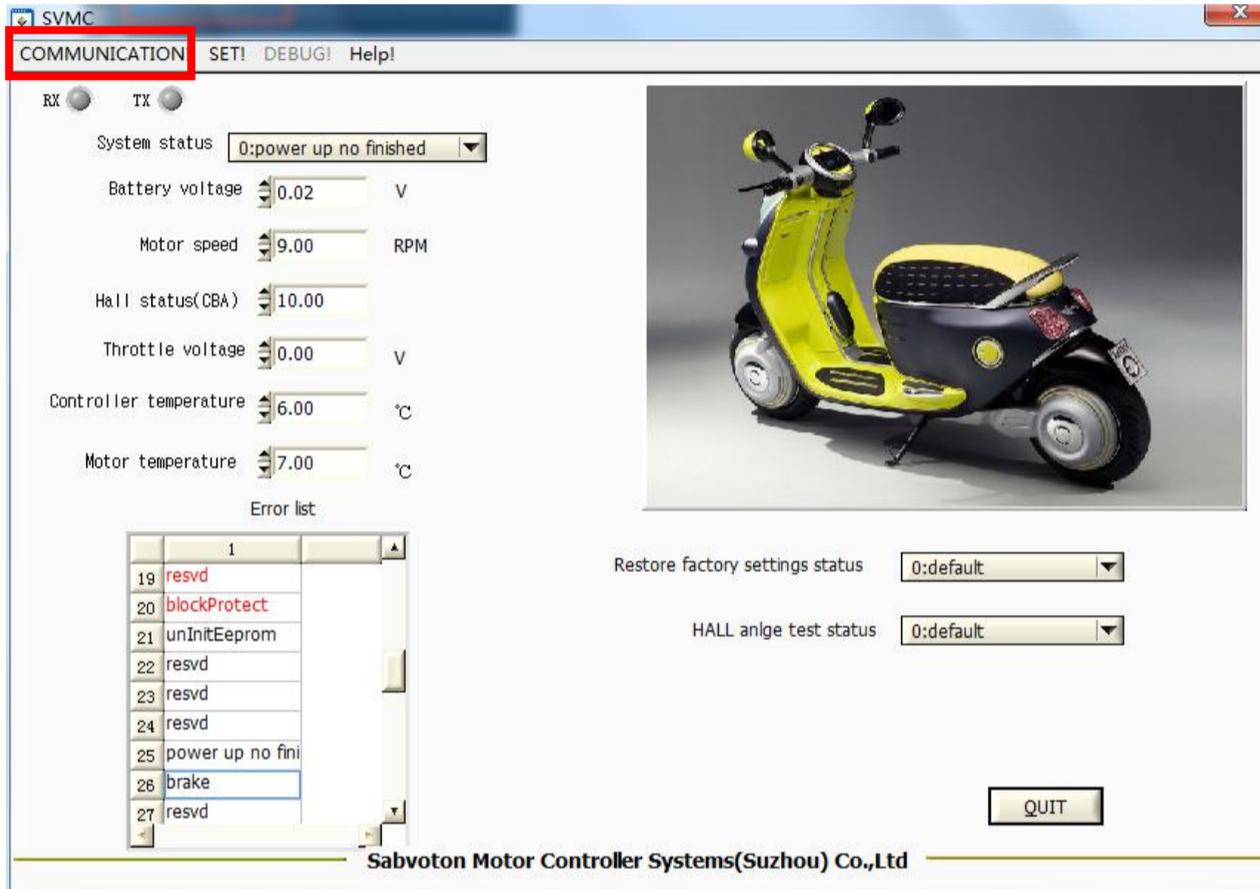
- ① Check your computer system type. If it's 32 bit, then you could install USB driver 32-bit version.
- ② Open software to installation.



③ Installation finished. Open the software.



④ The controller setting dialog box open. At this status, before the controller connected with PC, all the parameters in main setting dialog not correct.



4.2.2 Communication controller with PC

Caution : to be sure all connection is right before power on.

① **Only adjust parameters of controller in PC (not match with motor)**

For all controller made after 2016.1.15, the controller no need to power on by battery when in adjust parameter purpose.

Simply adjust controller parameters

- No temp sensor type controller: connect controller with computer directly



- With temp sensor type controller

If the controller/motor with temp sensor, pls. connect motor hall plug with controller, then connect the controller with computer directly.

② **Adjust parameters of controller in PC(with motor)**

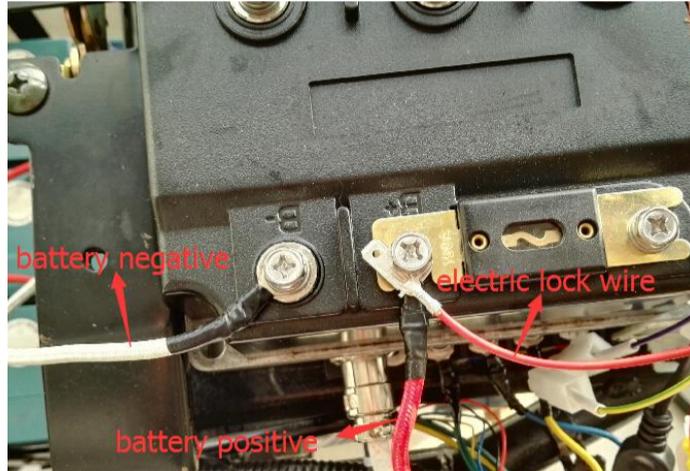
- B+ / B- / U / V / W connection

B+ from controller connect with battery positive, B- from controller connect with battery negative, U,V,W from controller should connect according to the manual(generally UVW for yellow-blue-green). The positive and negative poles must be correct! For different brand motor, the UVW may will have different connection.

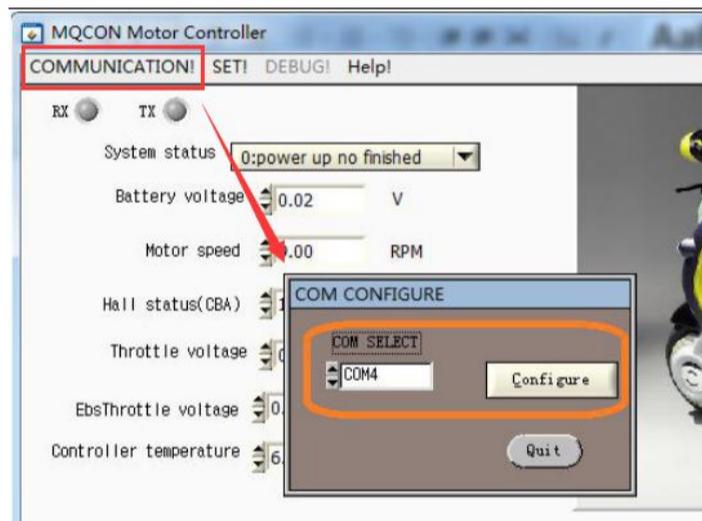
- E-lock, Hall plug connection, throttle, USB connect with PC

E-lock, Hall plug and throttle should be connected.

If you don't have e-lock, pls. connect the e-lock wire from controller to battery positive.



- ③ Check your PC COM number, open "Device manager" → "COM and LPT" → "USB-SERIAL CH430(COM5)". Set the same "COM SELECT" with your PC COM number, click "configure".



After connected controller with PC, when RX and TX twinkle alternately, the communication is successful, the data on the interface come from the controller setting.

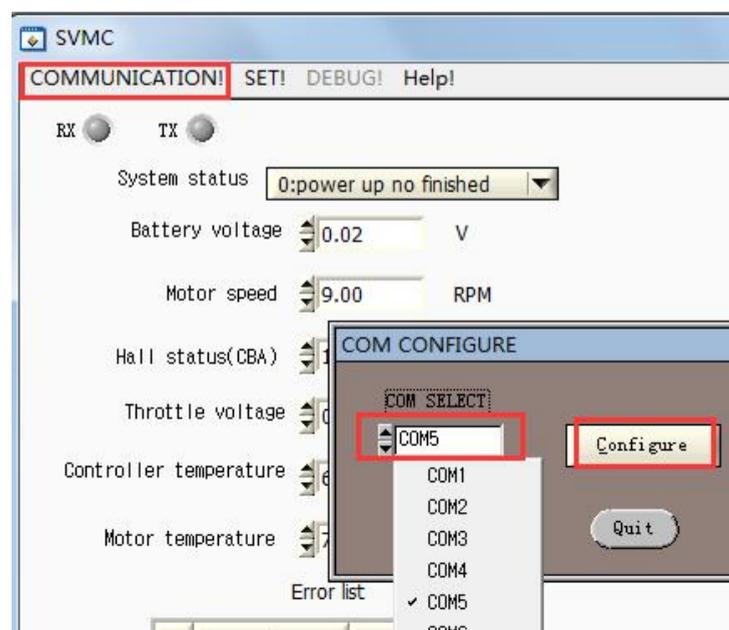
Caution: Do not ride your vehicle when the USB cable connected with controller.

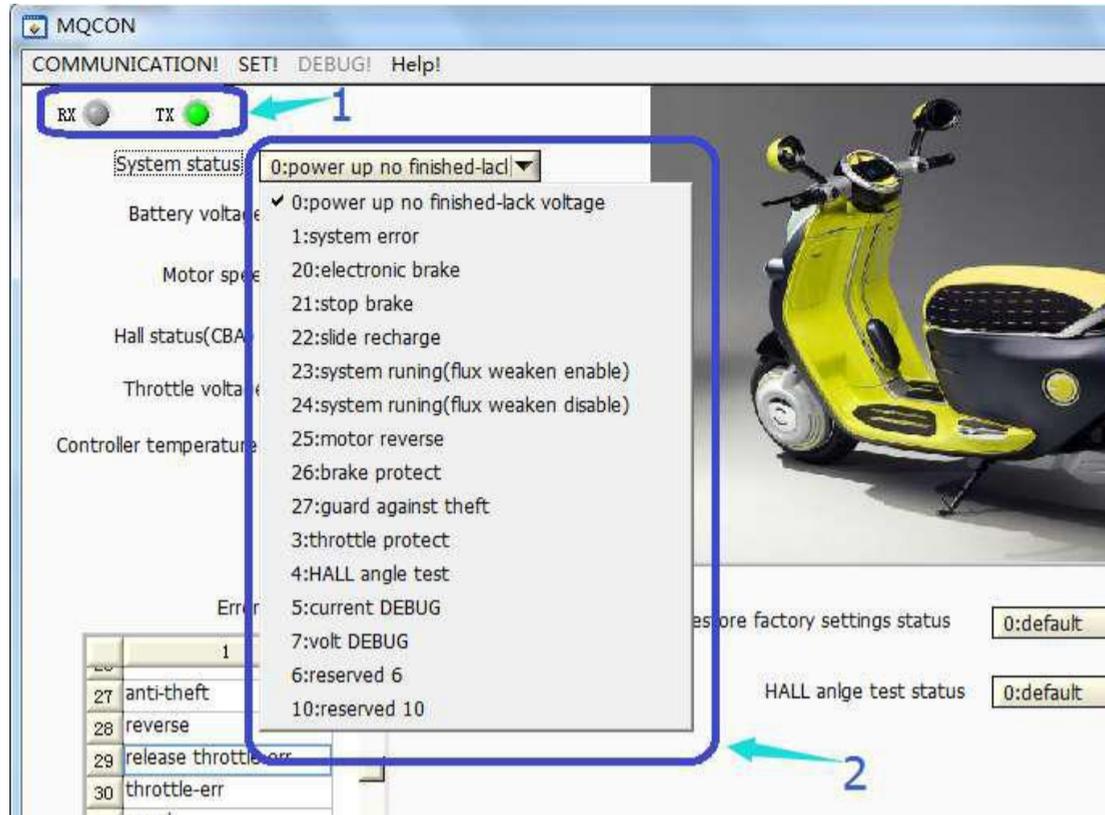
4.3 Debugging

After communication is successful between PC and controller, the system status show system running, you could enjoy to set the parameters accordingly.

4.3.1 Main surface

The information on the main interface describe the controller real status and error list, it cannot be edit.





- ① When RX and TX twinkle alternately, the communication is successful, the data on the interface come from the controller setting. If only TX twinkle, the communication is invalid, the data is unmeaning.
- ② "system status" describe current status and error of controller, it help the users to find controller error and resolve problem easily.

Status	description
0 : power up no finished	When power on,if the controller detect battery voltage is lower than the lack voltage setting, for example the lack voltage setting is 60V, it detect the battery voltage is 50v,then it will show "power up no finished".
1 : system error	When the controller detect errors, it will show that, the specific error can be found from the error list (the red font in the error list is current error)
20 : electronic brake	The controller enter e-brake mode and the throttle input is invalid (while in e-brake to stop the motor, the controller will charge for the battery)
31 : stop brake	The controller is in brake mode and the throttle input is invalid and the controller close the pwm output.
23 : system runing (flux weaken enable)	Controller is in normal running mode and it can enter flux weaken at high speed.
24 : system runing (flux weaken disable)	Controller is in normal running mode and it can not enter flux weaken at high speed
25 : motor reverse	The reverse signal is valid and controller enter reverse mode, if throttle input is valid, the motor will spin in reverse direction.
26 : brake protection	The throttle is invalid and must be release.
27 : guard against theft	The anti-theft input is valid and the controller lock the motor.
3 : throttle protect	While power on, controller detect throttle, voltage is higher than the min valid throttle voltage setting, it will enter throttle protect.
4 : hall angle test	Controller is in hall angle test mode

③- After communication is ok, the data in picture, 3 will be refreshed (for some type controller, the data only be updated when motor is still or speed in very low)

Battery voltage: the battery voltage

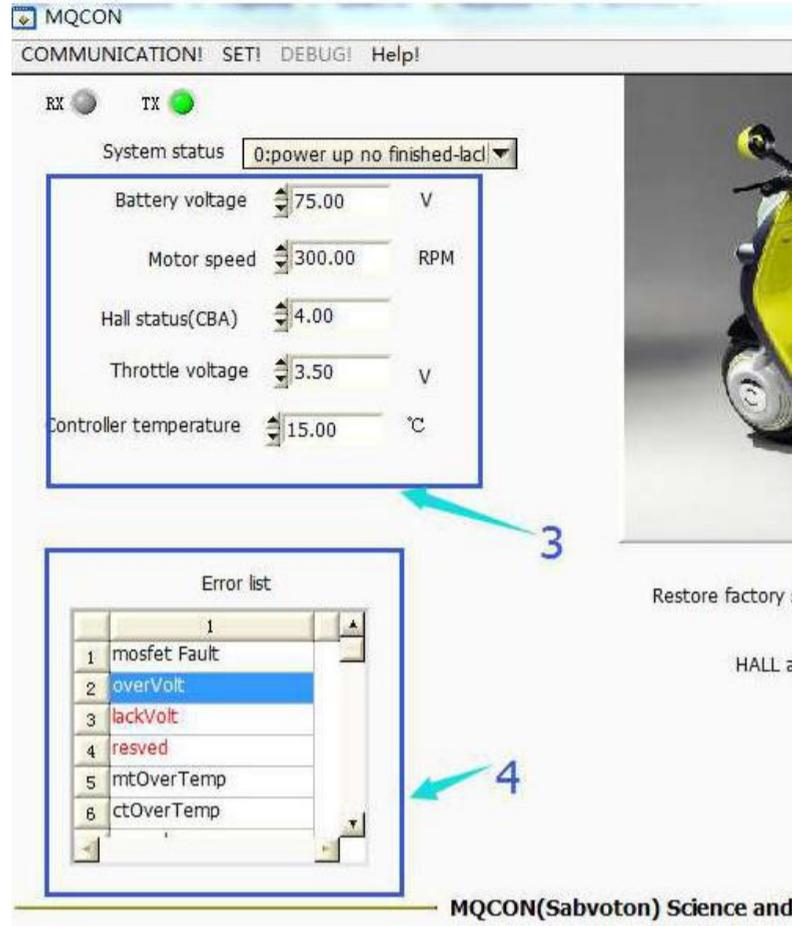
Motor speed: unit is RMP, that is " r/min", the data is relate to polar pairs setting

Hall status(CBA): the value only show any one of 1 2 3 4 5 6 ; if it show 0 or 7, the motor hall is wrong or the controller hall circuit is wrong

Throttle voltage: throttle voltage real voltage ,while. When spin the throttle ,the value will change.

Controller temperature: the temperature of controller

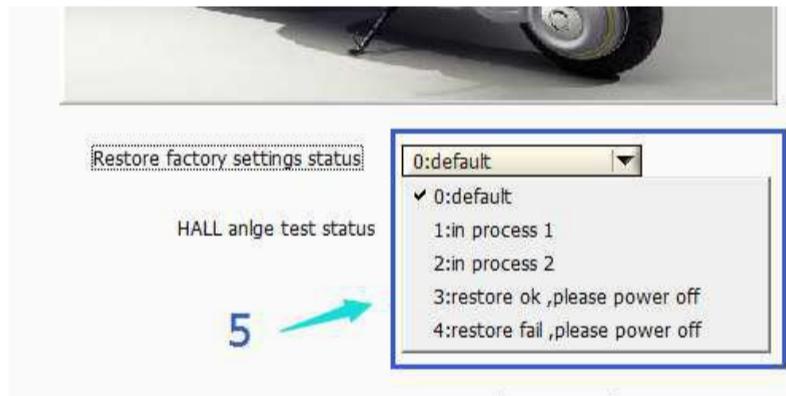
④- Error list, only red front is the current fault or status which should be attention:



⑤- When execute “restore factory setting”in SET-DEBUG tab, the main interface will show the steps of the restore,

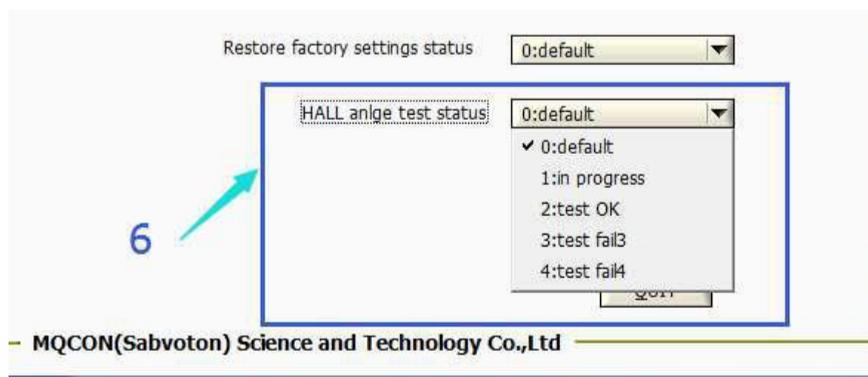
Finally, if it show “3: restore ok, please power off”, then please reset the controller.

Finally, If it show “4: restore fail, please power off” , maybe the store circuit is broken, please contact the supplier.



⑥- When execute hall angle test ,the step and result will be showed as picture 6,

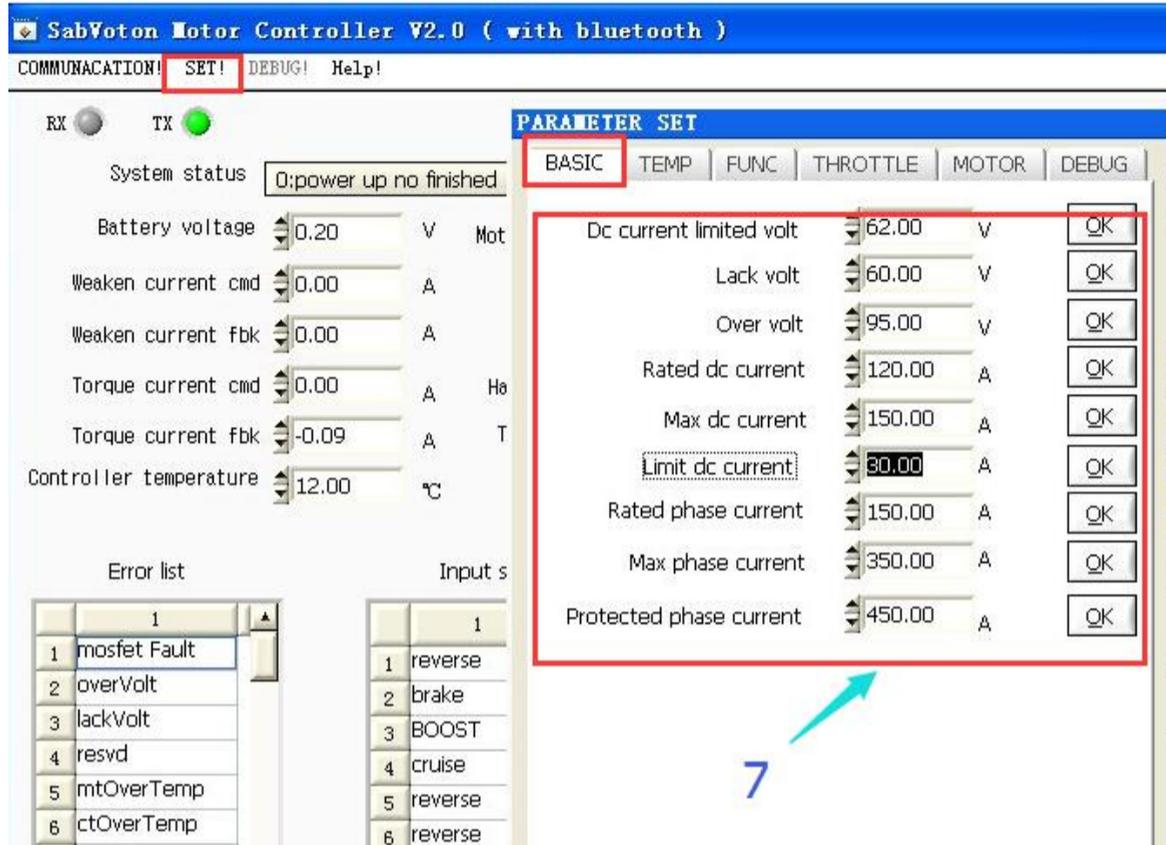
Finally, if show “3: test failed” or “4: test failed 4”, please use bigger test given current(such as 25A or 30A) in SET-DEBUG TAB to redo the hall angle test. If it still failed ,please exchange any of two phase wire to redo the hall angle test.



4.3.2 Parameter Set for Basic

Any modification should be set ok, otherwise the controller will not receive the new setting. If it need to be saved, the “parameter store” in SET-DEBUG should be executed after all modification.

⑦- Picture 7 show the basic setting, if the user setting exceed the parameters range, the controller will ignore that setting.



Basic Parameters	Description
Dc current limited volt	If you set 62v as DC current limited volt, it means when your volt in 62v, the DC current will be limited to the data you set "Limit DC current".
Lack volt	If controller detect the battery voltage is lower than the setting ,it will stop work. Generally, if battery is 72V, the setting is about 60V; if battery is 60V, the setting is about 50V; if battery is 48V,the setting is about 42V.
over volt	If controller detect the battery voltage is higher than the setting, it will stop work. Generally, if battery is 48v or 60v or 72V,the setting is about 95V;
Rated DC current	No need to change, generally default is fine.
Max. DC current	It limit the max dc input current to controller ,that setting is according to controller type; For example: SVMC72150 setting is no more than 150A; SVMC72100 setting is no more than 100A; SVMC7280 setting is no more than 80A; SVMC7260 setting is no more than 60A. For unlocked 72150, no more than 200A.
Limit DC current	If you set in 60A for this parameter, when the battery volt is equal to the data you set for "Dc current limited volt", the controller will be limit DC current to 60A.
Rated phase current	"rated phase current" determine the continuous load endurance. That setting is according to controller type; For example: SVMC72150 setting is about 150A; SVMC72100 setting is about 100A; SVMC7280 setting is about 80A; SVMC7260 setting is about 60A.
Max phase current	It determine the max output torque. When the throttle is in max position, the controller output the max phase current. that setting is according to controller type; For example: SVMC72150 setting is no more than 350A; SVMC72100 setting is no more than 250A; SVMC7280 setting is no more than 200A; SVMC7260 setting is no more than 175A. For unloced 72150, no more than 400A.
Protected phase current	The controller will stop running when it detect the real phase current exceed the setting that setting is according to controller type; For example: SVMC72150 setting is no more than 450A;SVMC72100 setting is no more than 300A; SVMC7280 setting is no more than 250A; SVMC7260 setting is no more than 225A; SVMC7245 setting is no more than 175A.

4.3.3 Parameter Set for Temp

⑧- Controller temperature setting, any setting about temperature should not exceed 100°C.

Suggest Parameters for temperature:

Unwork temp: 90°C

Rework temp: 80°C

Limited current temp: 70°C

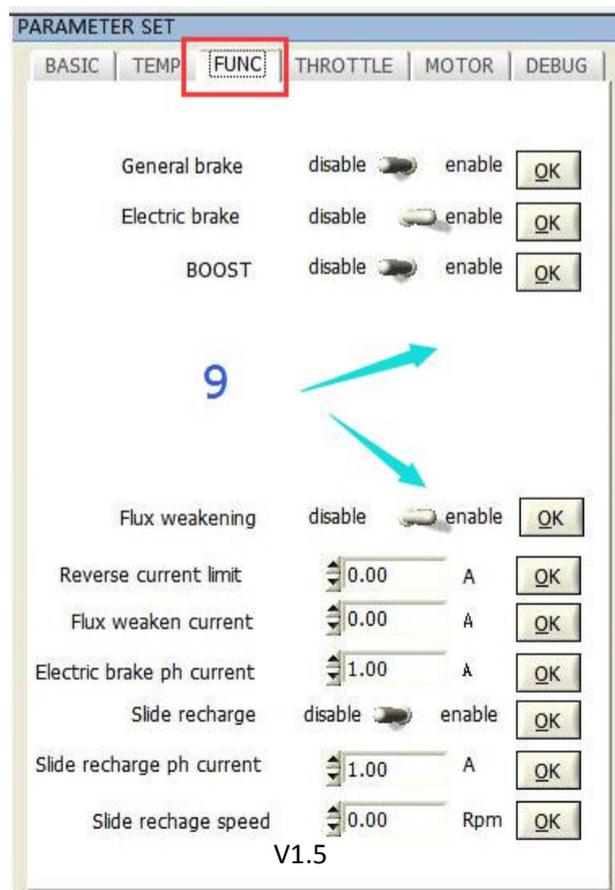


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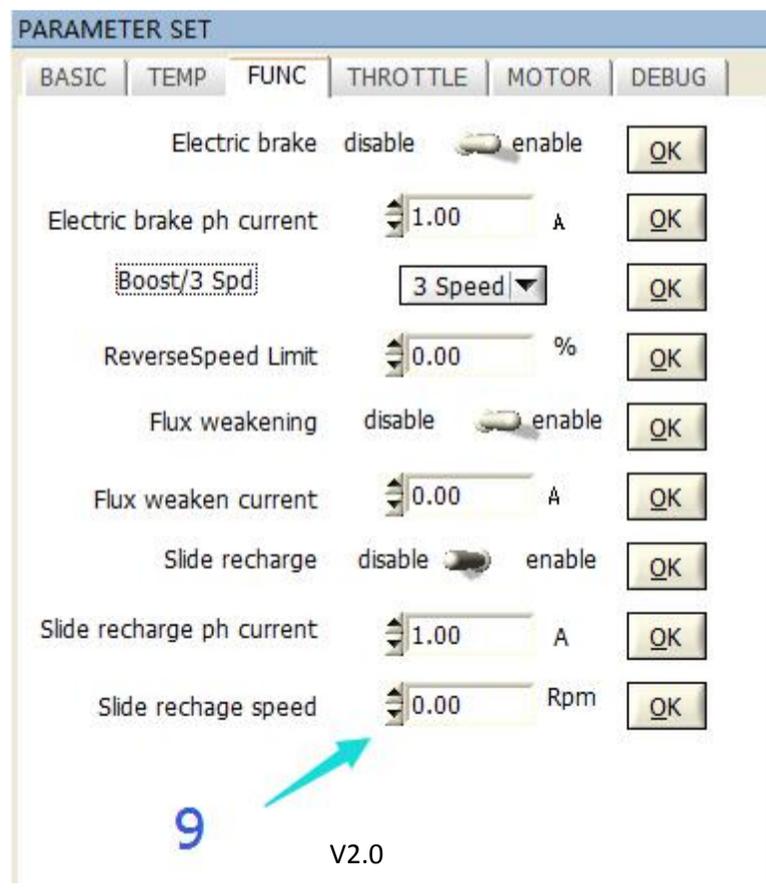
Temp Parameters	Description
Unwork temperature	When controller temperature exceed the value,it will close the pwm and stop running We recommend about 90, it should be smaller than 100°C.
Rework temperature	When controller enter temperature protected ,the controller stop running ,then the temperature will come down ,when it is under the value , the controller can running again in limit current mode. We recommend about 80°C, it should be smaller than the unwork temperature.
Limited current temperature	When controller temperature exceed the value, it will limit current output, and the motor torque will be limited", We recommend about 70°C, it should be smaller than the Rework temperature.

4.3.4 Parameter Set for FUNC

⑨- Function Parameters



V1.5



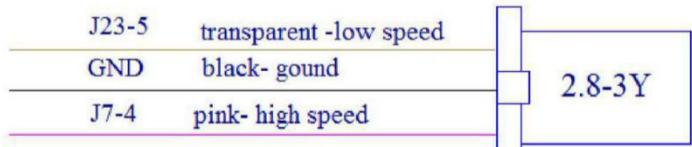
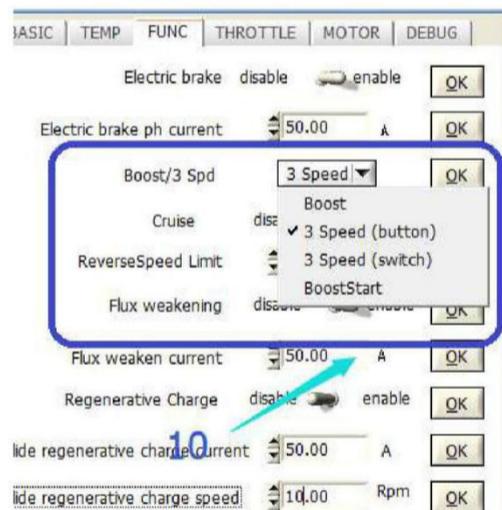
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V2.0

Func Parameters	Description
General brake disable or enable	You could enable "general brake" or "electric brake", cannot enable two in the same time. For general brake function enabled, the controller just close the pwm output and let the motor to speed down by itself.
Electric brake disable or enable	if enable the electric brake, when brake switch is valid, the e-brake try to prevent the motor running and charge the battery; if disable the electric brake, when brake switch is valid, the controller just close the pwm output and let the motor to speed down by itself.
Boost/ 3 spd	If the controller does run in limit speed mode , it will belong to one of the set mode here.
Flux weakening enable or disable	If disable ,the max speed will reduce about 10~15%, and will extend the max mileage greatly. If enable ,the max speed and max dissipative current will be improved about 10~15%, the factory set is enable.
Reverse speed limit	Limit the speed in reverse mode . it does not limit the reverse torque. Value range: 0~100%.
Flux weaken current	When the value is below 50, it will improve the max speed with economic dissipative current , when the value exceed 50 , controller will consume much more current to improve speed, and the controller temperature will rise very fast. Value range: no more than 80A , we recommend about 50A.
Electric brake ph current	It set the strength of the e-brake ,it base on the motorcycle weight and driver feel. The bigger the value ,the stronger the brake effect. We recommend about 50a,it should not exceed the max phase current.
Slide recharge	If enable ,the controller will prevent the motor when release throttle. If disable ,the controller just close the pwm output and let the motor speed down by itself when release throttle.
Slide recharge ph current	The value is valid only when the regenerative is enabled. The value decide the strength to prevent the motor. it base on the motorcycle weight ,motor speed and driver feel. range: 0A~max phase current, we recommend 50A
Slide recharge speed	The value is valid only when the regenerative is enabled. When motor speed exceed the value ,controller will prevent the motor. if speed is under the value , controller stop to prevent the motor range: 1~1000rpm , we recommend 10.

⑩- Boost /3 speed

The picture is 3 speed connector. The black is battery negative, we call it ground wire.



Boost/ 3 speed	Description
Boost mode	if boost mode is selected, when the pink wire connect to ground wire and disconnect after about 1 second(use a button). the controller will enter boost mode and limit dc current according to the" boost dc current "setting. it will quit the boost mode after 30 second automatically.
Boost start mode	If boost start mode is selected, every time when the motor spin from zero speed, the controller will limit the dc current according to the "boost dc current" setting. after about 3 second, it will limit dc current according to "dc limit current"automatically.
3 speed (button)	If 3 speed (button) is selected. Use a button(which can be reset by itself) to connect the pink wire and ground wire. push it and release ,the speed gear will change according as follows:: 3-2-1-2-3-2-1-2-3-..... When power on ,the controller is in 3 gear mode (high speed mode)
3 speed (switch)	Use such switch to realize the 3 speed(switch) mode. if 3 speed (switch) mode selected, Connect the pink and ground wire. Enter high speed mode Connect the transparent and ground wire. Enter low speed mode Disconnect pink ,transparent wire and ground ,enter middle speed mode.

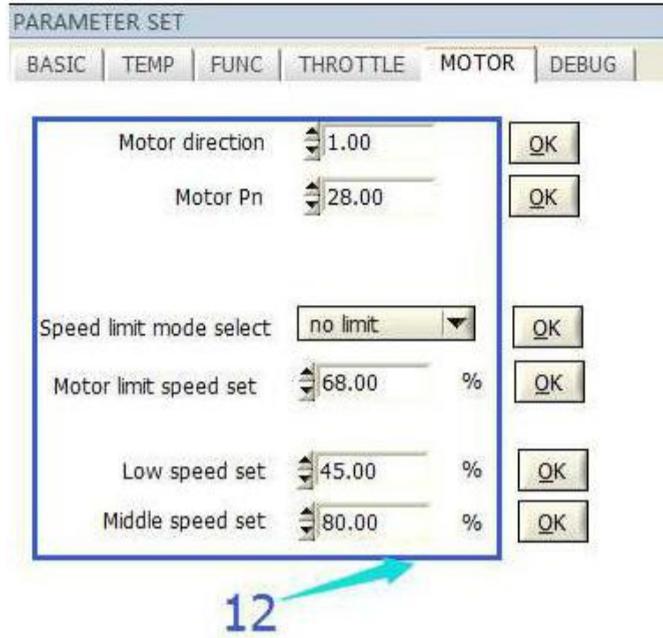
4.3.5 Parameter Set for Throttle



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Throttle Parameters	Description
Throttle min volt	"throttle min volt" means the inspecting voltage when the throttle position is "0" after power on/correspond 0 phase current. It mean throttle min valid voltage, only throttle real voltage is higher than the value, the controller will output pwm. How to set the value? It should be 0.3~0.5V higher than the throttle value on the interface when release throttle .
Throttle max volt	"throttle max volt" means the inspecting voltage when the throttle is fully twisted after power on/correspond max phase current. It should be 0.3~0.5V lower than the throttle value on the interface when throttle is in max position. The throttle min volt should be set at least 0.1V higher than the voltage which was inspected when the throttle position is "0" after power on, or the controller will suffer throttle protection fault when power on.
Starting torque adjustment	The throttle max volt should be set the same as the value which was inspected when the throttle was fully twisted after power on. Improve the starting torque by reducing the value of "throttle middle volt" which is between "3.5V~2V". And by raise the throttle middle phase current one can improve the starting torque as well. -----1)For the controller with a limiting DC current is 60-80A, it is recommended to set the throttle middle phase current 60-120A. -----2)For the controller with a limiting DC current is 80-100A, it is recommended to set the throttle middle phase current 80-150A. -----3)For the controller with a limiting DC current is 100-150A, it is recommended to set the throttle middle phase current 80-200A.
Accelerate time Decelerate time	The less the "acceleration time" or "deceleration time" is, the faster the throttle will response. "accelerate time" determine the response time for the controller to response the throttle output during the accelerate process. "decelerate time" determine the response time for the controller to response the throttle release during the decelerate process. If motor direction is 0. The smaller the accelerate time, the accelerate faster; The smaller the decelerate time, the decelerate faster. If motor direction is 1. The smaller the decelerate time, the accelerate faster; The smaller the accelerate time, the decelerate faster. Value range: 10~800
Throttle mid volt	Value range: 2.0~2.5V
Throttle mid current	The value distribute the output phase current command. The bigger the mid current , the bigger the output torque in first half throttle span. vice-versa Value range: 1/3~2/3 of max phase current

4.3.6 Parameter Set for Motor

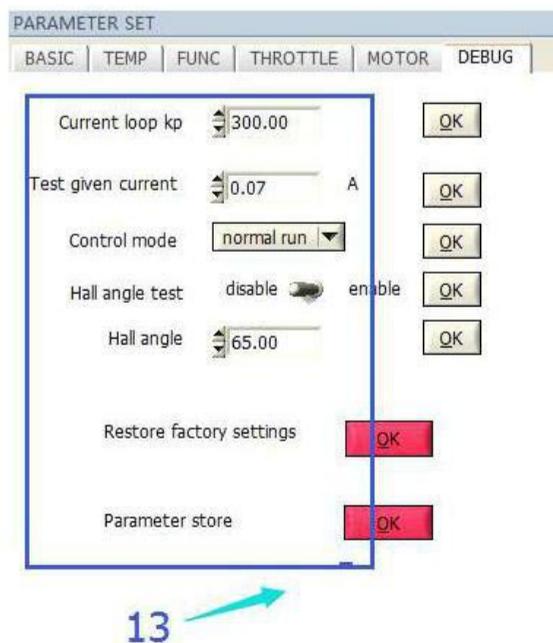


Parameter Name	Description
Motor direction	After the motor hall is matched, if the motor spins backwards, you could change the direction by changing the value here (switch from 0 to 1 or from 1 to 0). It is used to change the spin direction of motor.
Motor pn	Two magnet steels will be counted as a pair of pole; For example Motor pn is "20" for a motor with 40 pcs of magnet steel; This parameters should be confirmed with your motor supplier, they know this parameter well. If this data set not correct, the motor rpm shown in wrong data in the system.
Motor LMD	This parameter is only useful to our engineer during the adjustment, so normally the customer can ignore this value.
Speed limit mode select	Intern set: the max speed will limited according to the "motor limit speed set". Extern set: if the extern speed limit switch is valid, the max speed will limited according to the "motor limit speed set". No limit: the speed will be limited according to the gear in 3 spd mode.
Intern speed	For each of our controller, user can limit the maximum speed in our software. If the "motor limit speed set" is 50% it means the current maximum speed is limited to 50% of the original maximum speed.
Extern limit	Some users need to limit the maximum speed during their driving, in this case, we will offer a "speed limiting" function cable, that when the cable is connected with a ground 0V, the speed limiting is enabled.
Low speed set	Under 3 spd mode, the low speed will be limited according to the low speed set
Middle speed	Under 3 spd mode, the middle speed will be limited according to the middle speed set

Remark: to use 3 spd mode, " no limit" must be selected

4.3.7 Parameter Set for Debug

Before angle matching, the motor must be without any load and the battery must power on .



Debug Parameters	Description
Current loop kp	The parameter will be different for different motors as the technique and craft is different too. One could adjust the value by himself to suit their motors. But this value shall not exceed 3000. There is no need to adjust the "current loop ki" normally. If the driver feel shake obviously, maybe we can modified the value to have a try. Generally, for 205 stator motor, set 999, for 273 stator motor, set 299. (you can adjust this parameter based on our data according to your real test, it can reduce vibration and noise)
Test given current	Value range: 10~30A, generally use 15A to do test. If the motor with great reluctance force, just improve the value to make it spin evently. For mid-drive motor, it generally set 25A.
Control mode	Normal mode or hall test mode selected.
Hall angle test	If hall angle already confirmed, pls. disable it. If it's the first match for new motor, pls. do the hall angle test first, make sure the battery power on and motor on no-load status, otherwise it will be failed.
Hall angle	When main interface indicate the hall angle test ok , the hall angle will be updated after switch another tab(not DEBUG TAB) and then back to BEBUG TAB. If we know the hall angle in advance ,input the angle directly without hall angle testing. For example, QS Motor V3, Hall angle 245±10; normal motor hall angle 66±10.
Reset factory setting	If execute the command, Controller will use the factory setting
Parameter store	If execute the command, all modified parameters will be saved after next powered on

!!!! Hall Angle Test (important for first match with new brand motor) !!!!

- Test given current: Value range: 10~30A, generally use 15A to do test. If the motor with great reluctance force, just improve the value to make it spin evenly.
- Select HALL angle test in Control mode, and Click OK on the right.
- Enable hall angle test, and click OK on the right.
- Then you will find the motor spin very slowly, when the matching finish, the hall status shown in the main interface will display the matching result from 1~6. If matching succeed, it will indicate: 2: test ok. On the BEBUG page, hall angle will update the latest matching angle. Click OK, click parameter store to YES and click OK.
- After matching, shut off the controller and then power on it again , then check the matching angle. if the angle is updated, change the throttle input slowly to run the motor. Otherwise, the angle should be matched once more.

Caution:

- (1). when angle test failed in type 4, you can exchange any two phase wires and match again.
- (2). When angle test failed in type 3, pls. check the connection between motor and controller, meanwhile change the Test given current to test again.
- (3). if the motor reverse, you can exchange any two phase wires and match again. Or you can just set as following :
Type 1 at motor direction input field. and click ok. it will change the spin direction.

4.4 Bluetooth Programmable

The second option is customers can buy our Bluetooth adapter to connect the controller to Android Phone. We don't have to use USB converter any more when you use Bluetooth converter for programming the controller. But Bluetooth only suitable for **Android system** currently.

Please download the controller user program from our website for free.

<http://www.mqcon.com/menu/downloads.html>

Chapter 5 Maintenance

There are no user-serviceable parts inside the controllers. Do not attempt to open the controller as this will void your warranty. However, periodic, exterior cleaning of the controller should be carried out. The controller is a high powered device. When working with any battery powered vehicle, proper safety precautions should be taken that include, but are not limited to, proper training, wearing eye protection, avoidance of loose clothing, hair and jewelry. Always use insulated tools.

Following circumstances are not included in the free repair scope.

- the appearance looks seriously damaged and distorted by customer;
- the shell of controller was separated privately;
- the controller is damaged due to the wrong connecting without following the instructions, especially that the positive and negative poles are reversed;
- switch lock into electricity causes the voltage too high, then the controller can be damaged;
- inflow makes the controller damaged.
- unlocked type controller.

The warranty time is one year for the controller excepted above circumstances.

5.1 Cleaning

Although the controller requires virtually no maintenance after properly installation, the following minor maintenance is recommended in certain applications.

- Remove power by disconnecting the battery, starting with battery positive.
- Discharge the capacitors in the controller by connecting a load (such as a contactor coil, resistor or a horn) across the controller's B+ and B- terminals.
- Remove any dirt or corrosion from the bus bar area. The controller should be wiped with a moist rag. Make sure that the controller is dry before reconnecting the battery.
- Make sure the connections to the bus bars, if fitted are tight. To avoid physically stressing the bus bars use two, well-insulated wrenches.

5.2 Configuration

You can configure the controller with a host computer through USB port.

MQ Brushless Motor Controller User's Manual V 1.1

- Disconnect motor wiring from controller for configuring existing parameters in the user program or Android APP. If this operation is too much extra job for you, please make sure the motor must be stopped before programming.
- The controller may display fault code, but it doesn't affect programming or configuration. But it will affect the Identification angle operation. Please try to eliminate the error codes before Identification angle operation.
- Use a straight through USB converter provided by MQ to connect to a host computer. Provide >+18V to PWR (for a 24V controller, provide >+8V) . Wire power supply return (supply negative) to any RTN pin.
- MQ controller requires a 4pin connector to USB Converter to support the communication. Customers may download PC software or Android APP to program the controller before running the motor. You may do Identification angle for brushless motor with hall sensors after running the software or Android APP.

Chapter 6 Tablet of Error Codes

Special for SM serial controller:

Flicker	Fault
2	Anti-speed protection
3	Throttle Fault
4	Hall Fault
5	Motor Rotation Blockage
6	Overcurrent Protection
7	OverVoltage Protection
8	UnderVoltage Protection
9	Hardware Protection
10	Brake
11	Top Bridge Arm Driving Failure
12	Bottom Bridge Arm Driving Failure
13	Over Temperature of Motor

Error Codes for other controllers except SM model.

Flicker	Fault	Description	Measurement
1	hardware over current	hardware failures caused over current	restoring the default setting, turn off the power, and then open, reset the parameters, if still have fault, the controller is damaged
2	overvoltage	Battery voltage is more than the highest working voltage of the set of controller	According to the actual battery voltage adjustment overvoltage value
3	undervoltage	Battery voltage is lower than the highest working voltage of the set of controller	According to the actual battery voltage adjustment undervoltage value
4	reserve	reserve	
5	electric motor overtemp	The electric motor's temperature more than set value	Check whether the temperature sensor is connected normally,
6	controller overtemp	The controller's temperature more than set value	Temperature of controller is too high, do the heat dissipation of the controller
7	reserve		
8	Instantaneous overcurrent	Phase current instantly over the over-current protect phase current	whether the setting of current ratio are accurate,higher protection phase current/lower maximum working phase current
9	overload	The phase current of controller is higher than the set value at a certain of time	
10	reserve		
11	save error	Setting the data saved error	turn off the power then open it and readjust the parameters parameter and save it
12	hall test fault	Maching the motor controller is hall fault	
13	hall fault	Motor hall fault	Checking the connection of controller' hall and motor's hall is normal
18	over speed		
20	block protection		
21	initialization error		Reset can elimete the error
25	power up no finished	Busbar voltage lower than undervoltage settings	Adjust the undervoltage value
26	brake		Brake state
27	anti-theft		Ati-theft state
28	backup		Backup state
29	brake protect		
30	runaway protection		Handle's voltage is abnormal,adjusting the voltage value of controller settings,or change the handle

Chapter 7 Contact Us

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