

WS-1 Brushless E-wheelchair control system

Operating rules, Instruction, Programming

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1. Brief

This is an innovative and intelligent controller for brushless e-wheelchair, making it possible for users to operate the wheelchair freely and steadily and to move in any direction. This brushless control system adopts the controller installed with programmable chip to realize the two brushless DC motors spinning at different speed and directions, thus making sure the wheelchair to move freely in any direction, also making the users to enjoy the power simply controlled by their fingers. WS-1 brushless e-wheelchair control system includes upper part and under parts, the upper part consists of joystick and button display, it controls the shifting of upper joystick and under drive CPU communication through a piece of CPU internal, the whole system is user-friendly and easy to learn. Brushless control system gains many advantages over brushed one: Higher efficiency, low noise, full capability for climbing, and much longer cycle life because of non carbon brush wearing.

Please read the manual carefully for better use of the controller. The instructions will guide you to operate correctly, making sure the reliability and safety of the brushless e-wheelchair.

This brushless e-wheelchair control system includes upper part and under part.

View for our E-wheelchair:



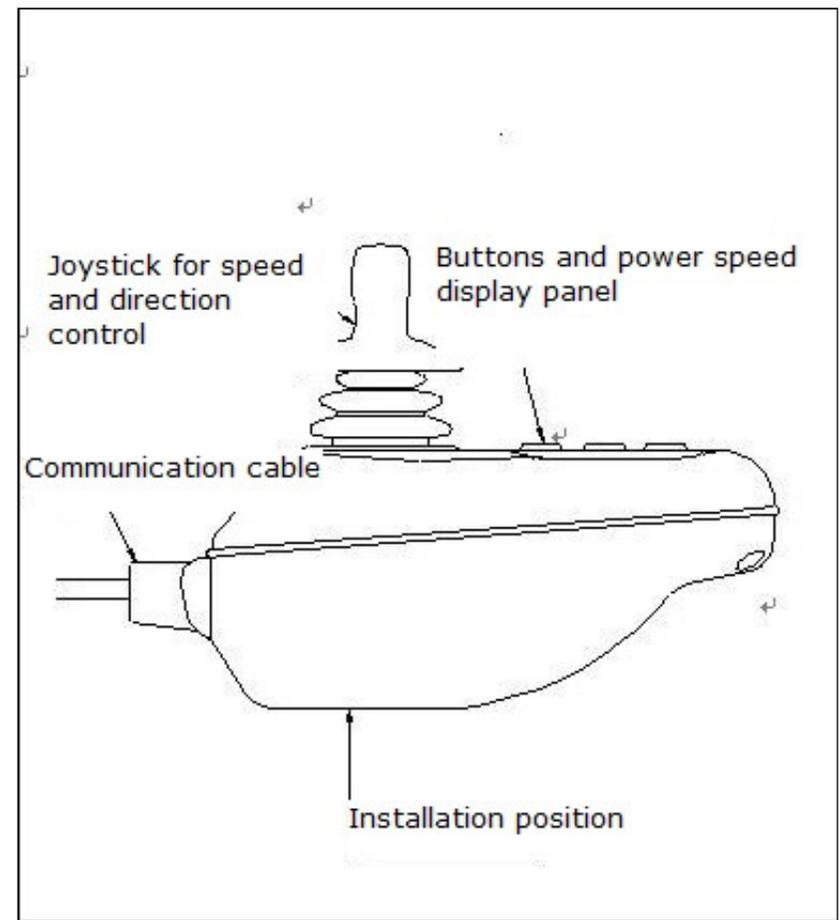
Appearance for this controller as below:



2. Matters to pay attention

2.1 Introductions for all parts of controller

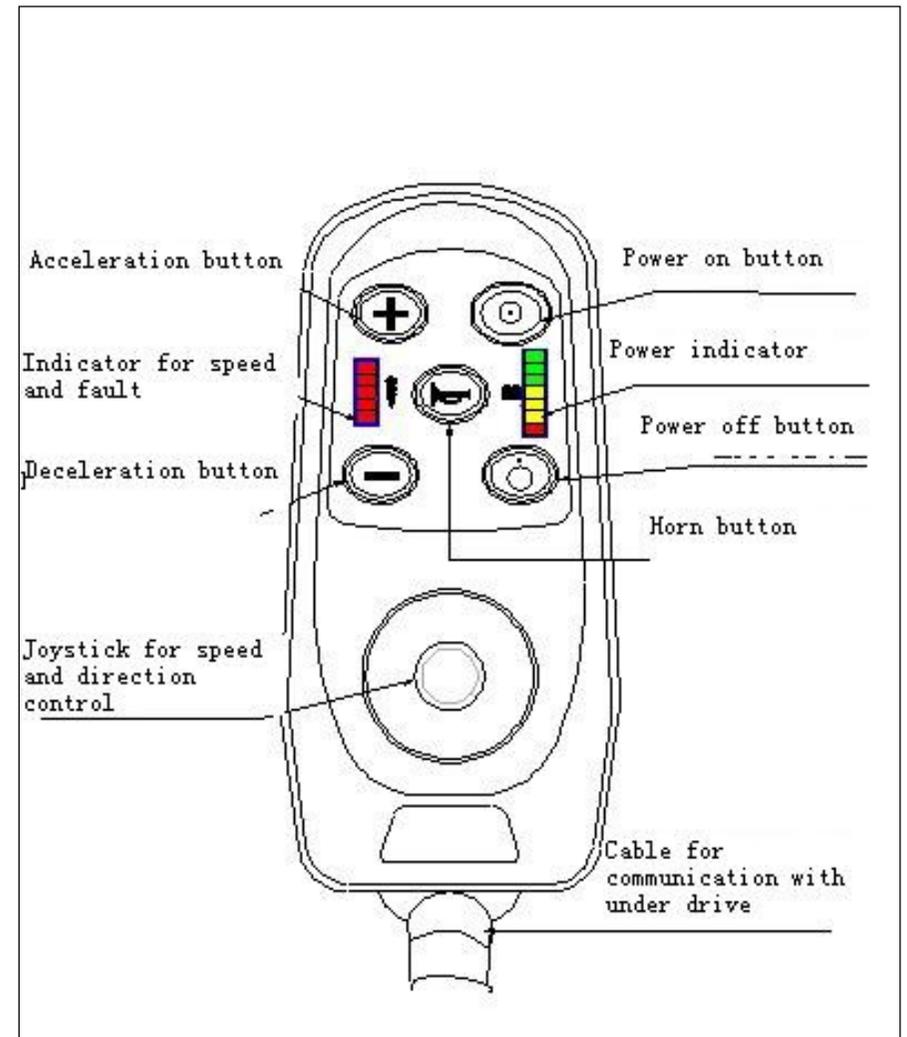
Image for upper controlling box:



2. 2 Avoid the controller from collision, especially the joystick. Do not collide the controller or joystick with obstacles when using it. Once running the wheelchair, make sure to prevent control system from collision. Do not pull the cable overly, in case it's broken.

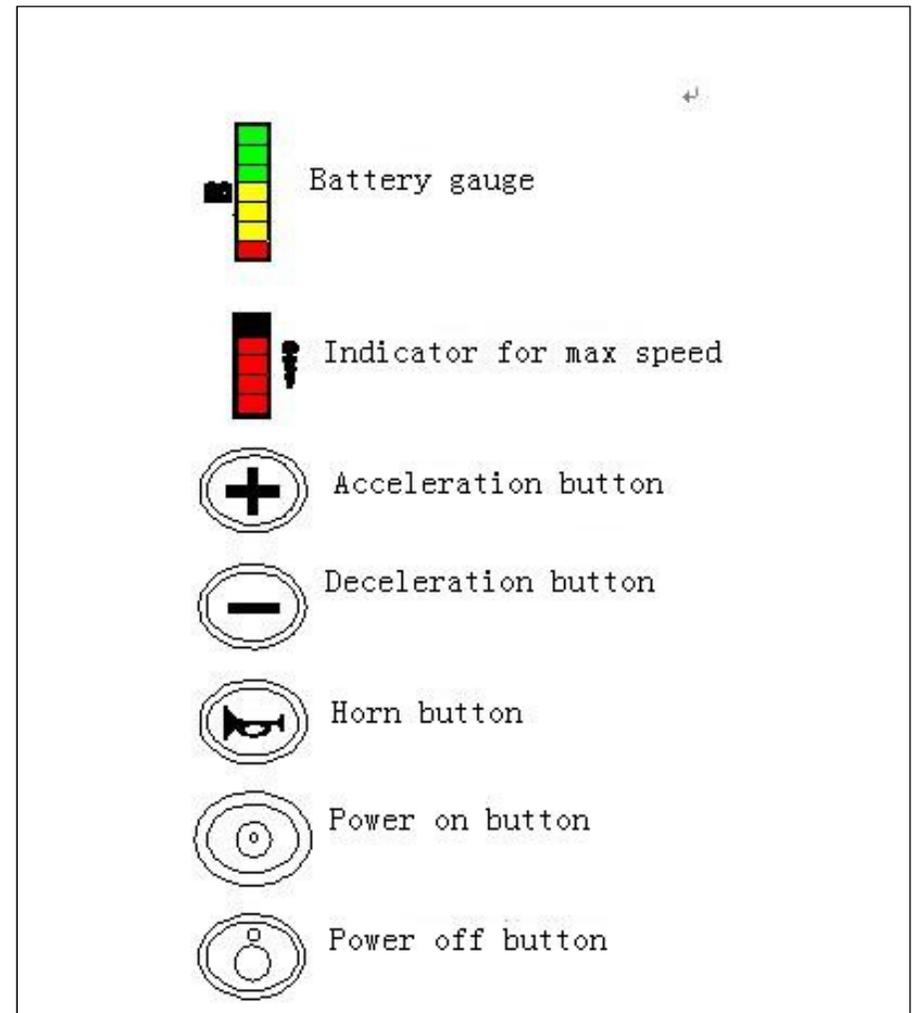
2. 3 The electric components of this control system are assembled with industrial machine parts, and are under aging treatment after accurate adjustment, thus making sure the e-wheelchair to work normally under various situation. However, the reliability of this control system will be improved if you avoid using it on extreme conditions. Please prevent the control system from water, or use it under environment of high humidity.

2.4 Introduction for all parts on control panel:



(Overlooking)

2.5 Introduction for buttons & display panel



3. Function introduction

3.1 Function of all buttons

Controller power is on when pressing "Battery on button", meanwhile, lights for "battery gauge" and "speed rank" are also on. The power will be off when pressing "Battery off button". Press "accelerate button" or "decelerate button" to adjust the speed of wheelchair. Press "horn button" to use the horn. Do not stop the motor by pressing "battery off button", or, the cycle life of the drive components will be shortened.

3.2 "battery gauge" will indicate whether the battery power is well connected and how much power available in the battery.

3.3 "speed grade display" includes five grades, all lights on indicates full speed, less lights on means lower speed limit. Meanwhile, the controller fault will be indicated when the lights flash intermittently.

3.4 Description for the flash of indicating light on control panel (fault indication):

 <p>1</p>	<p>No.1 red light flashing: low battery</p>
 <p>2</p>	<p>No.2 red light flashing: No signal for joystick</p>
 <p>3</p>	<p>No.3 red light flashing: Battery charging</p>
 <p>4</p>	<p>No.4 red light flashing: push the joystick to power on or motor disconnected</p>
 <p>5</p>	<p>Brake solenoid disconnected or damaged</p>

If above happens, please check the joint of related plug-in and cables, then the related components.

Evaluation of the battery power in wheelchair: The display window consists of seven lighting diodes, three are green, three are yellow, one is red. When the battery is full, seven lights will all be on, and they will be off gradually as the battery is decreasing, when all the lights are off except the red ones, battery is low, in the meantime, the No.1 light for " speed grade display" flashes intermittently to remind you to charge the battery.

**** Tips:** Do not drive the wheelchair when the battery is low, in case that it may bring you troubles outdoors, for example: Out of battery power in the middle of the road. We will take no responsibility for any loss caused by your ignorance of our warning.

4. Battery charging

Please insert the charger plug into socket to charge the battery. When the controller and charger are connected for the battery charging, do not drive the wheelchair.

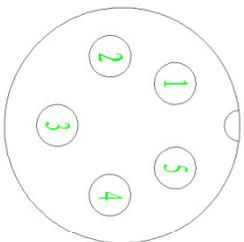
**** Tips 1:** make sure the charger fit in the right food pole of charging socket on controller. Or, it may cause fire or burn. We will take no responsibility for any loss caused by your ignorance of our warning.

**** Tips 2:** Please use the charger special for e-wheelchair to charge the battery. It may cause damage for battery, controller, charger, even cause overheating, fire or burning by improper use. We will take no responsibility for any loss caused by your ignorance of our warning.

5. Electrical specifications and parameters for product

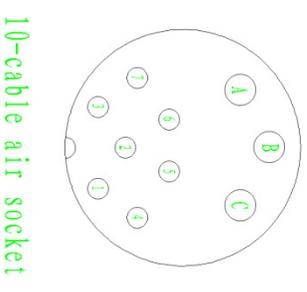
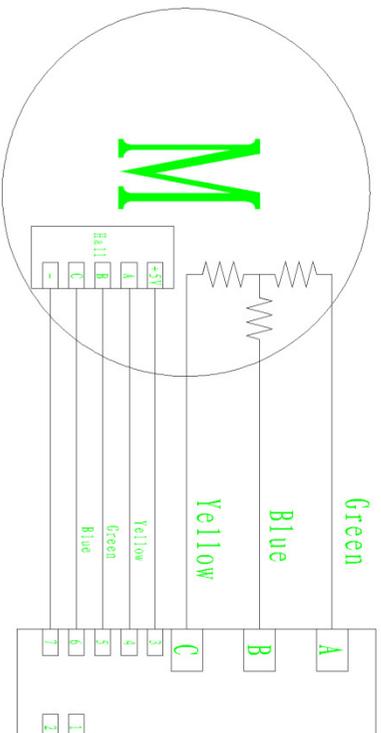
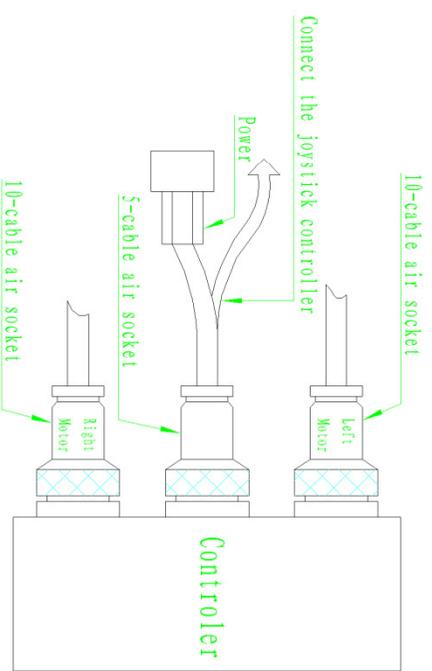
- **Supply voltage:** DC24V
- **Operating voltage:** DC18V ~ DC 28V
- **Peak voltage:** DC38V
- **PWM frequency:** 19.5KHZ ($\pm 1\%$)
- **Braking voltage:** DC 24V ~ DC 6V
- **Braking current:** Max 1A Min 0.1A (per unit)
- **Maximum charge current for battery:** 12A
- **Maximum drive current for motor:** 40A (two)
- **Operating temperature:** $-25^{\circ}\text{C} \sim +50^{\circ}\text{C}$
- **Storage temperature:** $-40^{\circ}\text{C} \sim +65^{\circ}\text{C}$
- **Humidity level allowed:** IPX4
- **EMC test already done to wheelchair**
- **Magnetic susceptibility:** 30V/m according to EN12184 and ANSI/RESNA
- **Electromagnetic radiation:** According to EN55022 B level
- **ESD: IEC801 section 2 ESD: IEC801**
- **Function: electronic reverse brake**
- **Function: Automatic detects for current cut by brake**

6. Wiring diagram for under drive:



Function
1 Power(+) (Red)
2 Setting/Charging(Blue)
3 Communication (Green)
4 Communication (-) (Black)
5 Power(-) (Black)

5-cable air socket



10-cable air socket

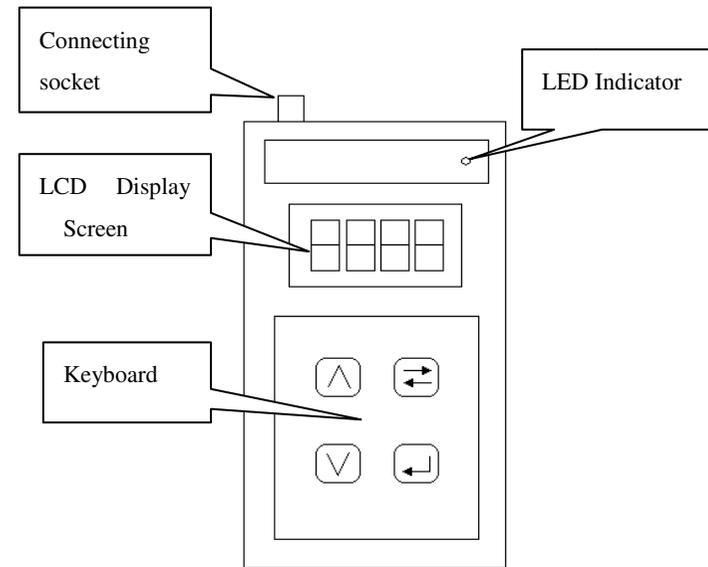
7. Programming

If you find it hard for the wheelchair to reach full speed or you are not satisfied with the hardness of start and stop, you may program the controller to meet your demand. You can use SC208 programmer especially designed by our company to realize it. SC208. SC208 is a handheld electronic devices, which can change the parameter of controller once connected with it. Your supplier will program parameters for the wheelchair according to your need. Please comply with the requirement below to re-program the controller, also put down the parameters changed by you for future reference.

**** Tips :** Programming should be proceeded by the professionals with in-depth understanding of WS-1 control system. Programming error may bring hidden dangers to use. We will take no responsibility for any loss if the setting parameters are changed without authorization.

7.1 Appearance and function of setter

7.1.1 Setter appearance as below:



Four buttons on the setter:

1. Up button  , add one number at every press
2. Down button  , reduce one number at every press
3. Shifting button  , switch selection
4. OK button  , save the setting parameters

7.2 Modify the parameters of brushless e-wheelchair by setter

Turn off the power, then insert one side of the connecting cable into air plug, and other side into the programming interface (the charger port), and then turn on the power.

The screen of setter will display 0-9 in order, menu option No.1 is displayed once completed. If it shows "1.1", left of the decimal point is menu item, right of the decimal point is parameters. When the menu option flashes, you can switch between menu option and parameter to choose the flicker bit by pressing shifting button. Press Up, Down button to change the flicker data. Press OK button to save your set for the parameter, if no need to save, you can press shifting button to back to menu options

Please turn off the power of controller and pull out the connecting cable after the programming is completed.

7.3 Description of menu options, including 14 options:

Option 1: Acceleration

Adjust the acceleration of e-wheelchair speed from slow to fast, setting rank: 1~5, greater the number is, faster will the acceleration be.

Option 2: Deceleration

Adjust the deceleration of e-wheelchair speed from fast to slow, setting rank: 1~5, greater the number is, faster will the deceleration be.

Option 3: Steering acceleration

Adjust the acceleration of e-wheelchair speed from slow to fast, setting rank: 1~5, greater the number is, faster will the acceleration be.

Option4: Steering deceleration

Adjust the deceleration of e-wheelchair speed from fast to slow, setting rank: 1~5, greater the number is, faster will the deceleration be.

Option 5: under-voltage

Adjust the under-voltage protection, setting rank: 1-5, it is 21V when the 24V controller is at the third grade, interval between each grades is 2V, the bigger the number is, the higher the under-voltage is.

Option 6: Reverse speed

Adjust the maximum speed of reverse driving, setting rank: 1-5, the bigger the number is the higher the reverse speed is.

Option 7: Maximum forward speed

Adjust the maximum forward speed of the wheelchair, setting rank: 1-5, the bigger the number is , the higher the maximum speed is.

Option8: Reverse driving tone setting

Set the reverse tone when reverse driving, setting rank: 0~1, 0: tone off, 1: tone on.

Option 9: Solenoid brake setting

Set the solenoid brake device to drive the wheelchair, setting rank 0~1, 0: wheelchair can be driven without solenoid brake, 1: wheelchair cannot be driven without solenoid brake, if this device cannot be detected, there will be alarm to forbid driving.

Option 10: Automatic shut down time for controller

In order to save the power, the power will be shut down automatically

if you do not operate the wheelchair for long time and forget to shut down the power, and the time to automatic shut down can be set, setting rank: 1-5, 10 minutes per rank. (For example: if you set it to third rank, time to automatic shut down is 30 minutes).

Option 11: Phase identification for brushless motor (left motor)

It's set to make the controller identify the phase of brushless motor correctly. Attention: the wheel to be set should be overhead when during the operation. This setting will be able to shift among six status of the motor, the phase state will be changed when pressing the up button, then push the joystick on upper control box, if the motor rotate in the same way of the pushing direction (pay attention that the motor rotate steadily with minimum current in the meantime), press the ok button. If the setting effect is not satisfying, try it again. (Actually we have set it for you at state 6, and if you change for new motor, you may follow the instructions above to set again)。

Option 12: Direction setting for brushless motor (left motor)

0: forward rotation, 1: reverse rotation.

Option 13: phase identification for brushless motor (right motor)

Completely be according to option 11.

Option 14: Direction setting for brushless motor (right motor)

0: forward rotation, 1: reverse rotation.

Option 15: Adjustment of speed deviation for left motor

(0: Original rate, 1-20: slow down gradually)

Option 16: Adjustment of speed deviation for right motor

(0: Original rate, 1-20: slow down gradually)

Option 17: Settings of release delay time for solenoid brake

(0: 0.5 seconds, 1: 1 second, 2: 1.5 seconds, 3: 2 seconds, 4: 2.5 seconds, 4:3 seconds)

7.3 Cautions for use

1. Make sure if your motor is installed with electromagnetic brake before setting (according to option 9), and please identify the motor phase (according to option 11 & option 13)
2. Cable connection must be operated under condition of power cut-off.
3. Do not press the button too hard.
4. Prevent the device from humidity and shock.