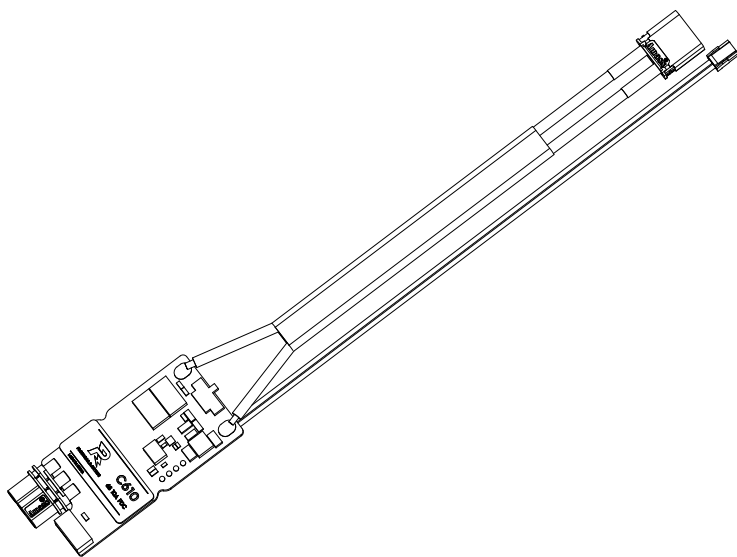# RoboMaster

C610 Brushless DC Motor Speed Controller

User Guide

v1.0   2019.03

ROBOMASTER

Disclaimer

Thank you for purchasing the ROBOMASTER™ C610 Brushless DC Motor Speed Controller (hereinafter referred to as "product"). Read the disclaimer carefully before using this product. By using this product, you hereby agree to this disclaimer and signify that you have read it fully. Install and use this product in strict accordance with the user guide. SZ DJI TECHNOLOGY CO., LTD. and its affiliated companies assume no liability for damage(s) or injuries incurred directly or indirectly from using, installing, or modifying this product improperly, including but not limited to using non-designated accessories.

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Warnings

1. Make sure that there are no short circuits and all the cables are correctly connected when using the speed controller.
2. The speed controller heats when the output power is too high. Handle carefully to avoid scalding.
3. Make sure the heat-shrink tubing is in good condition. Replace it when necessary.
4. The serial port and CAN port cannot be used simultaneously. Power off the speed controller, change to the port you want to use, and power on the speed controller again.
5. Make sure to use the speed controller in strict accordance with the Specifications section. Failure to do so may reduce the product service life or even lead to permanent damage.

Introduction

Using a 32-bit motor driver chip and field-oriented control (FOC), the RoboMaster C610 Brushless DC Motor Speed Controller enables precise control over motor torque. It is compatible with the M2006 P36 Brushless DC Gear Motor* to create a complete propulsion system. Users can configure and update the speed controller firmware using RoboMaster Assistant.

Features

• Provides CAN bus command control.
• Supports a maximum continuous current of 10 A.
• Quickly assigns ID numbers to all speed controllers connected to the CAN bus.
• Acquires the position and rotational speed information of the rotor via the CAN bus.
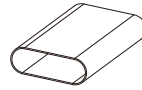
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* Refer to the M2006 P36 Brushless DC Gear Motor User Guide for more information about this product.

In the Box

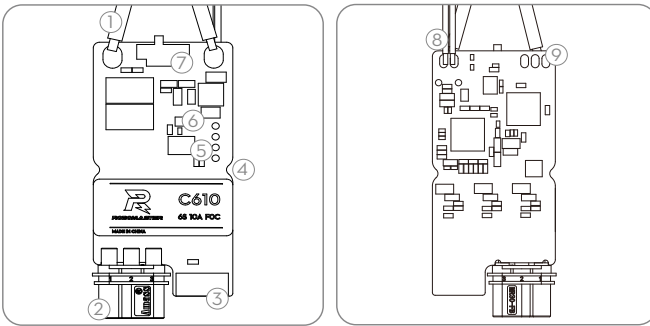C610 Speed Controller × 1
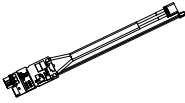
Heat-shrink Tubing × 1

Overview

C610 Brushless DC Motor Speed Controller

1. Power Cable
   Connects to a 24 V power supply to provide power for the speed controller.

2. 3-Phase Power Cable
   Connects to the 3-phase cable of the M2006 motor. Make sure the cables are securely connected.

3. 4-Pin Port
   Connects to the 4-pin cable of the M2006 motor to acquire position information of the rotor.

4. Securing Grooves
   There are two securing grooves on either side of the speed controller. Use M2 screws to secure the speed controller.

5. Set Button
   Configures the speed controller. Refer to Using the Set Button section for more information.

6. Status LED
   Indicates the speed controller's operating status. Refer to the Status LED Description section for more information.

7. CAN Terminal Resistance Switch

   Switch to ON or NC to connect or disconnect the 120 Ω terminal resistance, according to CAN bus wiring regulations and other relevant regulations.

8. CAN cable

   Receives the CAN controlling signal of the control panel. The bitrate of the CAN bus is 1 Mbps.

9. Serial Port

   Connects to a USB-to-serial converter by soldering. Connect the USB-to-serial converter to a computer to configure the parameters or update the firmware of the speed controller via RoboMaster Assistant.

⚠ When the CAN bus command control is in use, the information of the position and rotational speed of the rotor can be acquired. Make sure to consider the bandwidth of the CAN bus wire when it is in use.
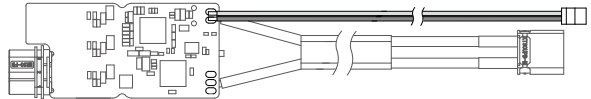
Serial Port

Side view:
RXD, TXD, and GND
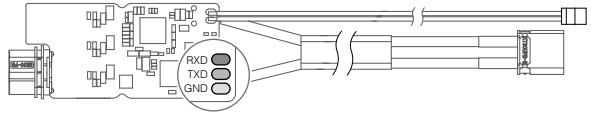
CAN Cable

Side view:
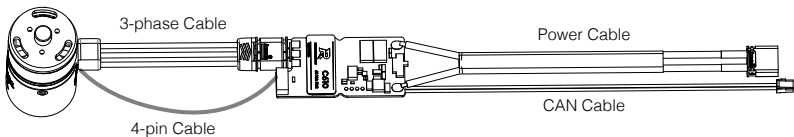Red (CAN_H) and black (CAN_L)

Connecting the Speed Controller

1. Connect the 4-pin cable of the motor to the 4-pin port on the speed controller.
2. Connect the 3-phase cable of the motor to the 3-phase port on the speed controller. Make sure the cables are correctly connected.
3. Connect the CAN cable to the CAN port on the control panel.
4. Connect the power cable to a power supply.

Dimensions
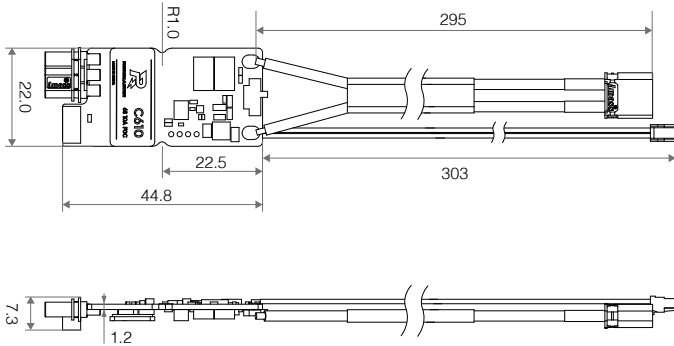
Unit: mm
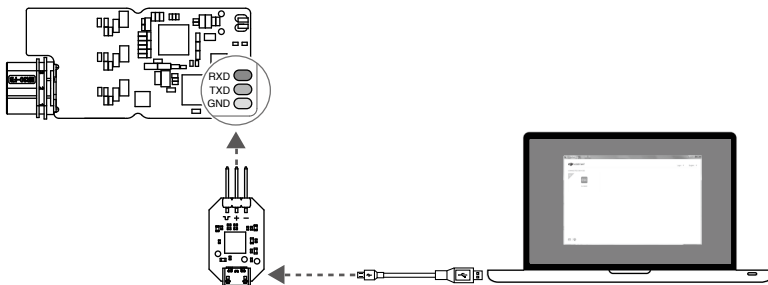
Securing the Speed Controller

There are two securing grooves on either side of the speed controller. The grooves have a diameter of 2 mm, and it is recommended to use M2 screws. The heat-shrink tubing must be cut in order for the M2 screws to pass through the grooves. DJI bears no responsibility for any damage caused to the heat-shrink tubing when it is cut.

Using RoboMaster Assistant

To configure the speed controller or update its firmware, use a Takyon Updater or a compatible USB-to-serial converter via RoboMaster Assistant.

⚠ The voltage of the USB-to-serial converter must be 3.3 V.

1. Download RoboMaster Assistant from the official RoboMaster website.
   https://www.robomaster.com/products/components/assistant
2. Connect the speed controller to the Takyon Updater by soldering, and connect the Takyon Updater to a computer. Make sure the PWM cable is correctly connected ("-" for GND, "+" for TXD and "⊓" for RXD). A USB-to-serial converter can be used in place of a Takyon Updater.

3. Connect the speed controller to a power supply.
4. Launch RoboMaster Assistant.
5. Click Settings to adjust parameters.
6. Click Firmware Update and select the version you want for the speed controller. RoboMaster Assistant will automatically download and update the firmware.

Status LED Description

The status LED is used to indicate the operational status of the speed controller. In situations where there is both a warning and an abnormal working condition, the LED only indicates the abnormal working condition. In situations that indicate multiple warnings or abnormal working conditions, the LED only indicates the warning or abnormal working condition that emits the least amount of blinks. Note that the speed controller automatically cuts off the output stream when it has detected an abnormal working condition.

Normal	Description
Blinks green x times every second	The number of blinks indicates the ID of the speed controller. The ID range is from one to eight.
Quick ID Setting	Description
Solid orange	Setting the ID of the speed controller.
Calibration	Description
Blinks green quickly	The speed controller is calibrating.
Warning	Description
Blinks orange twice every second	More than one speed controller connected to the CAN bus share the same ID.
Abnormal	Description
Blinks red once every second	The voltage of the power supply is too high (only detected in self-diagnosis when powering on.)
Blinks red twice every second	The 3-phase cable of the motor is not connected.
Blinks red three times every second	The 4-pin cable connected on the motor has lost signal.
Blinks red quickly	Motor calibration failed.

Warning Sound Description

When in use, the motor connected to the speed controller beeps to indicate the working status of the whole system.

Normal Sound	Description
Power-on music	The system is ready.
Abnormal Sound	Description
BB--BB--BB……	The motor stalls.
BBB--BBB--BBB……	The 4-pin cable connected on the motor has lost signal

Using the Set Button

1. Separate ID Setting

   Follow the steps below to assign a unique ID to each speed controller (from 1-8):

   a. Press the Set button once to activate separate ID assignment mode for the speed controller. Once the speed controller is in ID assignment mode, the status LED is powered off.

   b. Press the Set button again to assign an ID to each speed controller. The number of times you press the button is the ID of the speed controller. The status LED blinks orange each time the button is pressed.

   c. If the Set button is idle for three seconds, the speed controller automatically saves the ID entered. Restart the speed controller after assigning the ID.

   ⚠ Multiple speed controllers connected to the same CAN bus cannot share the same ID. Any speed controllers with the same ID will blink orange twice every second and cut off the output stream.

2. Quick ID Setting

   Follow the steps below to quickly assign an ID to all speed controllers connected to the CAN bus. A maximum of eight speed controllers can be connected.

   a. Make sure all speed controllers are working normally. Press the Set button on any speed controller once to activate separate ID assignment mode and then press and hold the Set button again until the status LEDs of all the connected speed controllers turn solid orange. All the speed controllers will automatically be assigned an ID.

   b. The ID of each speed controller will be assigned based on the order you turn the M2006 rotors. Turn each M2006 rotor at least 180° in either direction in the order you wish to assign the ID. Restart the speed controllers after assigning IDs.

   ⚠ If the M2006 rotor is not turned, the speed controller saves the original ID that it received after powering on. The speed controller stops working if the speed controller shares the same ID with another speed controller connected to the same CAN bus.

   Make sure to connect or disconnect the terminal resistance according to the CAN bus wiring and relevant regulations. Otherwise, the CAN Bus communication may not work properly.

3. M2006 Calibration

   After the speed controller and motor are connected and powered on, calibrate the motor to make sure it is working properly.

   a. Press and hold the Set button. Release when the status LED starts to blink green quickly.

   b. The motor will begin calibration. When calibration is complete, the motor stops rotating.

   ⚠ Calibrate the motor before using for the first time or when the motor or the speed controller has been changed in the system. It is recommended to calibrate the motors without a payload. The motor continues to rotate during calibration. DO NOT touch the motor during calibration. If calibration fails several times, replace the motor.

CAN Communication Protocol

1. Speed Controller Receiving Message Format

The two identifiers (0×200 and 0×1FF) control the current output of each of the four speed controllers by ID. The controllable current range is -10000 ~ 0 ~ 10000. The corresponding speed controller output torque current range is -10 ~ 0 ~ 10 A.

Identifier : 0×200   Frame type : Standard
Frame format : DATA   DLC : 8 Bytes

Data Field	Description	Speed Controller ID
DATA[0]	Controls the current value in higher order byte (8 bits)	1
DATA[1]	Controls the current value in lower order byte (8 bits)	
DATA[2]	Controls the current value in higher order byte (8 bits)	2
DATA[3]	Controls the current value in lower order byte (8 bits)	
DATA[4]	Controls the current value in higher order byte (8 bits)	3
DATA[5]	Controls the current value in lower order byte (8 bits)	
DATA[6]	Controls the current value in higher order byte (8 bits)	4
DATA[7]	Controls the current value in lower order byte (8 bits)	

Identifier : 0×1FF   Frame type : Standard
Frame format : DATA   DLC : 8 Bytes

Data Fields	Description	Speed Controller ID
DATA[0]	Controls the current value in higher order byte (8 bits)	5
DATA[1]	Controls the current value in lower order byte (8 bits)	
DATA[2]	Controls the current value in higher order byte (8 bits)	6
DATA[3]	Controls the current value in lower order byte (8 bits)	
DATA[4]	Controls the current value in higher order byte (8 bits)	7
DATA[5]	Controls the current value in lower order byte (8 bits)	
DATA[6]	Controls the current value in higher order byte (8 bits)	8
DATA[7]	Controls the current value in lower order byte (8 bits)	

2. Speed Controller Sending Message Format

The format in which the speed controller sends feedback data to the CAN bus. Identifier is determined by 0×200 + speed controller ID. For example, if the speed controller ID is 1, the identifier of that speed controller is 0×201.

Frame type : Standard   Frame format : DATA   DLC : 8 Bytes

| Data Fields	Description	Data Fields	Description
DATA[0]	Controls the rotor mechanical angle in higher order byte (8 bits)	DATA[4]	Actual torque current in higher order byte (8 bits)
DATA[1]	Controls the rotor mechanical angle in lower order byte (8 bits)	DATA[5]	Actual torque current in lower order byte (8 bits)

DATA[2]	Controls the rotational speed in higher order byte (8 bits)	DATA[6]	Null
DATA[3]	Controls the rotational speed in lower order byte (8 bits)	DATA[7]	Null

Sending frequency: 1 KHz by default (can be changed using RoboMaster Assistant)

Rotor mechanical angle value range: 0 ~ 8191 (corresponding mechanical angle range: 0 ~ 360°)

Rotor speed value unit: rpm

Performance Diagram (Using M2006 Motor)
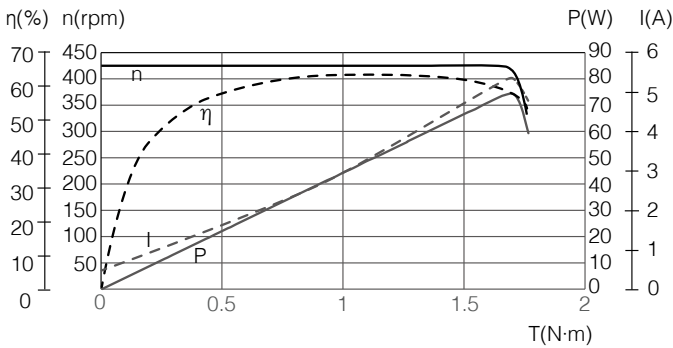
η – Electrical Efficiency, T – Torque, I – Current, P – Output Power, n – Rotational Speed

The data above was collected in a laboratory setting with an input voltage of 24 V, at the temperature of 25° C (77° F), and under normal dissipation conditions. These figures should be used for reference only. Make sure to use the speed controller in accordance with the actual working environment and consider working conditions such as working temperature and dissipation.

Specifications

Rated Voltage (DC)	24 V	Weight	17 g
Max Allowable Current* (continuous)	10 A	Dimensions	50×22×7.3 mm (L×W×H)
CAN Bus Bitrate	1 Mbps	Operating Temperature Range	0–55° C (32–131° F)

* Tested at a temperature of 25°C (77° F) in well-ventilated laboratory conditions.

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