

Instruction Manual

Warning: you must initialize your motor module through the IQ Control Center before use

1 Power and Communication Setup

- Power
 - Use an XT60 connector to connect to your battery or power supply
- Communication
 - Use a JST-GH 4 connector for UAVCAN communication
 - Use a 3 pin 0.1" header connector for UART and PWM protocols (standard PWM, DShot, etc.)

2 Module Settings

- Download the IQ Control Center (user interface)
 - Go to www.iq-control.com/support
 - Click the link provided on the Control Center page. This will direct you to our GitHub page.
 - Download the Windows/Mac/Linux version according to your operating system
 - Proceed through installation
- Connect your module (see section 6 for specific details)
 - Make sure the module is disconnected from any application and does not have propellers attached
 - Plug USB to UART chip into computer
 - Plug/solder communication wires to the above device
 - Plug/solder power wires to a power source (must be between 12V and 48V)
 - In the top right of the IQ Control Center interface, select the correct com port. Note: you may need to install appropriate drivers.
 - Click the “Connect” button. If successful, the interface will say “Motor Connected Successfully” in the top message bar. If unsuccessful, it will give you an error message.
- Set module application values
 - At the top of the General tab, you can upload specific settings for your application
 - If your application is in the list, select it and click “Set”
 - * There are many options for the speed modules, including pre-made settings for velocity mode, voltage mode, and PWM mode
 - * Currently, the only pre-made setting for the position module is the factory default
 - If your application is not in the list or you prefer to change settings yourself, you’ll have to change settings manually

- Navigate to the General, Tuning and Advanced tabs to change specific module settings
 - All users should visit the “General” tab before using their module
 - Change module settings to desired value or mode, if necessary
 - Click the “Save” button next to a changed setting to update it on the module
 - * Any unsaved, changed setting will have a * appear next to the parameter name
 - * To revert to the value currently on the motor, click the ”Check Saved Value” button
 - **WARNING: exercise extreme caution when changing values in the Advanced tab. A bad setting may result in a motor being permanently damaged or cause erratic behavior**

3 Drone Setup

- Prior to connecting the modules to your drone, open the IQ Control Center to initialize (see section 2)
 - Set appropriate module settings using the pre-made settings at the top of the IQ Control Center General tab (see section 7) or set your own
 - Set module direction (this includes both CW vs. CCW and 2D vs. 3D mode)
 - Set FC mode (2D vs. 3D). If FC is using dshot and in 3D mode, set this value to 3D. Otherwise set this to 2D.
 - If using UAVCAN, set your UAVCAN Node ID and Node Index
 - If necessary, set motor PID gains in the Tuning tab. In most cases, the default values are satisfactory.
- Configure your flight controller to be compatible with IQ modules
 - Open your flight controller’s user interface
 - Enable Air Mode
 - * This prevents the motor from shutting off at minimum throttle
 - * **WARNING: you may see integrator wind up when the vehicle is on the ground depending on your FC and settings**
 - Lower motor idle throttle (optional)
 - * IQ motors do not require an idle throttle value
 - * If you set this to 0, the motors will not spin when the FC is armed
 - Change other FC settings as you would normally
- Fasten the modules to your drone’s frame with the provided mounting screws. **WARNING: using mounting screws that are too long will damage the motor. See the datasheet for details.**
- Solder/plug in the power wires to the power distribution board
- Solder/plug in the communication wires to the flight controller
- When using an analog protocol (1-2ms standard, OneShot125, OneShot42, MultiShot) you will need to calibrate the ESCs. See your FC’s instructions for the procedure.

- Arming Procedure
 - If this is your first time setting up the vehicle, do this without props to test motor settings
 - Arm your FC normally
 - The motors will only arm once throttle is in the appropriate place
 - * 2D mode - motors arm at minimum throttle (throttle stick all the way down)
 - * 3D mode - motors arm at mid throttle (throttle stick in the middle)
 - The motors will play the arming tune and spin slowly
 - Once you've tested motor settings, disarm your FC
- Add the propellers (see section 4)
- Repeat the arming process and fly!
- **WARNING: if your motors are hot after a short hover test, decrease PD gains and lower the filter frequencies on your FC.**

4 Propeller Setup

- Insert the centering feature
- Place the propeller over and around the centering feature
- Place the top mount over the propeller and screw in the top mount and propeller to the rotor with the screws supplied with your propeller
- Note: centering tool, mount, and screws not provided with IQ module as they are usually supplied with the propeller

5 Position Application Setup

- Before connecting the module, download the firmware that is appropriate for your application (see section 8)
 - The servo position firmware accepts standard PWM, OneShot, MultiShot, and DShot inputs as well as IQ's UART protocol and can operate in position, velocity, voltage, or PWM mode
 - The step/direction firmware mimics a stepper motor with one line as step (TX/Telem), and the other line as the direction (RX/PWM)
- Open the IQ Control Center to initialize (see section 2)
 - If your application involves a rotation to linear conversion, change the conversion factor to meters per radian in the General tab
 - In the Tuning tab, Set initial position, PID gains, etc.
 - In the Advanced tab, Set safety features, such as timeout and max angular speed
- Connect your module's power wires to a power source (between 12V and 48V)

- Connect your communication wires to your arduino, computer, etc.
- Mount your module to the application
- If communicating over UART, use the IQ libraries (available at www.iq-control.com/support) to send commands to your module*

**For more detailed instructions on communicating with the modules, refer to the ReadTheDocs page at <https://iqmotion.readthedocs.io/>*

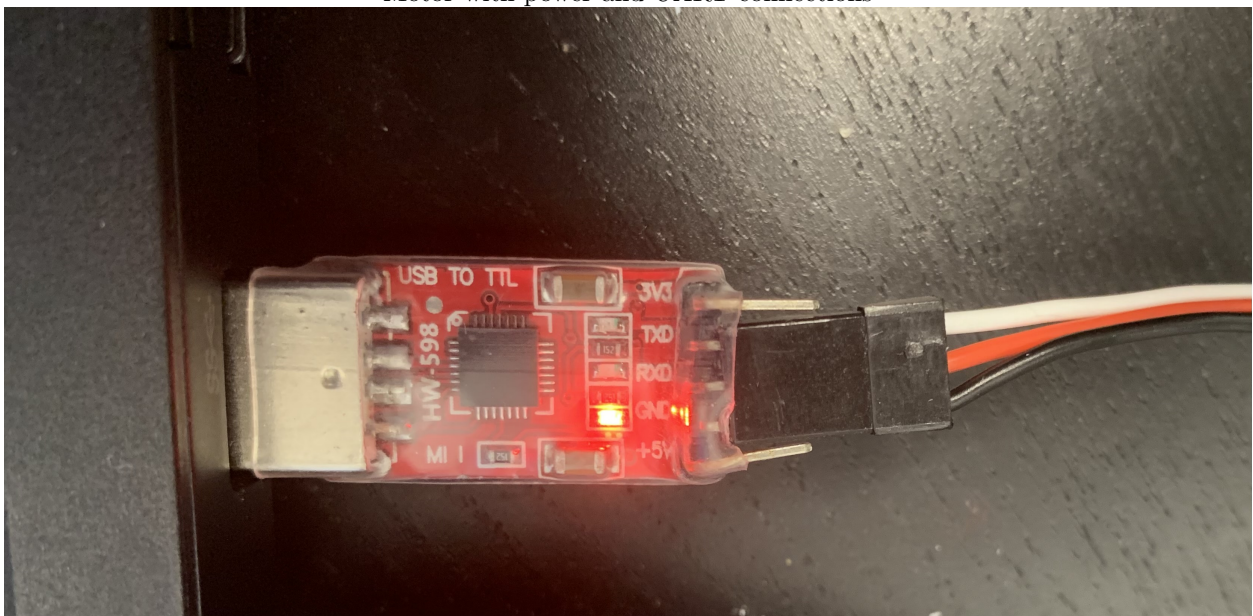
6 Connect Computer via USB to UART

This is the recommended method for communication.

- Connect your FTDI, CP2102, CP2104 or similar device to USB
- Using jumper wires connect (see images below):
 - The GND of your USB to UART device to the GND (black) wire on the motor
 - The TX of your USB to UART device to the RX (white) wire on the motor
 - The RX of your USB to UART device to the TX (red) wire on the motor



Motor with power and UART connections



FTDI chip plugged into computer

7 Pre-Made Application Settings

- These pre-made settings were designed to give users maximum performance in their specific application
- Settings Description: Speed Module
 - speed_factory_default - factory default, unconfigured
 - T-Motor 26x8.5R - settings for velocity (closed-loop) mode using a T-Motor G26x8.5R (right-handed) propeller
 - T-Motor 28x9.2R - settings for velocity mode using a T-Motor NS28x9.2R (right-handed) propeller
 - T-Motor 30x10R - settings for velocity mode using a T-Motor NS30x10R (right-handed) propeller
 - PWM Mode - use any propeller as you would with a standard motor/ESC, PWM (open-loop) mode
 - 12s_empty - voltage mode, motor will run as if it is running an empty 12S battery
 - 12s_full - voltage mode, motor will run as if it is running a full 12S battery
 - 6s_empty - voltage mode, motor will run as if it is running an empty 6S battery
 - 6s_full - voltage mode, motor will run as if it is running a full 6S battery

Tip: The defaults for specific props allow you to run the motor in velocity (closed-loop) mode for maximum performance. If you're unable to do this, we suggest using PWM mode as you would with a standard motor/ESC or one of the voltage modes

- Settings Description: Position Module
 - position_factory_default - factory default, unconfigured
- Make your own pre-settings (for advanced users)
 - Locate and open the IQ Control Center's "resources" folder
 - Open the "defaults" folder
 - Here you will see all of the .json files that correspond to the GUI's pre-made settings list
 - Create your own file by copying one of the factory default .json files and renaming it
 - In that new file, you can change the parameter values. Save this file once you're done editing.
 - Quit out of and reopen the IQ Control Center
 - Your new setting should now appear in the list of pre-settings in the General tab

8 Flashing New Firmware

Download Firmware

- Go to: www.iq-control.com/products
- Navigate to your product
- Select and download your desired firmware (.bin file)

Flash Firmware

- Disconnect motor from your application and remove props
- Open the IQ Control Center and connect your module (see section 2 for download instructions)
- Navigate to the “Firmware” tab
- Click the “Select Firmware Binary (.bin)” button
- Navigate to and select the “.bin” file that you downloaded
- Keep the motor plugged in and select the “Flash” button
- **WARNING: The flashing process takes a number of seconds. Do not unplug power or communication while the motor is flashing as this could lead to a bricked or difficult to recover motor.**

9 Safety Instructions

- IQ motor modules and the machines they actuate can be dangerous and cause bodily harm. Please use caution when working with motors.
- Plugging the power wires from the battery into the module incorrectly can cause a spark or a fire. This will result in damage to the motor, controller, and other vehicle components, and may cause bodily harm.
- Please keep hands and fingers clear of the motor and machine during operation.
- While spinning the module with a propeller, please keep a safe distance and use appropriate eye and ear protection. Contact with a spinning propeller can cause severe bodily harm. Always disarm all motors before approaching your vehicle.
- Please exercise caution when changing motor settings and PID gains. In particular, disabling or changing built-in limits (e.g. temperature limit, max current limit, velocity redline, etc.) can be dangerous and cause irreparable damage to the module.
- The modules may get hot during operation. Do not touch a module immediately after operation as it may cause a burn.
- While piloting a drone, please follow all federal and local regulations regarding the operation of Small Unmanned Aircraft Systems.

10 Revision History

Table 1: Revision History

Version	Date	Changes
1.0	2021-10-25	Initial Version