IQ2306 Position Module

1 Features
- Low power position control
- Precise to 0.022°
- 4.8% more shaft power than same sized motors
- Built-in minimum jerk trajectory generator
- Multi-turn position control with tunable PID
- Voltage controller
- PWM controller
- Coast and brake modes
- No minimum speed
- Built-in linear motion conversion
- Silent motion
- Immediate reversibility
- Backdrivable
- Regenerative braking
- Active freewheeling
- Current limiter
- Temperature limiter
- Serial (UART) w/ access to control parameters
  - (Optional) 1-2ms PWM
  - (Optional) Oneshot (42, 125)
  - (Optional) MultiShot
  - (Optional) DShot (150-1200) (autodetect)
  - (Optional) Step/direction input
  - (Optional) Anticogging torque ripple reduction

2 Applications
- Robotics
- Gimbals
- CNC machines
- 3D printers
- Laboratory devices
- Automated manufacturing machinery
- Haptic devices
- Hobby/Maker devices

3 Description
The IQ2306 Position Module is an integrated motor and controller with a wide range of position based applications. Its performance is comparable to or better than other 2306 sized (NEMA 11, 28mm stepper) motors and can operate at any speed between -4,800 and 4800 RPM thanks to its sensored control. Its closed-loop PID controller tracks targets across multiple revolutions, making it ideal for applications with transmissions, both rotary and linear. This sits on top of a voltage controller, which compensates for varying input voltages. Finally, the core is a raw PWM controller. Any of the above controllers can be used by the user. The IQ2306 Position Module has a built-in rotary to linear calculation converter, which allows the user to communicate to the firmware in native linear units. The onboard minimum jerk trajectory generator with 32 segment queue produces smooth, human-like motions with minimal computation and communication overhead from the application controller.

1 Estimated, ±20%
4 Motor Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed Constant</td>
<td>$K_v$</td>
<td>180</td>
<td>RPM/V</td>
<td></td>
</tr>
<tr>
<td>Torque/EMF Constant</td>
<td>$K_t$</td>
<td>0.053</td>
<td>N m A$^{-1}$</td>
<td></td>
</tr>
<tr>
<td>Resistance</td>
<td>$R$</td>
<td>4.7</td>
<td>Ω</td>
<td>25°C</td>
</tr>
<tr>
<td>Mass</td>
<td>$m$</td>
<td>37.4</td>
<td>g</td>
<td>Without wires/accessories</td>
</tr>
<tr>
<td>Continuous Torque</td>
<td>$\tau_c$</td>
<td>65</td>
<td>N mm</td>
<td>25°C ambient</td>
</tr>
<tr>
<td>Continuous Torque</td>
<td>$\tau_c$</td>
<td>130</td>
<td>N mm</td>
<td>In airflow, 25°C ambient</td>
</tr>
<tr>
<td>Continuous Current</td>
<td>$I_S$</td>
<td>1.3</td>
<td>A</td>
<td>Motor current, 25°C ambient</td>
</tr>
<tr>
<td>Continuous Current</td>
<td>$I_S$</td>
<td>2.5</td>
<td>A</td>
<td>Motor current, in airflow, 25°C ambient</td>
</tr>
<tr>
<td>Pulsed Current</td>
<td>$I_{SP}$</td>
<td>5.3</td>
<td>A</td>
<td>Maximum supply voltage limited</td>
</tr>
<tr>
<td>No Load Speed</td>
<td>$\omega_0$</td>
<td>199</td>
<td>rad s$^{-1}$</td>
<td>@$V_{CC} = 10$ V</td>
</tr>
<tr>
<td>No Load Current</td>
<td>$I_0$</td>
<td>0.02</td>
<td>A</td>
<td>@$V_{CC} = 10$ V</td>
</tr>
</tbody>
</table>

5 Electrical Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Symbol</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>$V_{CC}$</td>
<td>5</td>
<td>25.2</td>
<td>V</td>
<td>Designed for 2S-6S LiPo, use with caution on 6S</td>
</tr>
<tr>
<td>Digital Logic Voltage</td>
<td>$V_L$</td>
<td>-0.3</td>
<td>7.3</td>
<td>V</td>
<td>3.3 V system, 5 V tolerant</td>
</tr>
<tr>
<td>Temperature</td>
<td>$T$</td>
<td>-20</td>
<td>105</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

6 Electrical Interface

![JR Servo Communication Connector](image)

Figure 1: JR Servo Communication Connector
6.1 Communication Wiring

The standard communication connector is a JR type servo connector with 15cm of wire. These connectors have 0.1in spacing and can be inserted into standard perfboard and breadboards with a 3x1 0.1in male-to-male header. Black is minus (ground). Red is motor controller TX (host RX) and telemetry output. White is motor controller RX (host TX) and pwm input.

6.2 Supply Wiring

Power is transmitted to the IQ2306 Position Module via the two supplied 16 AWG (1.31 mm²), silicone encased, 15cm long wires. Black is minus (ground). Red is positive.
7 Mechanical Interface
8 Motor Performance

Motor Performance @ 1V Commanded

Motor Performance @ 3V Commanded
Motor Performance @ 18V Commanded

Motor Performance @ 21V Commanded