

User Manual: NexBot Robotics STP113-004 NEMA 23 Stepper Motor 3.0 Nm

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1. Safety Information

READ ALL SAFETY INSTRUCTIONS BEFORE OPERATION. Failure to follow safety procedures may result in serious injury or equipment damage.

DANGER: Risk of lethal electric shock. Always disconnect and lock out main system power before wiring or servicing the motor. Capacitors in the driver can store a dangerous charge even after power is removed.

WARNING: Motor surfaces can exceed 80°C (176°F) during operation, creating a burn hazard. Do not touch the motor until it has had adequate time to cool down.

WARNING: The motor can produce rapid, high-torque motion. Keep hands, hair, clothing, and tools away from the shaft and any connected mechanisms to prevent entanglement and serious injury.

CAUTION: Do not strike or apply excessive axial or radial force to the motor shaft. This can damage the internal bearings and encoders, leading to premature failure.

NOTICE: The STP113-004 motor is rated IP40. It is not protected against ingress of water, oils, or other liquids. Ensure it is installed in a clean, dry environment to prevent damage.

2. Product Overview

The NexBot Robotics STP113-004 is a high-performance two-phase hybrid stepper motor engineered for precise, repeatable motion control in industrial automation and robotics applications. This motor provides a robust solution for tasks requiring accurate positioning and high torque in a compact NEMA 23 frame. At its core, the STP113-004 delivers a substantial holding torque of 3.0 Nm, enabling it to reliably drive loads and overcome resistance without losing steps. This high torque-to-size ratio is critical for applications such as automated assembly, material handling, and positioning auxiliary axes on robotic workcells. The motor operates with a standard 1.8° step angle (200 steps per revolution), which provides the fine resolution needed for tasks demanding high accuracy. This precision ensures that components are placed correctly and processes are executed with minimal error, contributing to higher overall product quality and system throughput. The motor's construction is optimized for durability and long service life in demanding industrial environments. It features a laminated steel stator and an optimized rotor design to maximize torque output and efficiency while minimizing detent torque for smoother microstepping performance. Housed in a rugged casing with aluminum end caps, it is rated at IP40, providing protection against solid objects larger than 1mm. Its standard NEMA 23 mounting flange (57.2 x 57.2 mm) simplifies mechanical integration, allowing for direct installation into new designs or as a replacement component in existing machinery. Designed for operational flexibility, the STP113-004 is compatible with a wide range of industry-standard microstepping motion control systems and operates effectively within a 24-48VDC voltage range. Proper heat dissipation is recommended to maintain optimal performance during continuous high-load operation. This stepper motor is an ideal component for system integrators and maintenance teams seeking a dependable and precise motion solution for smaller robotic systems and automated equipment.

3. Getting Started

1. Product Overview

The NexBot Robotics STP113-004 is a two-phase, hybrid NEMA 23 stepper motor providing 3.0 Nm of holding torque. It is engineered for open-loop positioning systems requiring high precision and reliability. It operates on a 24-48VDC power supply with a compatible stepper motor driver.

2. Principle of Operation

This motor moves in discrete angular steps by sequencing current through its internal electromagnetic coils. The position is determined by the number of electrical pulses sent from a controller to the driver. This allows for precise positioning without the need for a feedback sensor in most applications.

3. Driver and Power Supply Selection

For optimal performance, pair the STP113-004 with a microstepping driver capable of supplying its rated phase current. The power supply voltage should be between 24 and 48VDC; a higher voltage generally results in better torque at higher speeds. The power supply must be rated to handle the current requirements of the entire system.

4. Operation

Torque and Speed

The specified 3.0 Nm torque is the holding torque at zero speed. As rotational speed increases, the available dynamic torque decreases. Consult the torque-speed curve in the product datasheet to ensure the motor provides sufficient torque for your application's target speed.

Tip: Using a higher supply voltage (e.g., 48VDC instead of 24VDC) will flatten the torque curve, providing more usable torque at higher speeds.

Microstepping

Microstepping electronically divides each full step into smaller increments, resulting in smoother rotation, lower noise, and higher resolution. While this can reduce vibration, it may also slightly reduce torque compared to full-stepping. A setting of 1/8 or 1/16 microstepping is a common choice for a good balance of performance.

Managing Resonance

All stepper motors have natural resonant frequencies where vibration and noise may increase, potentially causing missed steps. This can often be mitigated by avoiding these speed ranges, increasing the microstepping resolution, or using a driver with built-in electronic damping or anti-resonance features.

Tip: Adding a small amount of mechanical friction or inertia (a damper) to the system can also help break up resonant harmonics.

Thermal Considerations

The motor converts electrical energy into mechanical motion, with some energy lost as heat. It is normal for the motor to become hot during operation. To prevent overheating, ensure the motor is mounted on a surface that can act as a heatsink and maintain adequate airflow around the motor body.

Tip: Utilize the 'idle current reduction' feature on your stepper driver, which automatically lowers the current to the motor when it is stationary for an extended period, significantly reducing heat generation.

5. Maintenance Schedule

Interval	Task	Notes
Weekly	Visual Inspection	Check the motor for any buildup of dust or debris. Inspect lead wires for signs of wear or damage.
Monthly	Clean Motor Casing	Wipe the motor body with a dry, lint-free cloth to ensure optimal heat dissipation. Do not use solvents or liquid cleaners.
Quarterly	Check Mounting Hardware	Verify that the motor's mounting screws are secure and have not loosened due to vibration. Re-torque if necessary.

Interval	Task	Notes
Quarterly	Inspect Electrical Connections	Ensure that all wire connections at the driver terminal are tight and free of corrosion or discoloration.
Annually	Verify Mechanical Coupling	Inspect the shaft coupler for any signs of wear, backlash, or misalignment. Adjust or replace as needed to prevent stress on the motor bearings.
As Needed	Bearing Inspection	The bearings are sealed and lubricated for life. If audible noise (grinding, whining) or excessive vibration develops, the bearings may be worn and require motor replacement.

6. Troubleshooting

Symptom	Possible Cause	Solution
Motor hums but does not rotate.	One motor phase is disconnected; load is too high or jammed.	Power down and check all four motor wire connections. Disconnect the load and test the motor independently to rule out a mechanical jam.
Motor stalls or loses steps during operation.	Acceleration is too high; driver current is too low; load exceeds torque capacity at operating speed.	Reduce the acceleration/ deceleration values in the controller. Increase the driver current (do not exceed motor rating). Verify the load requirement against the motor's torque-speed curve.
Motor rotates in the wrong direction.	Wiring for one phase is reversed; 'direction' logic is inverted.	Power down and swap the two wires for one of the motor phases (e.g., swap A+ and A-). Alternatively, invert the direction signal in the control software.
Motor is excessively noisy and vibrates heavily.	Operating at a resonant speed; mechanical misalignment.	Change the operating speed to move out of the resonant zone. Increase the microstepping resolution on the driver. Check and correct the alignment between the motor shaft and the load.
Motor overheats quickly.	Driver current setting is too high; poor ventilation or heat sinking.	Verify the driver current is set to match the motor's rated current. Ensure the motor has adequate airflow and is mounted to a thermally conductive surface.
Motor has weak torque.	Driver current is set too low; incorrect motor wiring (e.g., series vs.	Increase the driver current setting to the correct value. Confirm the wiring scheme

Symptom	Possible Cause	Solution
	parallel on an 8-wire motor); insufficient power supply voltage.	matches the motor datasheet. Ensure the power supply is providing a stable voltage within the 24-48VDC range.
Motor moves erratically or twitches.	Electrical noise on step/direction signal lines; loose connection.	Use shielded cables for control signals and ground the shield at one end. Power down and re-seat all connections between the controller, driver, and motor.

7. Technical Specifications

Parameter	Value	Unit
Weight	1.2	kg
Material	Laminated Steel / Aluminum End Caps	
Voltage	24-48VDC	
IP Rating	IP40	
Country of Origin	JP	
Dimensions	57.2 x 57.2 x 113 mm	
Torque	3.0 Nm	