User Manual: NexBot Vision STP113-003 Stepper Motor 3.0 Nm

SKU: NXB-SRV-STP113-003 | Version: 1.0 | Brand: NexBot Robotics

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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 fatal electrical shock. Always disconnect and lock out main power before wiring or servicing the motor or driver.

WARNING: The motor housing can reach temperatures exceeding 80°C (176°F) during operation, posing a severe burn risk. Allow the motor to cool completely before touching.

WARNING: The motor can produce high torque and rapid movement. Keep hands, hair, and loose clothing away from the motor shaft and connected machinery during operation to prevent entanglement.

> **CAUTION:** Do not connect or disconnect the motor from the driver while power is applied. The resulting voltage spike can permanently damage the driver electronics.

> **NOTICE:** The NexBot Vision STP113-003 is rated at IP40, providing protection against solid objects over 1mm but no protection against liquids. Ensure the motor is installed in a dry, clean environment.

2. Product Overview

The NexBot Vision STP113-003 is a high-performance stepper motor engineered for precise, reliable motion control in demanding industrial robotics environments. This motor provides accurate open-loop positioning, making it an economical and dependable solution for a wide range of automated tasks. Its primary function is to convert digital pulses into precise mechanical shaft rotations, enabling controlled movement without complex feedback mechanisms. The key feature of the STP113-003 is its high holding torque of 3.0 Nm, which allows it to hold a load steady against external forces, ensuring axis stability and positional accuracy even when the motor is stationary. This is critical for applications where the robot arm must maintain a fixed position during a process. With a standard 1.8° step angle (200 steps per revolution), the motor delivers fine, repeatable positioning resolution suitable for intricate assembly, material handling, and pick-and-place operations. The robust internal design is optimized for high-speed microstepping, resulting in smoother, quieter operation and reduced resonance across its operational range. Constructed with a durable anodized aluminum body, this stepper motor is designed for longevity and effective thermal management. The housing efficiently dissipates heat, allowing the motor to operate at its peak performance during continuous duty cycles without overheating. This thermal stability contributes to a longer operational life and consistent performance. The STP113-003 is built to standard NEMA 23 frame specifications, ensuring straightforward mechanical integration with existing designs and NexBot robotics systems. Typical applications include driving wrist axes (J4-J6) on smaller articulated robots, auxiliary axes for tooling, or primary axes on collaborative and SCARA robots where precise, incremental motion is paramount. Installation is simplified by the standardized mounting pattern and shaft dimensions.

3. Getting Started

1. Product Overview

The NexBot Vision STP113-003 is a 2-phase hybrid stepper motor providing 3.0 Nm of holding torque. It is engineered for open-loop control systems where precision, reliability, and cost-effectiveness are critical. Its primary function is to convert digital pulse and direction signals from a driver into precise rotational movement.

2. Principle of Operation

Stepper motors move in discrete angular increments, or 'steps', in response to electrical pulses. The STP113-003 has a standard step angle of 1.8 degrees (200 steps per revolution). A compatible driver is required

to energize the motor windings in the correct sequence to produce motion.

3. Driver and Power Supply Selection

For optimal performance, pair this motor with a stepper driver that supports a 24-48VDC supply voltage and can be configured for the motor's rated phase current. A higher supply voltage within this range will generally yield better high-speed torque performance. Ensure the power supply is regulated and can handle the total current draw of the system.

4. Operation

Setting Operating Current

The current setting on the driver directly impacts motor torque and temperature. Set the driver's peak output current to match the motor's rated current to achieve full 3.0 Nm torque. For applications not requiring full torque, reducing the current can lower motor temperature and power consumption.

> **Tip:** Enable the driver's 'idle current reduction' feature to automatically lower the current when the motor is stationary, minimizing heat generation.

Microstepping for Smoothness

Microstepping electronically divides each full step into smaller increments, resulting in smoother rotation and reduced audible noise, especially at low speeds. While higher microstep settings improve resolution, they can slightly reduce effective torque. A setting of 8 or 16 microsteps per step is a common starting point.

Managing Resonance

Like all stepper motors, the STP113-003 may exhibit resonance at certain speed ranges, leading to increased vibration and potential step loss. This can often be mitigated by adjusting the operating speed, increasing microstepping, or using a driver with built-in anti-resonance algorithms.

> **Tip:** If resonance is a persistent issue, a small mechanical damper can be fitted to the rear shaft of the motor.

Thermal Considerations

The motor is designed to dissipate heat through its anodized aluminum body. Ensure there is adequate free air convection around the motor. For high duty cycle applications, mounting the motor to a substantial metal plate or frame will provide additional heatsinking and help maintain optimal operating temperatures.

5. Maintenance Schedule

Interval	Task	Notes
Weekly	Visually inspect the motor housing for excessive dust or debris buildup which can inhibit heat dissipation.	Clean with a dry cloth or low-pressure compressed air. Do not use liquid solvents.
Monthly	Check the tightness of the motor mounting screws and the shaft coupling set screws.	Vibration can cause fasteners to loosen over time. Re-torque to specification if needed.
Quarterly	Inspect the motor cable for any signs of chafing, cracking, or damage, especially at flex points.	Ensure cable strain relief is properly in place and effective.
Annually	Listen for any changes in the motor's operating sound, such as grinding or high-pitched whining.	Significant changes in sound can be an early indicator of bearing wear. The motor bearings are sealed for life and do not require lubrication.
As Needed	Verify mechanical alignment between the motor and the driven load, especially after a system crash or component replacement.	Misalignment is a primary cause of premature bearing failure and increased power consumption.

6. Troubleshooting

Symptom	Possible Cause	Solution
Motor hums loudly but does not turn.	Incorrect phase wiring or a disconnected phase wire.	Power down. Verify all four motor wires are connected to the correct A+, A-, B+, B- terminals on the driver.
Motor gets very hot, even at idle.	Driver current is set too high.	Check the driver's current setting and reduce it to match the motor's rated current. Enable idle current reduction if available.
Motor stalls or loses position during moves.	Load torque exceeds motor capability at the current speed, or acceleration is too high.	Reduce acceleration/ deceleration rates in the motion controller. Verify the mechanical load has not increased due to binding. Check the torque-

Symptom	Possible Cause	Solution
		speed curve to confirm sufficient torque.
Motor rotates in the wrong direction.	One phase winding is wired in reverse.	Power down. Swap the two wires for a single phase (e.g., reverse the A+ and A- connections).
Motor is excessively noisy or vibrates heavily at a specific speed.	Operating at a natural resonance frequency.	Adjust the operating speed to be above or below the resonance point. Increase the microstepping setting on the driver.
Motor shows no signs of life (no sound, no movement).	No power to the driver, or no command signal from the controller.	Use a multimeter to verify DC voltage at the driver's power input. Check the controller's signal wiring (PUL/DIR) and ensure the driver's 'Enable' input is active.

7. Technical Specifications

Parameter	Value	Unit
Weight	1.2	kg
Material	Anodized Aluminum	
Voltage	24-48VDC	
IP Rating	IP40	
Country of Origin	JP	
Dimensions	57 x 57 x 113 mm	
Torque	3.0 Nm	