

User Manual: NexBot Drives SD312-006 Single-Axis Force Sensor

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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 electric shock. The sensor operates on 24VDC. Always disconnect and lock out power before handling wiring or connections.

WARNING: Never exceed the sensor's maximum rated force. Overloading can cause permanent damage to the sensing element and lead to catastrophic failure of the end-of-arm tooling.

WARNING: Improper mounting can cause the sensor or attached tooling to detach during high-speed operation, creating a projectile hazard. Always use specified hardware and torque values.

CAUTION: The sensor housing is made of Anodized Aluminum 6061-T6. Avoid impacts from tools or other objects during installation and maintenance, as dents can affect sensor performance.

NOTICE: The SD312-006 is factory-calibrated. Do not attempt to perform a low-level recalibration without consulting NexBot Robotics support. A standard tare/zeroing operation is sufficient for most applications.

2. Product Overview

The NexBot Drives SD312-006 is a high-performance single-axis force sensor designed to provide precise force measurement and control in automated industrial applications. This sensor integrates directly into robotic end-of-arm tooling (EOAT) to give robots a sense of touch, enabling delicate and force-sensitive tasks that would otherwise require manual intervention. Its robust construction and reliable performance make it an essential component for advanced manufacturing, assembly, and quality control processes. The core of the SD312-006 is its durable strain gauge technology, which delivers accurate and repeatable force data with minimal hysteresis. With a nominal capacity of 1000 N (225 lbf), it is well-suited for a wide range of tasks, from inserting components with consistent pressure to performing surface finishing with a uniform tool force. A key benefit is its high overload protection, rated at 500% of nominal capacity, which safeguards the sensor against damage from unexpected impacts or programming errors, reducing downtime and replacement costs. The sensor communicates via the IO-Link protocol, simplifying integration with modern control systems and providing diagnostic data in addition to force readings. Built for demanding industrial environments, the SD312-006 features a compact housing made from anodized aluminum and carries an IP67 rating. This ensures it is fully protected against dust ingress and can withstand temporary immersion in water, making it suitable for use in environments with coolants, dust, or wash-down procedures. Common applications include force-limited assembly of electronics or mechanical parts, robotic grinding and deburring where consistent tool pressure is critical, and automated product testing cycles that require applying and measuring specific forces. Installation is straightforward, with standard mounting patterns compatible with many common robot flanges. The sensor operates on a standard 24VDC power supply, making it easy to integrate into existing machine control cabinets.

3. Getting Started

1. Product Overview

The NexBot Drives SD312-006 is a single-axis force sensor designed for industrial automation. It measures compressive and tensile forces along its primary axis, providing crucial feedback to the robot controller for tasks requiring precise force control. Its robust IP67-rated construction ensures reliability in demanding environments.

2. Understanding IO-Link Communication

This sensor uses the IO-Link protocol for digital communication. This allows for real-time transmission of force data, sensor diagnostics, and device parameters over a standard 3-wire cable. To communicate with the sensor, an IO-Link master and the corresponding IODD (IO Device Description) file are required.

3. Initial Power-Up and Verification

After physical installation, power on the system and connect to your IO-Link master's configuration software. The SD312-006 should be automatically detected. Verify that you can see a live process data value, which represents the current force measurement.

4. Operation

Reading Force Data

The primary process data output from the sensor is a signed integer value representing the measured force. This value must be scaled within the robot controller or PLC program according to the parameters defined in the IODD file to convert it into standard units like Newtons (N).

Tip: Always refer to the IODD file for the correct scaling factor to ensure accurate force readings in your application.

Performing a Tare (Zeroing) Operation

Before starting a force-sensitive task, it is critical to perform a tare operation. This command, sent via IO-Link, sets the current force reading (including the weight of the attached tool) as the new zero point. This ensures that subsequent measurements reflect only the force applied during the operation.

Configuring Force Thresholds

Using IO-Link parameters, you can configure up to two switching signal outputs (SSOs) within the sensor. These can be set to trigger at specific force thresholds, allowing for fast, hardware-level responses without relying on the controller's processing cycle. This is useful for part detection or overload prevention.

Interpreting Diagnostic Data

The sensor continuously monitors its internal health. Diagnostic information, such as overloads, temperature warnings, or communication errors, is available through IO-Link. Regularly polling this data in your control program can help predict maintenance needs and prevent unexpected downtime.

Tip: Set up alarms in your HMI or control system based on the sensor's diagnostic event flags for proactive fault handling.

Integrating with a Robot Program

The force data from the SD312-006 can be used to control robot motion in real-time. Common applications include constant-force polishing, peg-in-hole insertions where the robot stops on contact, or quality checks that verify assembly force. The logic for these routines is programmed within the robot controller, using the sensor's data as a primary input.

5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the sensor housing and cable for any signs of physical damage, wear, or fluid contamination.	Perform this check during the operator's pre-shift machine inspection.
Weekly	Check that the M12 connector's locking collar is secure and has not vibrated loose. Ensure the	Do not over-tighten the connector; hand-tight is sufficient.

Interval	Task	Notes
	cable is properly secured in its routing clips.	
Monthly	Clean the exterior of the anodized aluminum sensor housing with a soft cloth and a mild, non-corrosive cleaning agent.	The IP67 rating protects against dust and water ingress, but harsh chemicals should be avoided.
Quarterly	With the system de-energized, verify the torque of the sensor and EOAT mounting bolts. Re-torque to specification if necessary.	Vibration during normal operation can cause bolts to loosen over time.
Annually	Perform a calibration verification check. Use calibrated weights or a load cell to apply a known force and compare it to the sensor's reading to check for drift.	If the reading is outside of the specified tolerance, contact NexBot support. Do not attempt field recalibration.
As Needed	If a new firmware version is released by NexBot Robotics, update the sensor's firmware using the IO-Link master's device management tool.	Firmware updates can provide new features or improve performance.

6. Troubleshooting

Symptom	Possible Cause	Solution
Sensor is not detected by the IO-Link master.	No power to sensor; incorrect wiring; faulty cable; incorrect IO-Link port configuration.	Verify 24VDC is present at the sensor connection. Check wiring against the pinout diagram. Try a different cable or port. Ensure the port is set to 'IO-Link' mode, not 'DI'.
Force readings are erratic or noisy.	Electromagnetic interference (EMI); loose mounting bolts; high-frequency mechanical vibration.	Ensure the sensor cable is routed away from high-power motor cables. Verify all mounting bolts are torqued to specification. Investigate sources of mechanical vibration and isolate the robot if possible.
Force reading does not return to zero after a task.	Tare/zeroing operation was not performed correctly; mechanical binding or obstruction; sensor has sustained a permanent offset due to an overload event.	Re-run the tare command with no load on the tool. Check for anything physically interfering with the EOAT. If the offset persists after power cycling, the sensor may be damaged.
Force readings are consistent but seem	Incorrect scaling factor applied in the PLC or	Verify the scaling logic in your program matches the information in the sensor's

Symptom	Possible Cause	Solution
incorrect (e.g., too high or low).	robot controller; sensor is in the wrong units.	IODD file. Ensure all unit conversions (e.g., Newtons to pounds-force) are correct.
IO-Link master reports a 'Device Fault' event.	Internal sensor error; severe overload condition; supply voltage out of range.	Cycle power to the sensor. Check the detailed diagnostic message from the IO-Link master. Verify the 24VDC supply is stable and within specification. If the fault persists, contact technical support.
Visible damage to the sensor housing or connector.	Robot collision or impact from external object.	Immediately stop the system and de-energize. Inspect the sensor carefully. Do not operate the system if damage is significant, as internal components may be compromised. Replace the sensor.
Sensor readings drift with temperature changes.	Operating outside of the specified temperature range; rapid temperature fluctuations.	Ensure the ambient operating temperature is within the sensor's limits. If possible, allow the system to reach a stable temperature before performing high-precision tasks.

7. Technical Specifications

Parameter	Value	Unit
Weight	0.45	kg
Material	Anodized Aluminum 6061-T6	
Voltage	24VDC	
IP Rating	IP67	
Country of Origin	SE	
Protocol	IO-Link	
Dimensions	75 x 75 x 30 mm	