

# User Manual: NexBot Drives SD131-006 Single-Axis Servo Drive 6A

SKU: NXB-SRV-SD131-006 | Version: 1.0 | Brand: NexBot Robotics

## Table of Contents

1. Safety Information
2. Product Overview
3. Getting Started
4. Operation
5. Maintenance
6. Troubleshooting
7. Technical Specifications

## 1. Safety Information

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

**DANGER:** Hazardous voltage up to 600VDC can be present at the DC bus terminals for several minutes after power is removed. Wait at least 5 minutes after disconnecting mains power before servicing.

**WARNING:** Unexpected machine movement can occur if drive parameters are set incorrectly. Ensure the machine is mechanically clear and all personnel are at a safe distance before enabling the motor for the first time.

**WARNING:** The drive's heatsink can reach high temperatures during operation, posing a burn risk. Do not touch the drive body or heatsink until it has had sufficient time to cool.

**CAUTION:** The NexBot Drives SD131-006 contains electrostatic discharge (ESD) sensitive components. Always use proper ESD protection, such as a grounded wrist strap, when handling the drive with its covers removed.

**NOTICE:** Connecting or disconnecting motor or encoder cables while the drive is powered can cause permanent damage to the drive's electronics. Always de-energize the drive before modifying these connections.

## 2. Product Overview

The NexBot Drives SD131-006 is a compact, high-performance single-axis servo drive designed to deliver precise and dynamic motion control for demanding industrial automation applications. This drive is engineered to integrate seamlessly with a wide range of NexBot robotic systems, providing the power and responsiveness needed for tasks requiring high accuracy and repeatability. Engineered for reliability, the SD131-006 features a robust power stage capable of delivering 6A of continuous current, making it suitable for controlling axes in medium-payload robotic applications. Its advanced digital signal processing core enables sophisticated control algorithms, including auto-tuning and vibration suppression, which significantly reduce commissioning time and optimize machine performance. The drive's high-speed EtherCAT communication interface, with a cycle time down to 125  $\mu$ s, ensures tightly synchronized, real-time control, which is critical for coordinated multi-axis movements in applications such as automated welding, CNC machining, and high-speed pick-and-place. The drive operates on a 400VAC three-phase supply, aligning with common industrial power standards. Safety is a core design principle, and the SD131-006 includes an integrated Safe Torque Off (STO) function (SIL 3, PLe), allowing for the creation of safe machine designs without the need for external contactors. The compact, book-style housing is optimized for high-density cabinet installations, featuring DIN rail mounting and accessible terminals to simplify wiring and maintenance. This servo drive is an essential component for any system requiring dependable, high-fidelity motion control.

## 3. Getting Started

### 1. Software Installation

Install the NexBot MotionSuite software on your engineering PC. This software provides an interface for configuring, tuning, and diagnosing the SD131-006 servo drive. Ensure you have the latest version downloaded from the NexBot support portal.

### 2. Establishing EtherCAT Communication

Connect your PC to the EtherCAT master controller. Power on the system and use the master's software to scan the network. The SD131-006 should be automatically detected and identified by its device profile.

### 3. Initial Parameter Configuration

Using NexBot MotionSuite, load the correct motor profile for the connected servo motor. Verify that the encoder type, resolution, and other fundamental parameters match the motor's datasheet. Save the configuration to the drive's non-volatile memory.

### 4. First Motor Movement

Before enabling the drive, ensure the motor is unloaded and free to move. Use the jog function in the MotionSuite software at a very low speed to verify the direction of rotation is correct. If it is not, adjust the motor direction parameter and re-test.

## 4. Operation

### Control Modes

The SD131-006 supports multiple control modes, including Cyclic Synchronous Position (CSP), Cyclic Synchronous Velocity (CSV), and Cyclic Synchronous Torque (CST). The desired mode is selected and commanded by the EtherCAT master controller based on the application's requirements.

### Servo Loop Tuning

Proper tuning of the position, velocity, and current loops is critical for optimal performance. Use the auto-tuning function in MotionSuite for an initial baseline, then manually adjust the proportional (P), integral (I), and derivative (D) gains to fine-tune responsiveness and stability under load.

**Tip:** When tuning, use the built-in oscilloscope function to monitor command vs. actual position to visually identify overshoot, ringing, or following error. A well-tuned system will have the actual value track the command value closely with minimal error.

### Fault Diagnostics

The drive continuously monitors for over 50 potential fault conditions, such as over-current, over-voltage, and excessive following error. When a fault occurs, the drive will disable the motor output and display a specific fault code on its LED display and report it over EtherCAT. Refer to the troubleshooting guide to diagnose and resolve the issue.

### Using Digital I/O

The drive's digital inputs and outputs can be configured for various functions. Inputs can be used for hardware travel limits, motor brake release confirmation, or mode switching. Outputs can be used to signal drive status like 'Ready', 'Fault', or 'In Position' to a PLC.

### Parameter Backup and Restore

After the system is fully commissioned and tuned, it is crucial to perform a full parameter backup using the MotionSuite software. This saved file can be used to quickly configure a replacement SD131-006 drive in the event of a failure, minimizing machine downtime.

## 5. Maintenance Schedule

| Interval | Task  | Notes  |
|----------|---|--|
| Weekly   | Visually inspect the drive's status LED for any fault indications. Check the surrounding area for excessive dust, moisture, or debris.        | Address any active faults immediately. Clean the area around the drive if necessary. |
| Monthly  | Check the drive's cooling fan for proper operation. Ensure it spins freely and quietly when the drive is under load and the heatsink is warm. | A failed fan can lead to over-temperature faults and must be replaced.               |

| Interval  | Task  | Notes  |
|-----------|---|--|
| Quarterly | With power locked out, check the tightness of all power and motor terminal screws. Vibrations can cause connections to loosen over time.                          | Use a calibrated torque wrench to tighten screws to the specified values.                |
| Annually  | Perform a full parameter backup of the drive's configuration. This ensures you have a recent, known-good configuration file stored securely.                      | Store the backup file in a version-controlled location with the machine's documentation. |
| Annually  | Clean the drive's heatsink fins using compressed air. Ensure the air is clean, dry, and directed away from the internal electronics.                              | A clean heatsink is essential for proper thermal performance. Do not use solvents.       |
| As Needed | Check the NexBot support portal for any critical firmware updates for the SD131-006. Apply updates as recommended to improve performance or resolve known issues. | Always back up parameters before performing a firmware update.                           |

## 6. Troubleshooting

| Symptom  | Possible Cause   | Solution  |
|--|--|---|
| Drive status LED is off, no power.                                 | Missing or incorrect 400VAC input power, or a blown internal fuse.                                 | Verify the presence and voltage of all three phases at the L1, L2, L3 terminals. Check upstream breakers and fuses. If power is present, the drive may require factory service. |
| EtherCAT communication error.                                      | Damaged or disconnected cable, incorrect network topology, or EtherCAT master configuration error. | Check physical cables and connections. Verify the drive appears in the master's network scan. Ensure the ESI file is correctly loaded in the master configuration.              |
| Motor makes a high-pitched noise and vibrates but does not rotate. | Incorrect motor phase wiring (e.g., U, V, W swapped) or incorrect encoder configuration.           | Power down and verify motor wiring matches the documentation. In the software, confirm the motor and encoder parameters are correct for the installed motor.                    |
| Drive faults with 'Over-Temperature' error.                        | Blocked ventilation, cooling fan failure, excessive ambient temperature, or prolonged overload.    | Ensure a minimum of 50mm clearance above and below the drive. Check that the fan is operational. Verify the ambient cabinet   |

| Symptom   | Possible Cause   | Solution   |
|---|--|--|
|   |  | temperature is within the specified operating range.   |
| Drive faults with 'Following Error'.                    | The motor cannot physically keep up with the commanded position. This can be caused by a mechanical jam, excessive load, or servo tuning gains being set too high. | Check the mechanical system for any binding or obstructions. Verify the load is within the motor's capacity. Reduce acceleration/velocity commands or adjust tuning gains.                     |
| Drive faults with 'Over-Voltage' during deceleration.   | Regenerated energy from the motor is too high for the drive's internal bus capacitance. The external braking resistor is missing, incorrectly sized, or faulty.    | Verify the presence and integrity of the external braking resistor. Ensure its resistance and wattage values are correct for the application. Lengthen the deceleration ramp time if possible. |
| Drive does not enable; STO (Safe Torque Off) is active. | The safety circuit connected to the STO inputs is open.  | Check the machine's safety system (e.g., emergency stops, light curtains, safety relays) to find what is triggering the STO condition. Verify wiring to the STO terminals.                     |

## 7. Technical Specifications

| Parameter         | Value             | Unit |
|-------------------|-------------------|------|
| Weight            | 1.8               | kg   |
| Material          | Anodized Aluminum |      |
| Voltage           | 400VAC            |      |
| IP Rating         | IP20              |      |
| Country of Origin | CH                |      |
| Protocol          | EtherCAT          |      |
| Dimensions        | 170 x 55 x 165 mm |      |
| Torque            | 6 Nm              |      |