User Manual: NexBot Robotics SA011-005 6-Axis Robot Arm 10kg Payload

SKU: NXB-ROB-SA011-005 | 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: HIGH VOLTAGE. Lethal voltages are present inside the controller cabinet. Always perform Lockout/Tagout procedures on the main power disconnect before opening panels or performing service.

WARNING: The robot can move unexpectedly at high speed and force. All personnel must remain outside of the safety-fenced work envelope during automatic operation.

WARNING: Never exceed the maximum rated payload of 10 kg. Overloading can cause component failure, unpredictable motion, and potential injury.

CAUTION: Pinch points exist at all 6 axes. Keep hands, clothing, and tools clear of the robot joints during any movement.

NOTICE: The IP67 rating is only valid when all electrical connector covers are installed and all seals are intact. Do not operate with exposed connectors in wet environments.

2. Product Overview

The NexBot Robotics SA011-005 is a versatile 6-axis articulated robot arm designed for complex assembly, pick-and-place, and machine tending applications where precision and agility are critical. Engineered for high-duty cycle industrial environments, this robot arm provides a compact footprint without sacrificing performance, making it an excellent solution for integrating automation into constrained spaces. Key to its performance is a balanced combination of strength and speed. The 10 kg payload capacity makes it suitable for handling a wide range of parts and end-of-arm tooling, from small electronic components to larger machined parts, without compromising cycle times. A generous horizontal reach of 1,300 mm provides an extensive work envelope, allowing the robot to service multiple stations or access difficult-to-reach points within a workcell. This extended reach enhances its flexibility for tasks such as palletizing, packaging, and tending larger CNC machines. For applications demanding high accuracy, the SA011-005 delivers exceptional position repeatability of ±0.02 mm. This level of precision ensures consistent and reliable execution of tasks, which is essential for quality-critical processes like electronics assembly, precision dispensing, or intricate material handling. The arm's rigid construction, featuring a lightweight yet robust cast aluminum alloy frame, minimizes vibration and deflection even during rapid movements, contributing to its overall accuracy. Built for durability, the robot arm is sealed to an IP67 rating, providing complete protection against dust and enabling it to withstand temporary immersion in water. This makes it suitable for deployment in harsh manufacturing environments with exposure to coolants, dust, or washdown procedures. Installation is streamlined through a standardized ISO mounting flange, facilitating quick integration with existing cell layouts and tooling. Internally routed airlines and I/O cabling protect critical connections from external damage and reduce the risk of snagging during complex maneuvers, simplifying setup and improving long-term reliability.

3. Getting Started

1. System Power-Up

To power on the NexBot SA011-005 system, first ensure the main disconnect on the controller is switched ON. Next, turn the key switch on the controller panel to the ON position. The teach pendant will boot up, displaying the main system interface after initialization.

2. Understanding the Teach Pendant

The teach pendant is the primary interface for controlling the robot. Key features include the emergency stop button, the 3-position dead-man switch for enabling motion, a color touchscreen for programming, and physical keys for jogging each axis.

3. Enabling Servo Power

To allow robot motion, you must enable servo power. Grip the teach pendant and press and hold the dead-man switch to its middle position, then press the 'Servo ON' button on the touchscreen. A 'Servo Ready' indicator will appear.

4. Performing a Manual Jog

With servo power enabled, select a coordinate system (e.g., Joint). Press and hold the corresponding axis key (e.g., J1+) to move the robot. The speed of motion is controlled by the percentage override setting on the screen.

4. Operation

Defining a Tool Center Point (TCP)

The TCP defines the focal point of your end-effector. The system uses a multi-point calibration routine where you approach a fixed reference point from several different angles. An accurate TCP is critical for achieving the specified ±0.02 mm repeatability.

> **Tip:** For the highest accuracy, use a sharp, stationary reference point and approach it with orientations that differ by at least 45 degrees for each calibration point.

Setting Payload Data

To ensure optimal motion control and prevent excessive wear, you must define the mass properties of your attached payload. Enter the weight (up to 10 kg), center of gravity coordinates, and moments of inertia in the payload settings menu.

> **Tip:** If exact inertia values are unknown, use the auto-estimation feature, but manually measured data will always provide better performance.

Creating a Simple Program

A program consists of a sequence of recorded points and motion instructions. Manually jog the robot to a desired position, record the point, and select the motion type (Joint, Linear, Circular). Repeat this process to build a complete motion path.

Utilizing Coordinate Systems

The SA011-005 can be moved in different coordinate systems. 'Joint' moves one axis at a time. 'World' moves the TCP along X, Y, and Z axes relative to the robot's base. 'User' allows you to define a custom coordinate frame based on a fixture or work surface.

Monitoring System Status

The diagnostics screen on the teach pendant provides real-time information about axis positions, I/O status, motor currents, and active errors. Regularly monitoring this screen can help preemptively identify potential issues.

5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the robot arm and cables for signs of wear, damage, or fluid leaks. Clean any accumulated dust or debris from the robot surfaces.	Perform this check before starting the first shift of the day.

Interval	Task	Notes
Weekly	Test the functionality of the emergency stop buttons on the teach pendant and controller. Verify that activating an E-stop immediately cuts motor power.	Ensure the work area is clear before performing this test.
Monthly	Create a backup of all robot programs, parameters, and system configuration data onto a USB drive or network location.	Store backups in a secure, separate location.
Annually	Re-torque the robot base mounting bolts to their specified value. Check the tightness of the end-of-arm tooling fasteners.	Requires a calibrated torque wrench.
Every 3,000 Hours	Inspect the condition of the main robot umbilical cable for chafing or abrasion, especially at flex points.	Power down the system completely before handling cables.
Every 5,000 Hours	Replace the batteries for the absolute encoder backup system located in the robot base. This prevents loss of position data during power loss.	Robot mastering/ calibration is required after battery replacement.

6. Troubleshooting

Symptom	Possible Cause	Solution
Robot fails to power on; teach pendant is blank.	No incoming power to the controller or an E-stop circuit is open.	Verify 400-480VAC 3-Phase power is present at the controller's main disconnect. Ensure all E-stop buttons are released and safety gate circuits are closed.
Positioning is not accurate or repeatable.	The Tool Center Point (TCP) or payload data is incorrect, or the robot base is not secure.	Recalibrate the TCP using the built-in utility. Verify payload mass and center of gravity settings are accurate. Check the torque on the robot's base mounting bolts.
Teach pendant displays 'Servo Alarm' or 'Motor Overload' fault.	Motion is obstructed, payload exceeds 10 kg, or acceleration is too high.	Check the work envelope for any physical obstructions. Weigh the end-of-arm tooling and workpiece to confirm it is within limits. Reduce the acceleration/deceleration values in the program.
An 'Overtravel Limit' error is active.	An axis has been jogged beyond its programmed software limit.	Select the faulted axis and manually jog it in the opposite direction until it is back within the safe working range. The error should clear automatically.

Symptom	Possible Cause	Solution
Robot loses its position calibration after a full power cycle.	The absolute encoder backup batteries are depleted.	Power down the system and replace the encoder batteries in the robot base. After replacement, the robot will need to be re-mastered using the calibration procedure.
Teach pendant shows an EtherCAT communication error.	A network cable is disconnected, damaged, or there is a network configuration issue.	Inspect the EtherCAT cables at the controller and robot base for secure connections. Test the cable for continuity. Verify network settings with the PLC or master device.
Excessive noise or vibration during robot movement.	Loose mounting bolts or a potential internal mechanical issue.	Immediately stop the robot. Power down and verify the torque of all base and EOAT mounting bolts. If the issue persists, contact NexBot Robotics technical support for further diagnosis.

7. Technical Specifications

Parameter	Value	Unit
Weight	125.0	kg
Material	Cast Aluminum Alloy	
Voltage	400-480VAC 3-Phase	
IP Rating	IP67	
Country of Origin	US	
Protocol	EtherCAT	
Reach	1300 mm	
Payload	10 kg	
Axes	6	
Repeatability	±0.02 mm	