User Manual: NexBot Robotics CLR032-004 Cleanroom SCARA Robot 5kg

SKU: NXB-ROB-CLR032-004 | 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: HIGH VOLTAGE. Contact with terminals inside the robot controller or base can cause severe injury or death. Disconnect and lock out all input power before servicing.

WARNING: UNEXPECTED MOVEMENT. The robot may move unexpectedly during programming or operation. Maintain a safe distance from the robot's work envelope (400 mm reach) at all times unless motor power is disabled.

WARNING: CRUSH HAZARD. Keep hands and body parts clear of all robot joints and pinch points during operation. The robot can exert significant force, even at low speeds.

CAUTION: PAYLOAD LIMIT. Do not exceed the maximum specified payload of 5 kg, including the weight of the end-of-arm tooling. Overloading can cause excessive wear, decreased accuracy, and potential motor failure.

NOTICE: CLEANROOM PROTOCOL. Use only approved, non-shedding materials for cleaning and maintenance of the CLR032-004. The use of unauthorized solvents or abrasive materials can damage the robot's powder-coated surfaces and compromise the cleanroom environment.

2. Product Overview

The NexBot Robotics CLR032-004 is a high-speed, 4-axis SCARA robot specifically engineered for demanding applications within controlled environments. Its design and construction meet ISO 14644-1 Class 4 standards, making it an ideal solution for automation in semiconductor manufacturing, pharmaceutical processing, and medical device assembly where minimizing particulate contamination is critical. The robot's smooth, sealed surfaces and internal routing of air and electrical lines prevent particle shedding and simplify cleaning procedures. This robot delivers exceptional performance with a maximum payload capacity of 5 kg, suitable for handling delicate components such as silicon wafers, electronic parts, and sterile products. The compact arm architecture provides a horizontal reach of 400 mm, enabling efficient operation within space-constrained workcells without sacrificing performance. One of the key benefits is its outstanding position repeatability of ±0.01 mm, which ensures consistent and accurate placement for high-tolerance assembly, dispensing, and inspection tasks. This level of precision reduces process variability and enhances final product quality. Key applications for the CLR032-004 robot include wafer handling in fabrication plants, assembling and packaging medical devices in sterile environments, and sorting and kitting in pharmaceutical labs. Its robust construction ensures long-term reliability and operational uptime. The robot integrates seamlessly with standard industrial control systems via common communication protocols, allowing for straightforward deployment into new or existing automation lines. For maintenance, all service points are easily accessible, and the sealed design minimizes the ingress of contaminants during routine checks, preserving the integrity of the cleanroom environment.

3. Getting Started

1. System Power-Up Sequence

Before applying power, ensure all emergency stop buttons are in the released position. Turn on the main circuit breaker for the robot controller, then press the 'Power On' button on the controller. The system will initialize, and the robot will await a homing command from the control software or teach pendant.

2. Understanding the Teach Pendant

The teach pendant is the primary interface for manual robot control. Familiarize yourself with the axis jog keys, coordinate system selection (Joint, World, Tool), speed override controls, and the deadman switch. The deadman switch must be engaged to enable motor power for manual jogging.

3. Performing a Homing Routine

Homing (also known as referencing) establishes the robot's absolute position after power-up. From the teach pendant or control software, initiate the homing sequence. The robot will move each of its 4 axes to a known reference position, enabling accurate programmed movements.

4. Operation

Manual Jogging and Positioning

Manual jogging is used for teaching points or for recovery from a stopped position. Select the desired coordinate system and speed, then press and hold the deadman switch while pressing the corresponding axis movement keys on the teach pendant.

> **Tip:** Use the 'Joint' coordinate system for large, simple movements and switch to 'World' or 'Tool' for precise linear positioning of the end-effector.

Defining a Tool Center Point (TCP)

A correctly defined TCP is crucial for accurate linear movements and tool orientation. The TCP defines the focal point of your end-of-arm tooling. Use the built-in TCP definition utility to teach the system the X, Y, Z, and rotational offset from the robot's faceplate.

Programming Basic Motion

Robot programs consist of a series of recorded points and the motion types between them (e.g., Joint, Linear, Circular). Each point stores the positional data for all 4 axes. Additional commands can be inserted to control I/O, set speeds, or wait for external signals.

EtherCAT Communication

The CLR032-004 communicates via the EtherCAT protocol for high-speed, deterministic control. The robot acts as a slave device on the network, receiving motion commands from and sending status data to the master controller. Ensure the correct ESI (EtherCAT Slave Information) file is loaded in your master controller's engineering tool for proper configuration.

> **Tip:** Monitor the EtherCAT network status for diagnostic information like lost frames or communication errors to proactively address potential issues.

Payload Configuration

To optimize performance, configure the active payload settings in the control software. Input the mass (up to 5 kg) and center of gravity of your combined end-effector and workpiece. This allows the controller to adjust motor torque and acceleration profiles for smoother, faster, and more accurate motion.

5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the robot arm, cables, and connectors for any signs of wear, damage, or contamination. Verify that the work area is clear of obstructions.	This check should be part of the pre-shift startup procedure.
Weekly	Wipe down all external surfaces of the robot with a lint-free cloth and an	Pay special attention to joint seals to

Interval	Task	Notes
	approved cleanroom-compatible cleaning solution (e.g., 70% IPA).	ensure they are clean and intact.
Quarterly	Check the tightness of the robot's base mounting bolts using a calibrated torque wrench. Re-torque if necessary to the specification listed in the service manual.	Loose mounting is a common source of positioning errors.
Annually	Inspect and clean the controller's cooling fans and air filters. Ensure unobstructed airflow to prevent overheating of control electronics.	Perform this task with the controller powered off and locked out.
Annually / 2000 Hours	Verify robot repeatability using a calibration fixture or dial indicator. If outside the ±0.01 mm specification, perform a software calibration routine.	Keep a log of calibration results for trend analysis.
Every 2 Years / 4000 Hours	Replace the internal controller battery which maintains the absolute encoder positions. Failure to replace this battery will result in the loss of home positions upon power loss.	The robot must be re-homed or re-mastered after battery replacement.

6. Troubleshooting

Symptom	Possible Cause	Solution
Robot fails to power on; no status lights on controller.	No incoming AC power, main circuit breaker is tripped, or E-Stop is engaged.	Verify the 200-240VAC power source is active. Check and reset the main circuit breaker. Ensure all E-Stop buttons are released.
Positioning error or 'Following Error' alarm during motion.	The robot was physically obstructed, the payload exceeds the 5 kg limit, or acceleration is set too high for the current load.	Clear any obstruction. Verify the total payload is within limits. Reduce the programmed acceleration and velocity values in the motion profile.
Cannot jog the robot manually using the teach pendant.	Motor power is disabled, an E-stop is active, or the deadman switch is not fully engaged.	Press the motor power enable button, release all E-stops, and ensure the deadman switch is pressed and held while attempting to jog.
EtherCAT communication error reported by master controller.	Damaged or disconnected EtherCAT cable, incorrect network configuration, or master controller fault.	Inspect the EtherCAT cable and connections at both the robot and controller. Verify the robot's network address and cycle

Symptom	Possible Cause	Solution
		power on the EtherCAT master.
Robot loses its home position after a full power cycle.	The absolute encoder battery in the controller is depleted.	Schedule a maintenance task to replace the internal encoder battery. The robot will need to be re-homed or re-mastered after replacement.
Excessive noise or vibration during movement.	Loose base mounting bolts, an unbalanced/ insecure payload, or internal drive mechanism wear.	Torque the base mounting bolts to spec. Secure the end-of-arm tooling and payload. If noise persists, contact NexBot Robotics technical support for further diagnosis.
Reduced repeatability or inaccurate linear movements.	The Tool Center Point (TCP) is defined incorrectly, or the robot requires calibration.	Re-teach the TCP using the built-in utility, ensuring high precision. If the issue is not resolved, run the software calibration routine.

7. Technical Specifications

Parameter	Value	Unit
Weight	22.0	kg
Material	Anodized Aluminum with Powder Coating	
Voltage	200-240VAC	
IP Rating	IP65	
Country of Origin	DE	
Protocol	EtherCAT	
Dimensions	220 x 180 mm (Base Footprint)	
Reach	400 mm	
Payload	5 kg	
Axes	4	
Repeatability	±0.01 mm	