User Manual: NexBot Robotics TBL021-004 Collaborative Robot Arm 10kg Payload

SKU: NXB-ROB-TBL021-004 | 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: This equipment operates on 48VDC at high current. Contact with energized terminals can cause severe electrical shock or death. Always de-energize and apply LOTO before servicing.

WARNING: The robot can move unexpectedly at high speed and with significant force, even when appearing to be stopped. Maintain a safe distance from the robot's 850 mm reach envelope during operation unless a thorough risk assessment has been completed.

WARNING: Exceeding the 10 kg maximum payload can cause unpredictable behavior, premature wear, and component failure, leading to a dropped payload and potential injury.

CAUTION: Pinch points exist at all 6 axes. Keep hands and loose clothing away from joints during movement to prevent crushing or entanglement injuries.

NOTICE: The robot's internal electronics are sensitive to electrostatic discharge (ESD). Always wear an ESD wrist strap when accessing the controller internals or connection ports.

2. Product Overview

The NexBot Robotics TBL021-004 is a versatile 6-axis collaborative robot (cobot) designed for automating complex tasks in space-constrained environments where humans and robots work in close proximity. This robot arm combines a substantial 10 kg payload capacity with a compact footprint, making it suitable for a wide range of tabletop and bench-mounted applications without requiring significant facility modifications. Key to its performance is a sophisticated design that delivers exceptional precision. With a position repeatability of ±0.02 mm, the TBL021-004 ensures consistent and accurate execution of tasks, which is critical for applications such as electronics assembly, intricate material handling, and quality inspection. The robot's 850 mm reach provides a generous work envelope, allowing it to service multiple stations or handle larger workpieces within its operational area. This combination of reach and precision enables higher productivity and improved product quality. Designed for safe human-robot collaboration, this cobot features advanced, built-in force-sensing technology in all its joints. This allows the robot to detect unexpected contact and safely stop its motion, minimizing the need for extensive physical guarding and enabling more fluid interaction between operators and automation. The intuitive programming interface and lead-through teaching capabilities allow for rapid deployment and easy task programming, even for users with limited robotics experience. The TBL021-004 is an adaptable automation solution for machine tending, pick-and-place operations, packaging, and light assembly, helping to increase operational efficiency and flexibility.

3. Getting Started

1. Powering On and Off

To power on the NexBot Robotics TBL021-004, first turn on the main 48VDC power supply, then press the power button on the robot controller. To power off, execute a controlled stop from the teach pendant, then press the power button on the controller before switching off the main supply.

2. Understanding the Teach Pendant

The teach pendant is the primary interface for controlling the robot. It allows for manual jogging of the arm, creating and editing programs, configuring I/O, and viewing system diagnostics. Familiarize yourself with the E-Stop button, deadman switch, and navigation menus before operation.

3. Performing a Homing Routine

Before running any program, the robot must be homed to establish a known reference position for all axes. This is typically done automatically on startup or can be initiated manually from the 'Homing' or 'Calibration' menu on the teach pendant. Ensure the robot has a clear path to move all joints to their home switches.

4. Operation

Manual Jogging

Manual jogging allows for precise positioning of the robot arm. Select the desired axis (1-6) or coordinate system (Joint, World, Tool) on the teach pendant. While holding the deadman switch, use the directional controls to move the robot at a controlled speed.

> **Tip:** For linear movements, use the 'World' or 'Tool' coordinate systems. For reorienting the end effector without changing its position, use the 'Joint' coordinate system.

Creating a Basic Program

Programs are created by recording a series of waypoints. Jog the robot to a desired position, define the point type (e.g., linear, joint), and record it. Add commands for gripper actions or logic between waypoints to build a complete automation sequence.

Configuring Tool Center Point (TCP)

An accurate TCP is critical for precise operation. The TCP defines the focal point of your end-of-arm-tooling. Use the built-in TCP configuration wizard to define the X, Y, and Z offset from the robot's tool flange, as well as the tool's weight and center of gravity.

> **Tip:** Re-run the TCP configuration wizard anytime you modify or replace the end-of-arm tooling to maintain positioning accuracy.

Setting Collaborative Safety Limits

In collaborative mode, the robot's force, speed, and momentum are limited to ensure safety. Access the 'Safety Settings' menu to configure these parameters based on your application's risk assessment. These settings define the robot's behavior upon contact with an object or person.

Interfacing via EtherCAT

The TBL021-004 communicates using the EtherCAT protocol, allowing for high-speed integration with PLCs and other machine controllers. The robot's position, status, and I/O can be mapped as process data objects (PDOs) for real-time external control and monitoring. Refer to the EtherCAT ESI file for detailed object mapping.

5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the robot arm, cabling, and end-of-arm tooling for signs of wear, damage, or loose connections.	Perform this check before the start of each shift.
Weekly	Check for excessive noise or vibration from any of the 6 axes by jogging them through their full range of motion at a low speed.	Listen for any grinding or whining sounds that could indicate a gearbox issue.
Monthly	Create a full backup of all robot programs and system configuration settings to an external storage device.	Store backups in a secure, separate location.
Quarterly	Check the torque of the robot base mounting bolts and the	

Interval	Task	Notes
	end-of-arm-tooling mounting bolts.	Follow the torque specifications outlined in the installation guide.
Annually	Test the functionality of the brakes on all axes. This can be done via a diagnostic routine in the system menu.	Brakes should engage immediately upon power loss or an E-Stop condition.
Annually	Clean the exterior surfaces of the robot arm and controller using a lint-free cloth and an approved cleaning solution (e.g., isopropyl alcohol).	Ensure the robot is powered down. Avoid spraying liquid directly into joints or connector ports, consistent with its IP54 rating.

6. Troubleshooting

Symptom	Possible Cause	Solution
Robot fails to power on; no status lights on controller.	No incoming 48VDC power or faulty power supply.	Verify the 48VDC power source is on and check the power cable for damage. Use a multimeter to confirm voltage at the controller's power input terminals.
Position Deviation Fault during operation.	Robot collided with an object, payload exceeds 10 kg limit, or a motor encoder has failed.	Check the robot's path for obstructions. Verify the defined payload weight is accurate. Re-run the calibration routine. If the fault persists on a specific axis, contact NexBot support.
EtherCAT communication error.	Damaged or disconnected EtherCAT cable, incorrect network configuration, or EtherCAT master issue.	Check physical cable connections. Use a cable tester to validate the cable. Verify the robot's node address is correct in the master's configuration. Cycle power on the EtherCAT master and robot.
E-Stop Fault is active and cannot be cleared.	An external E-Stop button is pressed, or there is a wiring fault in the safety circuit.	Check all connected E-Stop buttons to ensure they are released. Inspect the safety circuit wiring at the controller for loose or broken connections.
Robot movement is jerky or not smooth.	Incorrect TCP or payload settings, or internal gearbox wear.	Recalculate and update the TCP and payload weight/center of gravity. If the issue continues, run system diagnostics and contact support for possible mechanical issues.

Symptom	Possible Cause	Solution
Cannot achieve specified repeatability of ±0.02 mm.	Loose mounting bolts on the base or EOAT, incorrect TCP configuration, or high ambient vibration.	Re-torque all mounting bolts to specification. Perform a high-precision TCP calibration. Ensure the mounting surface is stable and isolated from sources of vibration.

7. Technical Specifications

Parameter	Value	Unit
Weight	28.5	kg
Material	Anodized Aluminum and ABS Plastic	
Voltage	48VDC	
IP Rating	IP54	
Country of Origin	US	
Protocol	EtherCAT	
Reach	850 mm	
Payload	10 kg	
Axes	6	
Repeatability	±0.02 mm	