User Manual: NexBot Drives TBL021-002 Collaborative Robot Arm 10kg Payload

SKU: NXB-ROB-TBL021-002 | 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: Hazardous 48VDC voltages are present inside the controller. Always disconnect and lock out main power before opening controller panels or servicing electrical components.

WARNING: The robot can move unexpectedly and at high speed, causing serious injury or death. Never enter the robot's work envelope during automatic operation.

WARNING: Exceeding the 10 kg maximum payload can cause excessive wear, component failure, and unpredictable robot behavior. Always include the weight of the end-of-arm tooling in payload calculations.

CAUTION: The robot arm's joints may become hot during continuous operation. Avoid prolonged skin contact with the motor housings.

NOTICE: The TBL021-002 is rated IP54. It is protected from limited dust ingress and water spray from any direction, but it is not suitable for high-pressure washdown or fluid immersion.

2. Product Overview

The NexBot Drives TBL021-002 is a versatile 6-axis collaborative robot arm designed for automating tasks alongside human operators in diverse industrial settings. This cobot combines a substantial 10 kg payload capacity with a flexible and compact design, making it suitable for a wide range of applications without requiring extensive safety guarding. Its primary use is to enhance productivity and precision in repetitive or ergonomically challenging tasks. Key to its performance is a generous 1300 mm reach, which provides a large, accessible work envelope for interacting with multiple machines, conveyor systems, or large workpieces. The robot arm achieves a position repeatability of ±0.03 mm, ensuring consistent and high-quality results in delicate operations such as electronics assembly, intricate part handling, and quality inspection. The integrated force-torque sensing technology in each joint allows the robot to detect unexpected forces and stop safely, enabling safe collaboration with human workers in shared workspaces. This feature is critical for deploying the cobot in environments where complete separation is not feasible or desired. Common applications for the TBL021-002 robot include CNC machine tending, injection molding machine unloading, packaging and palletizing, and complex assembly sequences. Its intuitive programming interface allows operators with minimal robotics experience to create and modify routines quickly, reducing deployment time and lowering the barrier to automation. The robot is constructed from durable cast aluminum, providing a rigid yet lightweight structure for dynamic performance. Installation is streamlined with a standard ISO 9409-1-50-4-M6 mounting flange, allowing for easy integration with existing work cells and end-of-arm tooling.

3. Getting Started

1. Understanding the Robot Workspace

The TBL021-002 has a spherical work envelope with a maximum reach of 1300 mm from the center of its base. Before programming, it is crucial to identify all required task points, potential obstacles, and areas where human interaction will occur to plan a safe and efficient application.

2. Powering On and Homing

Before starting any work, ensure the robot is properly homed. After powering on the controller, use the teach pendant or software interface to initiate the homing sequence, which establishes a known reference position for all six axes.

3. Creating Your First Program

A robot program is a sequence of stored points (waypoints) and actions. Use the teach pendant to manually move the robot to a desired position, record the waypoint, and then repeat for all points in the task. Simple logic commands can be added to control grippers or interact with other equipment.

4. Operation

Jogging the Robot

Manual control, or 'jogging', is used for teaching points and testing motion. The robot can be jogged in several coordinate systems, including Joint, World, and Tool. Select the appropriate coordinate system on the teach pendant for intuitive manual positioning.

> **Tip:** For linear movements with a tool, always use the 'Tool' coordinate system after you have correctly configured your Tool Center Point (TCP).

Defining a Tool Center Point (TCP)

The TCP defines the focal point of your end-of-arm tooling. Accurately defining the TCP's position and orientation relative to the robot's flange is essential for precise linear and rotational movements, making tasks like dispensing or palletizing much easier to program.

Configuring Collaborative Safety

The TBL021-002's collaborative nature relies on configurable safety settings. Users can set limits on tool force, speed, and momentum. These settings allow the robot to safely stop or reverse upon contact with an unexpected object or person, enabling operation without traditional fencing after a proper risk assessment.

Using Digital I/O

The robot is equipped with configurable digital inputs and outputs (I/O) both at the controller and on the tool flange. These are used to interface with external equipment like sensors, actuators, and PLCs. Program logic can be based on the state of an input (e.g., wait for a part to be present) or can change the state of an output (e.g., activate a gripper).

> **Tip:** Use a 'handshake' method with I/O when interfacing with other automated equipment to ensure commands are received and actions are completed before the next step.

Working with EtherCAT

As an EtherCAT slave device, the TBL021-002 can be integrated into a larger control system. The EtherCAT master can send real-time position commands and receive status feedback, such as joint positions and system health, via Process Data Objects (PDOs).

5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the robot arm and cables for any signs of damage, wear, or loose connections. Check the software interface for any active errors or warnings.	This check should be performed by the operator before starting automatic operation.
Weekly	Clean the robot's exterior surfaces using a soft, lint-free cloth lightly dampened with isopropyl alcohol. Test all physical emergency stop buttons.	Do not spray cleaning fluids directly onto the robot joints or connectors.
Monthly	Check the condition and strain relief of the main robot umbilical cable, especially at points of flexion.	Ensure the cable is not rubbing against any sharp edges during operation.
Quarterly	Create a complete backup of all robot programs and system configuration settings.	Store backups on a secure network drive or external storage device.
Annually	Inspect all joint seals for signs of cracking, degradation, or grease leakage.	This task should be performed by a qualified technician.
Every 20,000 Hours	Perform gearbox lubrication service. This involves replacing the grease in all six joint gearboxes.	This is a major service item and must be performed by a NexBot-certified technician.

6. Troubleshooting

Symptom	Possible Cause	Solution
Robot fails to power on; status lights are off.	No 48VDC power to controller, or an emergency stop button is pressed.	Verify the 48VDC power supply is on and functioning. Check and reset all emergency stop buttons on the controller and teach pendant.
A 'Protective Stop' is triggered frequently during operation.	Collaborative force limits are set too low for the application, or the robot is making unintended contact	Observe the robot to identify the source of contact. If no contact is occurring, incrementally increase the force limit sensitivity after

Symptom	Possible Cause	Solution
	with its environment.	conducting a new risk assessment.
Robot does not reach the correct position.	The Tool Center Point (TCP) is not defined correctly, or the robot's mounting base has shifted.	Re-run the TCP definition wizard to ensure tool dimensions are accurate. Verify all robot base mounting bolts are torqued to specification.
Error: 'Joint Limit Violation'.	A programmed point has commanded a joint to move beyond its physical rotational limit.	Manually jog the robot away from the limit. Modify the program to use a different robot configuration or waypoint to avoid exceeding the joint limit.
Cannot establish communication over EtherCAT.	Incorrect wiring, duplicate EtherCAT slave address, or ESI file not loaded in the master.	Check physical cable connections. Ensure the robot's configured slave address is unique on the network. Verify the correct NexBot ESI (EtherCAT Slave Information) file is installed on the master controller.
Robot moves with excessive vibration or noise.	Payload settings are incorrect, or a joint gearbox is failing.	Ensure the payload weight and center of gravity are correctly entered in the software configuration. If the issue persists on a specific joint, contact technical support for service.
End-of-arm tool does not function.	Incorrect I/O wiring to the tool flange, or the tool is not receiving power.	Verify the tool's power and signal wiring according to the schematic. Use the software's manual I/O page to toggle the output and confirm signal with a multimeter.

7. Technical Specifications

Parameter	Value	Unit
Weight	33.5	kg

Parameter	Value	Unit
Material	Cast Aluminum Alloy	
Voltage	48VDC	
IP Rating	IP54	
Country of Origin	CH	
Protocol	EtherCAT	
Reach	1300 mm	
Payload	10 kg	
Axes	6	
Repeatability	±0.03 mm	