User Manual: NexBot Drives FLR022-002 Collaborative Robot Arm 10kg Payload

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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 voltage. The controller contains high-voltage components. Disconnect and lock out all power sources before opening controller panels or performing service. Failure to do so can result in severe injury or death.

WARNING: Unexpected robot motion can cause serious injury. Always remain outside the robot's maximum workspace during automatic operation. Ensure all safety systems are enabled and tested before use.

WARNING: Crushing and pinch point hazard. Keep hands and body parts clear of all robot joints and tooling during operation. The robot's 6 axes can move without warning in automatic mode.

CAUTION: Do not exceed the maximum payload of 10 kg, including the end-effector. Overloading the robot can cause excessive wear,

motor faults, and inaccurate positioning, potentially leading to equipment damage.

NOTICE: The NexBot Drives FLR022-002 contains sensitive electronic components. Observe proper electrostatic discharge (ESD) precautions when handling the controller or connecting cables to prevent damage.

2. Product Overview

The NexBot Drives FLR022-002 is a versatile 6-axis collaborative robot arm engineered for seamless integration into shared human-robot workspaces. This cobot is designed to handle a variety of automation tasks with precision and reliability, enhancing productivity without the need for extensive safety guarding typically required for traditional industrial robots. The key to its versatility is a robust 10 kg payload capacity, which allows the robot to manage heavier workpieces, utilize complex end-of-arm tooling, and perform tasks such as machine tending and light assembly. Its expansive 1300 mm horizontal reach provides a large, flexible work envelope, making it suitable for applications that require access across conveyors, into machinery, or for palletizing operations. High-precision tasks are executed flawlessly thanks to a position repeatability of ±0.05 mm, ensuring consistent quality in processes like electronics assembly, detailed inspection, and precise part placement. Safety is a core design principle of the FLR022-002. Integrated force and torque sensing in all six joints allows the robot to detect unexpected contact and safely stop its motion, enabling operators to work alongside it with confidence. This collaborative nature reduces the overall footprint and cost of the automation cell. Common applications for this robot include: - Machine Tending: Loading and unloading CNC machines, injection molding presses, and other manufacturing equipment. - Pick and Place: Transferring parts between production stages with speed and accuracy. - Assembly: Performing repetitive assembly tasks, such as screw driving, part insertion, and fastening. - Packaging and Palletizing: Stacking boxes, loading cases, and preparing goods for shipment. Deployment is streamlined through an intuitive programming interface that allows for quick setup and adjustments by personnel without deep robotics expertise. The robot arm features a standard ISO 9409-1-50-4-M6 tool flange for broad compatibility with a wide range of grippers and end effectors.

3. Getting Started

1. Powering On and Homing

Before starting work, ensure the main power switch on the controller is on. On the teach pendant, release any emergency stop buttons and press the 'Power On' button. The system will prompt you to perform a homing routine, which calibrates the position of all 6 axes.

2. Understanding the Teach Pendant

The teach pendant is the primary interface for controlling the FLR022-002. Familiarize yourself with the main screen layout, the emergency stop button, the dead-man switch, and the joystick used for manual jogging of the robot arm.

3. Manual Movement (Jogging)

To move the robot manually, select 'Manual' mode and hold the dead-man switch on the rear of the pendant. You can then use the on-screen controls or joystick to move the robot in different coordinate systems (Joint, Cartesian, Tool). Always start at a low speed percentage.

4. Creating a Simple Program

Enter 'Program' mode to create a new routine. Use the jogging functions to move the robot to a desired position, then press 'Add Waypoint' to record it. By linking a series of waypoints, you can create a simple motion path for the robot to follow.

4. Operation

Configuring Tool Center Point (TCP)

Accurate TCP configuration is critical for precise movement. The system provides a wizard to help you define the position and orientation of the attached end-effector relative to the robot's flange. You must also enter the tool's weight and center of gravity to ensure proper dynamics.

> **Tip:** For complex or irregularly shaped tools, use the multi-point TCP calibration method for the highest accuracy.

Setting Payload Data

After defining the TCP, you must input the payload data for the object being handled. This includes the weight of the workpiece. Accurate payload information is essential for the robot's collaborative safety functions and for maintaining performance without causing motor overloads.

Defining User Frames

A User Frame is a custom coordinate system that allows you to program robot movements relative to a workpiece or fixture, rather than the robot's base. This simplifies programming when working with angled or offset surfaces. The system provides a 3-point definition method to easily create new frames.

Implementing Collaborative Safety Features

The FLR022-002's collaborative nature relies on configurable safety settings. In the safety menu, you can adjust force and torque monitoring limits, define safety planes, and set reduced-speed zones to ensure safe operation alongside human workers.

> **Tip:** Always perform a thorough risk assessment for your specific application to determine the appropriate safety settings.

Using Digital I/O

The controller provides configurable digital inputs and outputs for interfacing with external equipment like grippers, sensors, or PLCs. You can control the state of outputs and read the state of inputs directly

within your robot program to create more complex automation sequences.

5. Maintenance Schedule

Interval	Task	Notes
Daily	Perform a visual inspection of the robot arm, cables, and controller for any signs of wear, damage, or loose connections. Check the teach pendant for any active error messages before starting operation.	This check should be part of the operator's pre-shift startup procedure.
Weekly	Wipe down the robot's Aluminum Alloy and ABS surfaces with a soft, dry, or slightly damp cloth to prevent dust buildup. Verify that cooling fans on the controller are operational and free of obstruction.	Do not use harsh solvents or abrasive cleaners. The unit is rated IP54, not for high-pressure washdowns.
Monthly	Test all safety circuits, including the emergency stop buttons on the teach pendant and controller, and any external safety devices. Verify that safety-related settings have not been unintentionally altered.	Log the results of each safety test in a maintenance record.
Quarterly	Check the torque of the main robot base mounting bolts to ensure they remain at the specified value. Inspect the integrity of joint seals for any signs of cracking or degradation.	Perform this task more frequently in high-vibration environments.
Annually	Create a complete backup of the robot's software, programs, and configuration settings. Store the backup in a secure location.	This is critical for disaster recovery and can significantly reduce downtime.
Annually	Check for excessive backlash in each of the 6 axes. This can be done by running a program designed to detect positioning deviations.	If backlash is outside of the specified tolerance, contact NexBot Robotics support for a service and calibration appointment.

6. Troubleshooting

Symptom	Possible Cause	Solution
Robot fails to power on; no lights on controller.	No incoming 48VDC power or main breaker is off.	Verify the 48VDC power supply is active and connected correctly. Check the main circuit breaker for the controller.
Teach pendant displays 'Emergency Stop Active' fault.	An E-Stop button on the pendant, controller, or external circuit is pressed.	Locate the engaged E-Stop button, twist to release it, and then clear the fault on the teach pendant.
A 'Protective Stop' is triggered during operation.	The robot has detected a collision or a force exceeding its configured safety limits.	Check the robot's path for obstructions. If none, review and adjust the application's collision sensitivity settings. Acknowledge the stop on the pendant to resume.
Robot position seems inaccurate or has poor repeatability.	Incorrect Tool Center Point (TCP) or payload data; loose mounting bolts.	Re-run the TCP calibration wizard and verify the mass properties of the tool and payload are entered correctly. Check the torque of the robot's base mounting bolts.
Teach pendant displays 'EtherCAT Communication Error'.	EtherCAT cable is disconnected, damaged, or there is a network configuration issue.	Inspect the EtherCAT cable between the controller and any connected devices. Ensure the network is configured correctly and cycle power to the system.
Joint limit error during program execution.	A programmed waypoint is outside the reachable range of one or more of the robot's 6 axes.	Manually jog the robot to the problematic waypoint to identify the limited joint. Adjust the waypoint's position or the robot's orientation to be within the valid working envelope.
Teach pendant screen is frozen or unresponsive.	Software issue or temporary loss of connection.	Attempt to disconnect and reconnect the teach pendant cable. If the issue persists, perform a controlled shutdown and restart of

Symptom	Possible Cause	Solution
		the entire robot controller.

7. Technical Specifications

Parameter	Value	Unit
Weight	28.5	kg
Material	Aluminum Alloy with ABS covers	
Voltage	48VDC	
IP Rating	IP54	
Country of Origin	KR	
Protocol	EtherCAT	
Reach	1300 mm	
Payload	10 kg	
Axes	6	
Repeatability	±0.05 mm	