User Manual: NexBot Robotics FLR022-004 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: Never exceed the 10 kg maximum payload. An overload condition can lead to uncontrolled motion, component failure, and fatal injury.

WARNING: Disconnect and lock out the 48VDC power source before performing any maintenance, cleaning, or hardware adjustments to prevent severe electrical shock.

WARNING: A risk assessment must be performed for every application. High-speed operation or hazardous end-of-arm tooling can create risks that require additional safety measures beyond the robot's inherent collaborative features.

CAUTION: The surfaces of the cast aluminum alloy joint housings can reach high temperatures during continuous operation. Avoid prolonged skin contact to prevent burns.

NOTICE: The FLR022-004 is rated IP54, protecting it from limited dust ingress and water spray. Do not pressure wash the unit or expose it to corrosive fluids.

2. Product Overview

The NexBot Robotics FLR022-004 is a 6-axis collaborative robot arm engineered for flexible automation and safe operation alongside human personnel in shared workspaces. This cobot provides an optimal balance of strength, reach, and safety, making it suitable for a wide array of industrial applications without the need for extensive safety fencing. Its core design philosophy centers on power and force limiting technology, where integrated sensors at each joint continuously monitor external forces, enabling the robot to automatically stop upon contact with an object or person, thus minimizing risk. Key features include a substantial 10 kg payload capacity, which allows the robot to handle heavier parts, tools, and end-of-arm tooling for tasks like machine tending and material handling. With a generous reach of 1300 mm, the FLR022-004 can service larger work areas and access components in complex machine setups. The arm's design ensures high positional accuracy, delivering a repeatability of ±0.03 mm for consistent and reliable process execution in applications demanding precision, such as electronics assembly and quality inspection. The FLR022-004 is built for rapid deployment and ease of use. It features an intuitive programming interface and a hand-guiding function, allowing operators to teach the robot new paths and tasks by simply moving the arm to the desired positions. This significantly reduces programming time and empowers non-expert users to adapt the robot to new production requirements quickly. Common applications for this cobot include pick-and-place operations, packaging and palletizing, automated assembly, and CNC machine tending. The robust cast aluminum construction and IP54 rating ensure durability and reliable performance in typical industrial environments.

3. Getting Started

1. Understanding the Control System

The FLR022-004 is controlled via an external controller connected over the EtherCAT protocol. All programming, configuration, and real-time control are managed through the NexBot Control Suite software or the provided teach pendant.

2. Powering On and Homing

Before starting any work, the robot must be powered on and homed. The homing procedure establishes a known reference position for all 6 axes, which is essential for the robot's positional accuracy and ±0.03 mm repeatability.

3. Using the Teach Pendant

The teach pendant is a handheld device for direct interaction. It allows you to manually move (jog) the robot, record positions (waypoints), enable freedrive mode for hand guiding, and monitor system status and errors.

4. Creating a Simple Program

A program is a sequence of waypoints and actions. Use the teach pendant to move the robot arm to a desired location, save the point, and repeat for each step. Actions like 'Wait', 'Set Output', or 'Grip' can be inserted between motion commands.

4. Operation

Jogging Modes

Manual robot movement is available in multiple coordinate systems: Joint, Base, and Tool. 'Base' mode moves the tool linearly along the X, Y, and Z axes of the robot's base, which is intuitive for simple pick-and-place tasks.

> **Tip:** For tasks requiring the tool to maintain its orientation, such as applying sealant, always use the 'Tool' coordinate system for jogging.

Freedrive (Hand Guiding)

Activate Freedrive mode to make the robot arm compliant and easy to move by hand. This is the fastest way to teach complex paths or positions that are difficult to reach by jogging. The robot's motors counteract gravity, making the arm feel weightless.

Configuring Payload and TCP

For optimal performance, you must accurately define the Tool Center Point (TCP) and the payload mass. The software uses this data to calculate the robot's dynamics, ensuring smooth motion and accurate force detection for collaborative safety.

> **Tip:** Always re-configure the payload when changing the workpiece, even if using the same gripper, to maintain optimal performance.

Running in Automatic Mode

Once a program is created and tested, it can be run in automatic mode. In this mode, the robot will execute the programmed sequence continuously or for a set number of cycles. Production runs should always be monitored, and operators must be trained on the location and use of the emergency stop.

Understanding Protective Stops

The robot's power and force limiting sensors will trigger a protective stop if it detects a collision or excessive force. This is a primary safety feature. After a protective stop, the cause must be investigated and cleared before the robot can resume operation.

5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the robot arm, cabling, and controller for any signs of damage, wear, or loose connections. Confirm the area is clear of debris.	This should be part of a pre-operation checklist at the start of every shift.
Weekly	Wipe down the robot's cast aluminum alloy surfaces with a soft cloth dampened with isopropyl alcohol to remove any buildup of dust or oil.	Do not spray cleaning fluids directly onto the robot joints or connectors.

Interval	Task	Notes
Monthly	Test the functionality of the physical emergency stop buttons on the controller and teach pendant.	Log the date of each successful safety circuit test.
Quarterly	Check the tightness of the base mounting bolts and the end-of-arm tooling fastener bolts. Re-torque if necessary.	Refer to the installation guide for official torque specifications.
Annually	Create a full backup of all robot programs and system configuration files.	Store the backup on a secure network drive or external storage device.
Every 5,000 Hours	Inspect the condition of the main robot harness for chafing or wear, especially at points of articulation.	Pay close attention to the cable's bend radius.
Every 20,000 Hours	Schedule a preventative maintenance service with a NexBot Robotics certified technician for gearbox lubrication and inspection.	This is critical for maximizing the operational life of the robot.

6. Troubleshooting

Symptom	Possible Cause	Solution
Robot fails to establish EtherCAT communication.	Damaged or disconnected network cable, incorrect network configuration, or controller fault.	Verify the EtherCAT cable is securely plugged into both the robot and the master controller. Inspect the cable for damage. Check the master's network diagnostics for errors.
A 'Protective Stop' is triggered frequently during a program.	The robot is colliding with an object, or the collaborative safety limits are too sensitive for the programmed speed and acceleration.	Observe the robot to identify any unintended contact. If no contact occurs, review the safety settings and adjust the force limits according to your risk assessment.
Robot position seems inaccurate or has poor repeatability.	The robot base or end-of-arm tooling is loose, or the TCP/payload data is incorrect.	Power down the robot and check that all mounting bolts are torqued to spec. Verify that the configured TCP and payload values in the software are accurate.
A 'Joint Overtemperature' fault occurs.	The robot is being operated beyond its duty cycle, or ambient temperature is too high.	Reduce the cycle speed or introduce dwell time into the program to allow the joint motor to cool. Ensure ambient

Symptom	Possible Cause	Solution
		temperature is within the specified operating range.
The robot will not power on; controller status lights are off.	No 48VDC power is being supplied to the robot.	Confirm the 48VDC power supply is on and functioning correctly. Use a multimeter to check for 48VDC at the robot's power input terminal.
Teach pendant is unresponsive or displays a connection error.	The pendant cable is not securely connected or is damaged.	Disconnect and reconnect the teach pendant cable, ensuring the locking mechanism engages. Inspect the cable and its pins for any signs of damage.
Grinding or clicking noise coming from a joint during movement.	Potential internal damage to the gearbox or a foreign object in the joint.	Immediately stop all robot operations. Do not attempt to move the affected joint. Contact NexBot Robotics technical support for service.

7. Technical Specifications

Parameter	Value	Unit
Weight	35.5	kg
Material	Cast Aluminum Alloy	
Voltage	48VDC	
IP Rating	IP54	
Country of Origin	IT	
Protocol	EtherCAT	
Reach	1300 mm	
Payload	10 kg	
Axes	6	
Repeatability	±0.03 mm	