User Manual: NexBot Drives 211-014 Robot Main Controller

SKU: NXB-GEN-211-014 | 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 voltages are present inside the controller and robot system. Disconnect and lock out all power sources before servicing to prevent fatal electric shock.

WARNING: Unexpected robot motion can occur during programming, testing, or due to system faults. Always remain outside the robot's maximum working envelope during operation unless all safety protocols for manual teaching are strictly followed.

WARNING: Do not modify or bypass any safety circuits. Doing so can lead to uncontrolled robot behavior, resulting in severe injury or death.

CAUTION: The controller's heat sinks can reach high temperatures during operation. Allow the unit to cool down completely before handling to avoid burns.

NOTICE: The NexBot Drives 211-014 contains components sensitive to electrostatic discharge (ESD). Always use an anti-static wrist strap when handling internal components or connecting cables.

2. Product Overview

The NexBot Drives 211-014 is a centralized robot main controller engineered to manage all motion, logic, and safety functions for a wide range of NexBot industrial robots. This controller serves as the core processing unit for complex automation cells, executing robot programs and coordinating with peripheral equipment. At its heart is a powerful quad-core processor that enables rapid program execution and smooth, multi-axis path interpolation, which is critical for applications requiring high precision and speed, such as arc welding or laser cutting. This low-latency network ensures that the robot responds instantly to commands, improving overall system performance and accuracy. The 211-014 controller is designed for scalability and integration. It features a generous allocation of onboard digital and analog I/O points, which can be expanded with additional EtherCAT modules to support up to 512 digital I/O points. This flexibility allows for seamless integration of conveyors, vision systems, and PLCs. Integrated safety functions, including Safe Torque Off (STO), are built-in to simplify the design of safety-rated workcells. Typical applications include high-speed pick-and-place, complex assembly, material handling, and automated dispensing. The unit is housed in a rugged, powder-coated steel enclosure designed for DIN rail or panel mounting inside a standard industrial control cabinet. Installation is streamlined with standard terminal blocks and accessible communication ports, minimizing setup time and simplifying maintenance.

3. Getting Started

1. Initial Power-Up Sequence

After completing all post-installation checks, apply 24VDC control power. The controller will initiate a boot sequence, indicated by flashing status LEDs. A solid green 'STATUS' LED and a solid orange 'POWER' LED indicate a successful boot-up and readiness for software connection.

2. Establishing Software Communication

Connect a laptop or PC running NexBot Studio software to the service Ethernet port on the controller. Configure the network settings on your PC to be on the same subnet as the controller's default address. Use the 'Discover Controller' function in the software to establish a connection.

3. Loading Robot Configuration

Once connected, the software will prompt you to load a robot configuration file. This file contains the specific kinematic, motor, and tuning parameters for the robot model being controlled. Ensure you select the correct file corresponding to your robot arm.

4. Performing a Manual Jog Test

In the software, switch the controller to 'Manual' or 'T1' mode. Enable the robot drives and use the manual jog controls to test each axis individually at a slow speed. This confirms correct motor phasing and axis configuration before running any programs.

4. Operation

Program Execution

Load a robot program using the NexBot Studio software and select the desired operating mode. In 'AUTO' mode, the program will run continuously upon receiving a start signal from a PLC or HMI. 'MANUAL' mode allows for step-by-step execution for testing and debugging purposes.

> **Tip:** Always perform a dry run of a new or modified program at low speed to verify the robot path before running at full production speed.

Fault Diagnosis and Reset

If the controller detects a fault, it will stop robot motion and the 'ERROR' LED will illuminate. The specific fault code and description can be viewed in the software's diagnostics screen. After resolving the underlying cause, use the 'Fault Reset' command to clear the error and resume operation.

Managing Digital I/O

The controller's digital inputs and outputs can be monitored in real-time through the I/O status screen in the software. This is useful for verifying sensor inputs or manually toggling outputs like gripper clamps for setup. I/O can be mapped to program variables for logic control.

> **Tip:** Create logical names or aliases for I/O points in the software to make your robot programs easier to read and troubleshoot.

System Backup

It is critical to regularly back up the entire controller configuration, including programs, system parameters, and network settings. Use the 'Create Archive' function in NexBot Studio to save a complete snapshot of the controller's memory to a file.

> **Tip:** Schedule system backups quarterly and before and after any significant programming or configuration changes.

EtherCAT Network Management

The EtherCAT status screen provides real-time diagnostics for the entire network connected to the controller. It displays the status of all nodes (slaves) and can help identify issues like communication dropouts or configuration mismatches. Any changes to the network hardware require a corresponding update to the software configuration.

5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the controller's status LEDs for any red error indicators.	A daily check ensures that any new faults are identified and addressed promptly.

Interval	Task	Notes
Monthly	Inspect and clean the controller's cooling fan filters to ensure unobstructed airflow.	Use compressed air at low pressure to blow dust out of the filters. Replace if damaged.
Quarterly	Check all power, ground, and communication cable connections for tightness and signs of wear or corrosion.	Perform this check with the power off. Retighten terminal screws if necessary.
Annually	Perform a full system backup of all robot programs and configuration parameters.	Store the backup file in a secure, remote location.
Annually	Verify the integrity of the main protective earth (PE) ground connection using a multimeter.	The resistance between the controller chassis and the main cabinet ground should be less than 0.1 ohms.
Every 5 Years	Replace the internal memory backup battery and the main cooling fans.	These components have a finite service life. Refer to the service manual for the specific part numbers and replacement procedure.

6. Troubleshooting

Symptom	Possible Cause	Solution
Controller does not power on; no LEDs are lit.	Missing 24VDC supply voltage, blown internal fuse, or faulty power supply.	Verify 24VDC is present at the power input terminals. If voltage is present, check the user-serviceable fuse. If the fuse is good, test or replace the external power supply.
STATUS LED is red, and an error is shown in the software.	A system fault has occurred, such as an E-stop, drive fault, or program error.	Identify the specific fault code in the software's diagnostic log. Address the root cause (e.g., reset E-stop, check motor cables) and then perform a fault reset.
Cannot establish communication with NexBot Studio software.	Incorrect PC network settings, faulty Ethernet cable, or incorrect controller IP address.	Ensure the PC's IP address is on the same subnet as the controller. Try a different Ethernet cable. Use the controller's USB service port for a direct connection if Ethernet fails.
Robot motion is jerky or inaccurate.	Poor motor tuning, loose mechanical components on the robot, or high electrical noise.	Run the auto-tuning procedure in the software. Inspect the robot arm for any mechanical looseness. Verify the integrity of the ground connection and ensure signal cables are

Symptom	Possible Cause	Solution
		shielded and separated from power cables.
Over-temperature fault is triggered.	Blocked or failed cooling fans, high ambient cabinet temperature, or excessive controller load.	Clean the fan filters and ensure fans are spinning. Verify the cabinet's cooling system is functional and the ambient temperature is within the specified range. If the issue persists, analyze the robot program for unnecessarily high acceleration.
EtherCAT network fault.	A break in the network cable, a powered-off slave device, or incorrect network configuration.	Check the status LEDs on all EtherCAT devices in the chain. Inspect all cables for damage. In the software, compare the detected network topology with the configured topology to find mismatches.
Controller loses robot's absolute encoder positions after a power cycle.	The internal battery for the absolute encoder memory is depleted.	Replace the internal battery following the procedure in the service manual. After replacement, the robot will need to be re-mastered to re-establish its absolute position.

7. Technical Specifications

Parameter	Value	Unit
Weight	7.5	kg
Material	Powder-coated Steel	
Voltage	24VDC	
IP Rating	IP20	
Country of Origin	JP	
Protocol	EtherCAT	
Dimensions	450 x 300 x 150 mm	