

# User Manual: NexBot Safety

## MA012-008 6-Axis Robot Arm 25kg 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:** This robot operates on high-voltage 480VAC power. Contact with energized components will cause death or severe electrical burns. Always perform lockout/tagout procedures before opening any electrical cabinet.

**WARNING:** Unexpected robot motion can cause fatal crushing or impact injuries. Never enter the robot's safeguarded space during automatic operation.

**WARNING:** Exceeding the 25 kg maximum payload can lead to brake failure and uncontrolled axis movement, potentially causing the arm to drop.

**CAUTION:** During operation, motor and gearbox surfaces can reach high temperatures. Avoid direct skin contact to prevent burns.

**NOTICE:** To maintain the IP67 rating, ensure all protective caps and cable connectors are securely fastened. Failure to do so can lead to damage from dust or moisture ingress.

## 2. Product Overview

The NexBot Safety MA012-008 is a versatile 6-axis articulated robot arm engineered for demanding industrial automation applications requiring precision and durability. This robot arm is an ideal solution for medium-payload operations, providing a balance of speed, strength, and a large work envelope to enhance production line efficiency and flexibility. **Key Features and Benefits:** The MA012-008 features a substantial 25 kg payload capacity, which allows it to handle a wide variety of parts, fixtures, and end-of-arm tooling. This capability makes it highly effective for tasks that are too strenuous or repetitive for manual labor. With an extensive reach of 1710 mm, the arm can service multiple machines, cover large work areas, and access difficult-to-reach points within a work cell, maximizing its utility. The six axes of motion provide exceptional dexterity, enabling complex tool paths and orientations necessary for intricate assembly, welding, and material handling tasks. Engineered for precision, this robot arm delivers an impressive position repeatability of  $\pm 0.04$  mm. This level of accuracy is critical for applications where quality and consistency are paramount, such as parts inspection, precise assembly, and dispensing. The robust construction, featuring a cast aluminum body and an IP67 rating, ensures reliable performance in harsh industrial environments with exposure to dust and liquids. **Common Applications:** - Machine Tending (CNC, injection molding) - Arc Welding and Spot Welding - Material Handling and Transfer - Palletizing and Depalletizing - Assembly and Dispensing The streamlined design facilitates straightforward integration into new or existing automation systems. Standard mounting patterns and connectivity options reduce setup time, allowing for faster deployment and return on investment. The MA012-008 represents a reliable and powerful tool for automating key manufacturing processes.

## 3. Getting Started

### 1. Powering On the System

To power on the NexBot Safety MA012-008, first ensure all Emergency Stop buttons are released. Then, turn the main disconnect switch on the controller cabinet to the 'ON' position. The system will boot, and the teach pendant will display the main startup screen.

### 2. Understanding the Teach Pendant

The teach pendant is your primary interface for controlling the robot. It features a color touchscreen, a physical E-Stop button, and enabling (dead-man) switches on the back. Use it to jog the robot, write and edit programs, and monitor system status.

### 3. Jogging the Robot Manually

To move the robot, you must be in T1 (Teach) mode and hold the enabling switch. Select a coordinate system (e.g., JOINT, WORLD) and press the corresponding directional buttons to move the arm. This is fundamental for teaching the robot new positions.

### 4. Defining a Tool Center Point (TCP)

The TCP defines the active point of your tool. Before programming, you must accurately define the TCP's position and orientation relative to the robot's Axis 6 flange. An inaccurate TCP will result in incorrect path movements.

## 4. Operation

### Creating a Program

A program consists of a sequence of recorded points and instructions. Manually jog the robot to a desired location, then use the 'Record Point' function on the teach pendant to save the position. Specify the motion type (Linear, Joint) for how the robot moves to that point.

**Tip:** Use 'Joint' motion for transitioning between distant points to save time, and 'Linear' motion for precise movements like approaching a part or following a straight path.

### Configuring Payload Settings

Accurately defining the payload is critical for performance and motor life. In the system settings, enter the mass properties of your end-of-arm tooling and workpiece, ensuring the total is under the 25 kg limit. The robot uses this data to optimize acceleration and torque.

### Running in Automatic Mode

To run a program in production, select 'AUTO' mode, close and lock the safety gate, and clear any faults. The program can then be initiated via an external signal from a PLC over PROFINET or from an operator panel. The robot will execute the program in a continuous loop.

### Using PROFINET for Integration

The MA012-008 uses PROFINET to communicate with the wider factory automation system. Configure digital I/O signals to receive commands like 'Cycle Start' from a PLC or to send status signals like 'Task Complete'. This enables seamless integration into an automated production line.

**Tip:** Group frequently used signals in the PLC logic to simplify troubleshooting and program flow.

### Monitoring System Status

Regularly check the diagnostics screen on the teach pendant. It provides real-time information on motor torques, axis positions, I/O status, and any active system alarms. Proactively monitoring this data can help you identify potential issues before they cause downtime.

## 5. Maintenance Schedule

Interval	Task	Notes
Daily	Visually inspect the robot arm and cables for any signs of damage, wear, or fluid leaks. Confirm the area is free of debris.	Perform before starting production.
Weekly	Test all Emergency Stop buttons and safety interlocks (e.g., safety gates) to ensure they function correctly.	Document each test in a safety log.

Interval	Task	Notes
Monthly	Clean the air filters on the controller cabinet to ensure proper airflow and prevent overheating.	Power down the controller before removing filters.
Annually	Re-torque the robot's base mounting bolts to specification. Check for excessive backlash in all axes.	Requires a calibrated torque wrench.
Every 3,000 Hours	Inspect and clean the electrical contacts within the controller cabinet. Check for any loose wire terminals.	Must be performed by a qualified technician with power locked out.
Every 5,000 Hours	Replace the memory backup batteries in both the robot arm base and the controller to prevent loss of calibration data.	The system will issue a 'Battery Low' warning when replacement is imminent.
Every 10,000 Hours	Perform gearbox lubrication service. A certified technician should drain a sample for analysis and replace or top-up grease/oil as required.	Use only NexBot-approved lubricants. Failure to do so will void the warranty.

## 6. Troubleshooting

Symptom	Possible Cause	Solution
Robot stops with a 'Singularity' error.	The robot's wrist axes (4, 5, 6) are aligned, causing an inability to calculate a linear path.	In the program, slightly change the angle of the preceding point to avoid the singular alignment. Alternatively, use a 'Joint' motion type for the problematic move.
An 'Axis Limit' error is triggered.	A programmed point is outside the robot's physical range of motion for a specific axis.	Edit the program point. Manually jog the robot to a reachable position and re-teach the point.
The robot is not responding to PROFINET commands.	Network cable is disconnected, IP address conflict, or incorrect device name.	Check physical cable connections. Verify the robot's network settings match the PLC project configuration. Ping the robot's IP address from the engineering station.
Positioning accuracy is poor (greater than $\pm 0.04$ mm).	Incorrect TCP or payload data, loose EOAT mounting bolts, or the robot requires re-mastering/calibration.	Verify TCP and payload settings are precise. Check that the EOAT is securely fastened. If the issue persists, run the calibration routine.

Symptom	Possible Cause	Solution
A 'Motion Supervision' or 'Path Deviation' error occurs.	The robot was unable to follow the programmed path, possibly due to an obstruction, overly aggressive acceleration, or incorrect payload settings.	Check the work envelope for obstructions. Reduce the programmed speed/acceleration. Verify payload data is accurate.
Controller fan is excessively loud or not spinning.	Fan is obstructed, dirty, or has failed.	Power down and lock out the controller. Inspect and clean the fan and vents. If the fan has failed, it must be replaced to prevent overheating.
E-Stop alarm is active but all buttons are released.	A fault in the safety circuit wiring or a defective E-Stop button/module.	Inspect the wiring for all devices in the E-Stop chain. This may require a certified technician to diagnose the safety circuit.

## 7. Technical Specifications

Parameter	Value	Unit
Weight	275.0	kg
Material	Cast Aluminum Alloy	
Voltage	480VAC	
IP Rating	IP67	
Country of Origin	JP	
Protocol	PROFINET	
Dimensions	650 x 580 mm (Base Footprint)	
Reach	1710 mm	
Payload	25 kg	
Axes	6	
Repeatability	±0.04 mm	