

User Manual: NexBot Robotics INC142-001 Incremental Encoder 1024 PPR

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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 device controls motion systems. Incorrect signals can cause sudden, powerful machine movement. Ensure all personnel are clear of the machine's operating envelope before applying power or testing.

WARNING: Supplying voltage above 24VDC or with reversed polarity will cause permanent damage to the encoder. Always verify power supply settings before connecting.

WARNING: The encoder housing must be connected to a proper earth ground. Failure to do so can result in unreliable signals and an increased risk of damage from electrical noise or faults.

CAUTION: The internal electronics are sensitive to electrostatic discharge (ESD). Handle the device with appropriate ESD precautions, especially when connectors are exposed.

NOTICE: To maintain the IP67 ingress protection rating, only use cables and connectors rated for IP67 or higher and ensure they are properly installed and tightened.

2. Product Overview

The NexBot Robotics INC142-001 is a high-precision incremental encoder designed to deliver accurate rotational position and velocity feedback for industrial robotic applications. This component is essential for closed-loop control systems, ensuring that robot movements are executed with the highest degree of accuracy and repeatability. Its robust construction and reliable signal output make it suitable for demanding manufacturing environments where uptime and precision are critical. Key to its performance is a resolution of 1024 Pulses Per Revolution (PPR), which allows the robot controller to track joint positions with fine granularity. This level of detail is crucial for tasks such as precision assembly, CNC machine tending, and intricate welding paths, where even minor deviations can impact product quality. The encoder utilizes a standard A/B/Z quadrature output signal. The A and B channels provide directional information, while the Z channel (index pulse) provides a precise reference point once per revolution, allowing for homing sequences and error checking. This proven signaling method offers high noise immunity and straightforward integration with NexBot Robotics servo drives and motion controllers. Engineered for durability, the INC142-001 features a rugged, anodized aluminum housing that provides excellent protection against physical impact and corrosion. With an IP67 rating, the encoder is fully sealed against dust ingress and can withstand temporary immersion in water, making it ideal for use in environments with coolants, washdown procedures, or high particulate levels. This robust design minimizes downtime and maintenance requirements associated with component failure in harsh conditions. The encoder operates on a flexible supply voltage range of 5-24VDC, ensuring compatibility with a wide variety of industrial control systems and power supplies. It features a standard 8mm hollow shaft design, allowing for direct and secure mounting onto motor shafts, reducing mechanical complexity and potential points of failure. Installation is streamlined through a standardized mounting flange and connector interface, ensuring it can be integrated as a direct replacement part for specified NexBot Robotics systems. This component is a core element in maintaining the positioning accuracy of articulated and collaborative robot arms, directly contributing to operational efficiency and consistent production quality.

3. Getting Started

1. Product Overview

The NexBot Robotics INC142-001 is a 1024 Pulses Per Revolution (PPR) incremental encoder. It provides real-time rotational feedback via standard A/B/Z quadrature signals and communicates status and configuration data over a PROFINET industrial network. Its robust anodized aluminum construction ensures reliability in demanding industrial environments.

2. Understanding Incremental Signals

The encoder outputs two square wave signals, A and B, which are 90 degrees out of phase. The control system uses the sequence of these signals to determine the direction of rotation and counts the pulses to determine position. The Z (index) signal provides one pulse per revolution, which is typically used for homing or precise position referencing.

3. PROFINET Network Integration

The INC142-001 operates as a PROFINET IO device. It must be integrated into a project using its GSDML file, which defines its communication properties for the IO controller (PLC). Once configured, it provides diagnostic data and can have its parameters set over the network.

4. Operation

Normal Operating State

During normal operation, the encoder will continuously transmit position data as the shaft rotates. The PROFINET diagnostic LEDs should indicate a stable network connection and no device faults. The control system should show a smooth and consistent change in position values corresponding to shaft movement.

Tip: Monitor the raw pulse count in your controller's software during initial setup to confirm smooth, linear counting without jumps or dropouts.

Interpreting Positional Data

The controller's high-speed counter input interprets the A/B quadrature signals. With 1024 PPR and 4x decoding (counting every edge of both A and B signals), the controller will register 4096 counts per full revolution of the encoder shaft.

Utilizing the Index (Z) Pulse

The Z-pulse is critical for establishing a machine's home or zero position. During a homing sequence, the machine moves until the controller detects the single Z-pulse, providing a highly repeatable reference point for all subsequent movements.

Tip: For applications requiring absolute positioning after power-up, a homing routine using the Z-pulse must be executed.

Environmental Resilience

The INC142-001 features an IP67 rating, making it dust-tight and protected against temporary immersion in water. The anodized aluminum body provides excellent corrosion resistance. Operate the device within its specified temperature and humidity ranges to ensure a long service life.

PROFINET Diagnostics

The encoder provides diagnostic information over the PROFINET network. This can include status information like network errors, internal faults, or over-temperature warnings (if applicable). Refer to the GSDML file documentation for a complete list of diagnostic alarms.

Tip: Program your HMI or PLC to display PROFINET diagnostic alarms from the encoder for proactive maintenance and faster troubleshooting.

5. Maintenance Schedule

Interval	Task	Notes
Weekly	Visually inspect the encoder housing, cables, and connectors for any signs of physical damage, wear, or contamination.	Pay close attention to the cable entry point for signs of stress or abrasion.
Monthly	Clean the exterior of the encoder housing. Use a soft cloth lightly dampened with a mild, non-corrosive cleaning agent.	Do not use high-pressure jets or harsh solvents, as this may compromise the seals despite the IP67 rating.
Quarterly	Check the tightness of the encoder's mounting screws and the shaft coupling set screws. Re-torque if necessary.	Vibration can cause hardware to loosen over time.
Annually	With the machine powered down, inspect all electrical terminal connections for tightness and signs of corrosion.	This is especially important in environments with high vibration or temperature cycling.
Annually	Inspect the shaft coupling for signs of wear, fatigue, or hardening of the flexible element.	A worn coupling can introduce positioning errors and should be replaced.
As Needed	If positional accuracy appears to degrade, perform a signal verification using an oscilloscope to check for clean, stable A/B/Z square waves.	Signal degradation can indicate electrical noise or internal component failure.

6. Troubleshooting

Symptom	Possible Cause	Solution
No position reading; encoder appears dead	No power to encoder, incorrect wiring, or internal failure.	Verify 5-24VDC is present at the encoder's power terminals. Check all wiring against the diagram. If power and wiring are correct, the encoder may need replacement.
Position counts in the wrong direction	Signal wires for channels A and B are reversed.	Power down the system and swap the connections for the A and B signal wires at the controller input.
Inaccurate or jumping position counts	Loose shaft coupling, mechanical vibration, or electrical noise.	Check that the shaft coupling is tight and aligned. Ensure encoder and signal cables are properly grounded and shielded, and routed away from motors or VFDs.
Encoder does not appear on the PROFINET network	Faulty network cable, incorrect IP address/device name, or network switch issue.	Test the network cable. Verify the device name and IP settings in the PLC project match the settings configured for the encoder. Check for link lights on the switch port.
Homing sequence fails; Z-pulse not detected	Z-channel wire is disconnected or broken, or an internal fault has occurred.	Verify the continuity and connection of the Z-channel wire from the encoder to the controller. If the wiring is correct, the encoder's Z-channel may have failed.
PROFINET communication is intermittent	Damaged network cable, loose M12 connector, or excessive network traffic.	Inspect the entire length of the PROFINET cable for damage. Ensure the M12 connector is fully tightened. Consult a network administrator to check for network load issues.
Encoder housing is excessively hot to the touch	Supply voltage is too high, or an internal short circuit has occurred.	Immediately disconnect power. Verify the power supply is within the 5-24VDC specification. If the voltage is correct, the encoder has an

Symptom	Possible Cause	Solution
		internal fault and must be replaced.

7. Technical Specifications

Parameter	Value	Unit
Weight	0.25	kg
Material	Anodized Aluminum	
Voltage	5-24VDC	
IP Rating	IP67	
Country of Origin	SE	
Protocol	PROFINET	
Dimensions	58 x 58 x 52 mm	