User Manual: NexBot Robotics CYC123-004 Cycloidal Gearbox 100:1 Ratio

SKU: NXB-GBX-CYC123-004 | 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 voltage. The connected motor operates on high voltage. Disconnect and lock out all power sources before installation or service. Failure to do so can result in severe injury or death.

WARNING: Pinch Hazard. The gearbox creates high torque at the output. Keep hands, clothing, and tools clear of all moving parts during operation to prevent crushing injuries.

WARNING: Heavy Component. The CYC123-004 weighs 7.5 kg. Use proper lifting techniques or mechanical assistance to avoid back injury during handling and installation.

CAUTION: Hot Surfaces. During continuous operation, the gearbox housing may reach temperatures that can cause burns. Allow the unit to cool completely before performing maintenance.

NOTICE: Use only NexBot Robotics approved lubricants. Using incorrect lubricants can lead to premature wear, overheating, and will void the product warranty.

2. Product Overview

The NexBot Robotics CYC123-004 is a high-performance cycloidal gearbox engineered to deliver exceptional precision and torque density for demanding robotic applications. This component is the core of motion control in articulated robot joints, providing the necessary torque multiplication and positional accuracy required for complex tasks. At its heart, the cycloidal reduction mechanism offers significant advantages over traditional planetary or harmonic gear systems. Its primary benefit is near-zero backlash, specified at less than 1 arc-minute, which is critical for applications requiring high repeatability, such as automated welding, precision assembly, and intricate material handling. This minimal lost motion ensures that the robot's end-of-arm tooling can be positioned with extreme accuracy, cycle after cycle. The design also provides exceptional torsional stiffness and a high shock load capacity (up to 500% of rated torque), allowing the robot to withstand unexpected impacts or rapid acceleration and deceleration commands without damage or loss of position. With a reduction ratio of 100:1, the CYC123-004 allows system designers to use smaller, higher-speed servo motors while still achieving substantial output torque. It delivers a continuous rated torque of 280 Nm and can handle intermittent peak torque demands up to 450 Nm, making it suitable for joints on medium to heavy payload robots. The gearbox features integrated, high-capacity angular contact bearings that can directly support heavy external loads and moments, simplifying the mechanical design of the robot joint and eliminating the need for additional external support bearings. The CYC123-004 is housed in a compact, rigid steel alloy casing measuring 180 x 180 x 95 mm. It is a fully sealed unit with an IP65 rating, ensuring protection against dust and water ingress in typical industrial environments. The unit is pre-lubricated with a specialized high-performance grease and is designed to be maintenance-free for its operational lifespan, reducing downtime and total cost of ownership. Installation is streamlined with standardized mounting patterns compatible with select NexBot Robotics servo motors and robot arm flanges. This gearbox is an ideal replacement or upgrade component for maintaining the peak performance and reliability of compatible NexBot Robotics systems.

3. Getting Started

1. Product Overview

The NexBot Robotics CYC123-004 is a zero-backlash cycloidal gearbox designed for high-precision robotic applications. Its 100:1 reduction ratio and robust construction provide the high torque and stiffness required for accurate and dynamic motion control. This manual provides guidelines for its safe installation, operation, and maintenance.

2. Component Identification

Familiarize yourself with the main components of the gearbox. These include the input shaft (motor side), the main housing, the output flange with mounting holes (load side), and the oil fill/drain plugs. The nameplate contains the model number, SKU, and serial number for service and identification.

3. Principle of Operation

The CYC123-004 utilizes a cycloidal disc and eccentric bearing mechanism to achieve high reduction ratios in a compact size. This design offers exceptional shock load capacity and very low backlash compared to other gearbox types, resulting in the high repeatability (<1 arc-min) essential for robotic tasks.

4. Operation

Torque Limits

The gearbox is designed for a continuous rated torque of 280 Nm. The peak torque of 450 Nm should only be encountered during brief periods of acceleration or deceleration. Consistently operating above the rated torque will significantly reduce the operational life of the unit.

> **Tip:** Monitor the motor current in your controller; a sustained high current draw is often an indicator of operating beyond the rated torque.

Operating Speed

The maximum recommended input speed is dependent on the application's duty cycle and thermal management. Exceeding the recommended input speed can lead to excessive heat generation and lubrication breakdown. Refer to the performance curves in the engineering datasheet for specific speed-torque limits.

Thermal Management

The gearbox is designed to dissipate heat generated during normal operation. Ensure adequate airflow around the unit's 180x180x95 mm housing. In high duty-cycle applications, monitor the housing temperature and consider external cooling if it consistently exceeds 80°C.

Positional Accuracy

The gearbox's inherent low backlash and high torsional stiffness contribute to its <1 arc-minute repeatability. To maintain this level of precision, ensure the gearbox is rigidly mounted to the machine frame and that all couplings are secure. Any looseness in the mechanical system will degrade performance.

> **Tip:** Periodically run a calibration routine on the robot to compensate for any minor mechanical wear over the unit's lifetime.

Emergency Stop (E-Stop) Conditions

During an E-stop, the gearbox is designed to withstand the peak torque of 450 Nm. However, frequent and aggressive emergency stops can cause cumulative fatigue. E-stop events should be logged and the cause investigated to prevent repeated shock loading.

5. Maintenance Schedule

Interval	Task	Notes
Weekly	Visually inspect the gearbox for any signs of oil leakage, particularly around the input and output seals.	A minor oil weep is acceptable, but any active dripping requires immediate attention.
Monthly	Listen for changes in operational noise. Any new grinding, whining, or clicking sounds should be investigated.	Use a mechanic's stethoscope or vibration analysis tool for a more accurate assessment.

Interval	Task	Notes
Quarterly	Check the torque of all external mounting bolts (gearbox-to-frame and motor-to-gearbox).	Bolts can loosen over time due to vibration and thermal cycling. Re-torque to original specifications.
Annually	Take a lubricant sample for analysis. Test for viscosity, water content, and particle contamination.	Oil analysis can predict internal wear and prevent catastrophic failure.
Every 5,000 Hours	Drain and replace the synthetic gear oil. Refer to the datasheet for the correct oil type and volume.	Always replace the drain plug gasket to ensure a proper seal.
As Needed	Clean the exterior of the gearbox housing to ensure proper heat dissipation.	Accumulated dust and grime can act as an insulator, causing the unit to run hotter.

6. Troubleshooting

Symptom	Possible Cause	Solution
Excessive Operating Noise or Vibration	Misalignment between motor and gearbox; worn internal bearings; loose mounting bolts.	Power down and lock out. Verify motor-gearbox alignment. Check torque on all mounting bolts. If noise persists, contact NexBot support for internal inspection.
Gearbox is Overheating	Operating continuously above rated torque; incorrect lubricant type or level; poor ventilation.	Reduce the load or duty cycle. Verify the lubricant is the correct type and filled to the proper level. Ensure there is adequate airflow around the unit.
Oil Leaking from Seals	Worn or damaged oil seals; over-pressurization of the housing due to a blocked breather.	Identify the source of the leak. Replace the damaged seal. Check and clear the breather plug if equipped.
Reduced Positional Accuracy / Increased Backlash	Internal gear wear from exceeding lifecycle; loose output flange connection; loose shaft coupling.	Verify all external connections are tight. If backlash is internal, the gearbox is likely nearing its end-of-life and may require replacement.
Output Shaft is Jerky or Does Not Rotate Smoothly	Damaged internal cycloidal disc or bearings, often from a severe shock load event.	Immediately stop operation. The unit requires internal inspection and repair by a qualified technician. Do not attempt to run the gearbox.

Symptom	Possible Cause	Solution
Motor Faults on Overcurrent	Mechanical binding inside the gearbox; load exceeds the peak torque rating (450 Nm).	Disconnect the load from the gearbox output to isolate the problem. If the motor still faults, the gearbox is seized. If not, the application load is too high.

7. Technical Specifications

Parameter	Value	Unit
Weight	7.5	kg
Material	Hardened Steel Alloy	
IP Rating	IP65	
Country of Origin	KR	
Dimensions	180 x 180 x 95 mm	
Repeatability	<1 arc-min	
Torque	Rated: 280 Nm / Peak: 450 Nm	