

C040 AMR CE Maintenance Manual



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Preface

Automated Guided Vehicles (hereafter referred to as AMR or AGV) are specifically designed for indoor material transportation. Before operating or performing maintenance on the AGV, thoroughly read this manual. You must be fully familiar with the AGV's operation and understand its operational and maintenance instructions; otherwise, serious accidents may occur. After reading, store this manual in a safe, dry location for future reference.

This manual details the AGV's performance specifications, operating procedures, and maintenance precautions. Ensure the device model matches the description herein during use or repair.

This AGV is classified as an industrial handling vehicle and complies with:

- EN ISO 3691-1 (Industrial trucks – Safety requirements and verification – Part 1)
- EN 1295 (Industrial trucks – Electromagnetic compatibility)
- EN 12053 (Safety of industrial trucks – Test methods for measuring noise emissions)
- EN 1175-1 (Safety of industrial trucks – Electrical requirements)
- GB/T 30029-2013 (General Rules for Design of Automated Guided Vehicles)
- ISO 13849-1:2015 Cat. 1 (Safety of machinery – Safety-related parts of control systems)

The AGV must only be used for its intended purpose within specified operational limits.

Chapter One Safety Instructions

1.1 On-Site Supervision

- Familiarize yourself with all operational guidelines.
- Train operators on AGV usage, safety, and maintenance.
- Ensure operators comply with safety regulations and maintenance protocols.

1.2 Occupational Safety

- Maintain AGV cleanliness and functionality. Perform daily/weekly inspections per maintenance schedules.
- Stop the AGV immediately if defects affecting safety are detected.
- In case of malfunction: Power off and notify supervisors.
- Do not repair components without authorization.
- Operators are responsible for personal and environmental safety.
- Report accidents immediately; leave the AGV undisturbed at the scene.

1.3 Operator Requirements

- Age ≥ 18 years.
- Physically and mentally fit (e.g., normal vision/hearing).
- Trained in operation, safety, and maintenance.
- Authorized by on-site supervisors.
- Understand AGV operational characteristics.
- Recommended: Wear safety shoes at all times.

1.4 Emergency Procedures

For malfunctions: Stop operation, power off. Do not use until repaired by authorized

personnel.

Safety Instructions

Trained personnel must oversee AGV safety during all shifts.

- Do not linger or play in the AGV's operating path.
- Do not transport unstable, unbalanced, or unsecured loads with a high center of gravity.
- Do not stand, sit, or walk on loads being handled by the AGV.
- Do not clean the AGV directly with liquids.
- Do not park, operate, adjust, or perform maintenance on slopes.
- Keep clear of the load-handling area.
- Keep clear of load-handling machinery.
- Before performing any maintenance, ensure the power is turned off.
- Before manually pushing the vehicle, release the drive motor brake.
- Use dedicated lifting tools for handling, and avoid applying force to weak areas such as the top cover or bumper sensors.
- Never transport loads exceeding the AGV's rated capacity.
- Never use the AGV to lift personnel.
- Never carry passengers.
- Never touch any moving parts.
- Never insert limbs into gaps in the AGV's chassis or lifting mechanisms.
- Never operate a malfunctioning unit. Immediately repair it or use manual controls to remove it from the system.
- Never modify program parameters (including control and scheduling programs) while the AGV is running.

1.5 Manual Operation

- Use only for fault recovery or maintenance.
- Operate with extreme caution, especially with loads.

- Continuously monitor surroundings.
- Ensure the path is clear of obstacles and personnel before manual movement.
- Ensure the load-handling area is unoccupied before manually operating the AGV.
- Verify AGV positioning during load handling.

1.6 Daily Safety Inspection

The following safety inspections must be performed regularly after system restart (at least once every 24 hours for continuously operating systems):

- **Emergency stop buttons:** Check condition and functionality. The AGV must stop when activated.
- **Obstacle avoidance sensors:** Verify operation. The AGV must stop when an obstacle enters the safety area.
- **Bumper sensors:** Test functionality by pressing each side (front, rear, left, right). The AGV must stop upon contact.
- **Warning devices:** Inspect status lights, indicators, and alarm horns during safety tests.
- **Drive motor brake:** Ensure proper function. The AGV should not be movable when powered off with the brake engaged.

1.7 Weekly Safety Inspection

Conduct the following inspections weekly:

- **Lifting mechanism:** Check structural integrity and operational stability.

1.8 Comprehensive Safety Inspection

Maintain a log documenting inspections, including date, time, inspector name, and remarks.

Warning: The AGV is a heavy-duty machine. Malfunctioning safety systems can cause severe damage. Report faults discovered by operators to maintenance personnel

immediately.

1.9 Noise

The average operator noise exposure level (LpA) complies with **EN 12053:2001** and **EN ISO 4871** (values listed in the manual).

Note: Higher sound pressure levels may occur due to operational methods, environmental factors, or external noise sources.

1.10 Use in Hazardous Environments

Standard AGVs are prohibited in explosive atmospheres. For AGVs specifically designed for hazardous conditions, please contact your dealer.

1.11 Maintenance and Structural Modifications

Do not modify the AGV without the manufacturer's written approval.

Prohibited actions: Adding/removing parts, welding, or bending components.

Unauthorized modifications will:

- Void the warranty.
- Allow the manufacturer to deny future maintenance.

Exceptions: Modifications are only permitted with the manufacturer's written consent, provided the user:

- Engages qualified safety engineers to design, test, and implement changes.
- Maintains permanent records of modification plans, tests, and execution.
- Updates load labels, stickers, manuals, and other documentation.

- Affixes a permanent, legible label on the AGV detailing:

- Modification type/date.

- Name/address of the modifying entity.

Chapter Two Operating Environment

2.1 System Composition

An AGV is a transport vehicle that operates autonomously within a defined area, performing material handling and assembly tasks using a specific navigation method. Typically, AGVs function as part of a larger intralogistics system, such as warehouses, semi-finished goods storage, or integrated manufacturing processes.

Each AGV is equipped with a manual control handle for temporary manual operation in special circumstances.

A single AGV is part of an integrated system that includes:

- Warehouse Management System (WMS)
- AGV Control System
- One or more AGVs
- Charging stations

2.2 Operating Conditions

- **Temperature range:**
 - Continuous operation: +5°C to +35°C
 - Short-term operation: 0°C to +40°C
 - For extreme temperatures (freezing or high-heat environments), consult the manufacturer for specialized AGV models.
- **Recommended humidity:** 40%–80% (non-condensing).
- **Floor requirements:**
 - Load-bearing capacity: Must support AGV + payload weight.
 - Surface friction coefficient: ≥ 0.5 (optimal surfaces: hard concrete or epoxy resin).

- **Flatness:** Must be level (see the manual for specific obstacle clearance details).

2.3 Restrictions

Do NOT operate the AGV in the following conditions:

- Transporting or lifting people.
- Explosive atmospheres.
- Floors with insufficient load capacity.
- If the AGV is damaged or malfunctioning.

2.4 Clearance Requirements

- Ensure adequate overhead clearance for the AGV and its load.
- Verify sufficient space when passing through doorways or narrow passages.

2.5 Floor Load Capacity

The combined weight of the AGV and its payload must never exceed the floor's maximum load capacity.

2.6 Lift Use

- Transporting AGVs between floors via lift requires supervisor approval.
- Ensure the total weight (AGV + payload) does not exceed the lift's rated capacity.

WARNING: No personnel should enter the lift while the AGV is moving in or out.

2.7 Operation on Slopes

Do NOT operate on slopes steeper than the maximum incline specified in **Chapter 3** (Technical Specifications).

Risks: Loss of traction, derailment, or mechanical damage.

Note: The AGV has a minimum ground clearance of 20mm—avoid uneven surfaces.

Chapter Three Operation Manual

3.1 Vehicle Overview

Figure 3-1

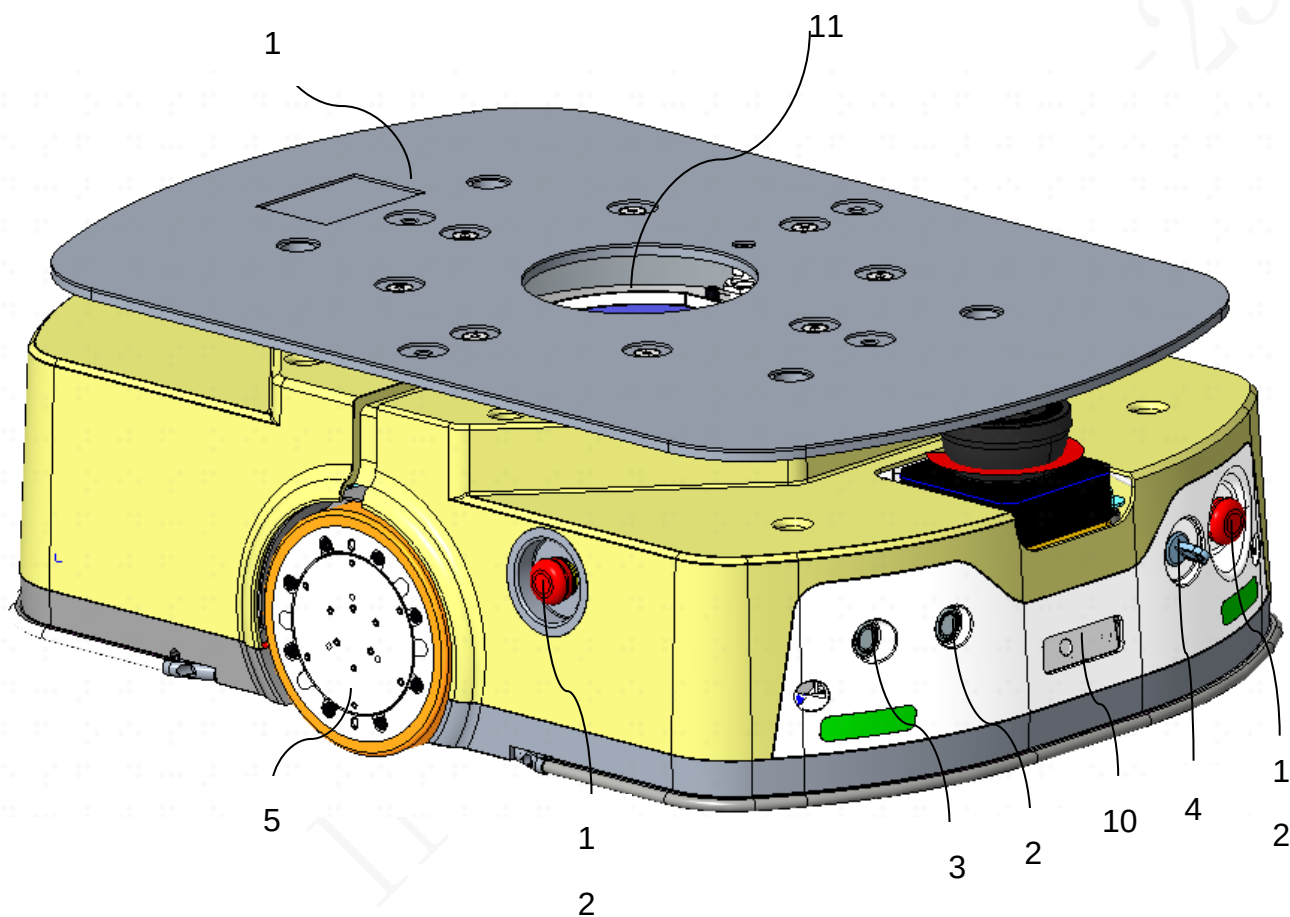


Figure 3-2

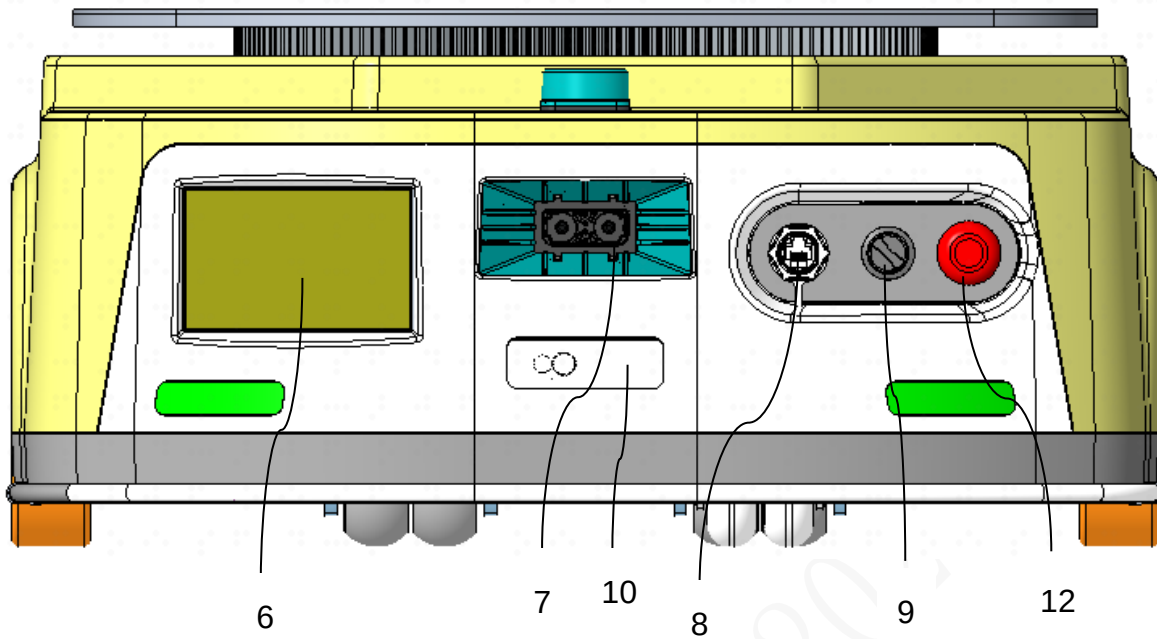
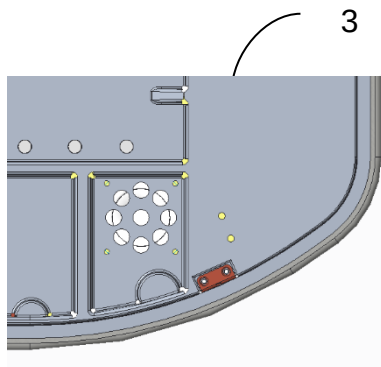


Table 3-1

No.	Components	Function
1	Lifting Platform	For load bearing
2	Maintenance Button	Pressed by user during maintenance
3	Confirmation Button	Button pressed by user to initiate startup
4	Power Button	Controls the vehicle's main power supply
5	Driving Wheel	Traction unit for movement
6	Display Screen	Displays fault codes and supports partial manual intervention operations
7	Auto Charging Port	Used for automatic charging
8	Network Debugging Interface	Equipment debugging interface
9	Manual/Auto switching	Toggles between manual mode and automatic mode
10	Stereo Camera	Provides 3D obstacle avoidance
11	Upward Camera	Identifies shelf QR codes and adjusts shelf alignment
12	Emergency stop Button	Pressed by user for emergency braking

Figure 3-4



Annotation:

1. Status Indicators (Front/Rear/Left/Right):
 - Green: Normal operation
 - Yellow: Warning
 - Red: Fault condition
 - Blue: Protected mode
2. Laser Scanner (Front-mounted): Navigation & obstacle detection.
 - Safety Area: If an obstacle is detected within this area, a safety stop command is generated, and an audible alarm sounds.
 - Warning Area: If an obstacle is detected within this area, the vehicle decelerates, and an audible alarm sounds. The Warning Area is larger than the Safety Area.
3. Signal Horn: Located under the vehicle. Emits musical tones during normal operation and warning sounds during obstacle avoidance or fault conditions.
4. Emergency Stop Buttons: One each on the front, rear, left, and right sides. Pressing any one immediately stops the vehicle.
5. Bumpers: One each on the front and rear. The vehicle stops upon collision.
6. TOF Sensors: One each on the front and rear. Provide 3D protective obstacle avoidance.
7. Contour Lights: One each on the left and right sides. Illuminate the vehicle's forward travel path and operating range.

Warning: The Emergency Stop should only be used in genuine emergencies. Avoid frequent use in non-emergency situations, as it can cause damage to the drive motor. To release the button, rotate it clockwise.

Chapter Four Maintenance

Regular inspections by qualified personnel are mandatory to ensure operational integrity.

4.1 Safety Instructions for Maintenance

- Maintain clean work areas (oil/water degrades performance)
- Remove metallic jewelry to prevent short circuits
- Verify clear operational paths before powering on
- Investigate abnormal sounds immediately (do not inspect device before shut down).
- Power down during extended inactivity

4.2 Safety Inspection

The following safety inspections must be performed regularly after system restart (at least once every 24 hours for continuously operating systems):

- **Emergency stop buttons:** Check condition and functionality. The AGV must stop when activated.
- **Obstacle avoidance sensors:** Verify operation. The AGV must stop when an obstacle enters the safety area.
- **Bumpers:** Test functionality by pressing each side (front, rear, left, right). The AGV must stop upon contact.
- **Warning devices:** Inspect status lights, indicators, and alarm horns during safety tests.
- **Drive motor brake:** Ensure proper function. The AGV should not be movable when powered off with the brake engaged.

Weekly Safety Inspection

Perform the following inspections once per week:

- **Lifting mechanism:** Inspect structural integrity and operational stability.

4.3 Daily Inspection

Table 4-1 Daily Inspection

Component	Inspection items	Method & Corrective Action
Laser Safety Scanner	Scratches/Damage	If found, identify the cause and replace (see Section 5.2.1).
	Dust/Obstruction	Clean gently with an alcohol-dampened soft cloth.
	Loose Connection	Check for looseness; if found, re-tighten (see Section 5.2.1).
Bumper	Rubber Strip Detachment	If detached from the frame, investigate and reattach. Replace if irreparable.
	Frame Connection	Check for looseness; tighten if necessary (see Section 5.2.2).
	Surface Damage	If damaged, replace (see Section 5.2.2).
Vehicle body	Coating/Scratches	Inspect for scratches; investigate causes if found.
Battery	Charge Level	Ensure sufficient charge. If not, troubleshoot charging issues.
Indicator	Functionality	Replace if malfunctioning (see Section 5.2.3).
Upward Camera	Dust and foreign object obstruction	Clean gently with an alcohol-dampened soft cloth.

4.4 Monthly Inspection

Table 4-2 Monthly Inspection

Component	Inspection items	Method & Corrective Action
Lifting Mechanism	Turntable Rotation Gap	Rotate manually until resistance is felt. If gap exceeds 2°, investigate and repair (see Section 5.3.3).
	Anti-Slip Pad	Replace if damaged or detached (see Section 5.1.1).
Driving Wheel	Wear/Cracks/Delamination	Replace if cracks, delamination, or >2mm wear (see Section 5.4.2).
	Loose Screws	Re-tighten if necessary (see Sections 5.4.2 & 5.6).
	Foreign Objects	Remove any entangled debris (see Section 5.4.2).

4.5 Semi-Annual Maintenance

Table 4-3 Semi-Annual Maintenance

Component	Inspection items	Method & Corrective Action
Slewing Bearing	Gear Tooth Wear	Check with a feeler gauge; replace if gap >0.2mm (see Section 5.3.3).
	Bolt Preload	Verify torque (see Sections 5.3.3 & 5.6).

	Seal Damage	Replace damaged seals (see Section 5.3.3).
	Cleaning	Remove wear debris from gear teeth.
Battery	Voltage	Fully charged voltage must be $\geq 50V$.
Vehicle Interior	Dust Accumulation	Blow out dust with compressed air (remove top cover; see Section 5.1.1).
Omnidirectional Wheel	Cracks/Delamination	Replace if damaged (see Section 5.4.1).
	Nut Preload	Re-tighten (see Sections 5.4.1 & 5.6).
	Axle Obstructions	Clear debris; ensure smooth rotation (see Section 5.4.1).
	Swivel Function	Verify smooth rotation (see Sections 5.4.1).

4.6 Annual Maintenance

Table 4-4 Annual Maintenance

Component	Inspection items	Method & Corrective Action
Lifting Screw	Lubrication	Apply grease to screw nut (see Section 5.3.3).
Lifting Motor	Connector Aging	Replace if degraded (see Section 5.3.5).
	Bolt Preload	Re-tighten (see Sections 5.3.5 & 5.6).
	Cable Wear	Replace if damaged (see Section 5.3.5).
Rotation Motor	Connector Aging	Replace if degraded (see Section 5.3.4).
	Cable Wear	Replace if damaged (see Section 5.3.4).
	Bolt Preload	Re-tighten (see Sections 5.3.4 & 5.6).
Drive Motor	Connector Aging	Replace if degraded (see Section 5.4.3).
	Bolt Preload	Re-tighten (see Sections 5.4.3 & 5.6).
	Cable Wear	Replace if aging or damaged (see Section 5.4.3).

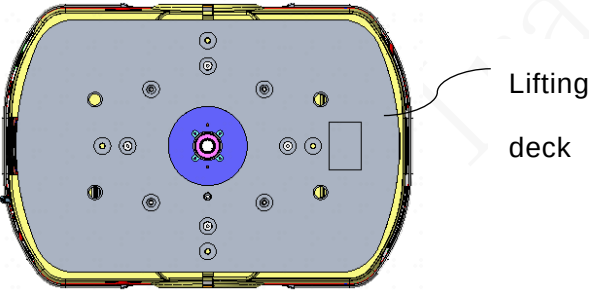
Chapter Five Maintenance

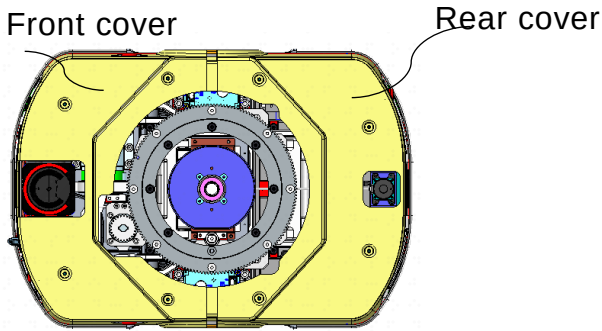
Warning: Only trained personnel may perform repairs. All spares must be original components.

Remarks: Apply threadlocker (243) to all M5+ screws upon reassembly.

5.1 Vehicle Body Shell

5.1.1 Top Cover

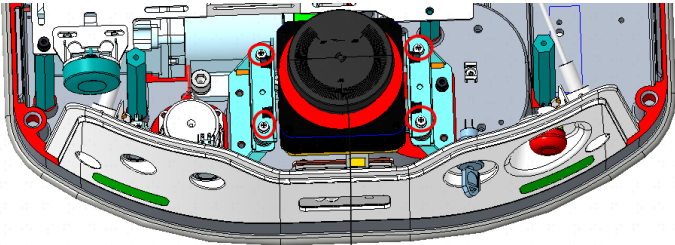
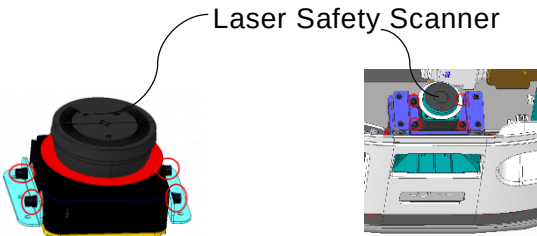
5.1.1 Top Cover Removal Guide		
Purpose: To inspect internal components or disconnect/reconnect internal electronic connectors.		
Components Involved: Lifting deck assembly, Vehicle upper cover assembly		
Tools & Materials: Hex wrench (5mm).		
Step	Illustration	Instructions
1. Remove the lifting deck		1. Use a 5mm hex wrench to remove the indicated M8×30 countersunk screws.
		2. Lift the lifting deck assembly away from the AGV body.
		Precautions
		1. Lifting deck is heavy: Recommend 2-person handling. 2. Coordinate movements to avoid pinching fingers during lifting/lowering.
2. Disassemble		1. Use a 5mm hex wrench to remove front (4 screws) and rear (4 screws) M5×12 cover screws.

the front and rear casing.		2. Lift the front cover upward carefully, then disconnect its wiring harness from the chassis. Avoid scraping the laser sensor and damaging wiring!
		3. Slide the rear cover backward, disconnect its wiring harness, and set aside. Avoid damaging wiring!
		4. Lift the front cover to the side, then disassembly is complete.
		Additional Note
		Front cover: Avoid scraping the laser sensor and damaging wiring!
		Rear cover: Avoid scraping the laser sensor and damaging wiring!

5.2 Safety Devices

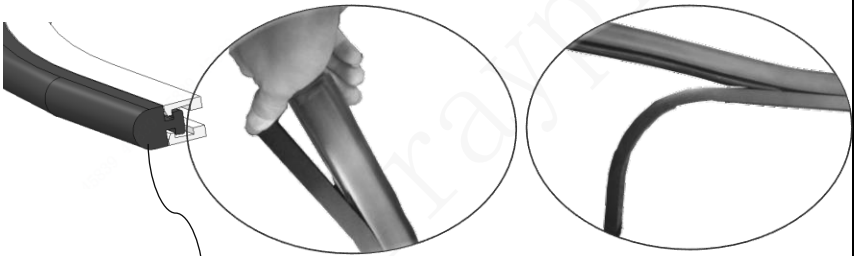
5.2.1 Laser Safety Scanner

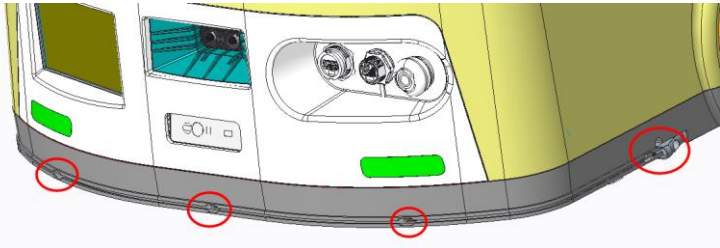
5.2.1 Laser Safety Scanner Replacement Guide		
Purpose: Replacement required due to laser safety scanner failure.		
Components Involved: Plastic front cover, Laser mounting plate, Laser safety scanner		
Tools & Materials: Phillips screwdriver, Hex key, Threadlocker 243		
Step	Illustration	Instructions
1. Remove the Top Cover	Refer to 5.1.1 Top Cover	Follow top cover removal procedure.

2.Disconnect Plug	N/A	Unplug the scanner's connector.
3. Remove the Laser Bracket	 Front Laser Bracket	Steps 1. Unscrew four M4×8 screws from the bracket assembly using a Phillips screwdriver. 2. Remove the laser unit together with its bracket. Remove the connector of the laser sensor. Precautions Avoid forceful pulling; the laser cable has limited length
4. Replace Laser Safety Scanner	 Laser Safety Scanner	Steps 1. Use the tool to remove the 4 screws shown in the illustration (front laser: unscrew M5 with a Hex key; rear laser: unscrew M3 with a Phillips screwdriver). 2. Install the new laser in reverse order of disassembly steps. Precautions 1. Handle scanner with care (high-value component). 2. Do not touch the lens surface.

5. Reassembly	Refer to the respective disassembly steps.	Reassemble in reverse order of disassembly steps.
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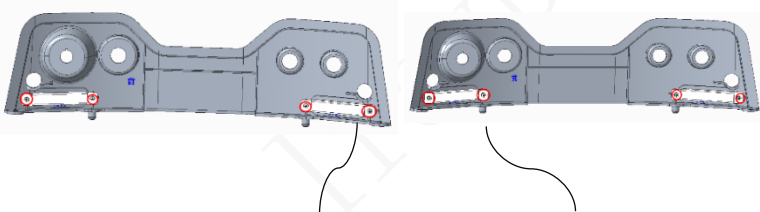
5.2.2 Bumper

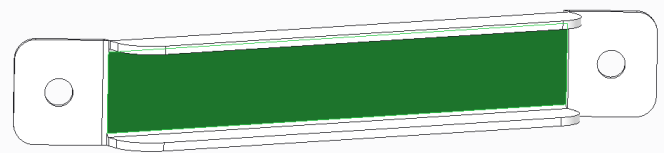
5.2.2 Bumper Removal Guide		
Purpose: Replace bumper.		
Components Involved: Bumper sensor (rubber strip part), Bumper frame, Lifting deck, Upper cover		
Tools & Materials: Phillips screwdriver, Soapy water (optional), Threadlocker 243		
Step	Illustration	Instructions
1. Remove the Top Cover	Remove the Top Cover, refer to 5.1 Top Cover.	Refer to 5.1 Top Cover.
2. Unplug Connector	N/A	Disconnect the plug-in that connects the bumper to other wires.
3. Remove Rubber Strip	 bumper rubber strip	Steps
		1. Starting from the end without wiring, pinch the rubber strip and pull it diagonally upward to remove it from the aluminum channel frame. Repeat the process toward the wired end until the entire strip is detached.
		Precautions
		1. It will be easier to disassemble from the wireless end. 2. The illustration does not show the complete vehicle; the actual frame is fixed to the entire vehicle.

4. Remove & Secure Aluminum Channel Frame (Skip to Step 6 if not needed)		<table><tr><th>Steps</th></tr><tr><td>1. Use a Phillips screwdriver to remove the screws (7 screws on each end, M3×6) from the aluminum channel.</td></tr><tr><td>2. Replace the aluminum channel frame and secure it.</td></tr></table>	Steps	1. Use a Phillips screwdriver to remove the screws (7 screws on each end, M3×6) from the aluminum channel.	2. Replace the aluminum channel frame and secure it.				
Steps									
1. Use a Phillips screwdriver to remove the screws (7 screws on each end, M3×6) from the aluminum channel.									
2. Replace the aluminum channel frame and secure it.									
5. Install Rubber Strip		<table><tr><th>Steps</th></tr><tr><td>1. Apply soapy water to the aluminum channel where the rubber strip will be fixed.</td></tr><tr><td>2. Insert the unwired end of the rubber strip into one end of the aluminum channel.</td></tr><tr><td>3. Push the strip along the channel until one end aligns with the channel.</td></tr><tr><td>4. Press the last end into the channel.</td></tr><tr><th>Precautions</th></tr><tr><td>1. The rubber strip has high friction with the aluminum channel, making installation difficult. Soapy water reduces friction for easier installation.</td></tr></table>	Steps	1. Apply soapy water to the aluminum channel where the rubber strip will be fixed.	2. Insert the unwired end of the rubber strip into one end of the aluminum channel.	3. Push the strip along the channel until one end aligns with the channel.	4. Press the last end into the channel.	Precautions	1. The rubber strip has high friction with the aluminum channel, making installation difficult. Soapy water reduces friction for easier installation.
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4. Press the last end into the channel.									
Precautions									
1. The rubber strip has high friction with the aluminum channel, making installation difficult. Soapy water reduces friction for easier installation.									

6. Reassembly	See the respective disassembly steps.	Tuck the safety edge wiring into the vehicle body and reconnect the plug. Reassemble other parts in reverse order of disassembly.
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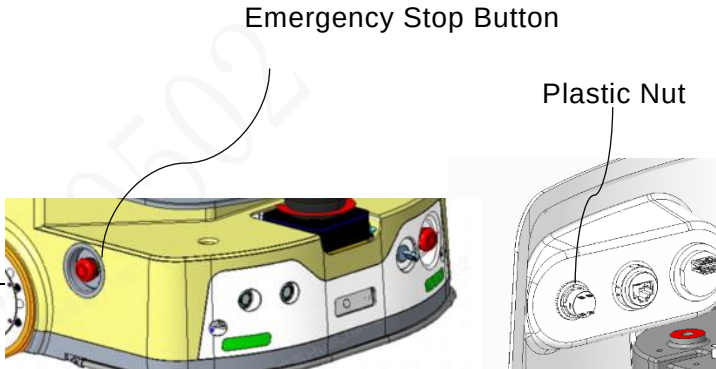
5.2.3 Indicator

5.2.3 Indicator Replacement Guide		
Purpose: Replacement required due to indicator failure.		
Components Involved: Lifting deck, Front housing, Light strip mounting plate, Indicator light		
Tools & Materials: Phillips screwdriver, Hex key, Threadlocker 243		
Step	Illustration	Instructions
1. Remove the Top Cover	Remove the Top Cover, refer to section 5.1.	See section 5.1.
2. Remove the Light Strip Mount Plate	 Front cover indicator Rear cover indicator	1. Use a phillips screwdriver to remove the 4 screws (M5×12) securing the button base, then use a Phillips screwdriver to remove 4 more screws (M3×10).
		2. Unplug the light strip connector.
		3. Remove the light strip mount plate.
		Precautions
		None
		Steps



3. Replace the light strip		1. Remove the old light strip from the mounting plate.
		2. Peel off the adhesive backing of the new light strip and stick it in place.
		Precautions
		None
4. Reassembly	Refer to the respective disassembly steps.	Reassemble in reverse order of disassembly.

5.2.4 Emergency Stop Switch

5.2.4 Emergency Stop Button Replacement Guide		
Purpose: Replacement required due to emergency stop button failure.		
Components Involved: Plastic front/rear cover, Emergency Stop Button		
Tools & Materials: Hex key		
Step	Illustration	Instructions
1. Remove Front/Rear Cover	See 5.1.1	See 5.1.1 for details.
2. Disassemble the Emergency Stop Button		1. Rotate the plastic nut counterclockwise to detach the button.
		Precautions

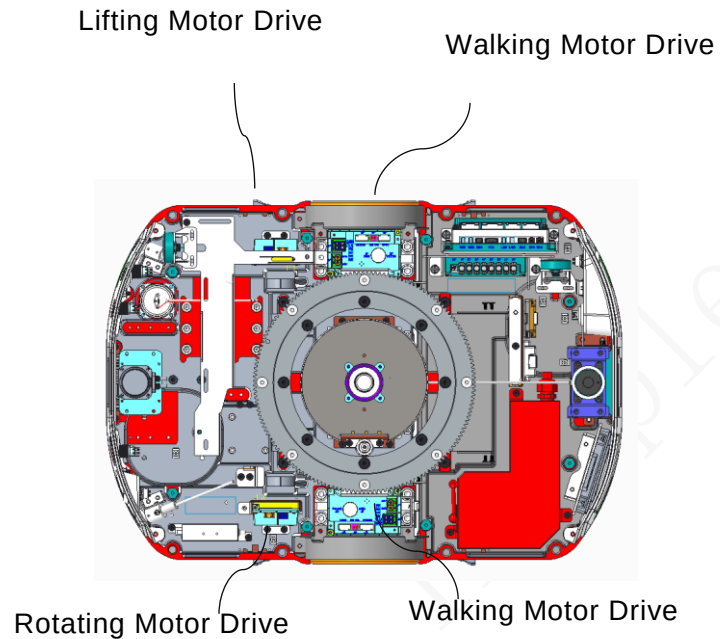
		1. Other button switches follow similar removal: loosen nut, unplug connector, then extract.
4. Reassembly	See the respective disassembly steps.	Reassemble in reverse order of disassembly.

5.3 Chassis Module

5.3.1 Motor Drive Removal

5.3.1 Motor Drive Replacement Guide		
Purpose: Replacement of Motor Actuator		
Components Involved in the Operation: Front and Rear Shell, Lifting Plate		
Tools & Materials: Hex key, Phillips screwdriver		
Step	Illustration	Instructions
1. Disassemble the Lifting Deck	Refer to procedure 1 for removing the Top Cover in section 5.1.1.	Refer to 5.1.1 (Top Cover Removal).
2. Remove Housing	Refer to procedure 2 for removing the Top Cover in section 5.1.1.	Refer to 5.1.2 (Top Cover Removal).
		Lifting Motor Driver:

3. Remove
Motor Drive



1. Using a 4mm hex key, loosen and remove the 3 screws (M5 socket head cap screws with washers) located diagonally at the wiring trough.

Lifting Motor Driver & Rotation Motor Driver:

2. Using a 4mm hex key, loosen and remove the 2 screws (M5 socket head cap screws with washers) on the driver's sheet metal bracket.

All Motor Drivers:

3. Using a Phillips screwdriver, loosen and remove the 2 screws (M4 pan head combination screws) located diagonally on the top of the driver.

4. A thermal pad is adhered to the bottom of the driver. Gently pry the driver loose from the side using the hex key.

Precautions:

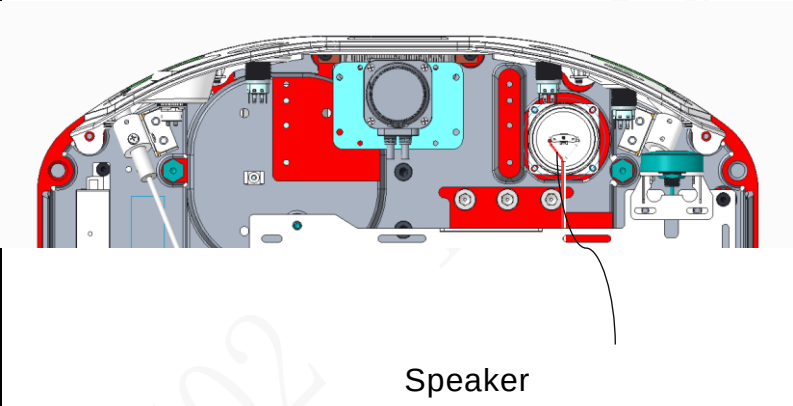
For the Lifting Motor Driver, remove and replace following steps 1 through 4 in order.

For the Rotation Motor Driver, remove and replace following steps 2 through 4 in order.

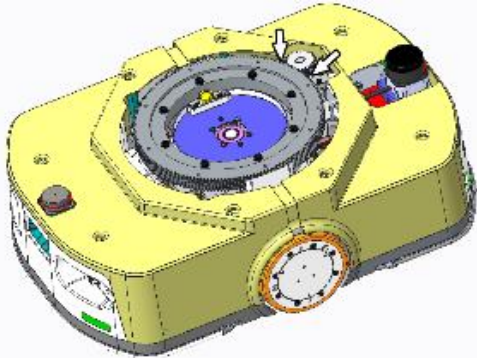
For the Travel Motor Driver(s), remove and replace only steps 3 and 4 in order.

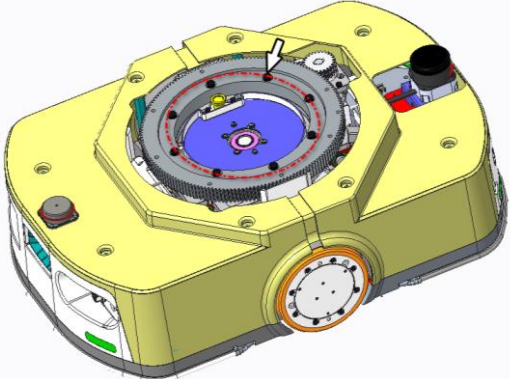
4. Reassembly	See the respective disassembly steps.	
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5.3.2 Speaker

5.3.2 Speaker, IO Cartridge, Relay, Main Controller, Switch Replacement Guide		
Purpose: Speaker Replacement		
Components Involved: Rear housing, Lifting deck		
Tools & Materials: Phillips screwdriver, Hex key		
Process	Schematic Diagram	Steps
1. Remove Lifting Deck & Housing	Refer to the procedures for disassembling the top cover in sections 5.1.1 and 5.1.2.	Refer to Sections 5.1.1 & 5.1.2
2. Remove Speaker		Steps
		1. Use a Phillips screwdriver to remove 4 Bolts (M4*10) to detach the Speaker.
3. Reassembly	See the respective disassembly steps.	Reassemble in reverse order of disassembly.

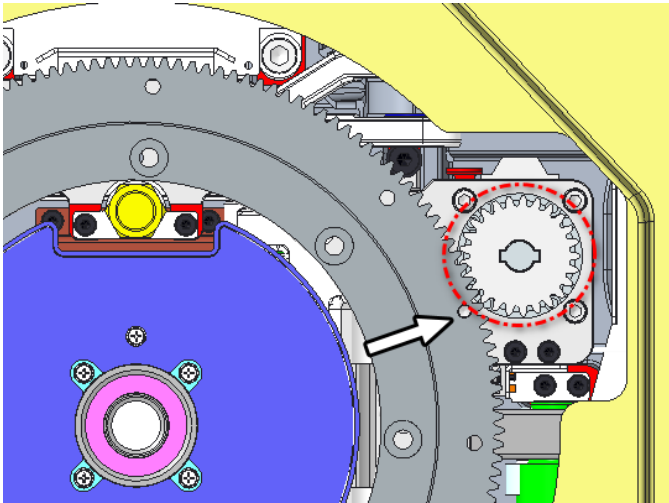
5.3.3 Slewing Support

5.3.3 Slewing Bearings Replacement/Maintenance Guide		
Purpose: Slewing Bearings Replacement/Maintenance (greasing)		
Components Involved: Front/Rear cover, Lifting deck, Slewing bearings		
Tools & Materials: Phillips screwdriver, 5mm/6mm Hex key, Threadlocker 243, Grease gun (for maintenance), Changcheng lubricant 7014-1		
Step	Illustration	Instructions
1. Remove the lifting deck	Refer to Procedure 1 in 5.1.1 (Top Cover Removal).	Refer to 5.1.1(Top Cover Removal).
2. Gear Lubrication (Skip if replacing)		Steps 1. Inject 7014-1 lubricant between large/small gears while rotating outer ring for even distribution.
		1. Use a 6mm Hex key to remove the fixing screws (8*M8) on the rotating support indicated by the red circle in the illustration. Precautions:

3. Remove Slewing Bearing		There are two locating pins below the slewing bearing. After removing the bolts, the slewing bearing can be pulled out directly upwards.
4. Replacement and Restoration	Refer to the respective disassembly steps.	1. Install new bearing, then reverse disassembly steps. Note: Clean mounting surface thoroughly before installation.

5.3.4 Rotating Motor Assembly

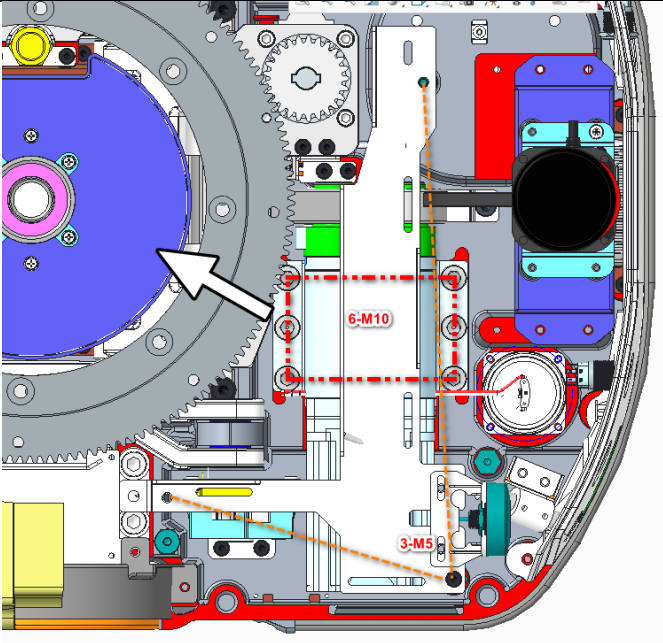
5.3.4 Rotating Motor Replacement Guide		
Purpose: Replacement of Rotating Motor Assembly		
Components Involved: Top cover, Lifting deck, Gears, Rotating motor		
Tools & Materials: 5mm hex keys, Diagonal cutters, Threadlocker 243, Cable ties		
Step	Illustration	Instructions
1. Remove the lifting deck	Refer to Procedure 1 in 5.1.1 (Top Cover Removal).	Refer to 5.1.1(Top Cover Removal).

2. Remove the housing (front cover)	Refer to Procedure 2 in 5.1.1 (Top Cover Removal).	Refer to 5.1.1(Top Cover Removal).
3. Remove the rotating motor		The rotation motor is secured by 4 M6 hex socket head cap screws. Removing/Installing the Rotation Motor: This can be done without removing the slewing ring bearing. Access Hole: The slewing ring bearing has one access hole specifically designed for inserting a hex key to reach the screw underneath it (as indicated by the arrow). Accessing Screws: Rotate the slewing ring bearing to align this access hole with the screw head obscured by the bearing. Once aligned, you can remove (or install) the screw through the hole. Motor Replacement: Replace the motor as needed. If space is insufficient, you can slightly raise the lifting mechanism to create more working room.
4. Reassembly	See the respective disassembly steps.	Reassemble in reverse order of disassembly.

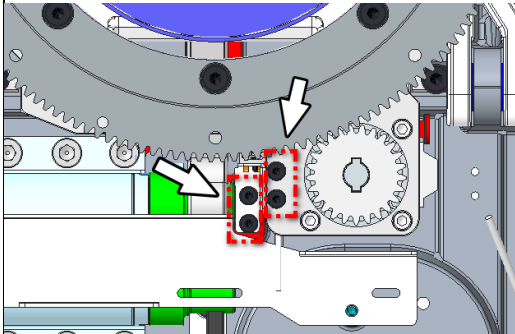
		1. Test motor operation before full reassembly to avoid rework.
		2. Replace any cut cable ties.

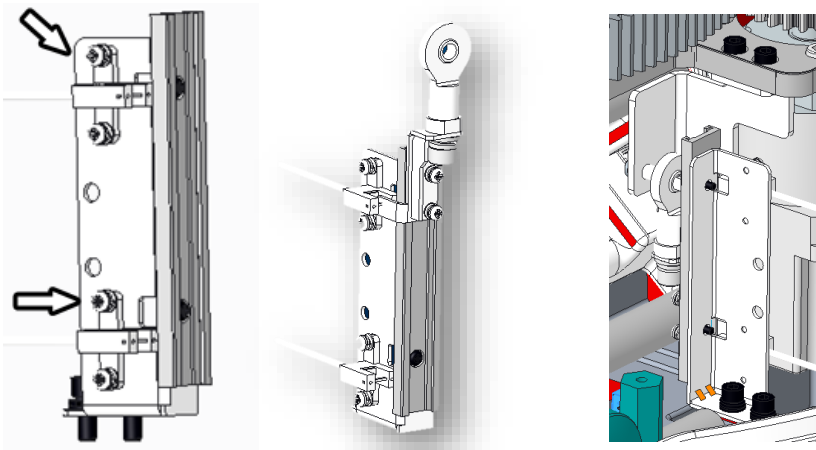
5.3.5 Lifting Motor Assembly

5.3.5 Lifting Motor Assembly Replacement Work Instruction		
Purpose: Replacement of Lifting Motor Assembly		
Components Involved: Front Cover, Lifting Deck, Slewing Support, Lifting Motor		
Tools & Materials: 4mm hex wrench, 8mm hex wrench, Cable Ties, Threadlocker 243		
Step	Illustration	Instructions
1. Remove the lifting deck	Refer to Step 1 of 5.1.1 (Top Cover Removal)	Refer to 5.1.1 (Top Cover Removal)
2. Remove the housing	Refer to Step 2 of 5.1.1 (Top Cover Removal)	Refer to 5.1.2 (Top Cover Removal)
3. Replace the lifting motor		Steps
		1. Using an 8mm hex key, remove the lifting motor assembly mounting screws (6 pcs - M10 screws). 2. Using a 4mm hex key, remove the three M5 screws securing the cable tray sheet metal (location indicated by the orange line). Flip the

		wiring harness and the sheet metal tray towards the connector end (Cut any interfering cable ties that prevent the tray from flipping). 3. Lift the tail end of the lifting motor assembly upwards, then slide it out.
6. Reassembly	See the respective disassembly steps.	Precautions
		If the hex key is insufficiently long making M10 screw removal difficult, you may first remove the slewing ring bearing. 1. Tilt the motor assembly to align it with the spherical bearing in the connecting rod. Insert it, then seat the assembly base into the rectangular slot. Tighten the 6 M10 screws (apply threadlocker). 2. Reassemble in reverse order of disassembly.

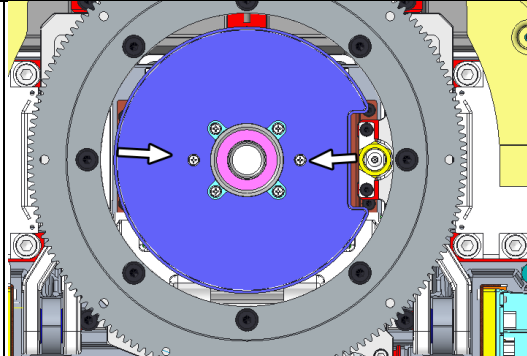
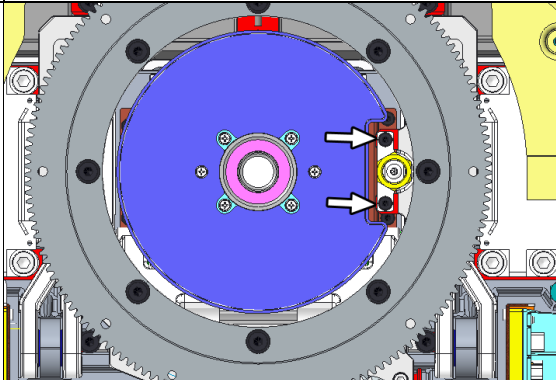
5.3.6 Lifting Proximity Switch

5.3.7 Lifting Proximity Switch Replacement Guide		
Purpose: Inspect internal vehicle components or disconnect/connect electronic component connectors inside the vehicle.		
Components Involved: Lifting deck, Front housing, Lifting proximity sensor.		
Tools & Materials: Long-handle Phillips screwdriver, 5mm hex wrench, 4mm hex wrench, diagonal cutters		
Step	Illustration	Instructions
1. Remove Lifting deck	Refer to Step 1 of 5.1.1 (Top Cover Removal)	Refer to 5.1.1 (Top Cover Removal)
2. Remove Housing	Refer to Step 2 of 5.1.1 (Top Cover Removal)	Refer to 5.1.2 (Top Cover Removal)
3. Remove Lifting Proximity Sensor Mounting Bracket.		1. Use a 4mm Allen Wrench to remove the four M5 screws shown in the illustration. 2. After cutting off the cable ties, remove the component;

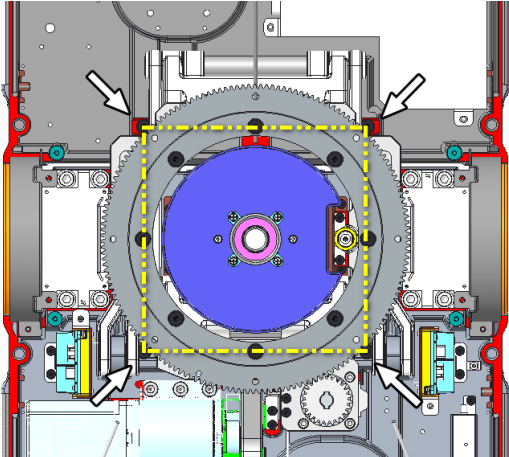
4. Replace the lifting proximity sensor		1. Use a Phillips screwdriver to remove the 4 fixing screws (M3 Phillips Screw) near the lifting sensor, and then replace the sensor.
5. Reassembly	See the respective disassembly steps.	Reassemble in reverse order of disassembly.

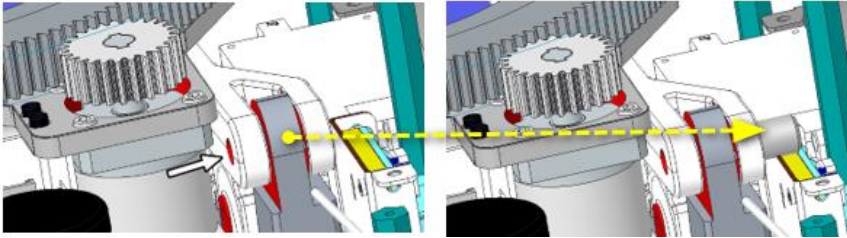
5.3.7 Rotating Proximity Switch

5.3.8 Rotating Proximity Switch Replacement Guide		
Purpose: Replace the rotary zero-position proximity sensor.		
Components Involved: Lifting deck, upper camera pallet, rotary proximity sensor.		
Tools & Materials: Phillips screwdriver, 4mm hex wrench, adjustable wrench.		
Step	Illustration	Instructions
1. Remove the lifting deck	Refer to Step 1 of 5.1.1 (Top Cover Removal)	Refer to 5.1.1 (Top Cover Removal)

2. Remove the camera pallet.		1. Use a Phillips screwdriver to loosen 2 pieces of the upper camera pallet (M4 Phillips screw), and remove it.
3. Remove the rotation sensor		Steps 1. Use a 4mm hex wrench to loosen the 2 fixing screws (M5×14 hex screws) that secure the rotating zero-position proximity sensor mounting sheet metal, and remove the mounting sheet metal. 2. Use an adjustable wrench to loosen the fixed nut of the sensor, unplug the connector, and replace the rotating sensor.
4. Reassembly	See the respective disassembly steps.	Reassemble in reverse order of disassembly.

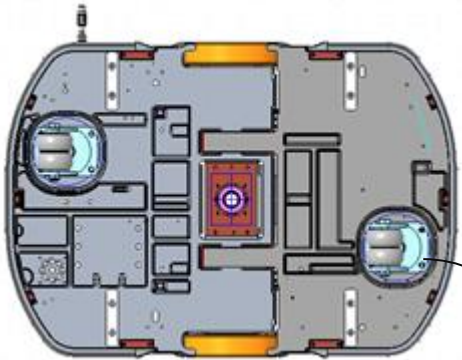
5.3.8 Lifting Mechanism

Lifting Mechanism Replacement Guide		
Purpose: Replacement required due to lifting mechanism failure.		
Components Involved: Lifting deck, front/rear housing, lifting mechanism		
Tools & Materials: Long-handle Phillips screwdriver, 4mm/5mm/6mm hex wrenches		
Process	Schematic Diagram	Steps
1. lower the mechanism	N/A	Operate the touchscreen to manually lower the lifting mechanism to the lowest position; if it is already at the lowest position, skip this step.
2. Remove the lifting deck.	Refer to Step 1 of 5.1.1 (Top Cover Removal)	Refer to 5.1.1 (Top Cover Removal)
3. Remove the housing	Refer to Step 2 of 5.1.1 (Top Cover Removal)	Refer to 5.1.2 (Top Cover Removal)
4. Remove lifting mechanism		1. Without removing the slewing ring bearing or the lifting motor assembly, use a long 6mm hex wrench to remove the 4 M8 screws.

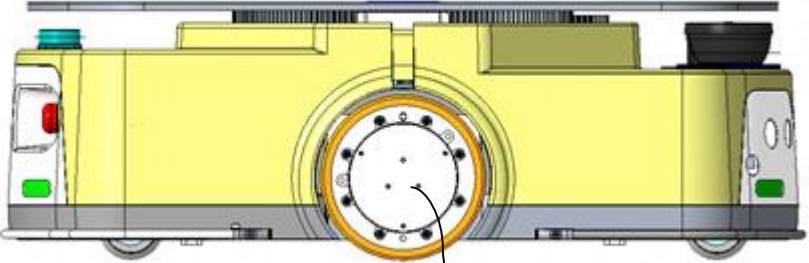
		2. Remove the left- and right-side short shaft covers (secured by 4 M5 countersunk screws each). Using the access holes shown in the side-view diagram, extract the two short shafts. 3. Disconnect the electrical connector(s). Cut any relevant cable ties. Disconnect the connecting rod from the output shaft of the lifting motor assembly. (Note: The spherical bearing allows for tilting to facilitate disconnection.) Pull the connecting rod assembly upwards to remove it.
5. Reassembly	See the respective disassembly steps.	1. Align and Seat Bearing: Align the connecting rod with the lifting motor assembly output shaft and seat the spherical bearing onto it. 2. Reassembly: Reassemble all other components by reversing the disassembly sequence.

5.4 Drive Unit

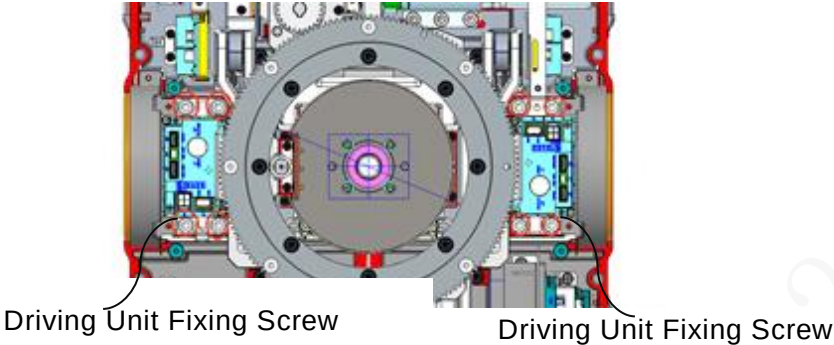
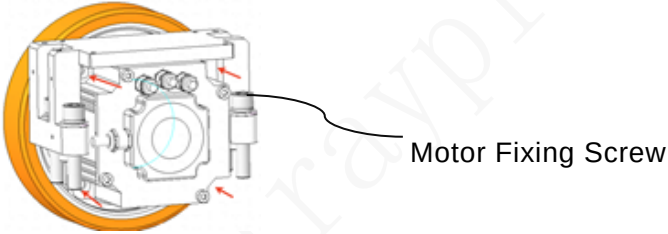
5.4.1 Omnidirectional Wheel

5.4.1 Omnidirectional Wheel Replacement Guide		
Purpose: Omnidirectional Wheel Replacement		
Components Involved: Omnidirectional Wheel		
Tools & Materials: Hex socket, ratchet wrench, 243 threadlocker		
Step	Illustration	Instructions
1. Remove the Omnidirectional Wheel		1. Lift the entire vehicle using hoisting equipment.
		2. Use a 6mm hex socket and ratchet wrench to remove the M8 nut on the omnidirectional wheel.
		3. When removing the last nut, support the omnidirectional wheel by hand. After removal, set the wheel aside.
		Precautions
		Ensure the hoisting equipment is secure and reliable.
2. Reassembly	See the respective disassembly steps.	Reassemble in reverse order of disassembly.

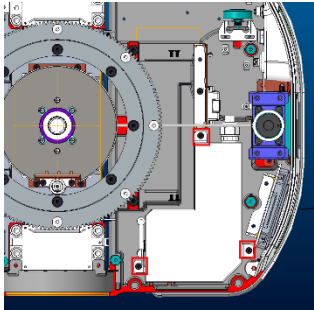
5.4.2 Drive Wheel

5.4.2 Drive Wheel Replacement Guide		
Purpose: Drive Wheel Replacement		
Components Involved: Top plate, rear housing, drive wheel		
Tools & Materials: Phillips screwdriver, hex key wrench, 2x M6*25 hex socket screws (for auxiliary disassembly)		
Step	Illustration	Instructions
1. Remove the drive wheel	 Drive Wheel	1. Refer to 5.1.1 to remove rear housing
		2. Lift entire vehicle using hoisting equipment and support with wood blocks to elevate drive wheels off ground
		3. Remove 8xM5 installation screws by 4mm hex key wrench.
		4. Use 2x M6*25 hex socket screws to jack out wheel by threading into side screw holes
		Precautions
		1. Ensure hoisting equipment is secure
2. Reassembly	Refer to the disassembly section.	2. Evenly thread both jacking screws - uneven depth may cause jamming
		Align the screw thread hole and gently tap the driving wheel in, then secure screws.

5.4.3 Drive Unit Assembly

3. Remove the drive unit screws.	 Driving Unit Fixing Screw Driving Unit Fixing Screw	1. Using an 8mm hex key, loosen and remove the 4 screws (M10 socket head cap screws) securing the drive unit. 2. Using two Phillips screwdrivers simultaneously, pry upwards on the drive unit to disengage its locating pins from the chassis. The entire unit can then be lifted out.
4. Motor reducer Assembly	 Motor Fixing Screw	1. Using a 6mm hex key, loosen and remove the 8 M8 screws securing the motor. Gently rock the motor to remove it. 2. Unless under exceptional circumstances, replace or repair the motor-gearbox assembly as a complete unit. Do not disassemble it.

5.5 Battery

5.5 Battery Replacement Work Instructions		
Purpose: Battery Replacement		
Components Involved: Battery cover in rear housing, battery retaining plate, battery		
Tools & Materials: hex key wrench		
Step	Illustration	Instructions
1. Remove the Lifting Deck	Refer to Step 1 of 5.1.1 (Top Cover Removal)	Refer to 5.1.1 (Top Cover Removal)
2. Remove the Housing	Refer to Step 2 of 5.1.1 (Top Cover Removal)	Refer to 5.1.2 (Top Cover Removal)
3. Pull the Connector	N/A	Remove the connector from the Battery.
4. Remove Battery	 Battery	1. Using a hex key, loosen the 3 screws (M5x12) on the battery retaining plate.
		2. Grasp the battery handles and gently lift the battery upwards to remove it.
		Precautions
		1. DO NOT use open flames near the battery. Explosion hazard.
		2. DO NOT short-circuit the battery terminals. Explosion hazard.
		3. DO NOT smoke while handling the battery.

5. Reassembly	See the respective disassembly steps.	Reassemble in reverse order of disassembly.
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5.6 Fastener

Thread Diameter	Pitch	Fastening Torque Tf, N·m									
		Performance Level 4.8		Performance Level 5.8		Performance Level 8.8		Performance Level 10.9		Performance Level 12.9	
		Standard Value	Torque Range	Standard Value	Torque Range	Standard Value	Torque Range	Standard Value	Torque Range	Standard Value	Torque Range
M3	0.5	0.6	0.5-0.7	0.8	0.7-0.9	1.2	1.1-1.5	1.6	1.2-1.9	2.0	1.6-2.3
M4	0.7	1.5	1.2-1.7	2	1.6-2.2	2.5	2.2-3.5	3.5	3.0-4.5	4.8	3.8-5.7
M5	0.8	3.0	2.5-3.5	3.5	3.2-4.4	5.0	4.5-6.7	7.0	5.8-8.8	9.3	7.4-11.2
M6	1	5.5	4.4-6.6	6.4	5.3-7.4	8	7.4-11.2	12	9.6-14.4	16	15-20
M8	1.25	13.5	10.3-14.4	15	12-18	20	16-26	32	26-36	42	35-53
	1	13.5	11.0-15.4	15	14-19	20	17-28	32	31-44	48	38-58
M10	1.5	24	20-28	30	25-35	40	36-52	65	51-69	80	74-88
	1.25	24	21-30	30	26-38	40	38-55	65	60-76	92	74-110
M12	1.75	42	35-50	54	44-62	75	61-94	110	90-130	140	128-170
	1.25	42	37-52	54	46-65	75	68-102	120	105-145	160	140-185
M14	2	60	56-80	70	54-94	120	97-150	160	140-180	230	204-273

	1.5	70	61-86	80	74-108	140	120-185	180	170-210	250	225-290
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Chapter Six Error Troubleshooting

6.1 Drive Unit

Table 6-1 Drive Unit

Fault Symptom	Possible Cause	Solution
Empty vehicle derails at specific locations	DM codes not meeting standards, poor alignment	Re-paste DM codes according to specifications
	DM codes contaminated or damaged	Replace with new DM codes
Fully loaded AGV derails at specific locations	Non-compliant ground conditions (excessive slope/height differences)	Modify ground to meet requirements
	Overloaded beyond rated capacity	Reduce load to within rated capacity
AGV randomly derails after 6+ months operation	Drive wheel wear exceeds 5mm	Replace (see 5.4.2)
	Omnidirectional wheel malfunction	Maintain/replace (see 5.4.1)
	Reducer failure	Replace (see 5.4.5)
Complete operation failure	Drive motor/driver malfunction	Maintain/replace (see 5.4.5)

6.2 Lifting Module

Table 6-2 Lifting Module

Fault Symptom	Possible Cause	Solution
AGV over-lifting causes motor overload	Upper limit proximity sensor failure	Replace (see 5.3.6 Lifting Proximity Switch)
AGV over-lowering causes motor overload	Lower limit proximity sensor failure	Replace (see 5.3.6 Lifting Proximity Switch)
Continuous rotation without zero positioning	Zero-point sensor failure	Replace (see 5.3.7 Rotary Proximity Switch)
	Loose zero-point sensor nut	Adjust and tighten
Lifting overload	Damaged lifting linkage	Replace (see 5.3.8)
	End cover/retaining ring dislodged causing optical shaft displacement	Reset optical shaft and secure end cover/retaining ring
	Lifting reducer damage	Replace (see 5.3.5)
Rotating motor overload	Rotary reducer damage	Replace (see 5.3.4)
	Debris in gear/slewing bearing engagement area	Clear debris (see 5.3.3)
	Slewing bearing damage	Replace (see 5.3.3)
Excessive lifting noise	Check for debris ingress causing connecting rod jamming.	
	Lifting reducer malfunction	Replace (see 5.3.6)
Lifting failure	Limit slot-type photoelectric sensor failure	Replace (see 5.3.6)
	Lifting motor/drive malfunction	Replace (see 5.3.5)
	Lifting reducer malfunction	Replace (see 5.3.5)