

HIWIN.

Delta Robot - RD403 Series

User Manual

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Multi Axis Robot

Pick-and-place / Assembly / Array and packaging / Semiconductor / Electro-Optical industry /

- Integrated Electric Gripper

Aerospace / Medical / Automotive industry / Machine tools / Machinery industry

- RAS Series RCV Series
- RCH Series

Linear Guideway

• Quiet Type--QH, QE, QW, QR

• Other--RG, E2, PG, SE, RC

Automation / Semiconductor / Medical Ball Type--HG, EG, WE, MG, CG



Ballscrew

- Precision Ground / Rolled Super S series
- Super T series
- Mini Roller
- Ecological & Economical
- lubrication Module E2

 Rotating Nut (R1)
- Energy-Saving & Thermal-
- Controlling (C1)
- Heavy Load Series (RD)
- Ball Spline

Medical Equipment

- Hospital / Rehabilitation centers /
- Nursing homes Robotic Gait Training System
- Hygiene System

/SMT / Food industry / LCD

Drives-D1, D1-N, D2

Motors-50W~2000W

Robotic Endoscope Holder



Bearing

- Machine tools / Robot
- Crossed Roller Bearings
- Ball Screw Bearings Linear Bearing
- Support Unit

Driven Tool Holders All kinds of turret

- VDI Systems
- Radial Series, Axial Series, MT
- BMT Systems DS, NM, GW, FO, MT, OM, MS



Linear Motor

- Automated transport / AOI application / Precision / Semiconductor
- Iron-core Linear Motor
- Coreless Linear Motor Linear Turbo Motor LMT
- Planar Servo Motor
- Air Bearing Platform
- X-Y Stage
- Gantry Systems



Torque Motor

(Direct Drive Motor) Inspection / Testing equipment /









Machine tools / Robot

Rotary Tables-TMS,TMY,TMN

TMRW Series

TMRI Series



Safety and Notice

- 1. Safety Information
 - Safety Responsibility and Effect
 - This safety information does not contain design, installation and operation information for a complete workstation or production line, and does not ensure complete system safety. To ensure personal safety, all machines must be designed and installed according to industrial safety regulations.
 - Users of *HIWIN* robots have the responsibility to design and install safety devices in compliance with industrial safety regulations, used to protect personal safety.
 - Compliance with the safety information on industrial robot described in this manual does not guarantee that safety problems will not occur with a *HIWIN* robot.
 - This robot is defined as a machinery component and potential hazards must be handled by the system integrator in accordance with ISO 102018-1/-2.



- 2. Description Related to Safety
 - I. Safety Symbol
 - \odot Carefully read the instructions in the user manual prior to robot use.

The following are the safety symbols used in this manual.

Symbol	Description		
A DANGER Failure to follow instructions with this symbol may response of the serious hazard or personal injury. Please be sure to with these instructions.			
🔔 WARNING	Failure to follow instructions with this symbol may result in personal injury or product damage. Please be sure to comply with these instructions.		
! CAUTION	Failure to follow instructions with this symbol may result in poor product performance. Please be sure to comply with these instructions.		

- II. Safety Grade
 - Common safety precautions are listed below. Please read carefully and comply with these instructions prior to robot use.

A DANGER	*	Do not store the machine in an environment with corrosion and flammable gas or close to a flammable
		object.
	*	Do not operate the machine in an environment with
		moisture, water or grease.
	*	Do not operate the machine at a place where strong



		vibration or heavy impact occurs.
		Potential dangers or abnormal situations shall be defined
		by the system integrator. If potential dangers or
		abnormal situations exist, the associated hazards must
📥 DANGER		be handled by the system integrator in accordance with
		the related standards.
	*	Do not immerse the electric wires into grease or water.
	*	Do not connect and operate the machine with wet hands.
	*	Be sure power is disconnected prior to repair and
		maintenance, and operate under conditions without risk
		of electrical shock.



	*	Do not climb on the manipulator.
	*	Do not block the outlet or put foreign objects into the
		Do not block the outlet of put foreign objects into the
		connector of manipulator.
	*	Do not pull the connector violently or twist the electric
		wires strongly.
	*	Do not frequently switch the power on/offand press the
\rm MARNING		control button.
	*	Emergency functions shall be defined by the system
		integrator in accordance with related standards.
	*	Do not shut off the power switch during operation.
	*	Do not open, modify, disassemble or maintain the
		machine without permission.
	*	Power must be disconnected from the machine when not
		in operation for an extended period.

▲ CAUTION	*	All operations shall be performed by trained staff.
	*	When demonstrating the robot, the speed should be kept
		low and operating conditions should be monitored to
		avoid workpiece release.



- 3. Safety Notice
 - I. Safety Risk
 - i. Installation
 - Ordinary Risk
 - Please follow this manual for installation procedures
 - Installation of emergency functions shall be defined by the system integrator in accordance with ISO 10218-1/-2.
 - Installation procedures must be conducted by trained staff.
 - Risk without electric shock
 - A safety area must be established outside the working range of the robot, and a safety device must be used to deter personnel without permission.
 - After releasing the servo motor brake, the robot will be moved by gravity, potentially causing operator injury.
 - When installing or disassembling mechanical parts, be aware that a dropped part could cause operator injury.



ii. End effector

- The end effector can be classified as two types:
 - A. Gripper: a pneumatic gripper, electric gripper or vacuum sucker used to load and unload.
 - B. Tool: Used for processes, such as soldering, cutting and surface treatment.
- The gripper-type end effector should prevent the workpiece from dropping or being damaged when the robot has a power error or other error. If potential dangers or abnormal situations exist when using end effector, the associated hazards must be handled by the system integrator in accordance with the related standards.

/ WARNING	*	The tool-type end effector is usually equipped with high voltage, high temperature or active shaft. Special attention should be paid during the operation.

- iii. Pneumatic Systems
 - Attention should be paid to pressure remaining in the pneumatic system after the power is disconnected.
 - Internal pressure must be released before the pneumatic system is maintained.
 - When the pneumatic system is operated, the clamped workpiece could drop due to the insufficient pressure or gravity.
 - \odot The pneumatic system must be equipped with a relief valve, that



can be applied in an emergency.

	*	Attention should be paid to the pressure in the
A WARNING		pneumatic system which is several times higher
		than atmospheric pressure.

iv. Risk caused by work environment

- All operating procedures must be specified by professional evaluation and according to industrial safety regulations.
- Maintenance must be conducted by trained personnel who clearly understand procedures for the whole system and possible risks.
- When operating procedures are interrupted, special attention should be observed during troubleshooting.



4. Intended use

HIWIN robots are industrial robots and intended for pick-and-place, handling, assembling, deburring, grinding and polishing. Use is only permitted under specified environments. For more detailed information, please see section 2.5 environmental conditions.

Use is not permitted under the following conditions:

- Use in potentially explosive environments
- Use without performing risk assessments
- Transportation of people and animals
- Operation outside the allowed operating parameters

5. Disposal

The disposal of HIWIN robot shall be in accordance with local environmental regulations.



6. Warranty Terms and Conditions

The period of warranty shall commence at the received date of HIWIN product (hereafter called "product") and shall cover a period of 12 months. The warranty does not cover damage and failure resulting from:

- Damage caused by use with the production line or the peripheral equipment not constructed by HIWIN.
- Operating method, environment and storage specifications not specifically recommended in the product manual.
- Damage caused by changing installation location, changing working environment, or improper transfer after being installed by the professional installer.
- Product or peripheral equipment damaged due to collision or accident caused by improper operation or installation by unauthorized staff.
- Installing non-genuine HIWIN products.

The following conditions are not covered by the warranty:

- The product serial number or date of manufacture (month and year) can not be verified.
- ▶ Non-genuine HIWIN products are used.
- > Adding or removing product components without authorization.
- Modification of product wiring or cables.
- Modification of the appearance of the product; removal of product components. e.g., removal of outer cover, drilling or cutting into product.
- Damage caused by natural disaster. i.e., fire, earthquake, tsunami, lightning, windstorms and floods, tornado, typhoon, hurricane etc.



HIWIN does not provide warranty or compensation for damage

caused by above-mentioned circumstances unless the user can prove that the product is defective.

For more information regarding warranty terms and conditions, please contact the technician or dealer with whom purchased was made.

	*	Improper modification or disassembly of the robot			
		may affect robot function, or stability or reduce			
		product life.			
A WARNING	*	The end-effector or cable for devices should be			
		installed and designed by professional staff to avoid			
		damaging the robot or causing robot malfunction.			
	*	Please contact a technician for special modifications			
		for production line set up.			
	*	For safety reasons, modification of the HIWIN			
		product is strictly prohibited.			



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1. Introduction

1.1 Serial Number and Model Name

Explanation of serial number is shown in Figure 1-1.





Explanation of model name is shown in Figure 1-2.







1.2 Product Specifications

The product specifications are shown in Table 1-1.

Table 1-1 Product specifications

Model Name.		Unit	RD403-1100-GB
Degrees of Freedom			4
Maximum Load Capacity		kg	3
Mation Dones	Horizontal		Ø 1100
Motion Range	Vertical	mm	300
Cycle Time*		sec.	0.3
Repeatability		mm	±0.1
Power Supply		V	3φ , 200 - 240
Power Frequency		Hz	50/60 (+/-1%)
Total Current		А	Max 4.5
Weight		kg	95(not including controller)
Protection Rating			IP 65

*The cycle time is based on back-and-forth movement over a vertical distance of 25mm and horizontal distance of 300mm with 0.1 kg load.



Figure 1-3 Cycle Time trajectory.



1.3 Appearance Dimension/Motion Range

The appearance dimensions and motion range are shown in Figure 1-4.



Figure 1-4 Appearance Dimensions and motion range

\rm WARNING	*	The robot payload will be greatly related to
		motion posture and movement speed. Therefore,
		over-current could happen even if the payload is
		under the allowable range. When this situation
		occurs, the posture and speed of robot must be
		modified.



1.4 Allowable Load of 4th Axis

Inertia from the size and weight of end effector and workpiece will affect robot performance. Please refer to the following table when designing end effector or evaluating clamped object.

Table 1-2 Allowable 4th Axis load

	Allowable Moment(N-m)	Allowable Moment of Inertia(kg-m ²)
		3kg : 5.63x10 ⁻⁴
4 th Axis	2.86	2kg : 6.41x10 ⁻⁴
		1kg : 7.27x10 ⁻⁴



Figure 1-5 Offset Distance and Allowable 4th Axis Load



1.5 Robot and Accessories

The robot and its accessories are shown in Table 1-3, Table 1-4, Table 1-5, Table 1-6 and Table 1-7.

Table 1-3 Robot and Accessory kit

No.	Item	Model Name	Quantity	Remark
1	Manipulator	RD403-1100-GB	1	
2	Mounting accessory kit		1	Please refer to 1-4
3	Power cable	CN2	1	

Table 1-4 Mounting accessory kit

No.	Item	Model Name	Quantity	Remark
1	Calibration block	RD403-CALI-SET I	1	
2	Calibration block	RD403-CALI-SET II	1	
3	Cable ties		4	
4	Plug-type cable ties		12	

Table 1- 5 Optional List

No.	Item	Model Name	Part Number	Quantity	Remark
1	Encoder battery pack		4C7014L3	1	
2	Limit accessory kit		4C201HM1	1	Please refer to 1-6
3	Consumable accessory kit		4C201HK1	1	Please refer to 1-7
4	Conveyor Tacking Encoder		462B00C7	1	
5	RD403-1100 frame		4C201B31	1	

Table 1- 6 Limit accessory kit

No.	Item	Model Name	Quantity	Remark
1	Hex head screw	M5x0.8Px20L SUS304	3	
2	Pin	D=5, L=10, R=0.8	6	
3	Mechanical stopper		6	



1	Tuble 1 7 Consumables decessory Rit				
No.	Item	Model Name	Quantity	Remark	
1	Plastic Washer		12		
2	Bushing		24		
3	Spring		12		
4	Button dust cover		3		

Table 1-7 Consumables accessory kit



1.6 Nameplates and Labels

The position and description of nameplates and labels are shown in Figure 1-6 and Table 1-6.

They must not be removed or rendered illegally.



Figure 1-6 Nameplates and labels position



No.	Nameplates and labels	Name	Description
1		<u>Collision</u>	Operator should keep a safe distance from robot system toprevent collision during operation.
2	A	Electrical shock	Please be aware of electric shock while installing or removing mechanical parts.
3	HUWIN: Articland Ricor MODL: Adds.710 D2 MANUKCIURD: 32023 LOAD: 22023 MANUKCIURD: 32023 MANGLI: 720m Provide Surgery 1 - 2202 TOTAL CURRENT Provide Surgery 1 - 2202 TOTAL CU	Specification	Robot specification and serial number.
4		Read manual	Read manual before operating the robot
5	$\begin{array}{c c} \bullet & \bullet \\ \hline & - \\ J3 \\ + \\ \bullet \end{array} \begin{array}{c} \bullet \\ J2 \\ + \\ \bullet \end{array} \begin{array}{c} \bullet \\ - \\ J1 \\ J1 \\ + \\ \bullet \end{array}$	Direction of motion	Direction of motion for individual axes.
6	BR 1	<u>Axis Break Release</u> <u>Button</u>	Break release buttons locate at each axis for calibration or emergency.

Table 1-6 N	ameplates and	labels	description



2. Transportation and Installation

2.1 Frame

The robot does not include optional frame.

The manipulator has three mounting points. The rated load capacity of each mounting point on the Z-axis of the RD403-1100-GB is 343N.

When the manipulator is installed, it must be moved to the bottom of the frame. When designing the frame, please leave space for the manipulator to move.



Figure 2-1 Dimensional Drawing of Recommended RD403-1100-GB Frame



2.2 Installation

2.2.1 Robot Installation Process

Item No.	Process	Remark
1	Confirm robustness and load capacity of frame.	Please refer to page no. 21
2	Prepare the necessary parts and tools for installation. E.g. sling, mounting bolts.	
3	Leave some space around installation area for peripheral equipments.	
4	Confirm if the arm posture will interfere with the frame	Please refer to page no.24
5	Use lifting equipment to assemble the robot arm to the frame.	Please refer to page no.25
6	Lock the mounting bolts to six fixing places on the base.	M12×1.75P×35L*6pcs Tightening Torque 62N-m
7	Place Controller.	
8	Connect Robot to Controller .	
9	Connect Teach Pendant to Controller.	

\rm MARNING	*	Please check and install the robot in accordance with the installation process. When installing robot, please avoid using only
		manpower.



2.2.2 Hang Posture forRobot

The swing angle of the upper arm and the overall motion range must be considered when establishing the installation space.

Please refer to chapter 1.2 for dimensions and motion range.

Figure 2-2 schematic diagram shows the upper mechanical limiting of the arm.



Figure 2- 2 Upper limits of the arm



End effector must always be in the center of the motion range when shipping. Figure 2-3 shows the robot transport posture with an upper arm swing angle of -7.8 degrees.



Figure 2- 3 Robot transport posture



To take the robot out from the box, please use a sling which is attached to the rings on the base to lift the robot.

Move the arm under the frame, and attach the sling to the rings, as shown in Figure 2-4.

Lift the robot, as shown in Figure 2-5. After moving the arm to the frame, use the attached M12x1.75Px35L bolts to lock it to the frame.



Figure 2-4 Hanging Schematic Diagram of Delta Robot





Figure 2-5 Hanging Schematic Diagram of Delta Robot





Recommended installation direction for arm relative to conveyor is shown in the figure below.



Figure 2-6 Recommended Installation Direction for Arm Relative to Conveyor of Delta Robot



2.3 Transportation

If transportation is required, please read the following notice carefully.

- > Please check safety mounting points prior to transport.
- > During the transportation, do not remove the cover or reverse the robot.
- > Personnel transporting the robot must have appropriate training and license
- > When transporting by air, the robot must be under stable pressure.
- When transporting by sea, be aware of the sealability to protect electronic components from moisture.
- When transportation is required, please confirm that the robot is at the original transport posture, refer to chapter 2.2.



Please transport in the correct transport posture to avoid damage to robot.



2.4 Environmental Conditions

Environmental Conditions is shown in Table 2-1.

Table 2-1 Environmental Conditions

Installation/Storage/Transportation Environment				
Ambient	550 °C			
temperature	5~50 C			
Ambient	20-75% R.H. (No dew, nor frost allowed)			
humidity				
Allowable	Under 1000 m sea level			
altitude				
	Do not use under corrosive environment			
Other	Do not use under flammable environment			
Other	Do not use under explosive environment			
	Do not use under radiative environment			



3. Maintenance and Inspection

This chapter will introduce methods and the steps to maintain the robot, including cover removal, installation, maintenance, battery replacement and calibration under normal conditions.



3.1 Maintenance and Inspection Interval

Maintenance and inspection can be classified as daily inspection and periodic inspection. Items in the daily inspection include power on/off and operation. Inspection items before power on/off and programming are respectively shown in Table 3-1. Items in the periodic inspection include those for routine check A, B, C, D and E. The inspection contents are shown in Table 3-2. The timetable can be scheduled according to the periodic inspection, as shown in Figure 3-1. Successfully completing the inspection items ensures product safety during expected product life and helps avoid risk of product malfunction.

	Inspection items	Remedies
	Inspection Before Turing	g the Power ON
1	Are any of the robot frame screws loose?	Check the screw tightening torque value
		(62 N-m).
2	Is the power cable securely connected?	Securely connect.
3	Check the wear degree of plastic washer.	Replace it if damaged.
		If needed, replace damaged parts as
		described in chapter 3.2.2
4	Check the wear degree of bushing.	Replace it if damaged.
		If needed, replace damaged parts as
		described in chapter 3.2.2

Table 3-1 Daily Inspection Items



5	Check the spring and hook integrity.	Replace it if damaged.
		If needed, replace damaged parts as
		described in chapter 3.2.3
6	Check the wear degree of J4-axis cable.	Check for damages.
		If a damage is discovered, please contact
		HIWIN directly.
7	Check the connecting cable betweenmanipulator,	Check for damages and wear.
	controller and teach pendant.	If it is damaged, please contact HIWIN
		directly.

	Inspection items	Remedies	
	Inspection After Turnin	ng the Power ON	
1	Is there any unusual motion or noise when	1. It is likely that the robot installation screws are not securely fastened to the	
	power is turned ON?	installation surface. Securely fasten the screws to the appropriate torque (62 N-m).	
		2. It is likely that a foreign material is between the robot and the installation surface. Please remove it.	
		3. If the above possibilities have been eliminated, it is likely that the rolling surface of the bearing or the gear tooth surface of reducer has been damaged. For this situation, please contact HIWIN	
		directly.	



Table 3-	2 Periodic	inspection	items
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	Inspection items	Remedies
	Monthly Inspection	on Items (A)
1	Are any of the screws on the manipulator	Securely tighten the screws.
	loose?	
2	Are any of the connector screws loose?	Securely tighten the screws.
3	Check the wear degree of bushing.	If there is wear, please replace.
4	Check damages on spring and hook.	If there is wear, please replace.
5	Check the end effector.	Please refer to end effector manual.



	Inspection items	Remedies							
	Quarterly Inspection Items (B)								
1	Replacement of plastic washer depends on the	Replace it if damaged.							
	distance between two ball joints, shown as the	If needed, replace damaged parts as							
	figure below.	described in chapter 3.2.2							
	100	When the distance between two ball joints							
		is less than 100mm, it is recommended to							
		replace the plastic washer.							
2	Check the outer surface of upper arm for	If there is damage, please contact HIWIN							
	cracks.	directly.							
3	Check the surface of ball joint for cracks.	If there is damage, please contact HIWIN							
		directly.							
	Semi-annual Inspect	ion Items (C)							
1	Check if the outer surface of movable plate	If there is damage, please contact HIWIN							
	has a crack.	directly.							
2	Check the sealability of waterproof connector.	If there is any damage, please contact							
		HIWIN directly.							
3	Check the wear degree of 4th cable.	If there is any damage, please contact							
		HIWIN directly.							



		Ι	nspection i	tems	Remedies		
Annual Inspection							Items (D)
1	Replace	eplace the encoder battery in the				Please refer to chapter 3.2.5 for backup	
	manipulator.						battery replacement.



Figure 3-1 Inspection schedule



3.2 Maintenance

Maintenance, cleaning and battery replacement will be introduced in this section. Please carefully read the contents, and operate according to the description. If needed, please contact HIWIN.

	*	Do not remove any part not described in this
		manual without permission.
	*	When performing maintenance and repair, the
CAUTION		home position will be shifted, making it
		nessesary to recalibrate the robot.
	*	Maintenance must be conducted by trained
		personnel



3.2.1 Robot Upper Arm



No.	Item	Quantity
1	Upper Arm	1
2	Ball Joint	2
3	Seal Cover	1





3.2.2 Robot Lower Arm



No.	Item	Quantity
1	Lower Arm	6
2	Plastic Washer	12
3	Bushing	24

A Danger	*	Prior to maintenance, power, pneumatic, and hydraulic systems should be stopped and all safety precautions should be taken. Disassembly of lower arm should follow the figure as shown to avoid damaging parts.
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Plastic Washer replacement method :

- 1. Insert a flathead screwdriver that has a tip less than 7mm into the hollow space of the plastic washer. Press the flathead screwdriver down toward the carbon fiber tube (the plastic washer should pop out from the slot) and remove the plastic washer, as shown in Figure 3-2.
- 2. Insert a new plastic washer into the slot. Use a rubber mallet to knock in the plastic washer. Make sure the flat surface of the plastic washer is on the same level as the flat surface of the lower arm, as shown in Figure 3-3.



Figure 3- 2 Plastic washer replacement



Figure 3- 3 Plastic washer installation



	*	When replacing the plastic washer, use a protective
		cushion between the flathead screwdriver and the
▲ WARNING		lower arm surface to avoid paint damage on the
		lower arm.
	*	When replacing the plastic washer, use rubber
		mallet to avoid damage to the lower arm.



Bushing replacement method :

- 1. Push the hook to untighten the bushings. Remove the hook and the bushings, as shown in Figure 3-4.
- 2. Assemble bushings on both ends. Fasten the hook until the "click" sound appears. Make sure the hook and the bushings are completely tightened, as shown in Figure 3-5.



Figure 3- 4 Bushing replacement



Figure 3- 5 Bushings installation



	*	Make sure the hook and bushings are completely
\rm MARNING		tightened to avoid disintegration and damage
		during operation.



3.2.3 Hook and Spring Unit



Check the spring is indeed engaged with the hook.

No.	Item	Quantity
1	Hook	12
2	Spring	12





Hook and spring replacement method :

- 1. Push the two lower arms toward the middle and push the hook firmly to remove it, as shown in Figure 3-6.
- 2. Attach the new spring with the hook first. Insert the spring into the long hole of the hook, and turn the spring into the groove clockwise to complete the installation of the spring and hook, as shown in Figure 3-7.
- 3. Fasten the new hook and spring to the bushing, and make sure trhere is a "click" sound to confirm that the hook and bushing are actually engaged, as shown in Figure 3-8.



Figure 3- 6 Hook and spring replacement





Figure 3-7 Hook and spring installation



Figure 3- 8 Hook and bushing installation

🔔 WARNING	*	Make sure the spring is completely tightened to
		avoid disintegration and damage during arm
		operation.



3.2.4 4th Axis Cable Connection



	*	Please start fixing the cable from the platform and set
		cable ties at the marks.
	*	The bending angle shall be reserved at the joint of 4^{th}
		axis cable, and shall hold the position of the cable.
	*	When installing the 4 th axis cable, the cable should be
Caution		closely fitted to the lower arm and fixed. Please, do not
		allow the cable to wind to avoid damaging it and
		reducing the product life.
	*	After installation of 4 th axis cable, please operate
		manually at the lowest speed (T1 mode) to ensure no
		winding of 4 th axis cable. For software instructions,
		please refer to HIWIN Robot System Software.



Recommended wiring installation mode:

External pneumatic / electrical components can be attached to holes provided on the robot base. The cable ties included in the mounting accessory kit can be used to attach the cables. It is recommended that the user install the plug-type cable ties to the holes on J1 or J3 upper arm to avoid all cables being attached on the same arm or overlapping with the fourth axis motor cables attached to the J2 upper arm. Special attention must be paid to the reserved cable length at rotational axes to avoid cable damage due to arm swinging up and down.



Figure 3-9 Recommended installation of Delta robot wiring



3.2.5 Replacement of Backup Battery

Absolute encoders are used to record position. When power is disconnected, power from the lithium battery (3.6V) backup battery will be employed to record the current position in the encoders.

The battery installed on the robot has a service life of roughly 1 year. Actual life will depend on operating conditions. When battery power is low, the customer should replace during maintenance. Figure 3-10 shows the method to replace battery.

Procedures of battery replacement are described below.

- 1. Ensure the power is disconnected to the manipulator.
- 2. Remove the cover over the base.
- 3. Remove the old battery after connecting the new battery. If all batteries are removed, the encoder absolute data will be lost and the a calibration must be performed.
- 4. After the battery is replaced, please install the over the base.



Figure 3- 10Battery replacement



3.3 Cleaning

3.3.1 Cleaning of Robot

The RD403 series robots are designed to meet IP65 specifications.

The robot arm should meet the following conditions

- Dust can not enter. Prevent contact.
- Nozzle out of the water column is 6.3mm.
- Housing equipment should have no negative effect with water spray from any angle.

The RD403 series robots are designed to be compatible with neutral detergent commonly used in the cleaning of food processing equipment. All robot components are designed to handle daily exposure to cleaning agents. Exposure may result in some discoloration of the materials, but no significant coating or material removal.

The remaining parts of the robot can be cleaned according to instructions for washing down.

• Sprinkle water cleaning

Neutral detergent can be used to clean the robot arm with water.

The smooth design of the RD403 series robots eliminates the possibility of contaminants or wateraccumulation.

• Wipe cleaning

A wipe with a 70-75% alcohol by volume can be used to clean the robot arm.



Before cleaning the robot, stop the power, pneumatic and hydraulic systems and take all safety precautions.



3.4 Home Calibration

There are jig tools for home calibration in the accessory kit, which are used for the calibration of the first to fourth axis. When performing calibration, the servo motor brake should be released manually.

- Calibration Timing
- Change of Absolute Encoder Value: When replacing a transmission part (servo motor, reducer or upper arm), the absolute encoder value will be changed. It is required to perform a calibration in accordance with standard procedures.
- 2. Disappearance of Absolute Encoder Value: If the absolute encoder value disappears, it is required to perform a calibration in accordance with the standard procedures.

Reasons for disappearance of absolute encoder value are listed as follows:

- 1. Insufficient power of battery.
- 2. Encoder error.
- 3. Abnormal connection between encoder and encoder battery
- 4. When crash occurs to the robot.

When the 1st, 2nd and 3rd axis of RD403-1100-GB is located at the calibration position, it is at the angle of -11.47°; When the 4th axis of RD403-1100-GB is located at the calibration position, it is at the angle of 0°.



Pay attention when manually releasing the brakes. The robot will move due to gravity or external force.



(1) Calibration of first to third-axis

Lock the calibration block(RD403-CALI-SET I) to the base to set the home position. Release the servo motor brake manually with the release button labeled BR1, BR2, and BR3. Move the arm to the calibration fixture, as shown in Figure 3-11.



Figure 3- 11 Illustration of first to third-axis home calibration

	*	Prior to performing calibration, the work
		process should be stopped and all safety
		precautions should be taken.
A Caution	*	When releasing the brake manually, the robot
		will move due to the influence of gravity or
		external force. Special attention is required for
		this operation.



- Cunor								
Item No.	Item							
1	Press the emergency stop button.							
2	Calibration is performed by using a calibration tool set (RD403-CALI-SET I) that is locked to the base.							
3	Release the emergency stop button, and clear the software error.							
4	Pressing the brake release button to release the brake and always release one axis a time.							
5	Adjust the axis to the calibration position.							
6	Release the brake release button to restore the brake.							
7	Clear the absolute encoder value.							
8	Restore the axis to a horizontal position.							
9	Repeat step 2~8 in sequence for the other axes.							
10	Determine the angle position of each axis in the software .							
10	ease refer to page No.51 Calibration for the angle value)							
11	Remove the calibration tool set (RD403-CALI-SET I).							
12	Complete calibration.							

• Calibration Standard Procedures





(2) Calibration of fourth-axis

For fourth-axis calibration, set the fourth-axis speed to the minimum speed until the groove of platform matches the groove of the end flange so that the calibration block (RD403-CALI-SET II) can be set in the two-phase matching slot for home calibration. As shown in Figure 3-12.



Figure 3-12 Illustration of fourth-axis home calibration

Item No.	Item				
1	Adjust the axis to the calibration position at the minimum speed.				
2	Place the calibration block in the calibration position.				
3	Clear the encoder value.				
4	Remove the calibration block.				
5	Determine the angle position of axis in the software .				
5	(please refer to page No.51 Calibration for the angle value)				
6	Complete calibration.				

• Calibration Standard Procedures



	*	Prior to performing calibration, the work
		process should be stopped and all safety
		precautions should be taken.
Caution	*	When releasing the brake manually, the robot
		will move due to the influence of gravity or
		external force. Special attention is required for
		this operation.

Delta Robot - RD403 Series User Manual

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