HIWIN®
Motion Control and System Technology

Articulated Robot -RA620

User Manual

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Motion Control and System Technology

INDUSTRIE 4.0 Best Partner

Multi Axis Robot

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

- Articulated Robot
- Delta Robot
- SCARA Robot
- Wafer Robot
- Electric Gripper
- Integrated Electric Gripper
- Rotary Joint

Single Axis Robot

Precision / Semiconductor /
Medical / FPD

- KK, SK
- KS, KA
- KU, KE, KC

Direct Drive Rotary Table

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

- RAB Series
- RAS Series
- RCV Series
- RCH Series

Ballscrew

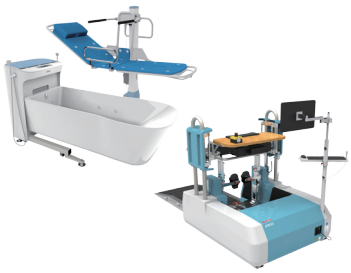
Precision Ground / Rolled

- 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

Linear Guideway

Automation / Semiconductor / Medical

- Ball Type--HG, EG, WE, MG, CG
- Quiet Type--QH, QE, QW, QR
- Other--RG, E2, PG, SE, RC



Medical Equipment

Hospital / Rehabilitation centers /
Nursing homes

- Robotic Gait Training System
- Hygiene System
- Robotic Endoscope Holder

Bearing

Machine tools / Robot

- Crossed Roller Bearings
- Ball Screw Bearings
- Linear Bearing
- Support Unit

AC Servo Motor & Drive

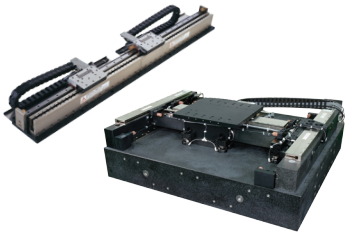
Semiconductor / Packaging machine
/SMT / Food industry / LCD

- Drives-D1, D1-N, D2
- Motors-50W~2000W

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 Precautions

1. Safety Information
   - Safety Responsibility & Effect
     - ⊙ This chapter explains how to use the robot safely. Be sure to read this chapter carefully before using the robot.
     - ⊙ The user of the HIWIN industrial robot has responsibility to design and install the safety device meeting the industrial safety regulations in order to ensure personal safety.
2. Description Related to Safety
   I. Safety Symbols

   ⊙ Carefully read the instructions in the user manual prior to robot use. The safety symbols used by this user manual are listed as follows.

Symbol	Description
 DANGER	Failure to follow instructions with this symbol may result in serious hazard or personal injury. Please be sure to comply 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. Working Person

   ⊙ The personnel can be classified as follows
   - ■ Operator:
     - Turns robot controller power ON/OFF
     - Starts robot program from operator`s panel
   - ■ Programmer or teaching operator:
     - Operates the robot
     - Teaches robot inside the safety fence
   - ■ Maintenance engineer:
     - Operates the robot
     - Teaches robot inside the safety fence
     - Maintenance, adjustment, replacement

   Programmer and the maintenance engineer must be trained on proper robot operation

3. Warnings

3.1 Common Safety Issues

DANGER	❖ All operating procedures should be established by professional assessment and in compliance with related industrial safety regulations. ❖ When operating robot, operator needs to wear safety equipment, such as smock for working environment, safety shoes and helmets. ❖ When encountering danger or other emergency or abnormal situation, please press the emergency stop button immediately and move the arm away with lower speed in manual mode. ❖ When considering the safety of the robot, the robot and the system must be considered together. Be sure to install safety fence or other safety equipment, the operator must be outside the safety fence to operate the robot. ❖ A safety zone should be established around the robot with an appropriate safety device to limit access of unauthorized personnel. ❖ Ensure the workpiece weight does not exceed the rated load or the tolerable torque. Exceeding these values could lead to the driver alarms or arm malfunction.
WARNING	❖ Personnel operating robot should be trained and licensed. ❖ To ensure personal safety, robot installation must comply with this manual and related industrial safety regulations. ❖ The control cabinet should not be placed near high voltage or machines that generate electromagnetic fields to prevent interference that could cause the robot to deviate or malfunction. ❖ Use of non-OEM repair parts may cause robot damage or malfunction. ❖ Beware high temperature generated by the controller and servo motor.

	❖ Do not over bend the cable to avoid poor circuit contact.

3.2 Operation

DANGER	❖ Programming should be done outside of the safety fence as far as possible. If it is inevitable to enter the safety fence, be prepared to press the emergency stop button whenever necessary. Operation should be restricted at low speed and keep your surroundings safely.

3.3 Maintenance

DANGER	❖ If the user need to perform maintenance procedures other than those specified by HIWIN, please contact us. ❖ Prior to repair and maintenance, please turn off power supply. ❖ Maintenance and repair should be performed by a qualified operator with a complete understanding of the entire system to avoid risk of robot damage or personal injury. ❖ While installing or removing mechanical parts, be aware that a dropped part could cause operator injury.
WARNING	❖ If the user want to replace parts other than those specified by HIWIN, please contact us. ❖ When replacing parts, avoid other foreign matter into the arm. ❖ Do not climb on robot.
CAUTION	❖ Be sure to carry out regular maintenance, otherwise it will affect the service life of the robot arm or other unpredictable danger.

3.4 End Effector

DANGER	❖ Special attention must be paid to the design of the end effector to prevent power lose or any other errors that could lead to workpiece release or damage. ❖ The end effector of tool type normally has the high voltage, high temperature or active rotary shaft. Special attention should be paid to the operating safety. ❖ The end effector should be mounted firmly on the robot to avoid workpiece release during operation that could cause personal injury or hazard.
WARNING	❖ The end effector may be equipped with its own control unit. Be sure control unit does not interfere with robot operation.

3.5 Pneumatic, Hydraulic System

DANGER	❖ When using the pneumatic, hydraulic system for operation, the gripping workpiece may fall due to insufficient pressure or gravity.

3.6 Emergency Stop

DANGER	❖ The robot or other control component should have at least one device for immediate halt of function, such as an emergency stop switch. ❖ The emergency stop button must be installed in an easily accessible location for quick stop. ❖ Performing an emergency stop will cut power to the servo motor, stop all movement, and disable control system. Emergency stop should be reset if the operating procedure is being restored. ❖ Avoid using emergency stop to replace a normal stop procedure. This could lead to unnecessary loss to robot.

Table of Contents

Edition	Date	Model	Remark
C08UC001-1711	2017.11.14	RA620	First edition

1. Transport and Installation

1.1 Transport

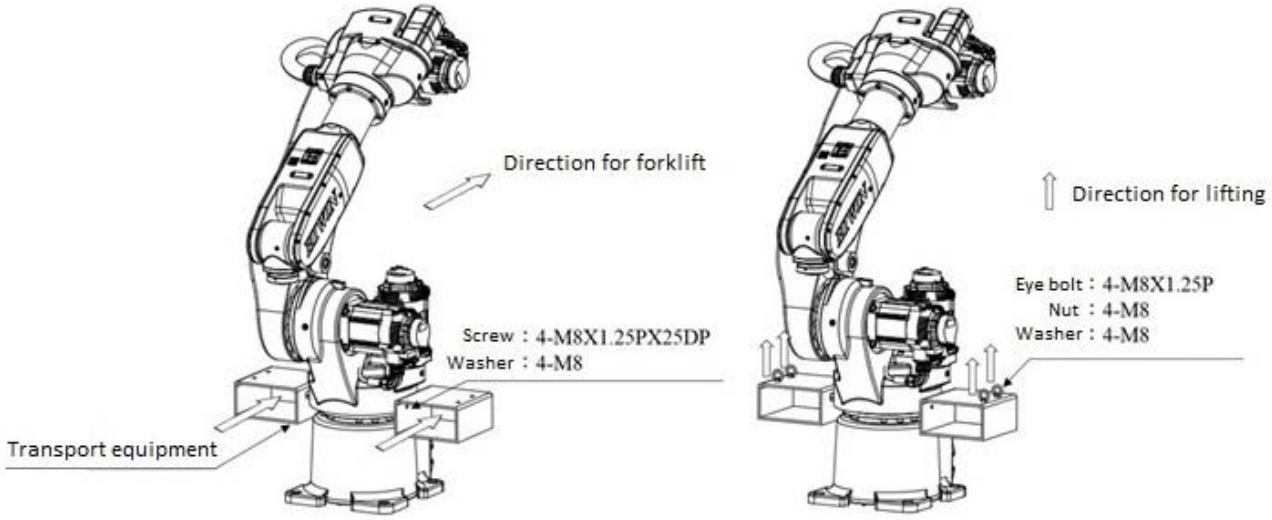
The transportation of the robot can use lifting tackle or forklift truck. The transportation procedure is as follows:

Step1. The angle of each joint is shown in the table of Figure 1-2 and 1-3.

Step2. Attach the suspension frame to the robot, as shown in Figure 1-1. When carrying the robot with lifting tackle, four M8×1.25P eye bolt, M8 nuts and M8 washers should be mounted on the suspension frame.

Step3. Move the robot to the desired position by lifting tackle or forklift truck.

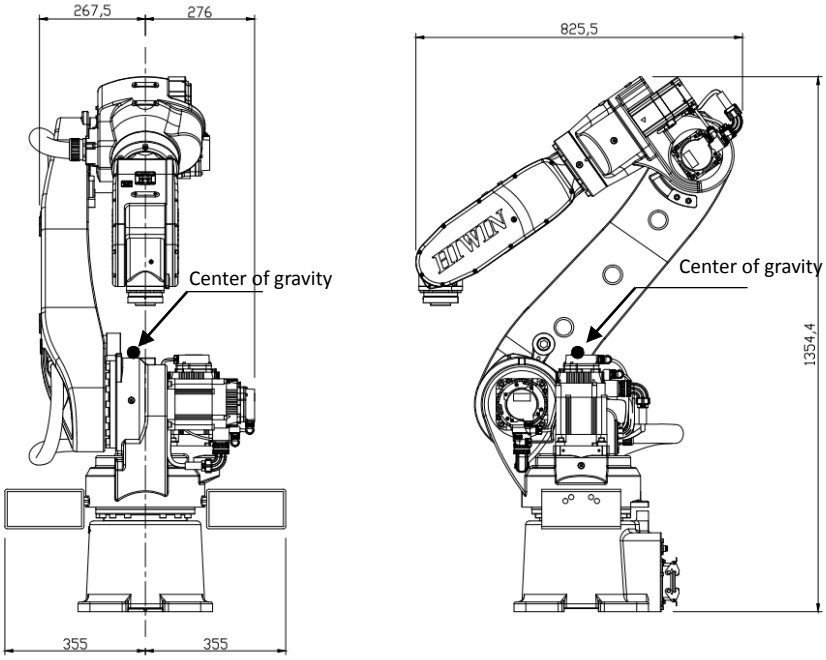
Step4. Remove the suspension frame.



Transport by forklift truck　　Transport by forklift tackle

Figure 1-1 Transportation

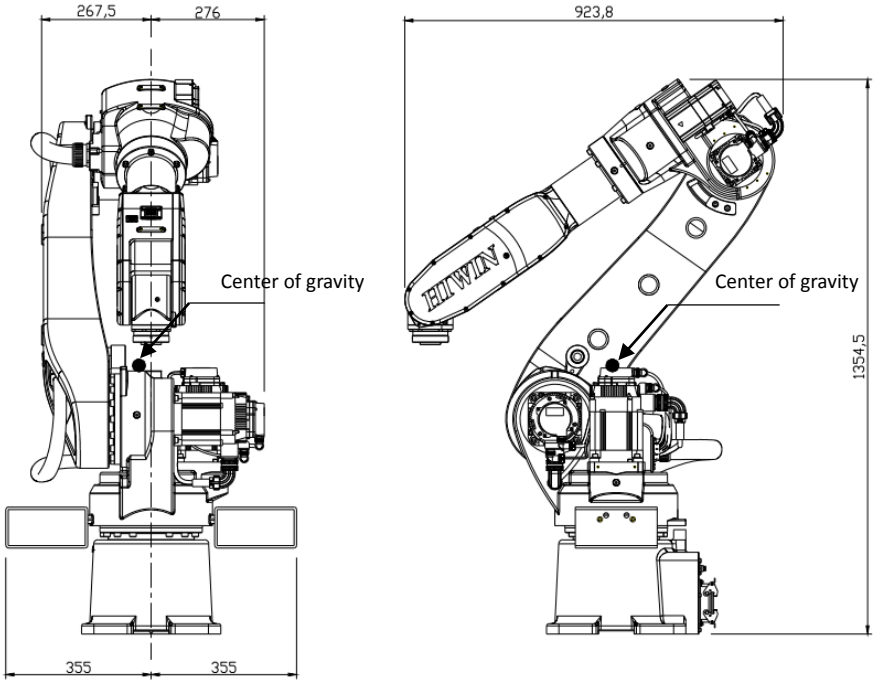
⚠ WARNING	❖ Before carrying the robot, be sure to remove the end effector. That will cause center of gravity changes. ❖ Please always stay in stable condition and avoid excessive vibration or shock during transportation. ❖ Placing the robot be sure to avoid the robot and the installation surface collision. ❖ After removing the suspension frame, please maintain it properly for re-transportation. ❖ Before operation, remove the suspension frame to avoid damage to the robot.



Weight of the robot: 226 kg

Transport position	
J1	0˚
J2	35˚
J3	-70˚
J4	0˚
J5	-55˚
J6	0˚

Figure 1-2 Transport position(RA620-1621)



Weight of robot: 230 kg

Transport position	
J1	0˚
J2	35˚
J3	-70˚
J4	0˚
J5	-55˚
J6	0˚

Figure 1-3Transport position(RA620-1739)

1.2 Installation

Figure 1-4 shows the installation dimensions of the robot. According to the dimensions, fix the robot with installation bolt (M16 Grade 12.9) on the installation surface. Figure 1-5 and Table 1-1 show the forces and moments acting on the installation surface. The installation surface must have sufficient strength to withstand the dynamic movement of the robot when operating at maximum speed.

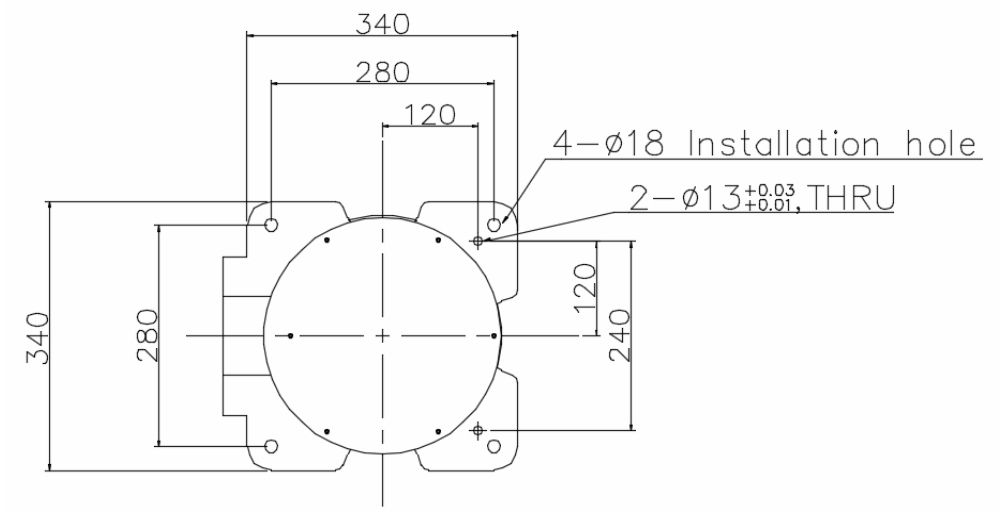


Figure1-4 Installation dimension

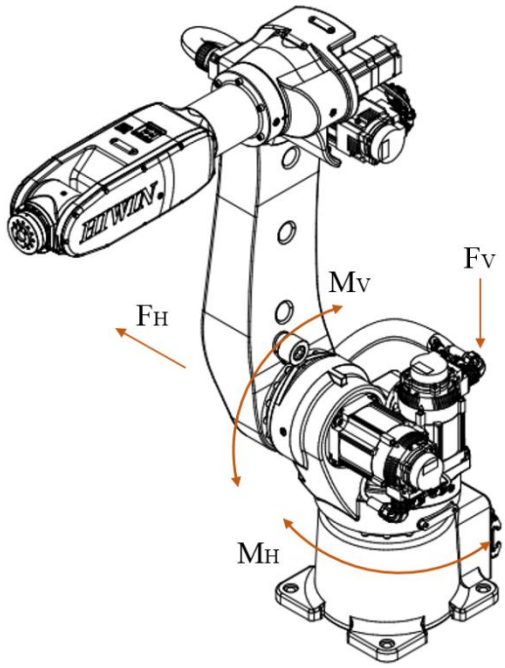


Figure 1-5 Forces and moments acting on the installation surface

Table 1-1 Value of forces and moments acting on the installation surface

	Vertical moment M_V (Nm)	Vertical force F_V (N)	Horizontal moment M_H (Nm)	Horizontal force F_H (N)
Stop	1550	2352	0	0
Acceleration /Deceleration	5114	5718	2735	4148

⚠ WARNING	❖ Ensure the installation surface has been leveled. It is recommended the roughness on this surface be 6.3a or less. If the installation surface is rough, the robot could produce the position shift during the operation. ❖ Ensure the position of the installation surface for the robot will not shift owing to the movement. ❖ Ensure the strength of the installation surface for the robot will not damage owing to the movement.

1.3 Connection with the Controller

Figure 1-6 shows the structure drawing of the robot. Figure 1-7 shows overview of the robot system. A robot system comprises the robot, the controller, CN2 connecting cable, and the teach pendant. The connection for the motor and air in/out are located at the rear of the J1 base, as shown in Figure 1-8. The pin assignment of the connection for the motor is shown in Table 1-2.

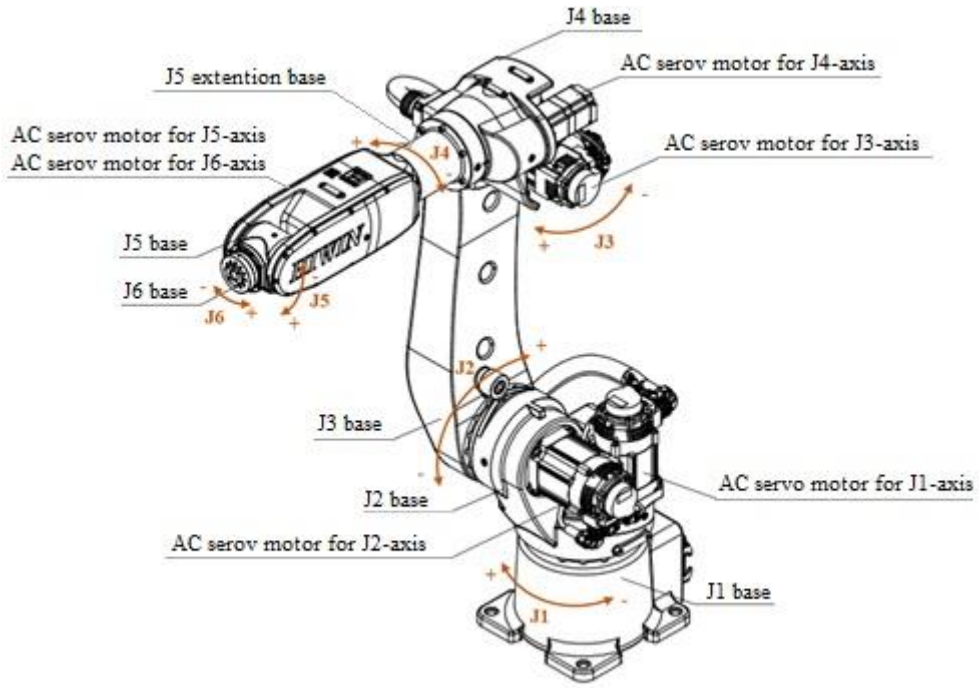


Figure 1-6 structure drawing of the robot

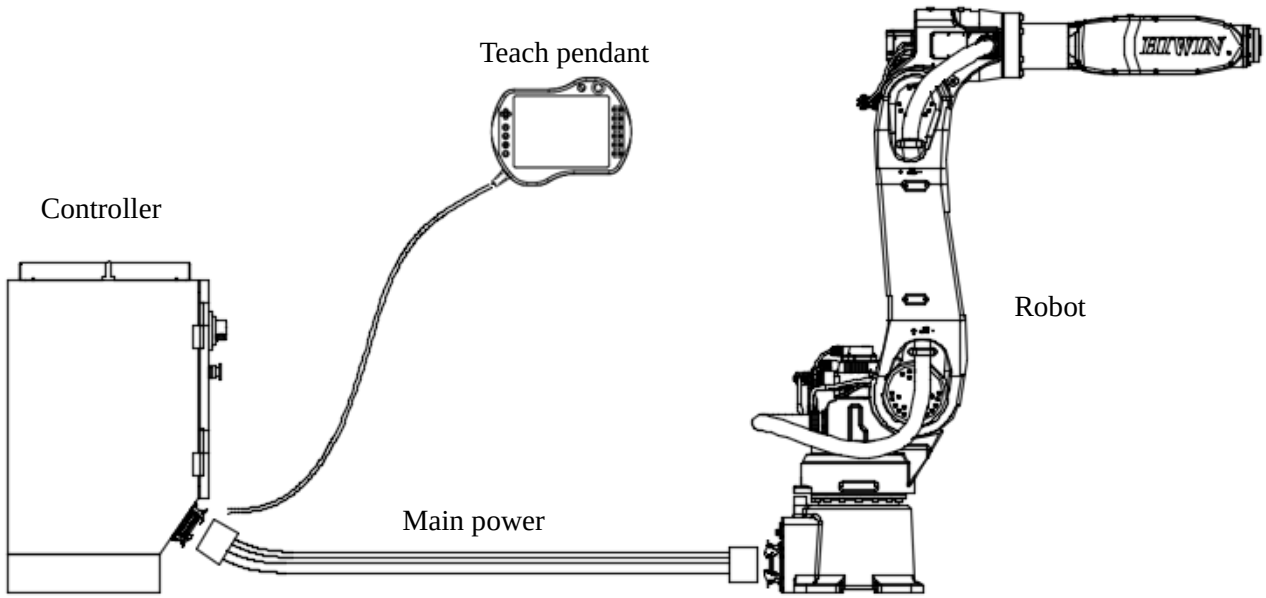


Figure 1-7 Illustration of robot and controller installation

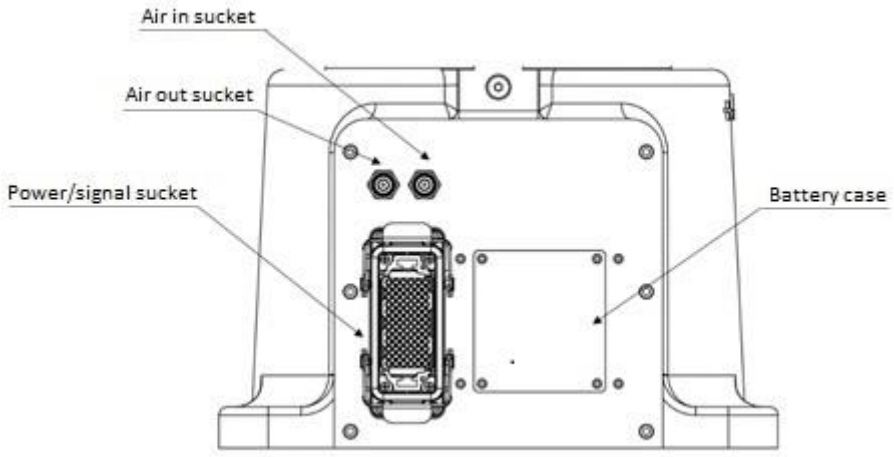


Figure 1-8 Interface at the rear of J1 base

Table 1-2 Pin assignment of the CN2

72	60	48	36	24	12
TX+	5V6-	5V6+	E6	P6-	P6+
71	59	47	35	23	11
TX-	5V5-	5V5+	E5	P5-	P5+
70	58	46	34	22	10
RX+	5V4-	5V4+	E4	P4-	P4+
69	57	45	33	21	9
RX-	5V3-	5V3+	E3	P3-	P3+
68	56	44	32	20	8
	5V2-	5V2+	E2	P2-	P2+
67	55	43	31	19	7
	5V1-	5V1+	E1	P1-	P1+
66	54	42	30	18	6
BK+	BK6-	G6	W6	V6	U6
65	53	41	29	17	5
0V	BK5-	G5	W5	V5	U5
64	52	40	28	16	4
24V	BK4-	G4	W4	V4	U4
63	51	39	27	15	3
	BK3-	G3	W3	V3	U3
62	50	38	26	14	2
	BK2-	G2	W2	V2	U2
61	49	37	25	13	1
	BK1-	G1	W1	V1	U1

⚠ WARNING	❖ When connecting the cable, be sure to turn off power supply first.

1.4 Grounding

A grounding cable (AWG#11, 4.2 mm^2) is used to connect the robot and the grounding area by the screw (M5x0.8Px12L) and the washer as shown in Figure 1-9.

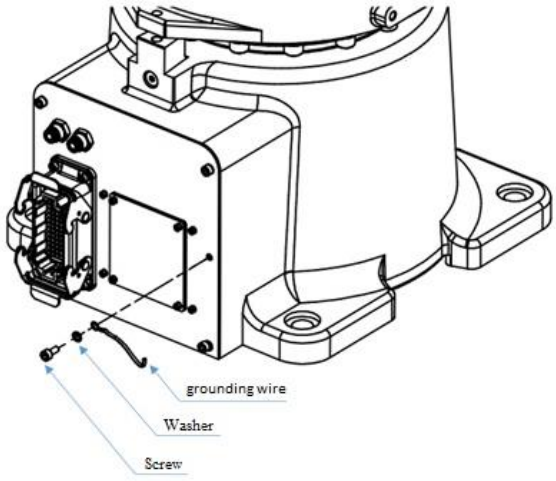


Figure 1-9. Connecting the grounding cable

1.5 Operating Ambient Conditions

The robot operating ambient conditions is shown in Table 1-3.

Table 1-3. Ambient conditions

Ambient conditions	
Ambient temperature (Operation)	0~45℃[* 1] No condensation permissible
Ambient relative humidity	75% R.H or less
Altitude	Up to 1000 m above mean sea level
Vibration	0.5G or less
Environment	• Keep away from flammable or corrosive solvents and gases. • Keep away from direct sunlight. • Keep away from sources of electric noise.

[Note 1]:

When the robot is stopped for a long period of time at the temperature near 0℃,the robot operation may have greater resistance in initial and then an overload alarm may be raised. It is recommended to warm up the robot at low speed for a few minutes.

1.6 Standard and Optional Equipment List

Standard and optional equipment list is shown in Table 1-4 and 1-5.

Table 1-4 Standard equipment list

Item	Part No.	Remark
RA620 Calibration tool set	4C201K01	Refer to section 4.1
Suspension frame set	4C200WS3	Refer to section 1.1
End effector I/O connector	4CA30008	Refer to section 3.4

Table 1-5 Optional equipment list

Item	Part No.	Remarks
Lithium battery	462600LN	Refer to section 5.2.1
Timing belt 505-5GT-9	453100SR	Refer to section 5.2.2 (RA620-1739)
Timing belt 540-5GT-9	4531012N	Refer to section 5.2.2 (RA620-1621)
End effector straight connector with 1.5m cable	4C7015J1	
End effector right angle connector with 1.5m cable	4C7015K1	
J1~J4 Lubrication grease	47110042	Refer to section 5.2.3
J5~J6 Lubrication grease	47110035	Refer to section 5.2.3

2. Basic Specifications

2.1 Description of Serial Number

The robot have a serial number on the rear of J1 base, and the explanation of serial number is shown in Figure 2-1.

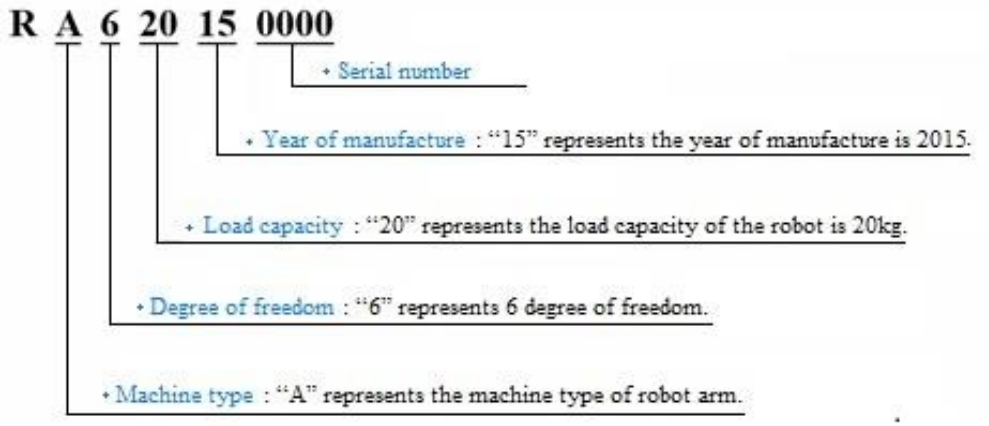
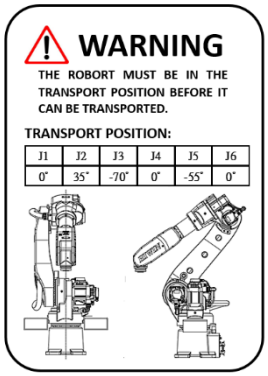
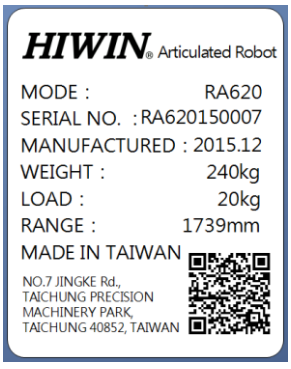


Figure 2-1 Description of serial number

2.2 Labels

The labels on the robot arm is shown in Table 2-1.

Table 2-1 Labels description

Labels	Name	Description
	Collision	Keep safety distance from robot system, and prevent colliding to operator during operation.
	Grounding	Make sure grounding is completed, or it will cause electric shock.
	Transport	Be aware of transport position when transporting robot, please refer to section 1-1 for detailed information.
	Specification	Robot specification and serial number
	Air in	The connection port of air tube for air input.
	Air out	The connection port of air tube for air out.
	Grease in	The hole for grease in.
	Grease out	The hole for grease out.

2.3 Robot Specifications

The robot specifications are as shown in Table 2-2

Table 2-2 The robot specifications

Item		Specification	
Model No.		RA620-1739	RA620-1621
Degrees of Freedom		6	
Installation		Floor (wall mounting, ceiling mounting) [*1]	
Load capacity		20kg [*2]	30kg[*2]
Maximum reach radius		1739 mm	1621mm
Cycle time		0.9 s [*3]	
Position Repeatability		±0.06 mm	
Motion range	J1	±180°	
	J2	+100°~-135°	
	J3	+190°~-80°	
	J4	±200°	
	J5	±130°	
	J6	±360°	
Maximum speed	J1	231° / s	
	J2	210° / s	
	J3	205° / s	
	J4	360° / s	
	J5	420°/ s	210°/ s
	J6	720°/ s	360°/ s
Allowable load moment at wrist	J4	34.2 N-m	65.5 N-m
	J5	34.2 N-m	65.5 N-m
	J6	22.3 N-m	34 N-m
Allowable load inertia at wrist	J4	1.35 kg- m^2	4.71 kg- m^2
	J5	1.35 kg- m^2	4.71 kg- m^2
	J6	0.6 kg- m^2	1.49 kg- m^2
Weight		230 kg	226 kg
Protection rating		Wrist(J5~J6) :IP65, Arm(J1~J4): IP54	
Acoustic noise level		Less than 75 dBA [*4]	

[Note 1]：The robot arm motion range shall be defined when used by mounting on the wall. So that the end effector does not interfere with the rear side of robot arm when mounting on the wall.

[Note 2]：When installing the end effector, please refer to section 2.5.

[Note 3]：The cycle time is the time that the robot is loaded at 20kg to forward and backward move in the vertical height 25mm and the horizontal distance 30mm, as shown in Figure 2-2.

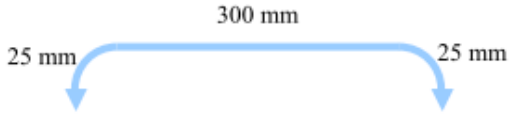


Figure 2-2 Moving path for cycle time

[Note 4]：This is measured at maximum speed and maximum load according to ISO11201:2010.

2.4 Outer Dimensions and Motion Range

The outer dimensions and motion range are shown in Figure 2-3 and 2-4.

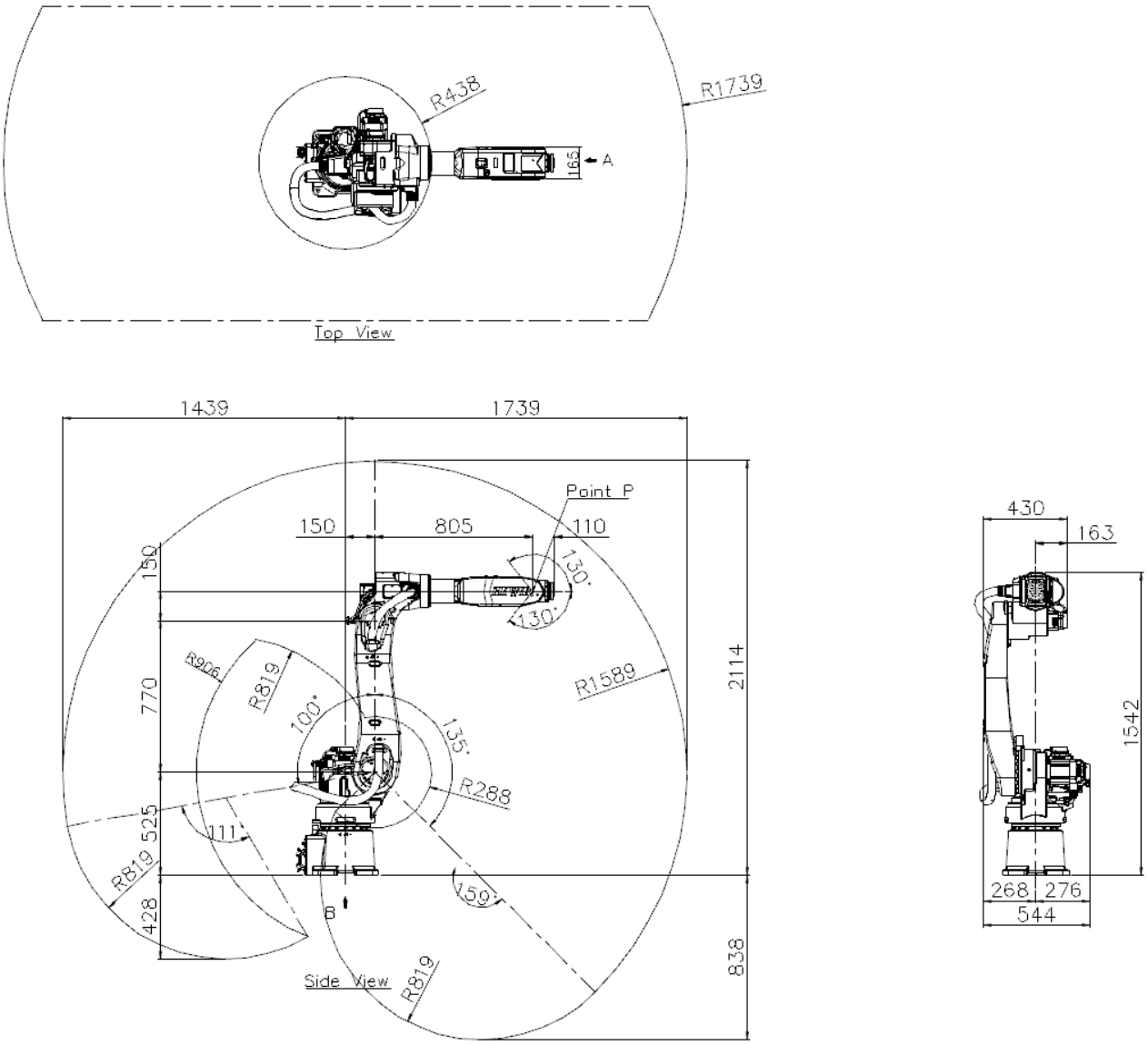


Figure 2-3. Outer dimension and motion range (RA620-1739)

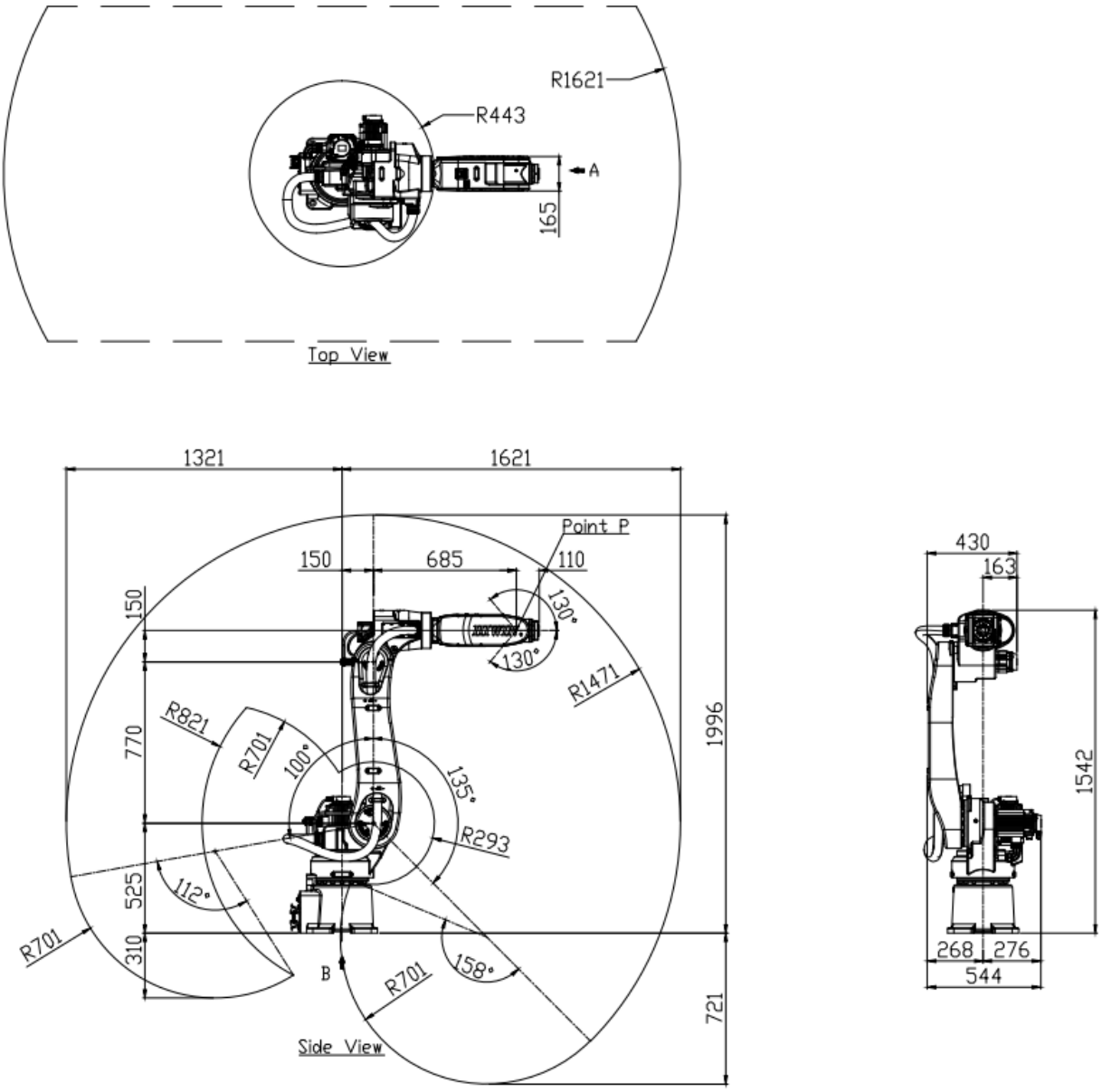


Figure 2-4. Outer dimension and motion range (RA620-1621)

2.5 Wrist Load conditions

The rated load of the robot end is not only limited by the weight but also limited by the position of the center of gravity of the load, where Figure 2-5 and 2-6 show the allowed position of the center of gravity.

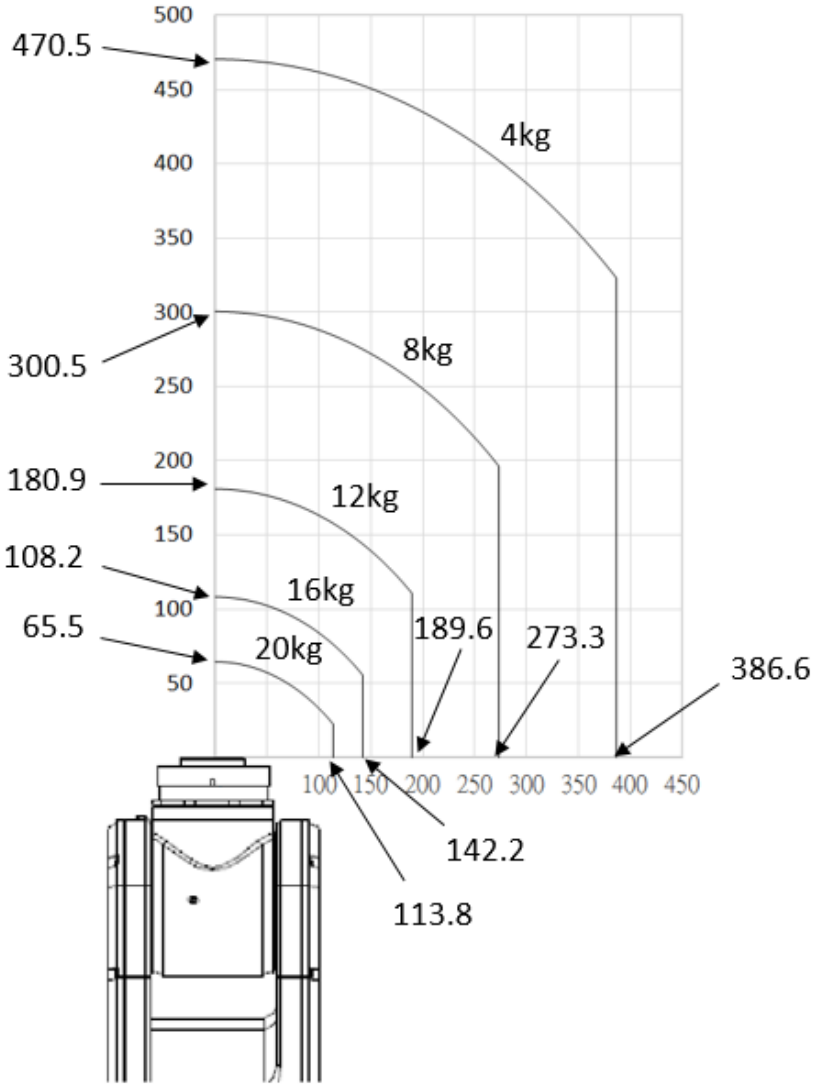


Figure 2-5. Wrist load diagram (RA620-1739)

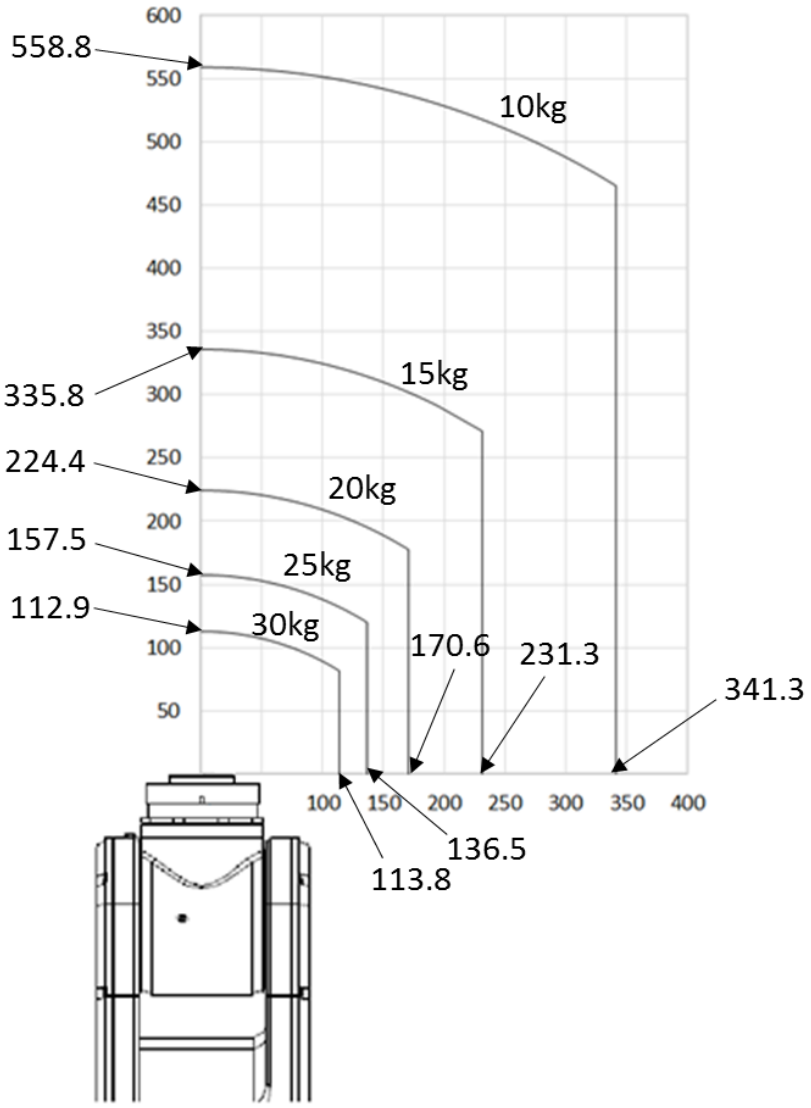


Figure 2-6. Wrist load diagram (RA620-1621)

3. Equipment Mounting Surface and Interface

3.1 Mounting surface for end effector

The mounting surface for end effector on the wrist end is shown in Figure 3-1.

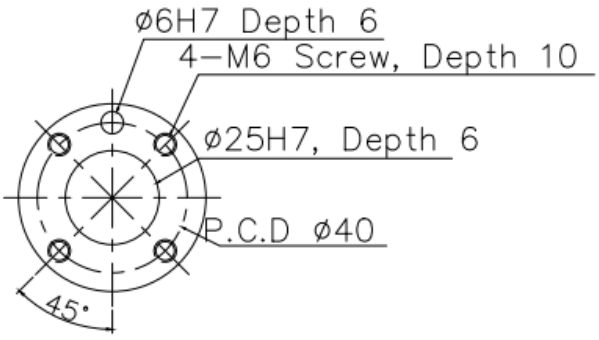


Figure 3-1. Mounting surface for end effector (RA620-1739 and RA620-1621)

3.2 Mounting Surface on the robot arm

Mounting surfaces for the peripheral equipment are shown in Figure 3-2~3-4.

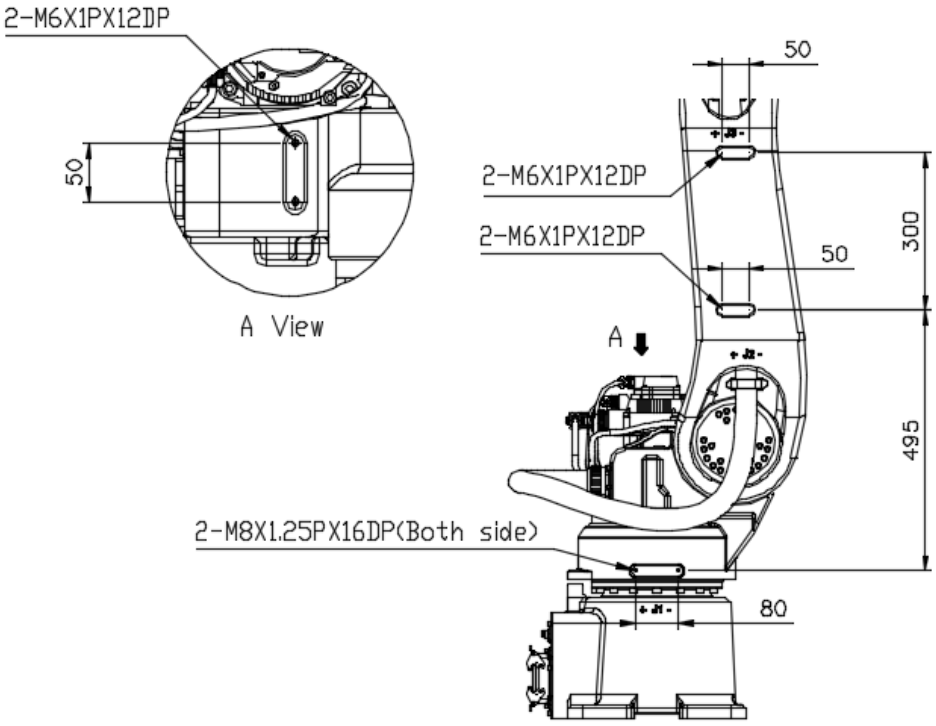


Figure 3-2. Mounting surfaces on the robot arm (RA620-1739 and RA620-1621)

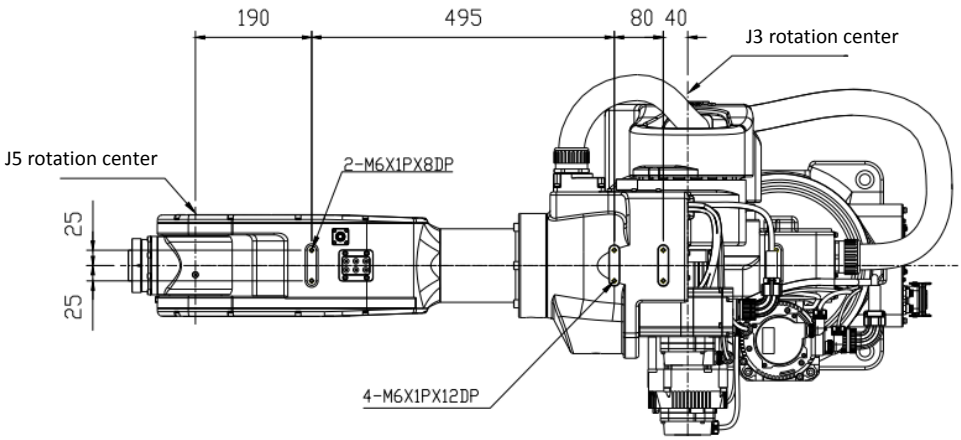


Figure 3-3. Mounting surfaces on the robot arm (RA620-1739)

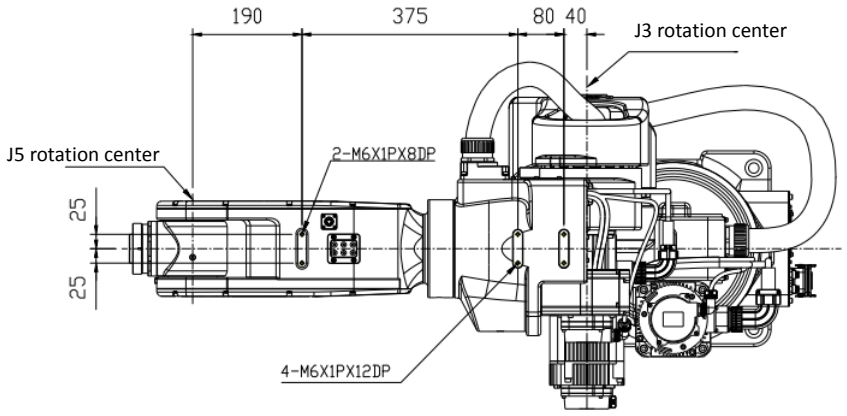
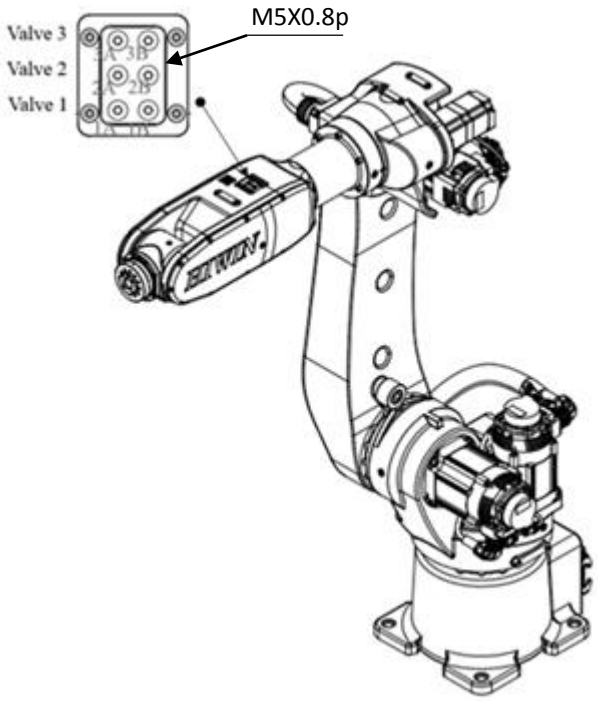


Figure 3-4. Mounting surfaces on the robot arm (RA620-1621)

⚠ WARNING	❖ When other equipment is installed on the robot, be aware of the interface between robot and motor cable.

3.3 Interface for Air supply

Air supply holes (AIR IN & AIR OUT) are prepared on the rear of the J1 base and the J5 base as shown in Figure 3-5, and the outer diameter of the air tube in the robot is φ6mm. The robot has three 5/2-way solenoid valves for end effector in the J5 base, and the schematic diagram for the values is shown in Figure 3-6。



No. of port	5
No. of position	2
Operating pressure range	0.15~0.7 MPa
Proof pressure	1 MPa
Effective orifice	11 mm^2
Response time	19 ms

Figure 3-5 The interface for air supply

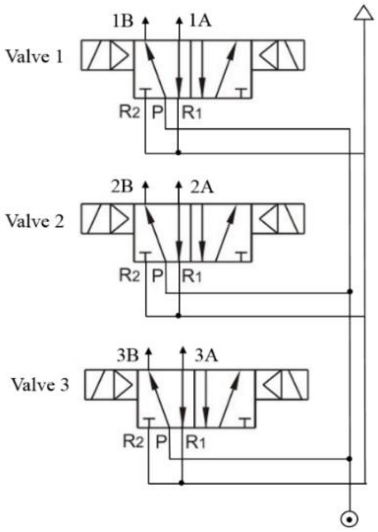


Figure 3-6. Pneumatic diagram

3.4 I/O Interface

I/O interface for end effector is on the J5 base as shown in Figure 3-7, and the pin assignment of I/O connector for user is shown in Figure 3-8. Figure 3-9 ~ 3-12 shows the wiring diagram of I/O interface.

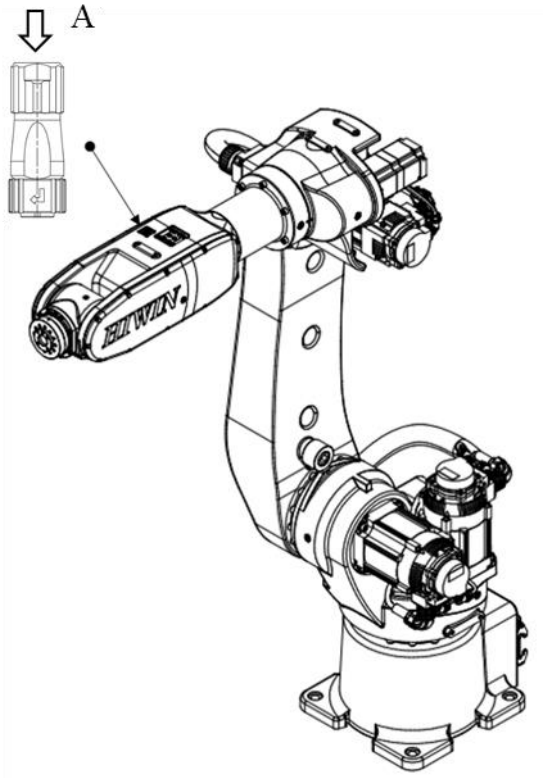


Figure 3-7. I/O interface for end effector

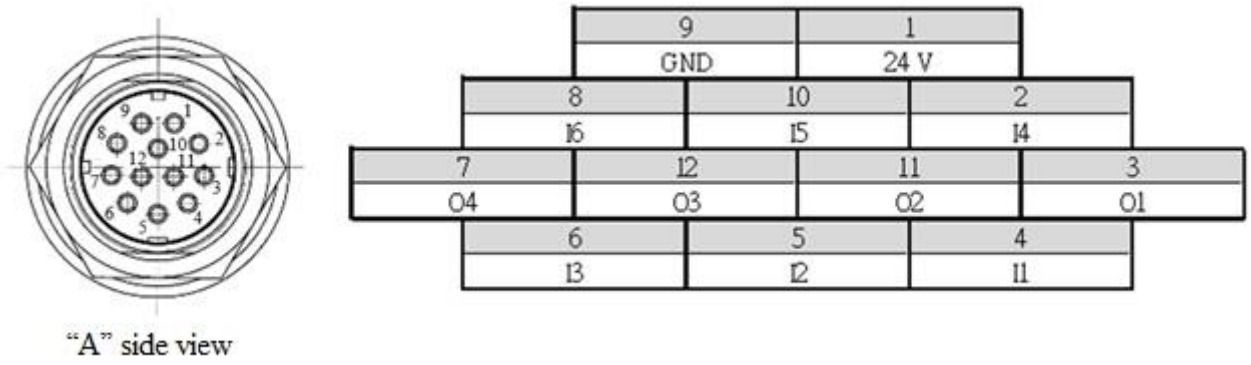


Figure 3-8 Pin definition of the I/O plug

(Power output: 24V/1A)

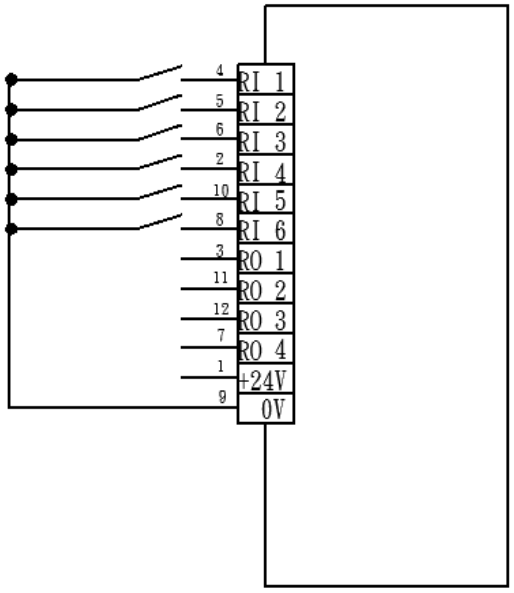


Figure 3-9. Wiring diagram of input (Standard: Sinking type)

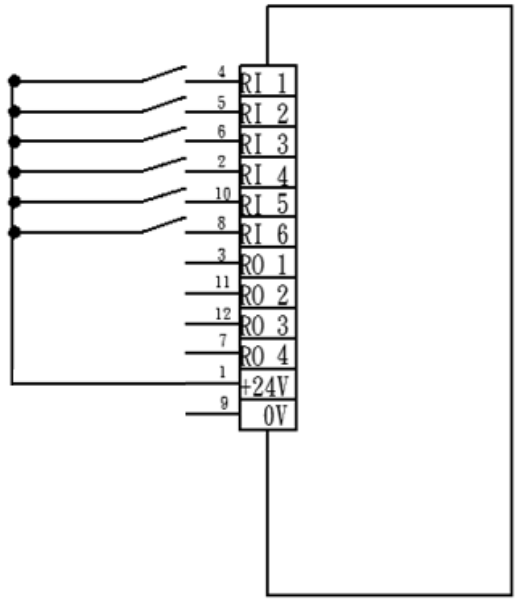


Figure 3-10. Wiring diagram of input (Optional: Sourcing type)

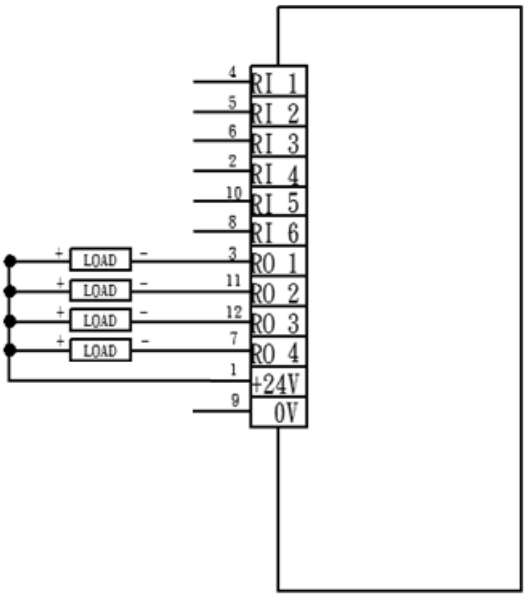


Figure 3-11. Wiring diagram of input (Standard: Sinking type)

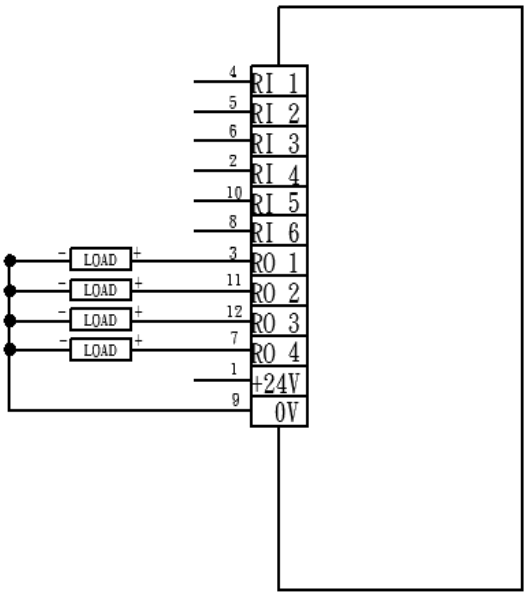


Figure 3-12. Wiring diagram of output (Optional: Sourcing type)

⚠ CAUTION	❖ Pin 1 and 9 are used for signal, not for input power of end effector. ❖ The maximum current at each pin is 100mA.

When operating robot, the cable of end effector might be tangled together with the robot. Fixing a cable-tie-fix-seat on the J5 base by using the screw (M6×1P), and secure the cable of end effector I/O connector as Figure 3-13.

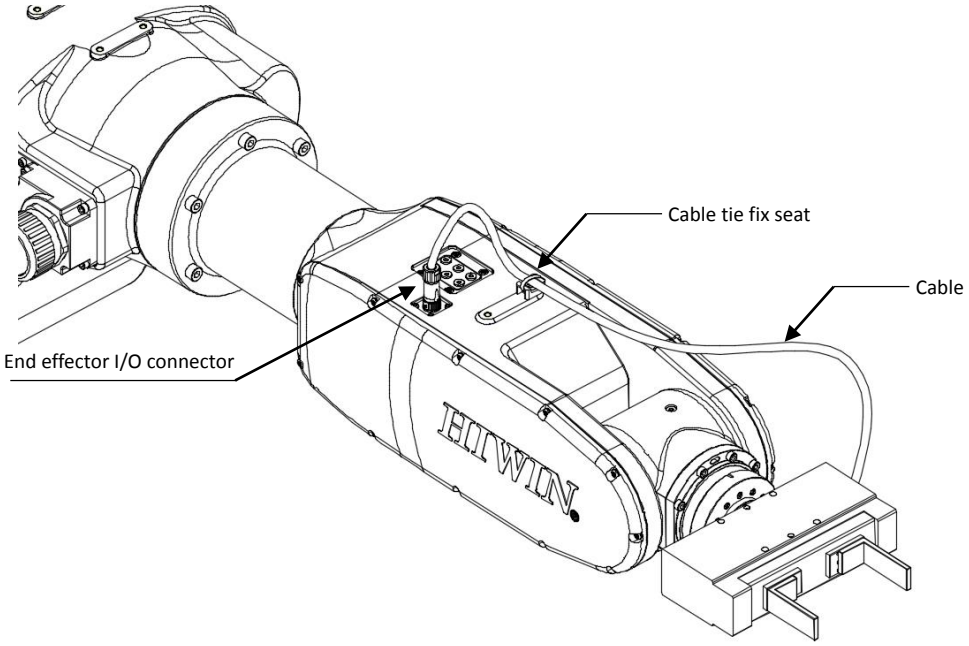
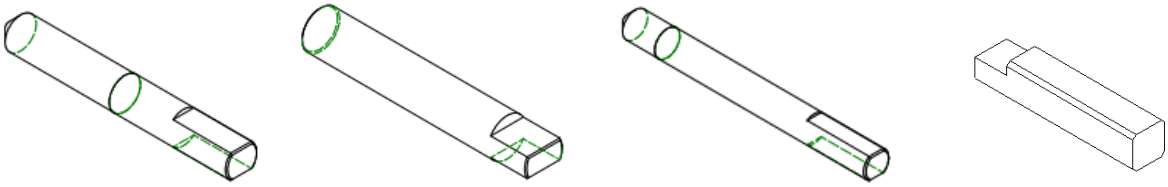


Figure 3-13. Fixing method for the cable of the end effector I/O connector

4. Calibration

4.1 Resetting Zero Position

The calibration tools for resetting zero position are shown in Figure 4-1. When reset zero position, operate the robot at low speed and move the robot to align the calibration tool with the pinhole.The robot is adjusted to the minimum speed during the calibration, and aligns the pinhole with the calibration tool to set up the original position. The procedure of resetting zero position with the calibration tools is shown in Figure 4-1 below.



4-1(a)	4-1(b)	4-1(c)	4-1(d)
J1~3	J4	J5	J6

Figure 4-1. The calibration tool set

- J1-axis zero position setting

  Step1: Operate J1 at low speed to align the pinhole of J2 base with the pinhole of J1 base.
  Step2: Insert the calibration tool for J1~3 to the pinhole to calibrate zero position.
  Step3: Complete the calibration and remove the calibration tool.
  Step4: Clear encoder by HRSS. (Refer to page 34)
  Step5: Resetting zero position of J1 axis is completed.

Figure 4-2 Illustration of J1-axis zero position setting

- J2-axis zero position setting

  Step1: Operate J2 at low speed to align the pinhole of J3 base with the pinhole of J1 base.

  Step2: Insert the calibration tool for J1~3 to the pinhole to calibrate zero position.

  Step3: Complete the calibration and remove the calibration tool.

  Step4: Clear encoder by HRSS. (Refer to page 34)

  Step5: Resetting zero position of J2-axis is completed.

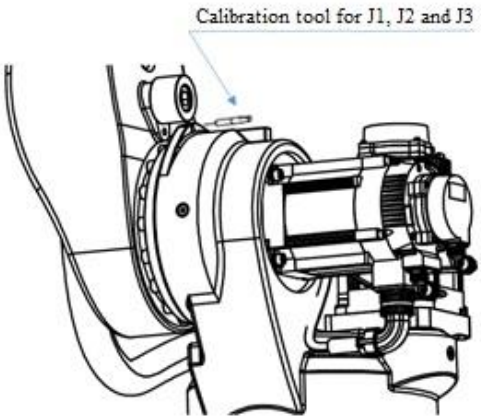


Figure 4-3 Illustration of J2-axis zero position setting

- J3-axis zero position setting

  Step1: Operate J3 at low speed to align the pinhole of J4 base with the pinhole of J3 base.

  Step2: Insert the calibration tool for J1~3 to the pinhole to calibrate zero position.

  Step3: Complete the calibration and remove the calibration tool.

  Step4: Clear encoder by HRSS. (Refer to page 34)

  Step5: Resetting zero position of J3-axis is completed.

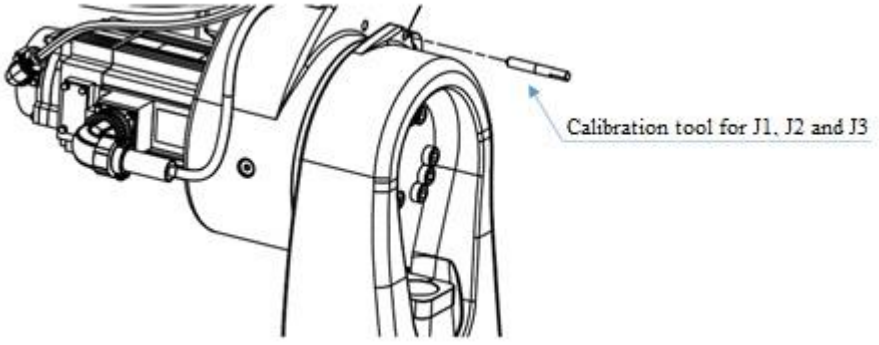


Figure 4-4 Illustration of J3-axis zero position setting

- J4-axis zero position setting

  Step1: Operate J4 at low speed to align the keyway of J5 base with the keyway of J4 base.

  Step2: Insert the calibration tool for J4 to the keyway to calibrate zero position.

  Step3: Complete the calibration and remove the calibration tool.

  Step4: Clear encoder by HRSS. (Refer to page 34)

  Step5: Resetting zero position of J4-axis is completed.

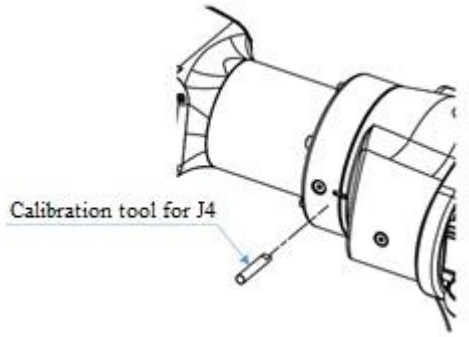


Figure 4-5 Illustration of J4-axis zero position setting

- J5 -axis zero position setting

  Step1: Operate J5 at low speed to align the pinhole of J6 base with the pinhole of J5 base.

  Step2: Insert the calibration tool for J5 to the pinhole to calibrate zero position.

  Step3: Complete the calibration and remove the calibration tool.

  Step4: Clear encoder by HRSS. (Refer to page 34)

  Step5: Resetting zero position of J5 -axis is completed.

Figure 4-6Illustration of J5-axis zero position setting

- J6-axis zero position setting

  Step1: Operate J6 at low speed to align the keyway of EE with the keyway of J6 base.

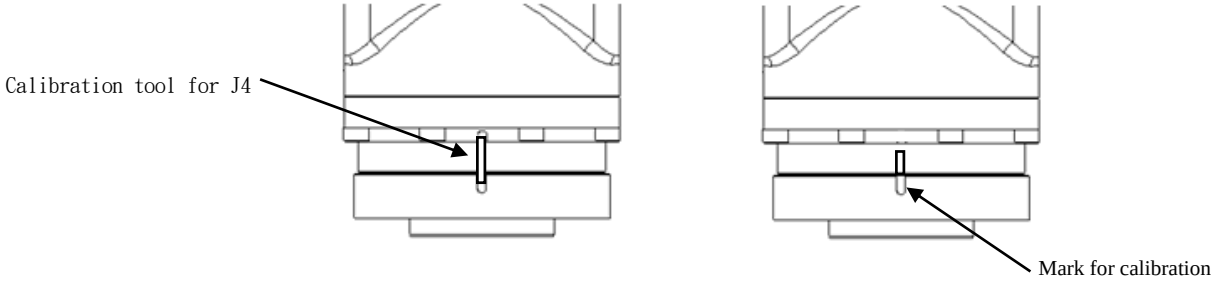
  Step2: Insert the calibration tool for J6 to the keyway to calibrate zero position.

  (Old design reference to Figure 4-7(b), align the calibration mark with the keyway.)

  Step3: Complete the calibration and remove the calibration tool.

  Step4: Clear encoder by HRSS. (Refer to page 34)

  Step5: Resetting zero position of J6-axis is completed.



4-7(a) 4-7(b)

Figure 4-7 Illustration of J6 -axis zero position setting

⊙ Clear encoder by HRSS

Step1: Select the “JOINT” as the coordinate system.

Step2: Move the robot to the zero position. (Refer to section 4-1)

Step3: Click Main Menu>>Start-up>>Master>>Clear Encoder. (As shown in Figure 4-8)

Step4: Double click the -axis to clear encoder. (As shown in Figure 4-8)

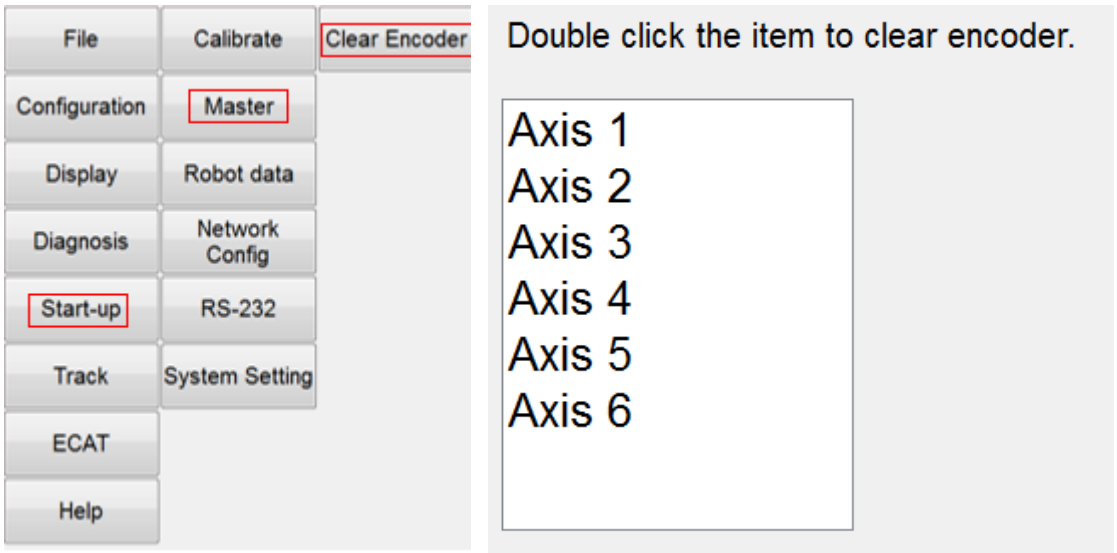


Figure 4-8 Clear encoder by HRSS

5. Maintenance and Check

This chapter will introduce the maintenance and periodical inspection procedures to maintain the robot for a reasonable service life. It includes the cover removal and installation, inspection and replacement of the timing belt, lubrication position, the procedures for replacing the battery, and other notes.

[Note 1] The operating time of the robot is defined as 3840 hours per year. When using the robot beyond this operating time, correct the maintenance frequencies shown in this chapter by calculation in proportion to the difference between the actual operating time and 3840 hours per year.

5.1 Periodic Inspection Items

The daily inspection items before the robot operation are shown in Table 5-1.

Table 5-1 Daily Inspection Items

	Inspection item	Remedies
Before turning power ON		
1	Are any of the robot installation screws, cover installation screws and end effector installation screws loose?	Securely tighten the screws.
2	Are any of cables securely connected? Such as the power and signal cable, grounding cable, the cable for teach pendant and the cable between the robot and other equipment.	Securely connect.
3	Is the pneumatic system normal? Are there any air leaks, drain clogging or hose damage? Is there air source normal?	Drain the drainage and replace the leaks part.
After turning power ON		
1	Check whether the robot moves smoothly without vibration or noise.	1. The robot installation screws might not be securely fastened to the installation surface. Securely tighten the screws. 2. If the roughness of the installation surface is uneven, modify the installation surface to the reasonable surface roughness. 3. The base might not be sufficiently rigid. Please reinforce the base to make it more rigid. 4. There might have foreign material between the robot and the installation surface. Please

		remove it. 5. Some operating positions might be too demanding for the robot mechanism, please adjust the load, speed or acceralation. Please reduce load or acceleration. 6. The timing belt might loosen or not in correct location. Please replace or adjust the timing belt. (Refer to section 5.2.2) 7. If the grease of the reducer has not been changed for a long period. Please change the grease. (Refer to section 5.2.3) 8. If the bearing or the reducer has damage on the rolling surface or the gear tooth surface. Please contact HIWIN direcly.
2	The repeatability is not within the tolerance.	1. The zero position of the robot might be rewritten. Please reset the zero position. (Refer to section 4.1) 2. If the repeatability is unstable, repair the robot by referring to the descriptions of unusual vibration and noise above.

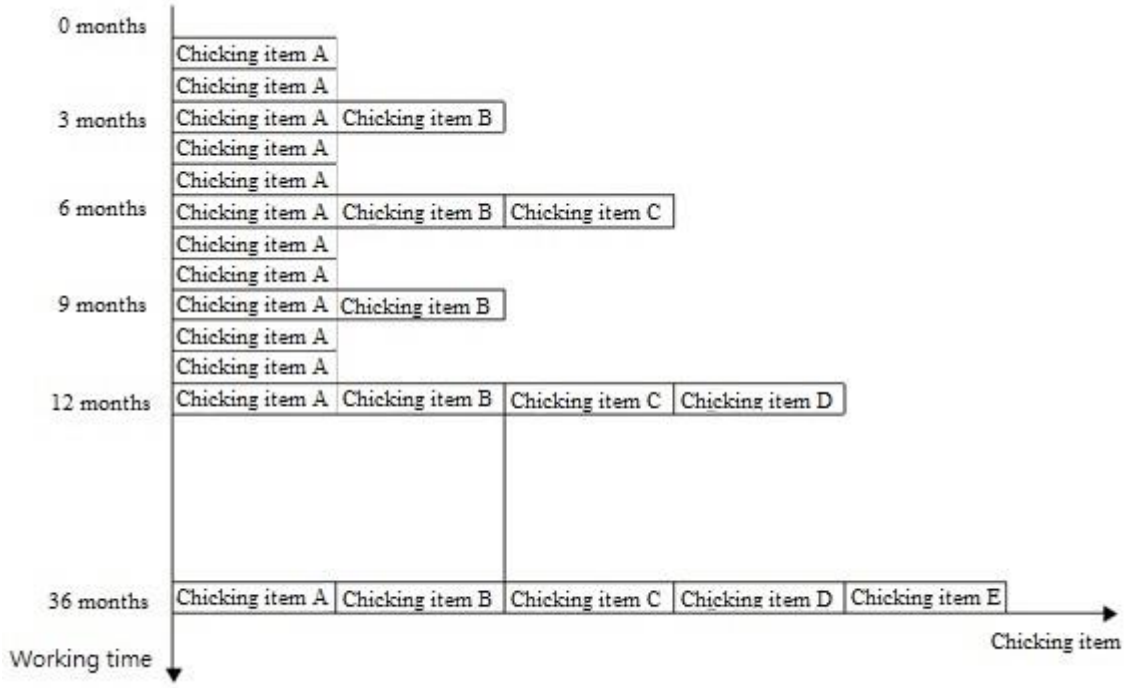
Table 5-2 Periodic inspection items

	Inspection item	Remedies
Inspection item A (1 month / 320 hours)		
1	Clean and check each part of the robot.	Check if there are any cracks and flows on the robot.
Inspection item B (3 months / 960 hours)		
1	Check the ventilation portion of the controller.	If it is dusty, turn off the power and clean the ventilation portion of the controller
Inspection item C (6 months / 1920 hours)		
1	Check whether the timing belt is abnormal.	Adjust the tension of the timing belt. If the friction at the timing belt is severe, replace it. Refer to section 5.2.2.
Inspection item D (1year / 3840 hours)		
1	Replace the backup battery in the robot.	Replace the backup battery. Refer to section 5.2.1
Inspection item E (3years/11520hours)		

1	Change the lubrication grease of the reducer.	Change the grease. Refer to section 5.2.3.

⚠ CAUTION	❖ In the initial operation, it is normal that the timing belt has some friction. If the rubber appear soon after cleaning it, please wipe them again and replace the belt.

Table 5-3 Inspection schedule



5.2 Maintenance

5.2.1 Backup Batteries Replacement

The absolute encoder of the motor is used to record the position of the robot. When the controller power turn off, the position data of each -axis is preserved by the backup batteries. The batteries are installed when the robot is shipped from the factory. If the batteries are in use, the annual change of batteries is needed. The service life of the batteries depends on the operating conditions of the robot. In order to avoid the loss of position data, the batteries need to be changed by the user periodically. The procedure for replacing the batteries of the robot is shown in Figure 5-1. The procedures are described as below.

Step1. Ensure the robot and controller are connected with the cables.

Step2. Keep the power on. Press the emergency stop button to prohibit the movement of the robot motion.

Step3. The battery box is located in the rear of the J1 base. Please remove the battery cover.

Step4. Replace the battery one by one. If all batteries are removed in the same time, the position data will be lost. Therefore, please resetting the robot to the zero position.

Step5. After replacing the battery, ensure to install the battery cover.

⚠ CAUTION	❖ All batteries should be changed simultaneously. If the old batteries are included, the service life of the batteries may be reduced.

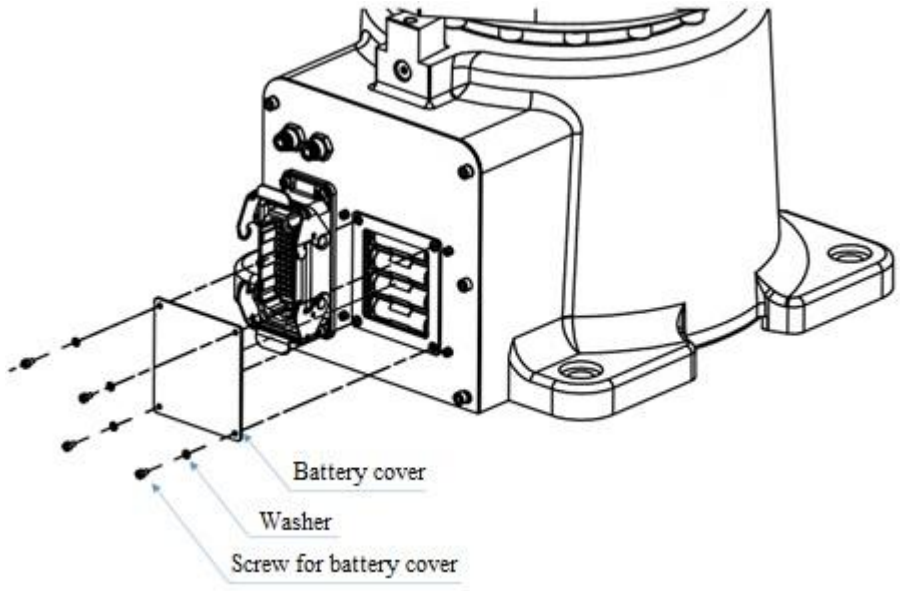


Figure 5-1. The backup batteries replacement

5.2.2 Timing Belt Replacement

The robot uses the timing belt for the driver system of the J5 and J6 -axis. Although the belt tension has been adjusted before the robot is shipped, the timing belt will wear depending on the robot working conditions. The belt tension might be lower than the standard over a long time operation. The timing belt should be periodically checked, maintained and replaced.

⊙ Timing Belt replacement period

Check the timing belt for about 6 months. The timing belt must be replaced if the belt teeth is found cracks, wear to approximately half of the tooth width, or break.

⊙ Timing Belt replacement period

It is very important to have proper belt tension. The belt tooth jumping will happen if the belt tension is too loose. If the belt tension is too tight, it will cause damage to the motor or bearing. Measuring methods for the belt by using fingers or tools are shown in Figure 5-2. The sonic tension meter is used to measure the belt tension. The specifications and standard tension of belt are shown in Table 5-4.

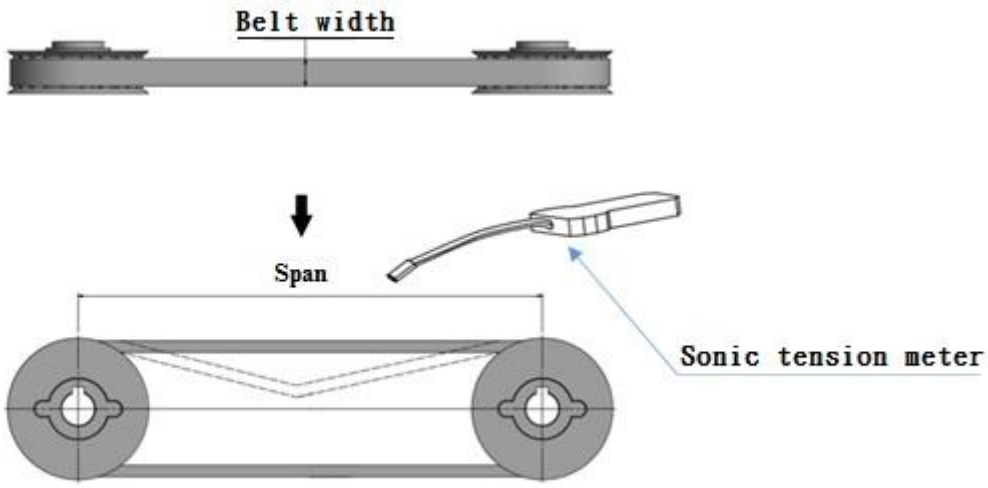


Figure 5-2 Measure belt tension

Table 5-4 The belt specifications

Model	Axis	Belt type	Width(mm)	Span(mm)	Tension(N)
RA620-1739	J5	505-5GT-9	9	188.6	55±10
	J6	505-5GT-9	9	188.6	55±10
RA620-1621	J5	540-5GT-9	9	188.6	55±10
	J6	540-5GT-9	9	188.6	55±10

⊙ Removing the cover

Before replacing the belt, remove the cover of the J5 base. The M4×0.7P×15L screws are used, as shown in Figure 5-3.

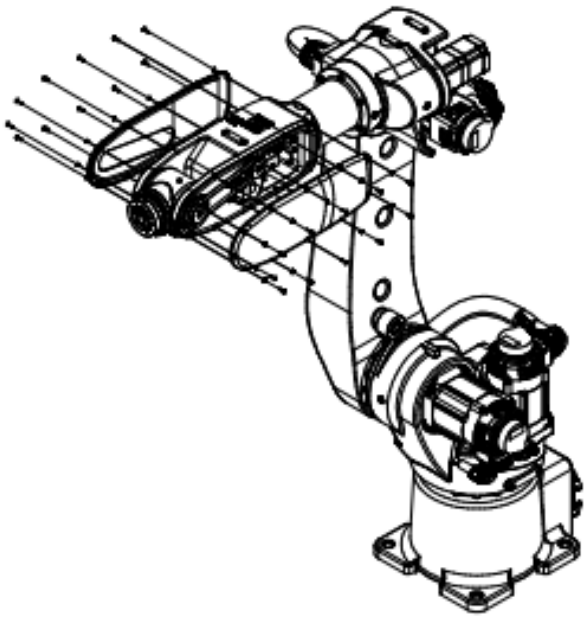


Figure 5-3 Removing the cover

⊙ Inspection, maintenance and replacement of timing belt in J5 -axis.

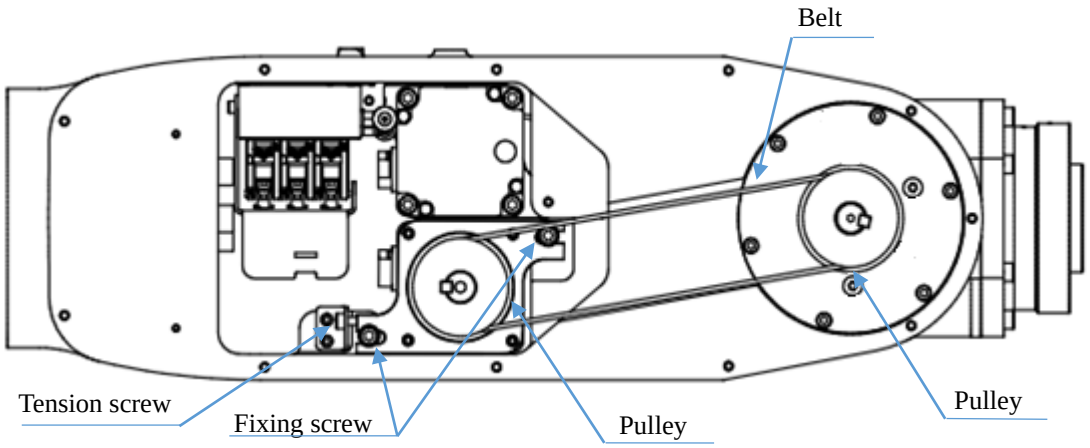


Figure 5-4 J5 -axis structure diagram (RA620-1739)

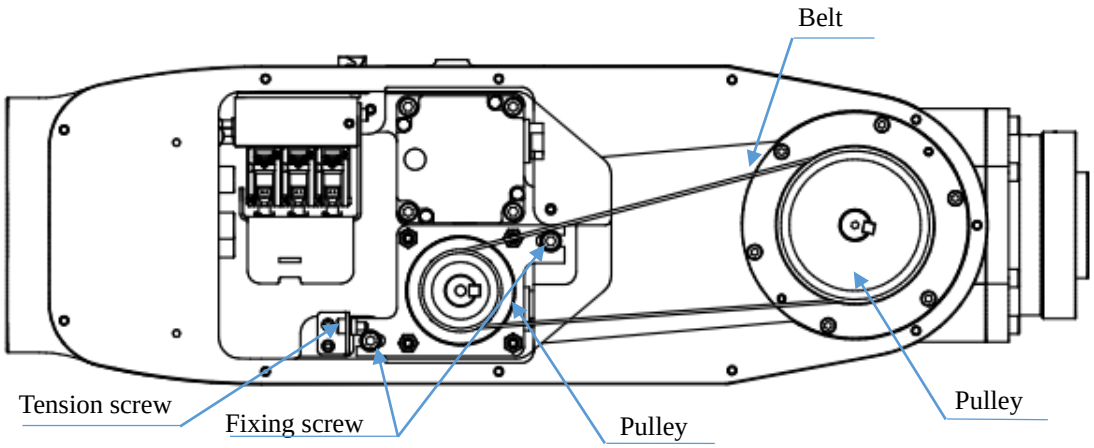


Figure 5-5 J5 -axis structure diagram (RA620-1621)

- Inspect J5 -axis timing belt
  - Step1. Ensure the power of controller be switched off.
  - Step2. Remove the cover of the J5 base.
  - Step3. Check whether the timing belt is normal.
  - Step4. If the timing belt is abnormal, refer to the following paragraph to replace the timing belt.
  - Step5. If the belt tension is lower than the standard, refer the following paragraph to adjust the belt tension.
- Adjust J5 -axis timing belt
  - Step1. Loose the two motor plate fixing screws, so that the motor can be moved.
  - Step2. Refer to Table 5-4, turn the adjusting screw to adjust the tension of the belt.
  - Step3. Tighten the two motor plate fixing screws(4.6 N-m).

- Replacing J5 -axis timing belt

  Step1. Remove the two motor plate fixing screws.

  Step2. Loose the adjusting screw to replace the timing belt.

  Step3. After replacing the belt, refer to the paragraph “Adjusting J5 -axis timing belt” above to adjust the tension of the belt.

⊙ Inspection, maintenance and replacement of J6 -axis timing belt

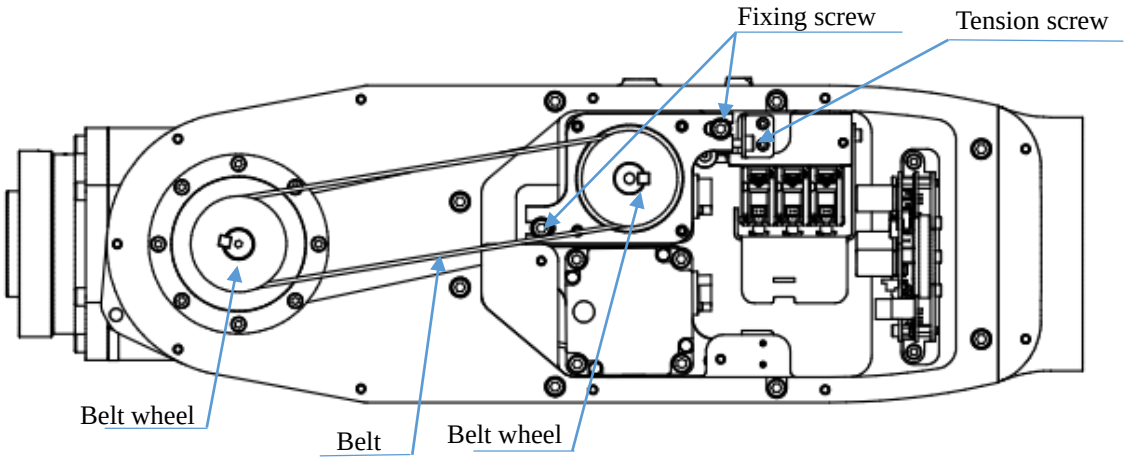


Figure 5-6 J6 -axis structure diagram

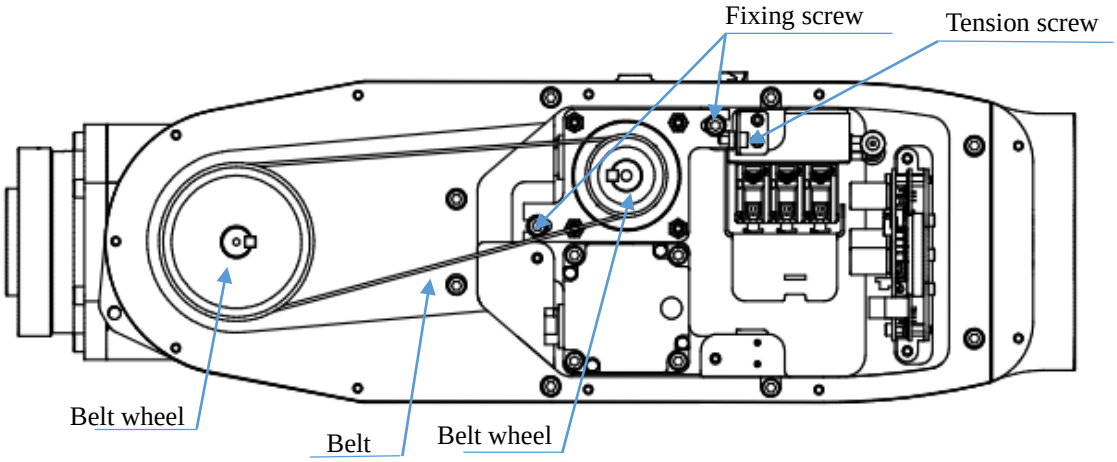


Figure 5-6 J6 -axis structure diagram

- Inspect J6 -axis timing belt

  Step1. Confirm that the controller power is OFF. Ensure the power of controller be switched off.

  Step2. Remove the cover of the J6 base.

  Step3. Check whether the timing belt is normal.

  Step4. If the timing belt is abnormal, refer to the following paragraph to replace the timing belt.

Step5. If the belt tension is lower than the standard, refer the following paragraph to adjust the belt tension.

- Adjusting J6 -axis timing belt
  Step1. Loose the two motor plate fixing screws, so that the motor can be moved.
  Step2. Refer to Table 5-5, turn the adjusting screw to adjust the tension of the belt.
  Step3. Tighten the two motor plate fixing screws. (4.6 N-m)

- Replacing J6 -axis timing belt
  Step1. Remove the two motor plate fixing screws.
  Step2. Loose the adjusting screw to replace the timing belt.
  Step3. After replacing the belt, refer to the paragraph “Adjusting J6 -axis timing belt” above to adjust the tension of the belt.

5.2.3 Grease Replenishment

⊙ The grease inlets and the air vents are shown in Figure 5-6.

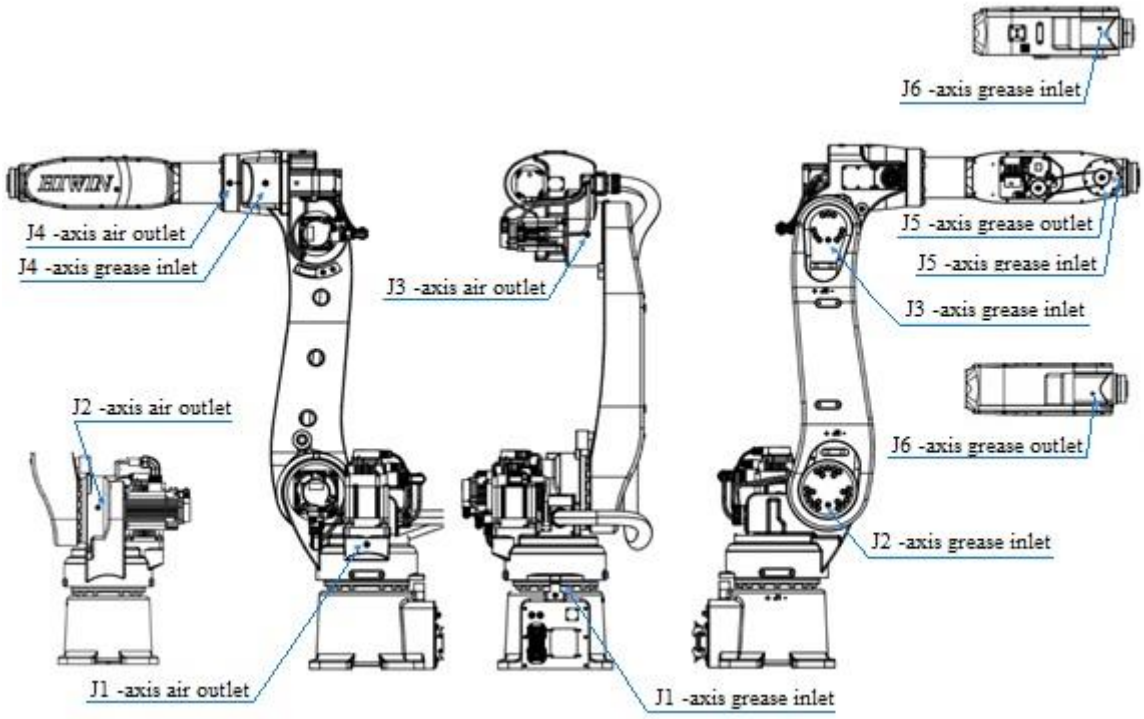


Figure 5-6 Lubrication and air inlet/outlet positions

⊙ Grease specification

⊙ Table 5-5 Grease specification

Part name	Grease nipple	Lubrication grease	Quantity	Lubrication interval
J1 reduction gear	M8	VIGOGREASE REO	1405 ml	11520Hr
J2 reduction gear	M8	VIGOGREASE REO	745 ml	
J3 reduction gear	M8	VIGOGREASE REO	350 ml	
J4 reduction gear	M8	VIGOGREASE REO	265 ml	
J5 reduction gear	M5	SK-1A	18 ml	
J6 reduction gear	M5	SK-1A	33 ml	

[Note1]：If the robot is not used for 2 years, replace the grease of each axis.

[Note2]：The J5 cover needs to be removed for J5 grease replacing.

⊙ Procedure of grease replenishment

Step1. The grease inlets and the air vents of the robot are shown in Figure 5-6.

Step2. Remove the screw of the grease inlet, and install the grease nipple.

Step3. Remove the screw of the air vent.

Step4. Replenish the grease from the grease inlet by the grease gun.

Step5. Install the screw of the air vent.

Step6. Remove the grease nipple, and install the screw of the grease inlet.

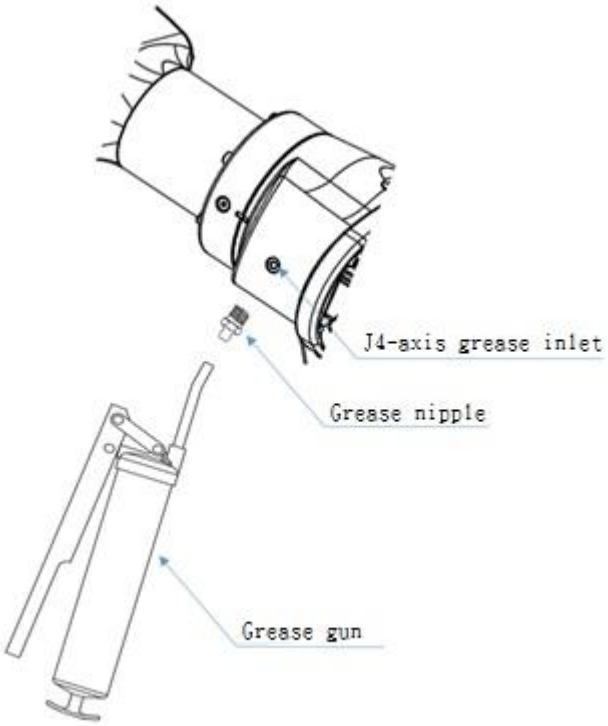


Figure 5-7 Grease replenishment

Articulated Robot - RA620 User Manual

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