



# Articulated Robot - RA610-GC

User Manual

Original Instruction





## 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



## Torque Motor 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 (Cool Type)
  - 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



## Bearing

- Machine Tools / Robot
- Crossed Roller Bearing
  - Ballscrew Bearing
  - Linear Bearing
  - Support Unit



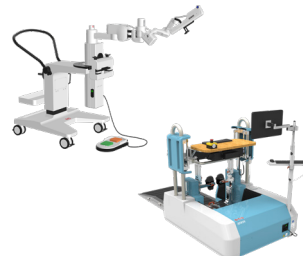
## DATORKER® Robot Reducer

- Robot / Automation Equipment / Semiconductor Equipment / Machine Tools
- WUT-PO Type
  - WUI-CO Type
  - WTI-PH Type
  - WTI-AH Type



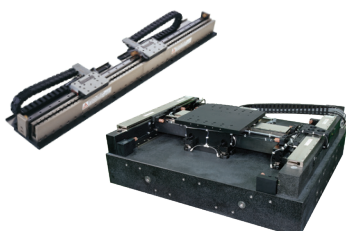
## AC Servo Motor & Drive

- Semiconductor / Packaging Machine / SMT / Food Industry / LCD
- Drives--D1, D1-N, D2T/D2T-LM
  - Motors--50W-2000W



## Medical Equipment

- Hospital / Rehabilitation Centers / Nursing Homes
- Robotic Gait Training System
  - Robotic Endoscope Holder



## 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

- Machine Tools
- Torque Motor--TMRW Series
- Inspection / Testing Equipment / Robot
- Direct Drive Motor--DMS, DMY, DMN Series

## 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 any of the damage and failure resulting from:


- The damage caused by using 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.
- The damage caused by changing installation place, 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 the unauthorized staff.
- Installing non-genuine HIWIN products.

The following conditions are not covered by the warranty:

- Product serial number or date of manufacture (month and year) cannot be verified.
- Using non-genuine HIWIN products.
- Adding or removing any components into/out the product without authorized.
- Any modification of the wiring and the cable of the product.
- Any modification of the appearance of the product; removal of the components inside the product. e.g., remove the outer cover, product drilling or cutting.
- Damage caused by any natural disaster. i.e., fire, earthquake, tsunami, lightning, windstorms and floods, tornado, typhoon, hurricane etc.

HIWIN does not provide any warranty or compensation to all the damage caused by above-mentioned circumstances unless the user can prove that the product is defective.

For more information towards warranty terms and conditions, please contact the technician or the dealer who you purchased with.

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>❖ Improper modification or disassemble the robot might reduce the robot function, stability or life.</li> <li>❖ The end-effector or the cable for devices should be installed and designed by a professional staff to avoid damaging the robot and robot malfunction.</li> <li>❖ Please contact the technician for special modification coming from production line set up.</li> <li>❖ For the safety reason, any modification for HIWIN product is strictly prohibited.</li> </ul>
--	--

## Safety Precautions



### 1. Safety Information


- Safety Responsibility and 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 following shows the safety symbols used in this user manual.

Symbol	Description
 <b>DANGER</b>	Failure to follow instructions with this symbol may result in serious hazard or personal injury. Please be sure to comply with these instructions.
 <b>WARNING</b>	Failure to follow instructions with this symbol may result in personal injury or product damage. Please be sure to comply with these instructions.



 <b>CAUTION</b>	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 ON/OFF
    - Starts robot program from operator's panel
    - Restore system alarm status
  - Programmer or teaching operator:
    - Operates the robot
    - Teaches robot inside the safety fence
  - Maintenance engineer:
    - Operates the robot
    - Teaches robot inside the safety fence
    - Does maintenance, adjustment, replacement
  
- ⦿ Programmer and the maintenance engineer must be trained for proper robot operation


3. Warning

3.1 Common Safety Issues


 <p><b>DANGER</b></p>	<ul style="list-style-type: none"> <li>❖ All operating procedures should be assessed by professional and in compliance with related industrial safety regulations.</li> <li>❖ When operating robot, operator needs to wear safety equipment, such as smock for working environment, safety shoes and helmets.</li> <li>❖ When encountering danger or other emergency or abnormal situation, please press the emergency stop button immediately and move the arm away with low speed in manual mode.</li> <li>❖ When considering safety of the robot, the robot and the system must be considered at the same time. Be sure to install safety fence or other safety equipment and the operator must stand outside the safety fence while operating the robot.</li> <li>❖ A safety zone should be established around the robot with an appropriate safety device to stop the unauthorized personnel from access.</li> <li>❖ While installing or removing mechanical components, be aware of a falling piece which may cause injury to operator.</li> <li>❖ Ensure the weight of workpiece does not exceed the rated load or the tolerable torque. Exceeding these values could lead to the driver alarm or malfunction of the robot.</li> <li>❖ Do not climb on robot.</li> <li>❖ The installation for emergency functions shall be defined by the system integrator in accordance with ISO 10218-1/-2.</li> </ul>
 <p><b>WARNING</b></p>	<ul style="list-style-type: none"> <li>❖ The personnel operating robot should be trained and licensed.</li> <li>❖ To ensure personal safety, robot installation must comply with this manual and related industrial safety regulations.</li> <li>❖ The control cabinet should not be placed near high voltage or machines that generate electromagnetic</li> </ul>

	<p>fields to prevent interference that could cause the robot to deviation or malfunction.</p> <ul style="list-style-type: none"> <li>❖ Using non-HIWIN repair components may cause robot damage or malfunction.</li> <li>❖ Beware of the heat generated by the controller and servo motor.</li> <li>❖ Do not overbend the cable to avoid poor circuit contact.</li> </ul>
--	---



### 3.2 Operation

 <b>DANGER</b>	<ul style="list-style-type: none"> <li>❖ Programming must be done outside of the safety fence. If it is inevitable to enter the safety fence, the emergency stop button must be pressed.</li> </ul>
---	---


### 3.3 Maintenance

 <b>DANGER</b>	<ul style="list-style-type: none"> <li>❖ Please contact us if the procedure not specified by HIWIN is needed.</li> <li>❖ Please contact us if the replacement of the component not specified by HIWIN is needed.</li> <li>❖ Be sure to carry out regular maintenance, otherwise it will affect the service life of the robot or other unexpected danger.</li> <li>❖ Prior to repair and maintenance, please turn off power supply.</li> <li>❖ Maintenance and repair should be performed by a qualified operator with a complete understanding of the entire system to avoid risk of robot damage and personal injury.</li> <li>❖ When replacing the components, avoid foreign material going into the robot.</li> </ul>
---	--


### 3.4 End Effector

 <p><b>DANGER</b></p>	<ul style="list-style-type: none"> <li>❖ More attention must be paid to the design of the end effector to prevent power loss or any other errors that could lead to workpiece falling or damage.</li> <li>❖ The tool-type end effector is usually equipped with high voltage, high temperature and active rotary shaft. Special attention should be paid to the operating safety.</li> <li>❖ The end effector should be mounted firmly on the robot to avoid workpiece release during operation which may cause personal injury or hazard.</li> </ul>
 <p><b>WARNING</b></p>	<ul style="list-style-type: none"> <li>❖ The end effector may be equipped with its own control unit. Be sure the control unit does not interfere with robot operation.</li> </ul>

### 3.5 Pneumatic, Hydraulic System

 <p><b>DANGER</b></p>	<ul style="list-style-type: none"> <li>❖ When using the pneumatic or hydraulic system, the gripped workpiece may fall due to insufficient pressure or gravity.</li> <li>❖ The pneumatic system must be equipped with the relief valve, so that can be applied in an emergency.</li> </ul>
--	---

### 3.6 Emergency Stop

 <p><b>DANGER</b></p>	<ul style="list-style-type: none"> <li>❖ The robot or other control component should have at least one device for immediate halt of a function, such as an emergency stop switch.</li> <li>❖ The emergency stop button must be installed in an easily accessible location for quick stop.</li> <li>❖ While executing an emergency stop, power to the servo motor will be cut, and all movements will be stopped. And the control system will be shut down. Emergency stop should be reset if the restoration of operating procedure is wanted.</li> <li>❖ Avoid using emergency stop to replace a normal stop procedure. This could lead to unnecessary loss to robot.</li> </ul>
--	---



#### 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 the specified environment, for more detailed information please see section 1.5 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 the local environmental regulations.

# Content

<b>1.</b>	<b>TRANSPORTATION AND INSTALLATION.....</b>	<b>10</b>
1.1	TRANSPORTATION .....	10
1.2	INSTALLATION.....	19
1.3	CONNECTION WITH THE CONTROLLER.....	21
1.4	GROUNDING.....	23
1.5	ENVIRONMENTAL CONDITIONS.....	24
1.6	STANDARD AND OPTIONAL EQUIPMENT LIST.....	25
<b>2.</b>	<b>BASIC SPECIFICATIONS .....</b>	<b>26</b>
2.1	DESCRIPTION OF MODEL NAME.....	26
2.2	LABELS.....	27
2.3	ROBOT SPECIFICATIONS.....	29
2.4	OUTER DIMENSIONS AND MOTION RANGE .....	31
2.5	WRIST LOAD CONDITIONS.....	35
<b>3.</b>	<b>EQUIPMENT MOUNTING INTERFACE.....</b>	<b>39</b>
3.1	END-EFFECTOR INTERFACE.....	39
3.2	MOUNTING SURFACE ON THE ROBOT.....	39
3.3	PNEUMATIC INTERFACE .....	42
3.4	R-I/O INTERFACE.....	43
<b>4.</b>	<b>CALIBRATION.....</b>	<b>47</b>
4.1	ZERO-POSITION SETTING.....	47
<b>5.</b>	<b>MANUAL BRAKE RELEASE DEVICE (OPTIONAL) .....</b>	<b>51</b>
5.1	SAFETY PRECAUTIONS.....	51
5.2	CONFIRMATION BEFORE USING.....	51
5.3	OPERATION .....	53
<b>6.</b>	<b>MAINTENANCE AND INSPECTION .....</b>	<b>55</b>
6.1	MAINTENANCE ITEMS.....	55
6.2	MAINTENANCE METHODS.....	59
	6.2.1 Backup Batteries Replacement .....	59
	6.2.2 Timing Belt Replacement.....	60
	6.2.3 Grease Replacement .....	64

<b>Version</b>	<b>Date</b>	<b>Product</b>	<b>Note</b>
1.0.0	2020.04.10	RA610-GC	First edition

# 1. Transportation and Installation

## 1.1 Transportation

Sling, crane or forklift truck can be used to transport the robot. The transportation procedure is as follows:

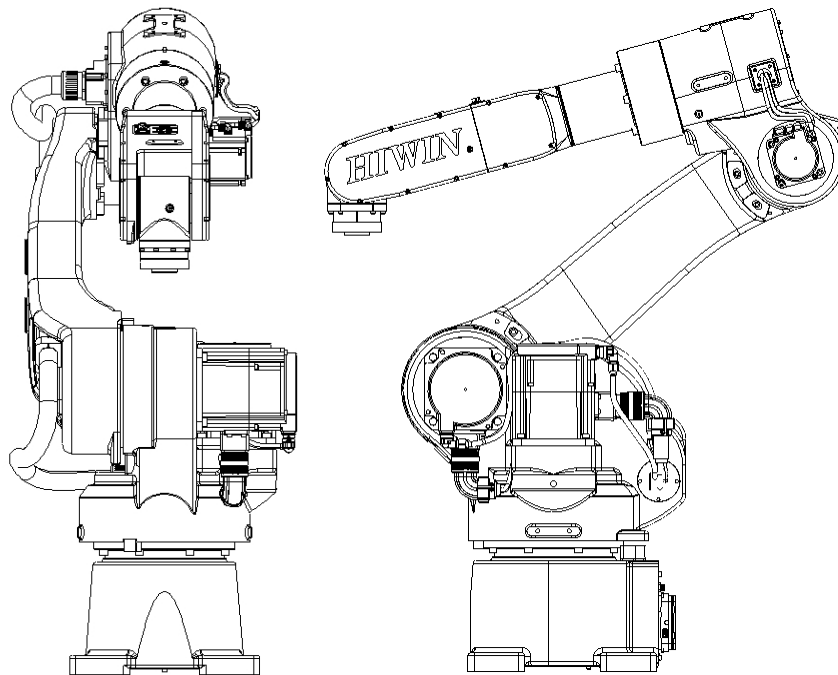
Transport by forklift truck:

- Step1. Move the robot into its transport position and the angle of each joint is shown in the table of Figure 1-1. Transport dimensions are shown in Figure 1-2(a)~(d).
- Step2. Secure the suspension plate to the robot with four M8x1.25Px20L head screw as shown in Figure 1-3(a)~(d).
- Step3. Move the robot to the desired position by forklift truck.
- Step4. Remove the suspension plate and firmly secure the robot.

Transport by sling and crane:


- Step1. Move the robot into its transport position and the angle of each joint is shown in the table of Figure 1-1. Transport dimensions are shown in Figure 1-2(a)~(d).
- Step2. Secure two M12x1.75Px22L eye bolts to the robot as shown in Figure 1-4 (a)~(e).
- Step3. Move the robot to the desired position by sling and crane.
- Step4. Remove the eye bolts and firmly secure the robot.

Please refer to section 1.2~1.5 for robot installation and precautions.



Transport position				
	RA610-1355-GC	RA610-1476-GC	RA610-1672-GC	RA610-1869-GC
J1	0°	0°	0°	0°
J2	45°	55°	45°	35°
J3	-75°	-75°	-80°	-80°
J4	0°	0°	0°	0°
J5	-60°	-70°	-55°	-45°
J6	0°	0°	0°	0°

Figure 1-1 Transport position

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>❖ Before carrying the robot, be sure to remove the end effector which changes the center of gravity.</li> <li>❖ Please keep stable, slow down and avoid excessive vibration or shock during transportation.</li> <li>❖ While placing the robot be sure to avoid the robot and the installation surface collision.</li> <li>❖ After removing the suspension plate, please maintain it properly for re-transportation.</li> <li>❖ Before operation, remove the suspension plate to avoid danger.</li> </ul>
--	--

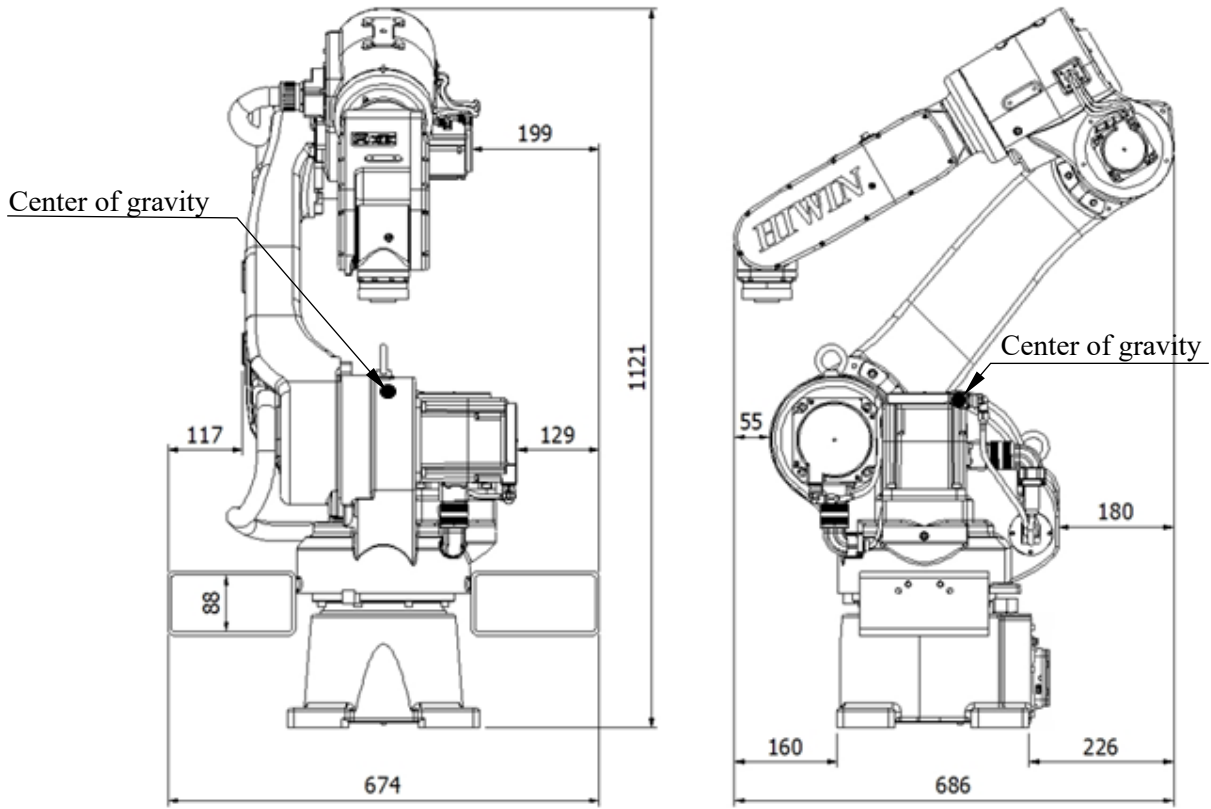


Figure 1-2(a) RA610-1355-GC Transport dimensions

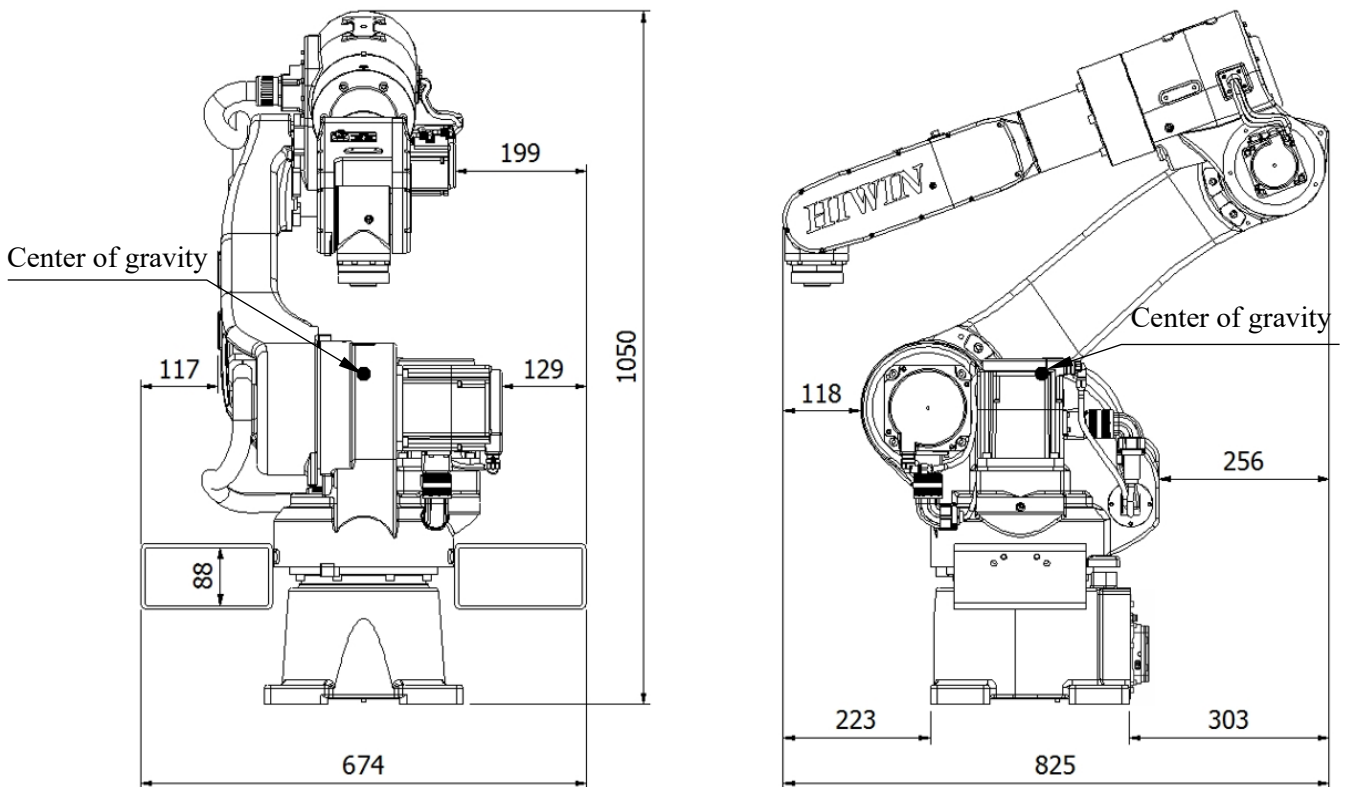


Figure 1-2(b) RA610-1476-GC Transport dimensions

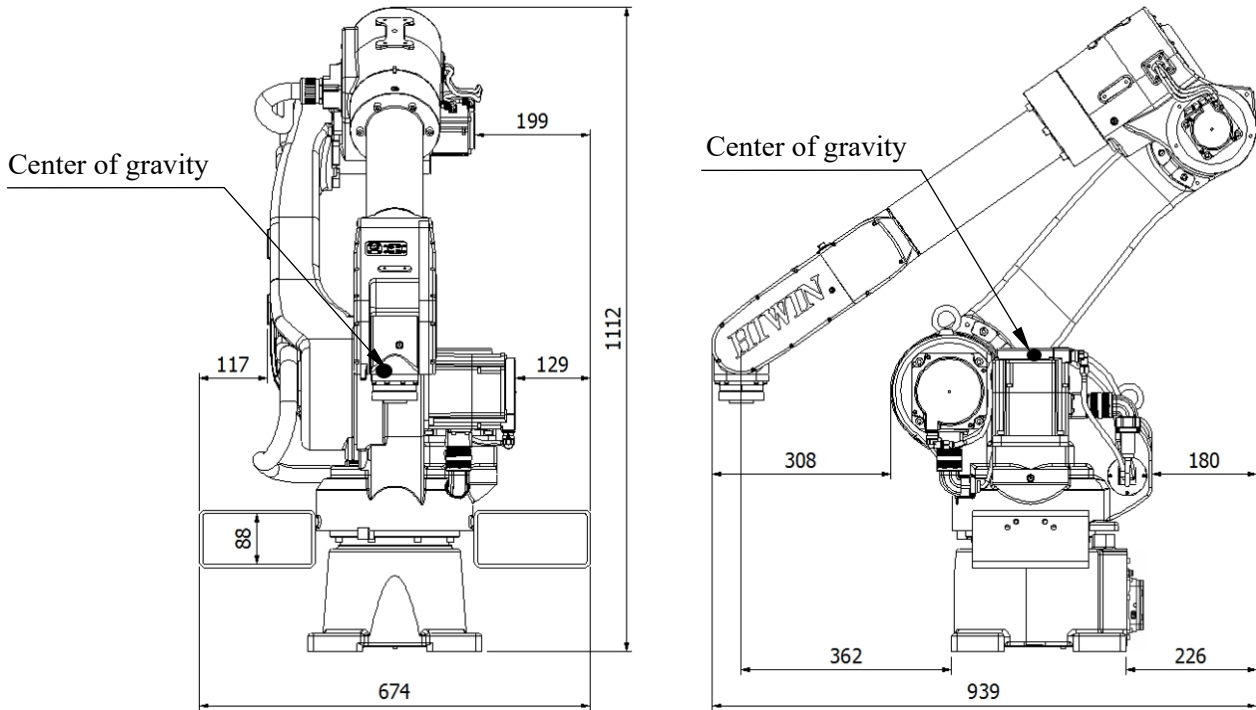


Figure 1-2(c) RA610-1672-GC Transport dimensions

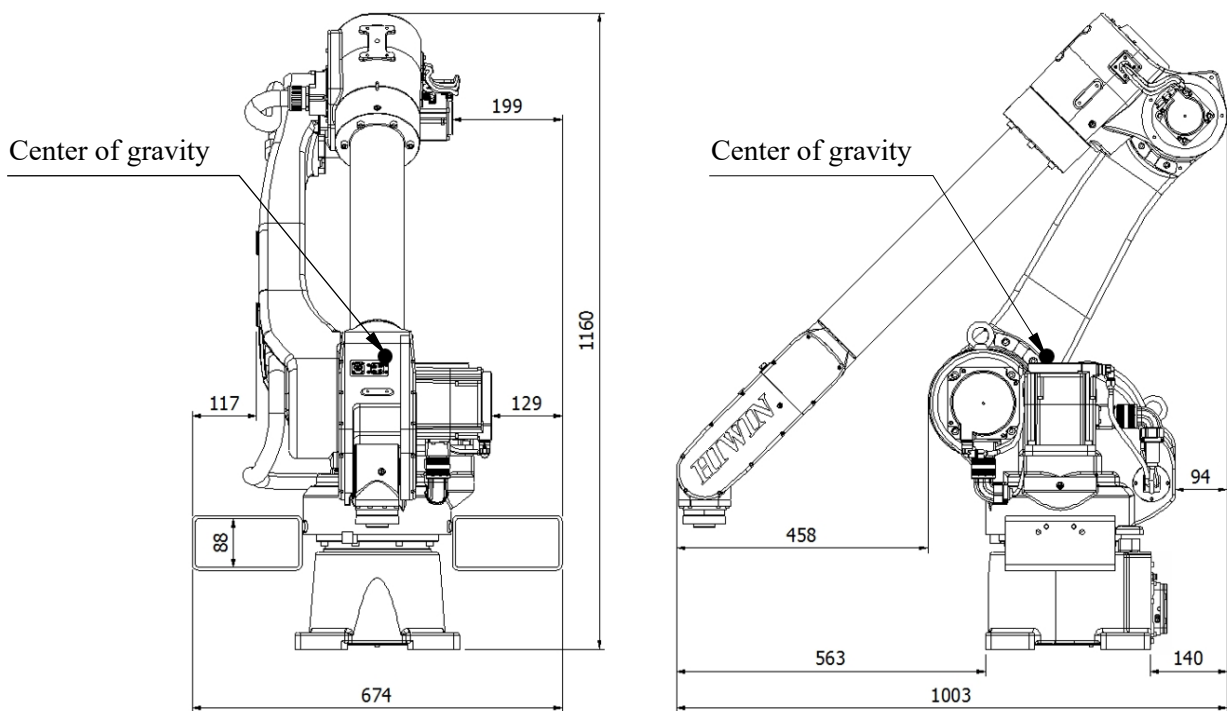


Figure 1-2(d) RA610-1869-GC Transport dimensions

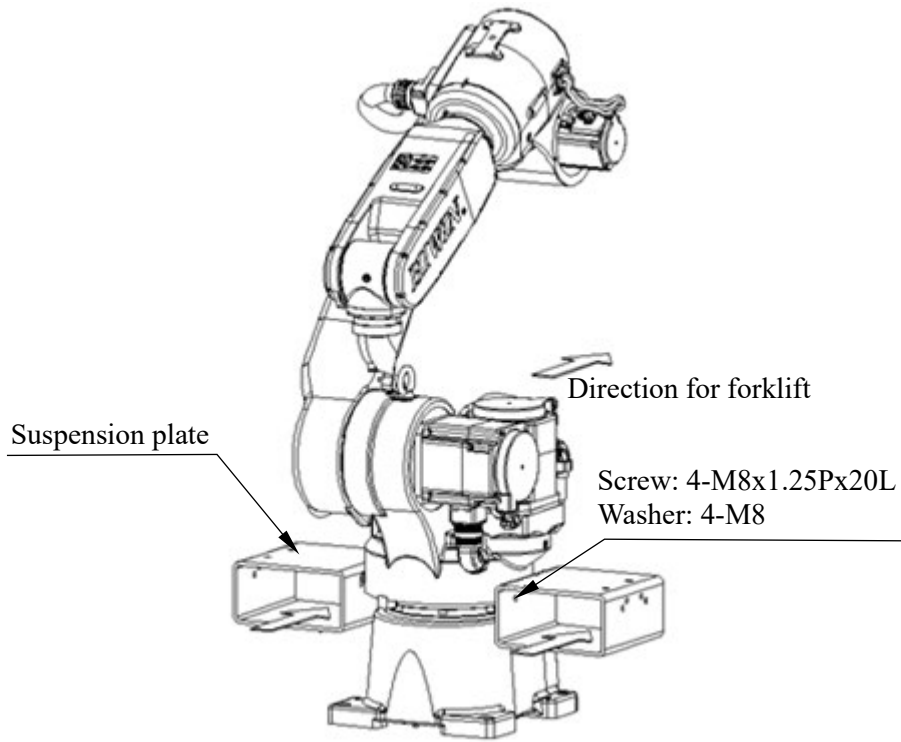


Figure 1-3(a) RA610-1355-GC Transport by forklift truck

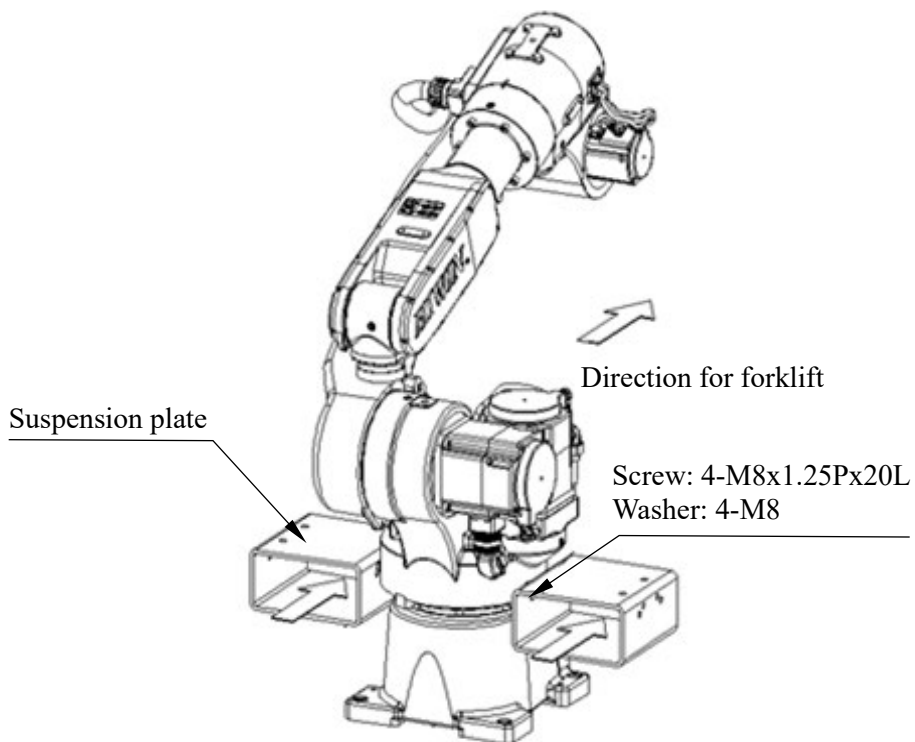


Figure 1-3(b) RA610-1476-GC Transport by forklift truck



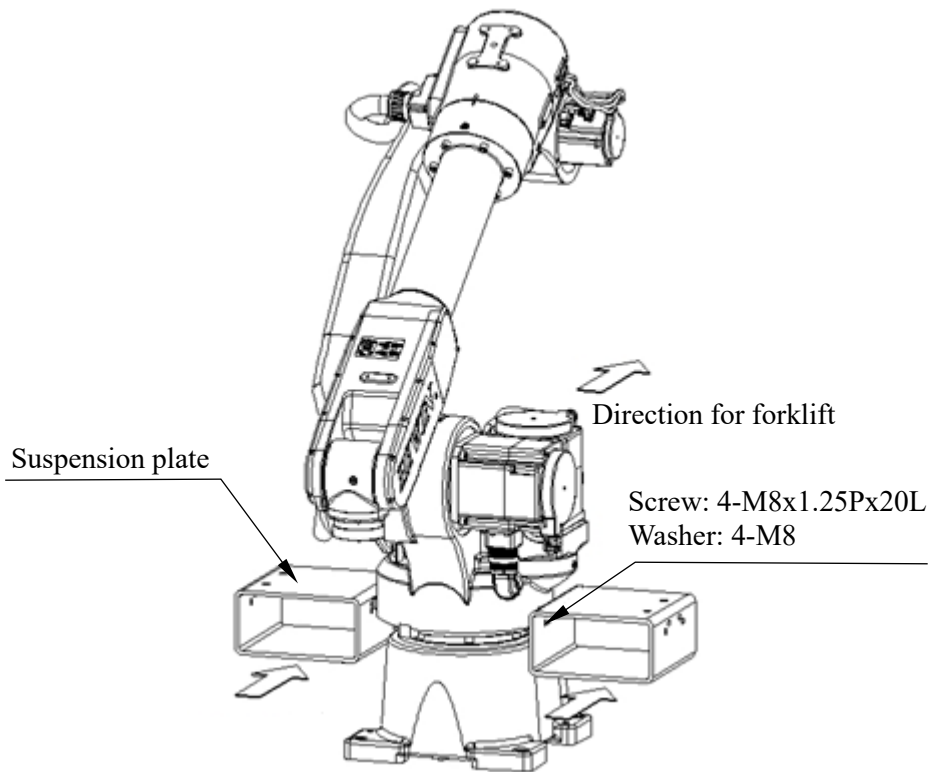


Figure 1-3(c) RA610-1672-GC Transport by forklift truck

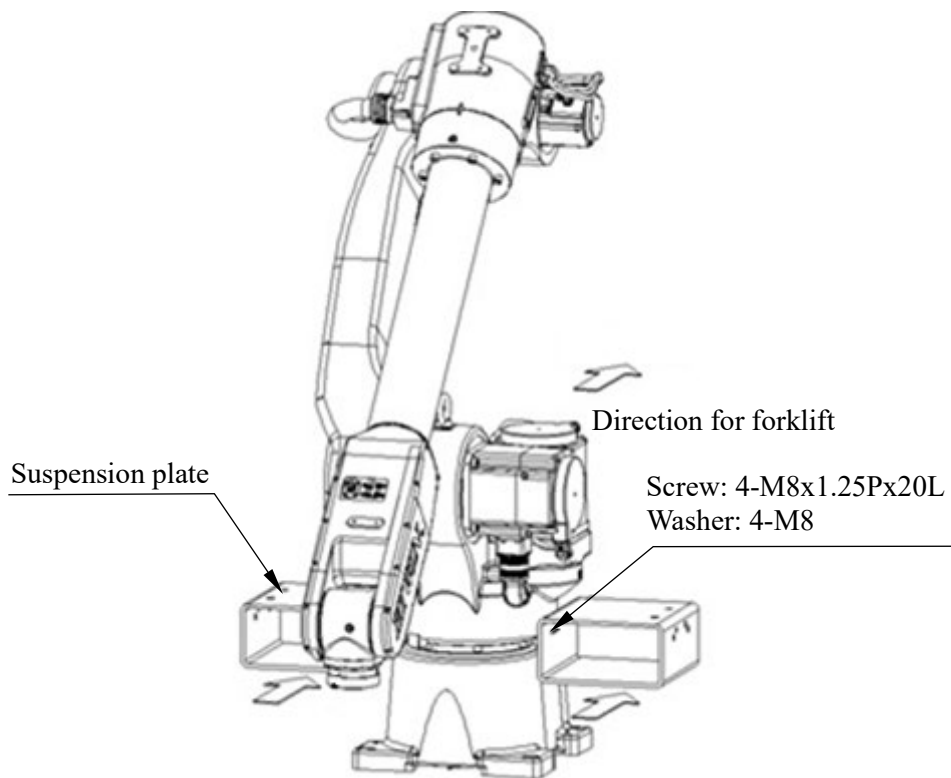


Figure 1-3(d) RA610-1869-GC Transport by forklift truck

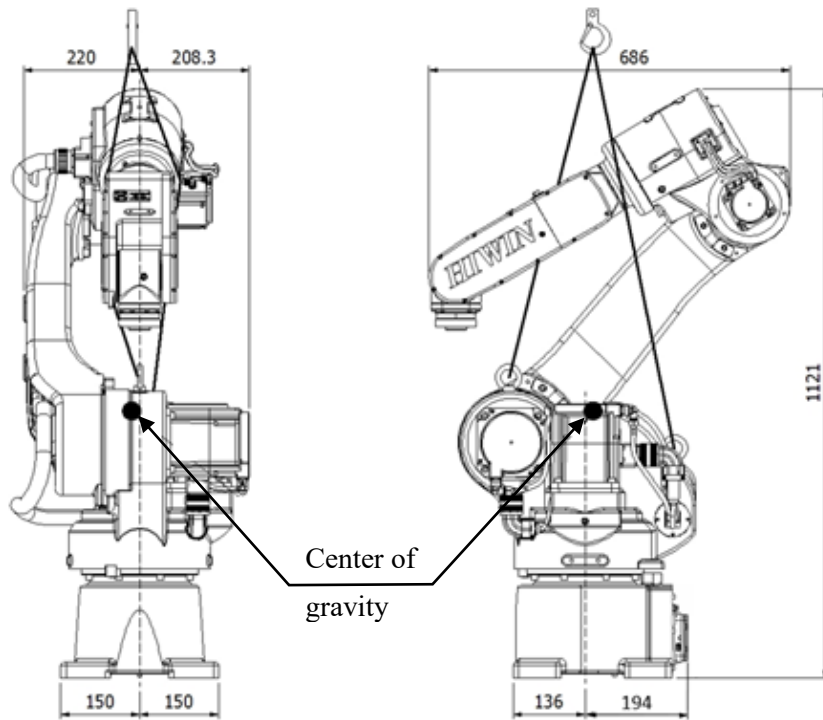


Figure 1-4(a) RA610-1355-GC Transport by sling

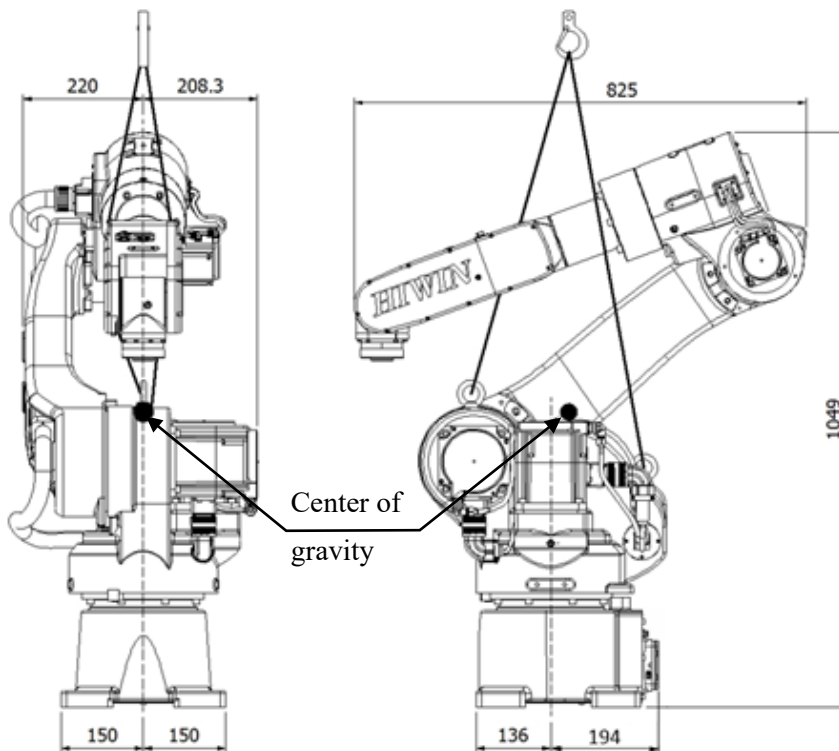


Figure 1-4(b) RA610-1476-GC Transport by sling

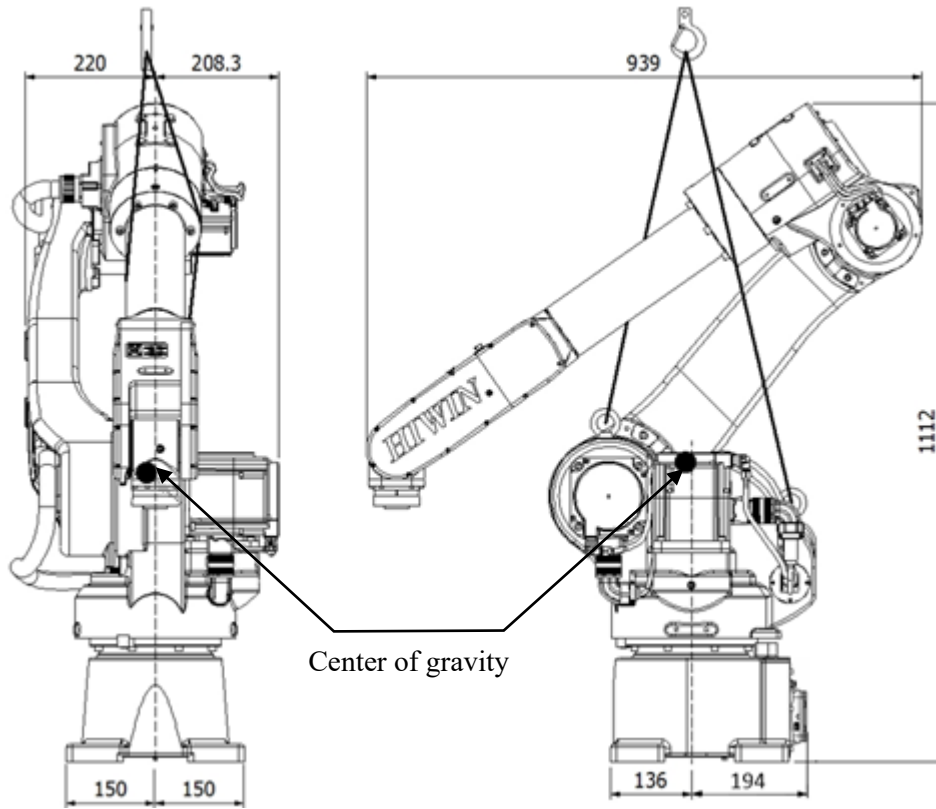


Figure 1-4(c) RA610-1672-GC Transport by sling

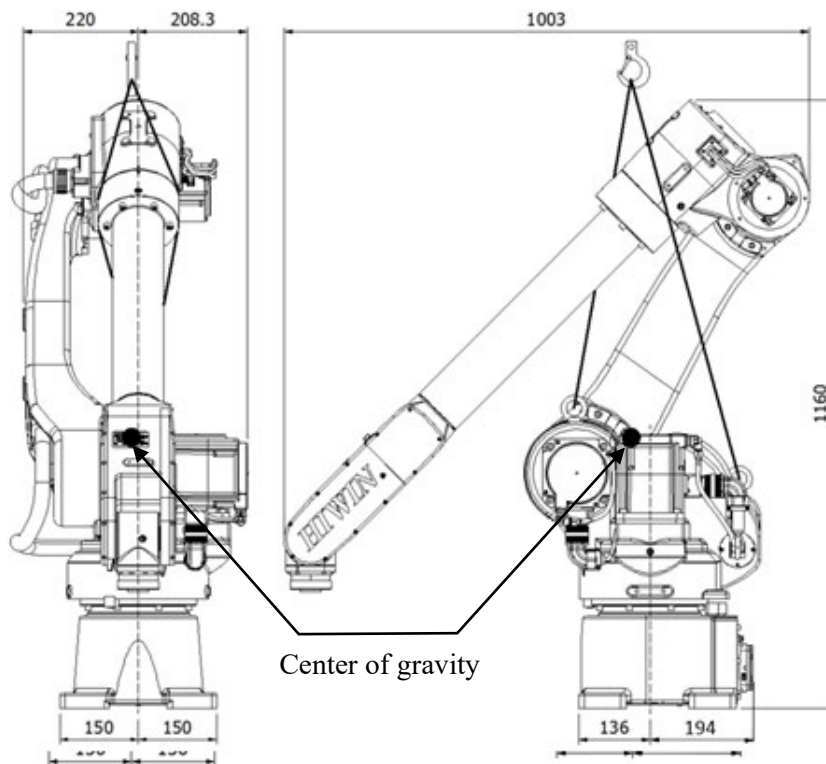


Figure 1-4(d) RA610-1869-GC Transport by sling

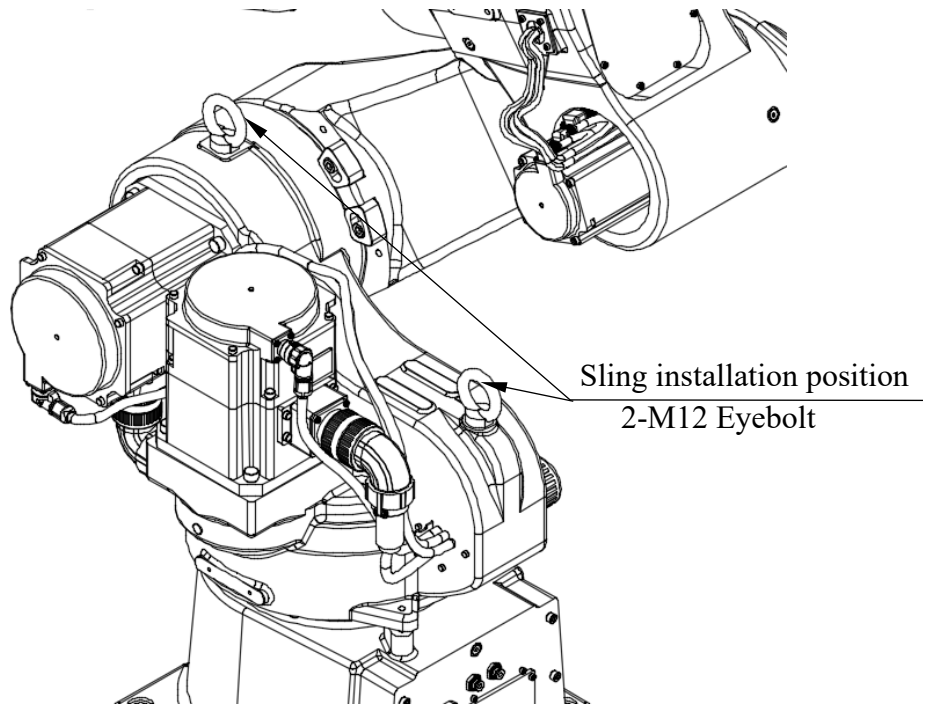


Figure 1-4(e) Eye bolt securement

## 1.2 Installation

Figure 1-5 shows the installation dimensions of the robot. According to the dimensions, fix the robot with M14 installation bolt on the installation surface. Figure 1-6 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.

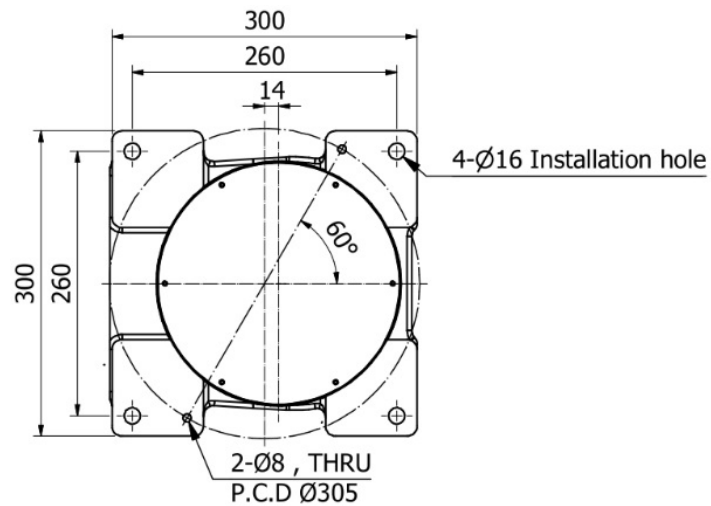


Figure 1-5 Base dimension

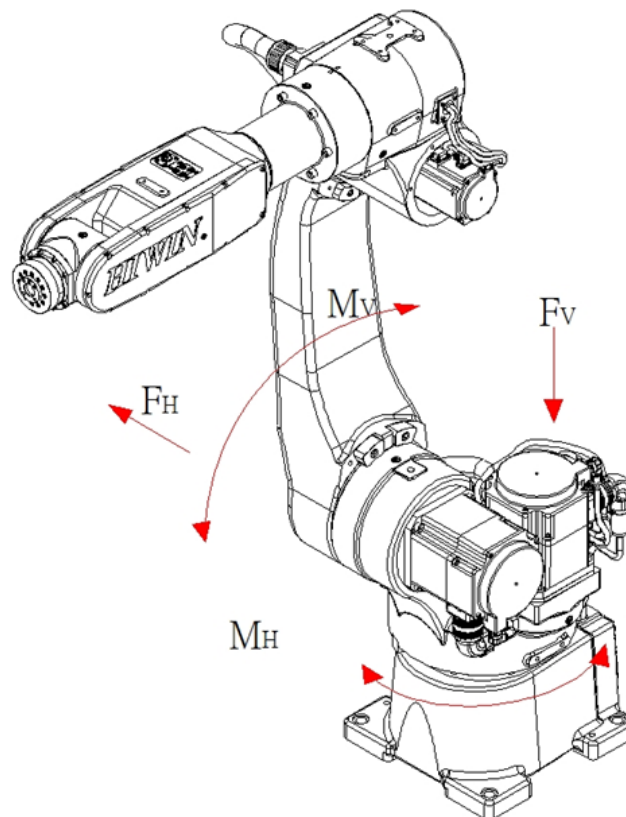



Figure 1-6 Forces and moments acting on the installation surface

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	661	1422	0	0
Acceleration /Deceleration	2201	2308	1021	937
Power cuts Stop	12129	6903	6985	5433

 <b>WARNING</b>	<ul style="list-style-type: none"> <li>❖ Ensure the installation surface is smooth plane which is recommended to be 6.3a or less for the roughness. If the installation surface is rough, the robot could produce the position shift during the operation.</li> <li>❖ Ensure the position of the installation surface for the robot will not shift owing to the movement.</li> <li>❖ Ensure the strength of the installation surface for the robot will not be damaged owing to the movement.</li> </ul>
--	--

### 1.3 Connection with the Controller

Figure 1-7 shows the structure drawing of the robot. Figure 1-8 shows overview of the robot system which comprises the robot, the controller, CN2 connecting cable, and the teach pendant. The J1 interface and the pin assignment of the power supply and signal connector are shown in Figure 1-9 and Table 1-2.

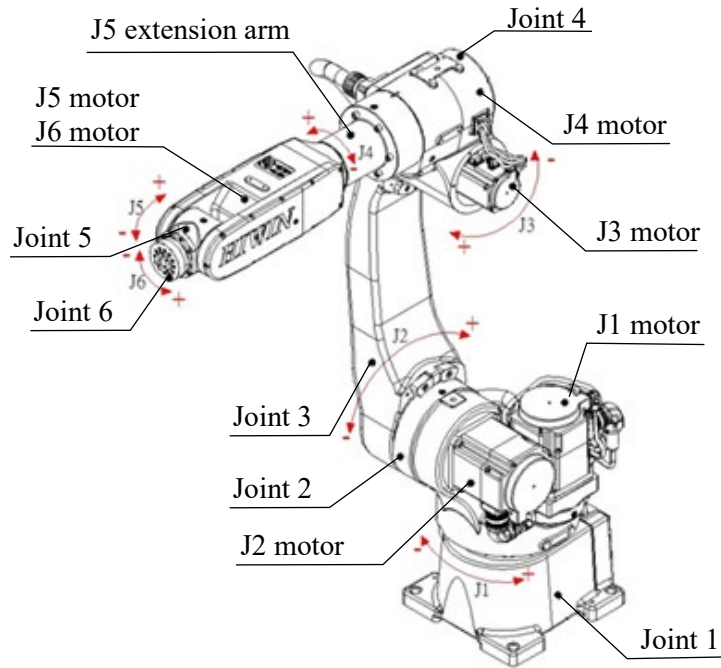


Figure 1-7 Drawing of robot structure

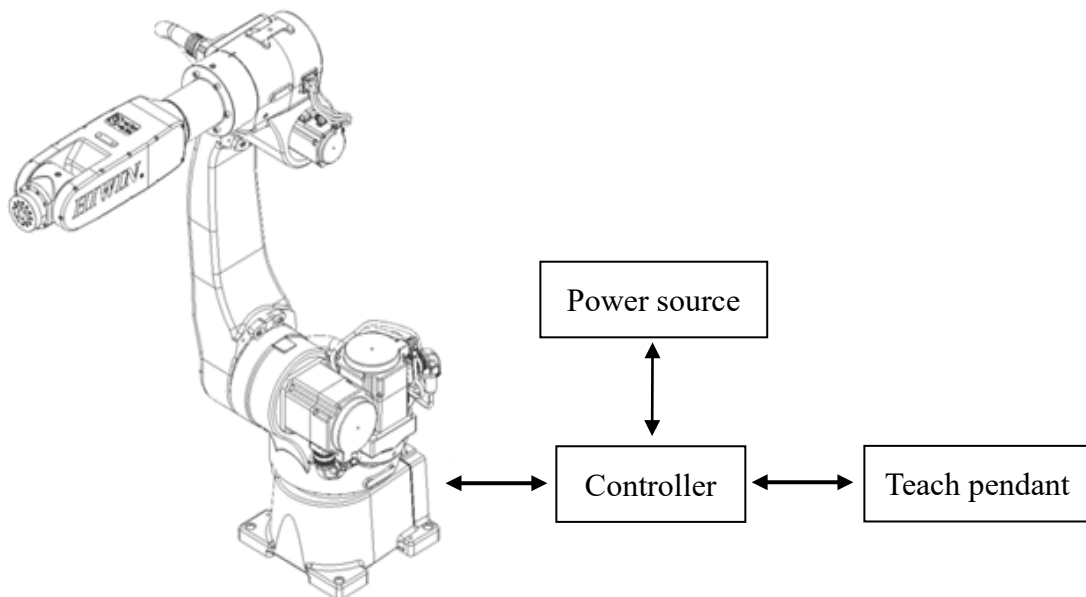
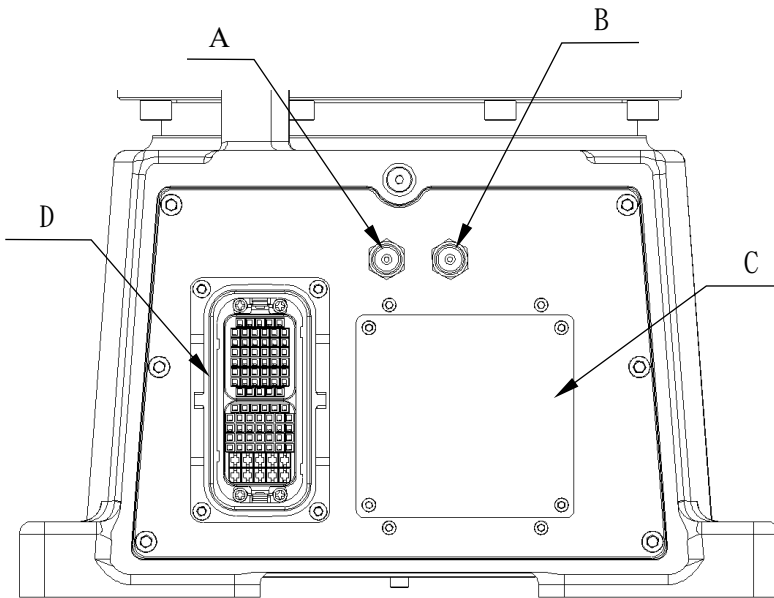


Figure 1-8 Robot and controller connection



Code	RA610-GC
A	Air in/out socket
B	Air in/out socket
C	Battery box
D	Power/Signal socket

Figure 1-9 Interface at the rear of J1

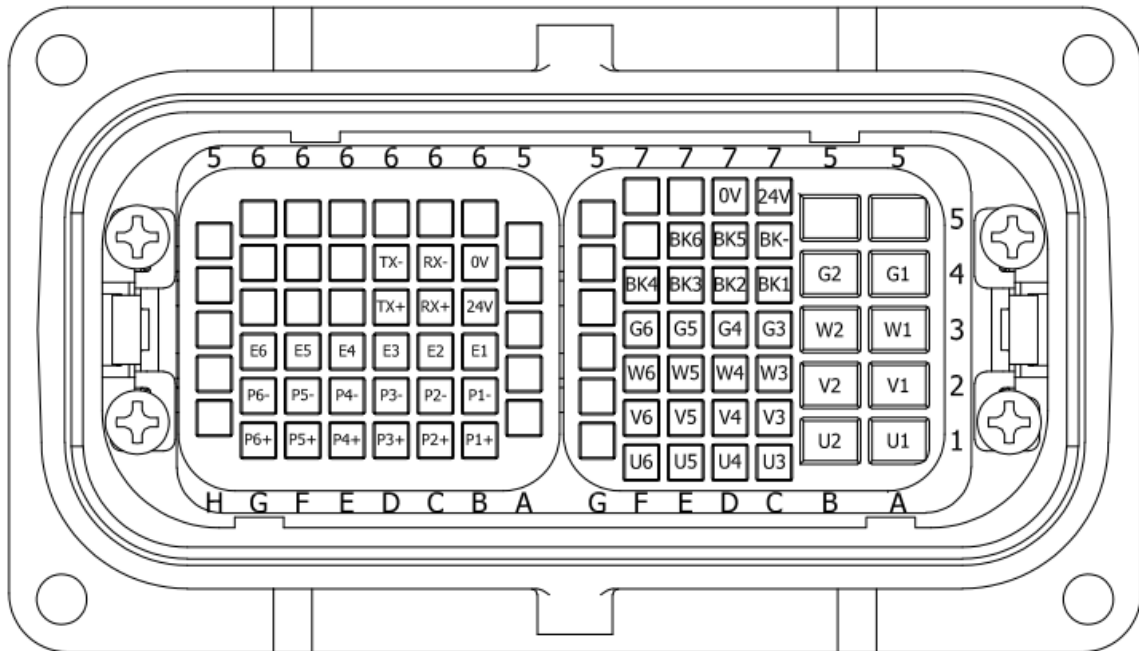



Figure 1-10 Pin assignment of the Power/Signal socket

 <p><b>WARNING</b></p>	<p>❖ When connecting the cable, be sure to turn off power supply first.</p>
---	---



## 1.4 Grounding

Figure 1-11 shows the grounding connection of the robot with the screw (M5×0.8P×12L).

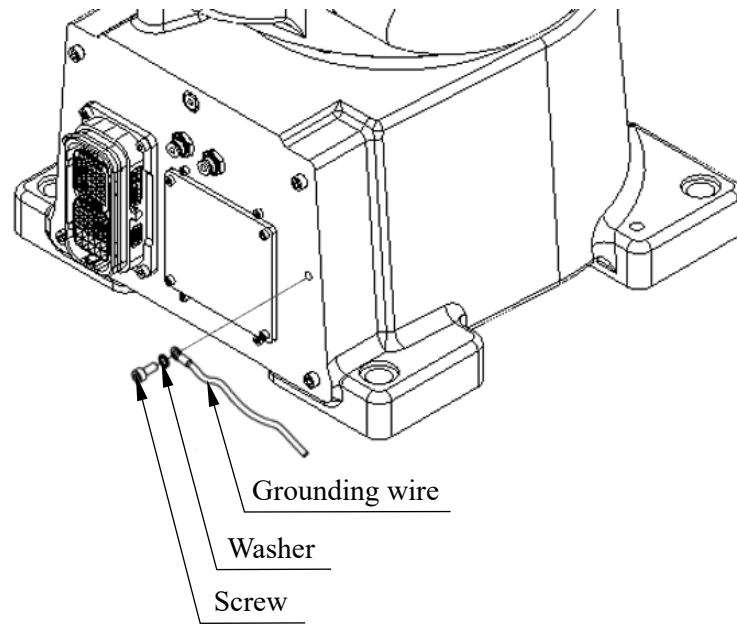



Figure 1-11 Grounding method

<p> <b>CAUTION</b></p>	<ul style="list-style-type: none"> <li>❖ The diameter of a grounding cable should not be larger than 14AWG.</li> <li>❖ The grounding cable of the robot should be connected directly to the main system grounding, not to the grounding for other equipment.</li> </ul>
---	---

## 1.5 Environmental Conditions

Environment condition is shown in Table 1-3.

Table 1-3 Environmental conditions

Installation/Storage/Transportation Environment	
Ambient temperature	0~45 °C [Note 1]
Ambient relative humidity	Under 75% R.H. No condensation permissible
Allowable altitude	Up to 1000 m above mean sea level [Note 2]
Allowable vibration	Under 0.5G
Others	Do not use under corrosive environment Do not use under flammable environment Do not use under explosive environment Do not use under radiative environment

[Note 1] : When the robot is stopped for a long period of time at the temperature near 0°C , the robot operation may have greater resistance in the beginning and then an overload alarm may be raised. It is recommended to warm up the robot at low speed for a few minutes.

[Note 2] : The performance level will be de-rated around 10% at an altitude over 1000m.

## 1.6 Standard and Optional Equipment List

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

Table 1-4 Standard and optional equipment list

Item	HIWIN Part No.	Standard	Optional	Remark
Robot accessory kit	RA610Z231-1	●	○	Contains suspension plate set, calibration tool set and end-effector I/O Cable
Suspension plate set	RA610Z231-2		○	Refer to section 1.1
Calibration tool set	RA610Z231-3		○	Refer to section 4.1
End-effector I/O Cable	RA610Z231-4		○	Refer to section 3.4
End-effector I/O water-proof cover	RA610Z231-5	●	○	
J5, J6 belt	RA610Z231-6		○	Refer to section 5.2.2
J1~J3 Grease	RA610Z231-7		○	Refer to section 6.2.3
Encoder battery	RA610Z231-8		○	Refer to section 6.2.1
Manual brake release device	RA610Z231-9		○	Refer to section 5
J1 adjustable mechanical stop set	RA610Z231-10		○	

## 2. Basic Specifications

### 2.1 Description of Model Name

There is a model name on the specification label of RA610-GC. The explanation of model name is shown below.

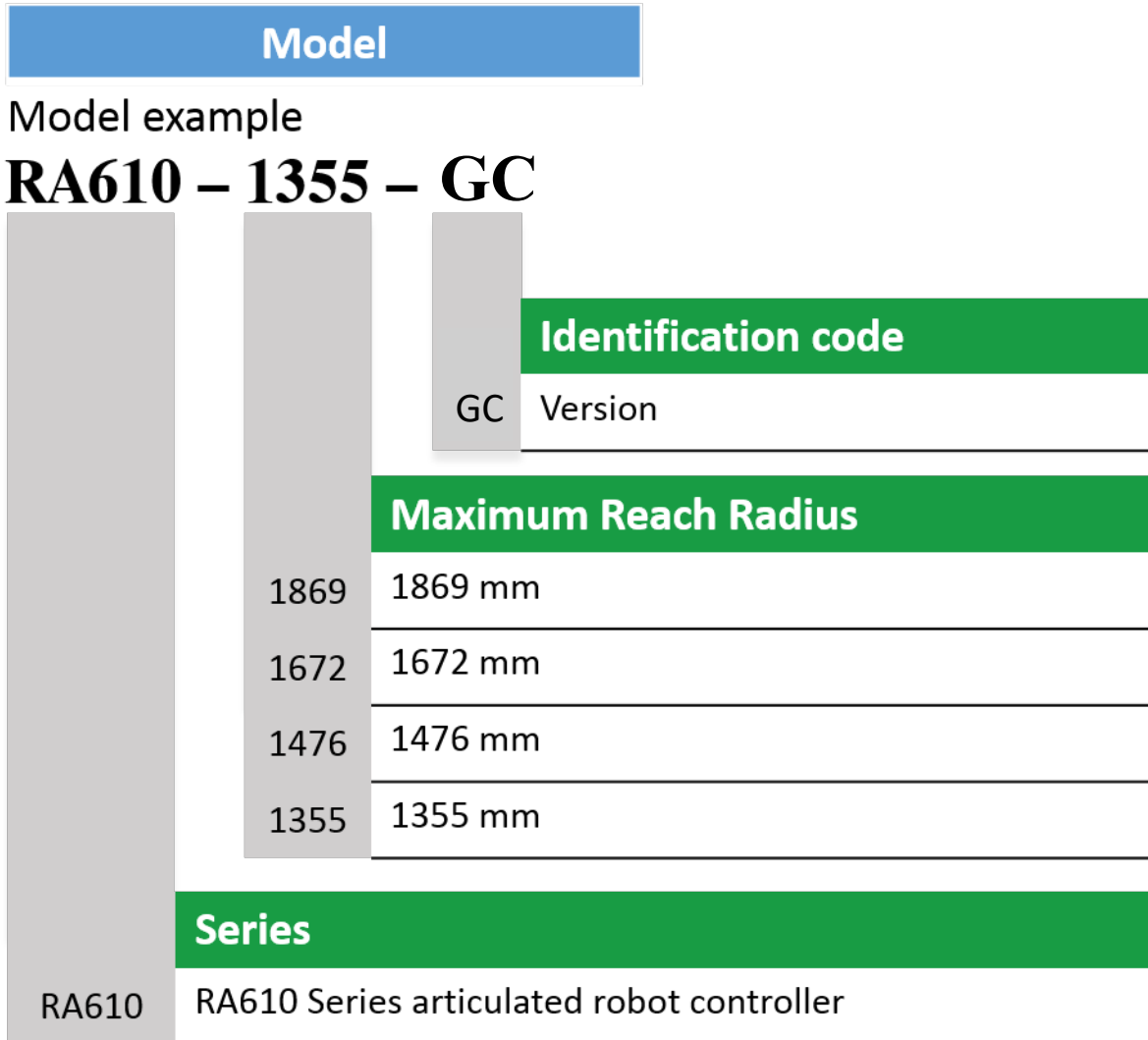





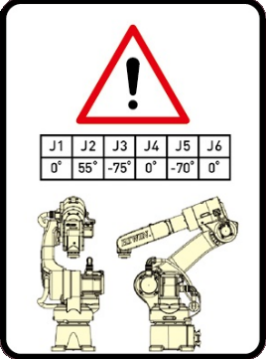
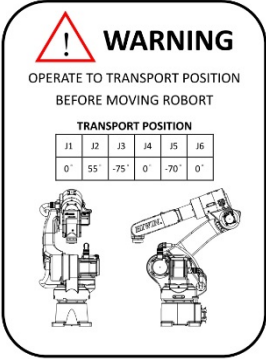




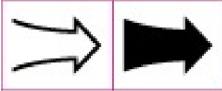


Figure 2-1 Model Diagram

## 2.2 Labels

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

Table 2-1 Labels description

Labels		Name	Description
		<u>Collision</u>	Keep safety distance from robot system, and prevent colliding to operator during operation.
		<u>Grounding</u>	Make sure grounding is completed, or it will cause electric shock.
		<u>Read manual</u>	Read user manual before operating manipulator.
		<u>Electric shock</u>	Pay more attention that the robot may have a risk of electric shock.
		<u>Transport</u>	Be aware of transport position when transporting robot, please refer to section 1-1 for detailed information.

 <p><b>HIWIN</b> Articulated Robot Read the instruction manual carefully before operate the product.</p> <p>Model: RA610-1476-GC Robot S/N: 本體製令號-序號 Controller S/N: 控制器製令號-序號 Manufacture Date: Nov. 2019 Weight: 147 KG Rated Payload: 10 KG Max. Reach: 1476 mm Pneumatic Pressure: 2-7 Bar Robot Type: Industrial</p> <p>Made in Taiwan No. 7, Jingke Road, Taichung Precision Machinery Park, Taichung 40852, Taiwan</p> 	<p><u>Specification</u></p>	<p>Robot specification and serial number</p>	
	<p><u>Air in/out</u></p>	<p>The connection port of air tube for air input and output.</p>	
	<p>GREASE IN</p>	<p><u>Grease in</u></p>	<p>The hole for grease in.</p>
	<p>GREASE OUT</p>	<p><u>Grease out</u></p>	<p>The hole for grease out.</p>
<p>CN2</p>	<p><u>CN2</u></p>	<p>CN2 power &amp; signal socket</p>	
<p>R-I/O</p>	<p><u>R-I/O</u></p>	<p>R-I/O connector</p>	

## 2.3 Robot Specifications

The robot specifications are as shown in Table 2-2.

Table 2-2 Robot specifications

Model name		RA610-GC			
Maximum reach radius(mm)		1355	1476	1672	1869
Degrees of freedom		6			
Installation [Note 1]		Floor 、 slope 、 wall mounting 、 ceiling mounting			
Nominal Load Capacity(kg) [Note 2]		12	10	10	7
Maximum Load Capacity (kg)		14	12	12	9
Cycle time(sec) [Note 3]		1			
Position Repeatability(mm)		±0.05		±0.06	
Motion range	J1	±170°			
	J2	+95°~ -150°			
	J3	+185°~ -85°			
	J4	±190°			
	J5	±135°			
	J6	±360°			
Maximum speed	J1	192° / s			
	J2	206° / s			
	J3	219° / s			
	J4	450° / s			
	J5	450° / s			
	J6	720° / s			
Allowable load moment at wrist	J4	16.9 N-m			
	J5	16.9 N-m			
	J6	10.98 N-m			
Allowable load inertia at wrist	J4	1.07 kg- m <sup>2</sup>			
	J5	1.07 kg- m <sup>2</sup>			
	J6	0.49 kg- m <sup>2</sup>			
Manipulator Weight (kg)		143	147	150	152
Integrated signal & power supply		6 input / 4 output			
Integrated air supply [Note 4]		Two channels of air connection			
Protection rating		IP54(IP65 at Wrist)			
Noise level [Note 5]		Less than 75 dB			

[Note 1]: Compared to mounting on the ground, the performance of the robot may be different when mounting on the wall or ceiling. Please contact HIWIN if there's any demand for this application.

[Note 2]: For details about load capacity, please refer to section 2.5.

[Note 3]: The cycle time is the time that the RA610-1476-GC is loaded at 10kg to forward and backward move in the vertical height 25mm and the horizontal distance 300mm, as shown in Figure 2-2.

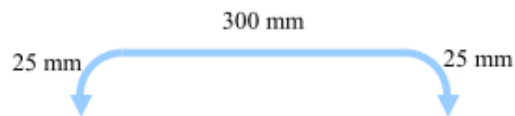


Figure 2-2 Cycle time trajectory

[Note 4]: Apply with M5 thread Ø4 air caliber connector.

[Note 5]: The noise level is measured at maximum speed and maximum load according to ISO11201.



## 2.4 Outer Dimensions and Motion Range

The outer dimensions and motion range are shown in Figure 2-3(a)~(d).

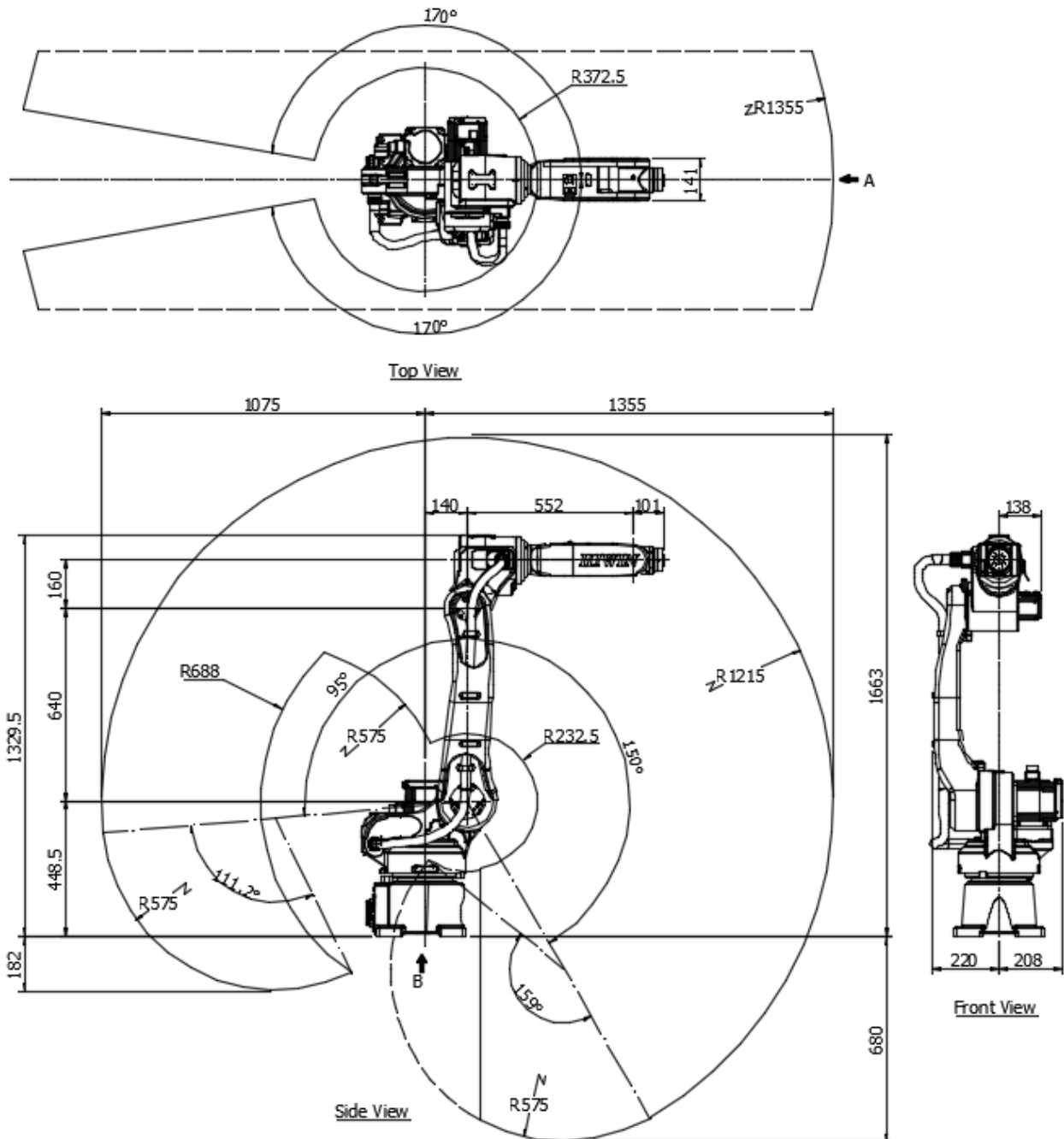


Figure 2-3(a) RA610-1355-GC Outer dimension and motion range

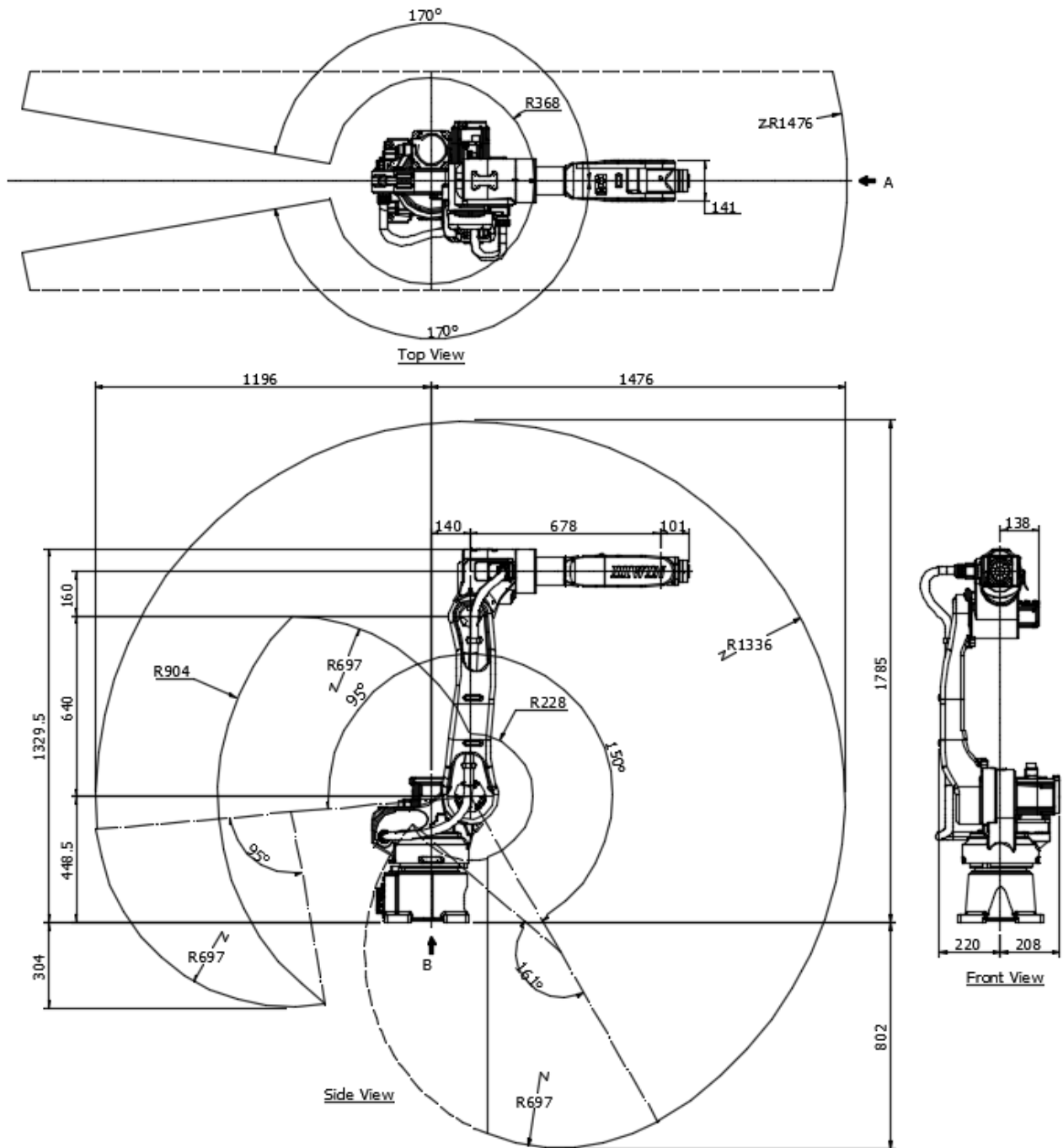


Figure 2-3(b) RA610-1476-GC Outer dimension and motion range

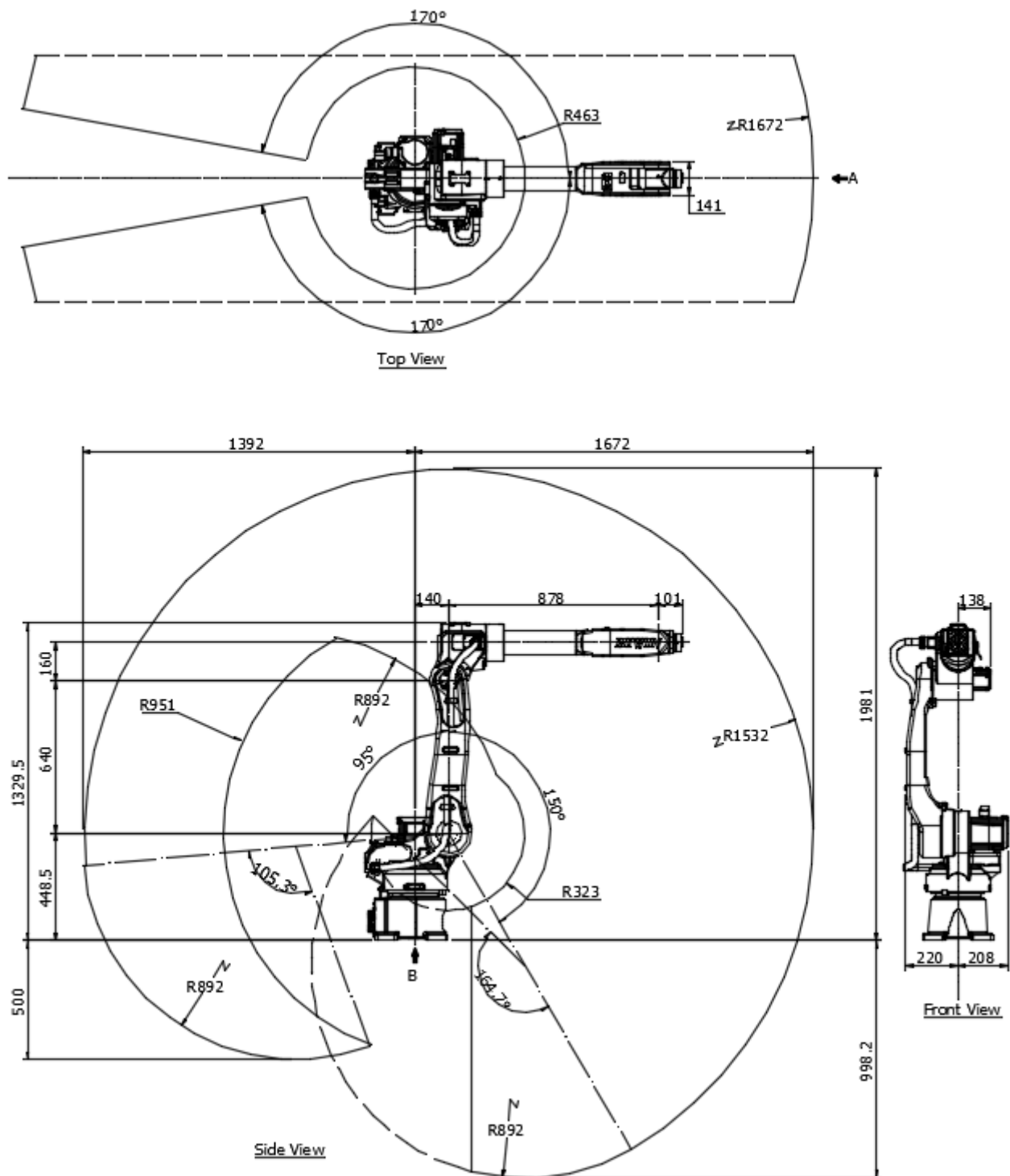


Figure 2-3(c) RA610-1672-GC Outer dimension and motion range

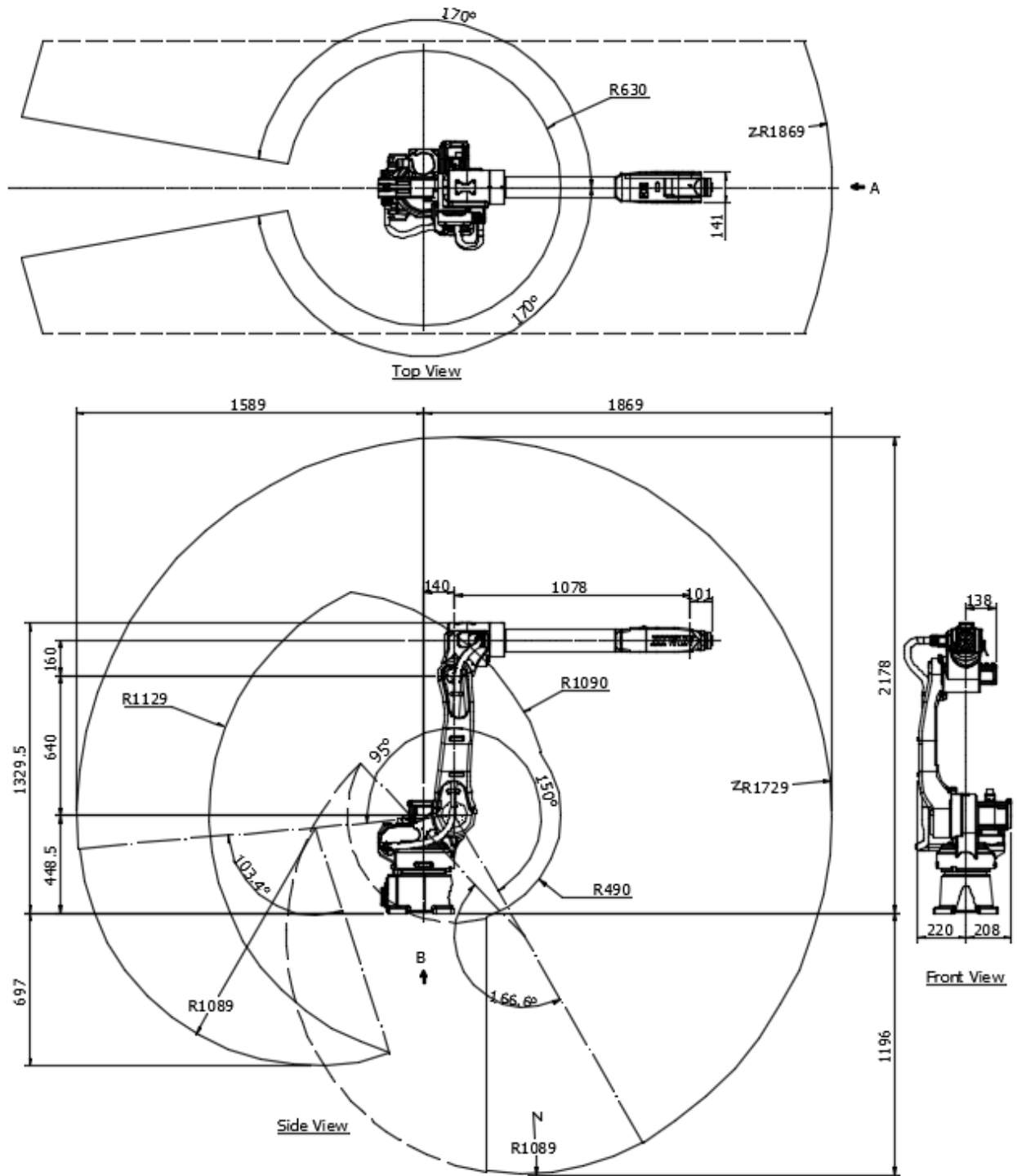


Figure 2-3(d) RA610-1869-GC Outer dimension and motion range

## 2.5 Wrist Load Conditions

The load capacity of the robot is not only limited by the weight of the load, but also limited by the position of load's center of gravity. Figure 2-4(a)~(d) shows the allowable position of load's center of gravity when the robot is loaded.

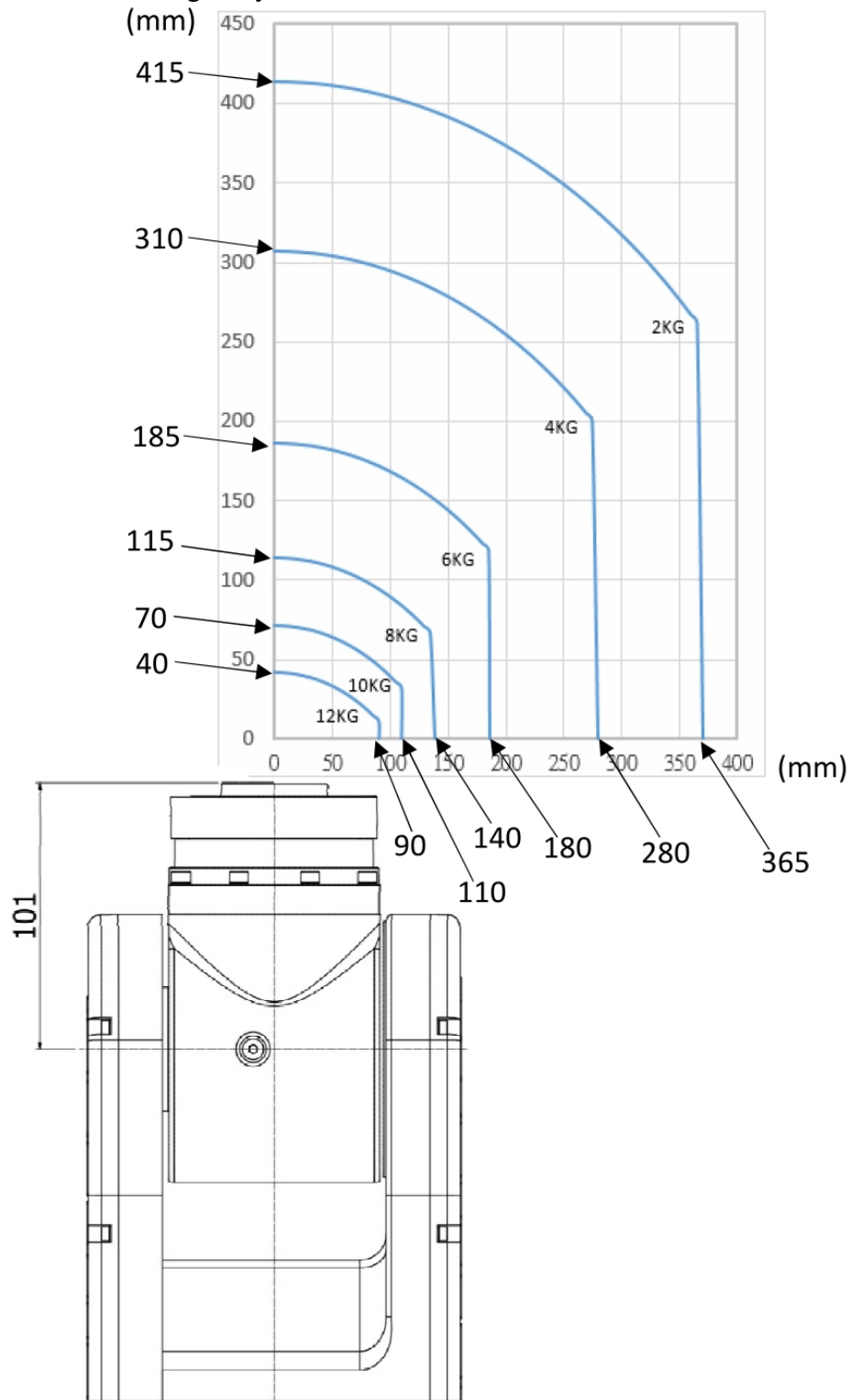


Figure 2-4(a) RA610-1355-GC Wrist moment diagram

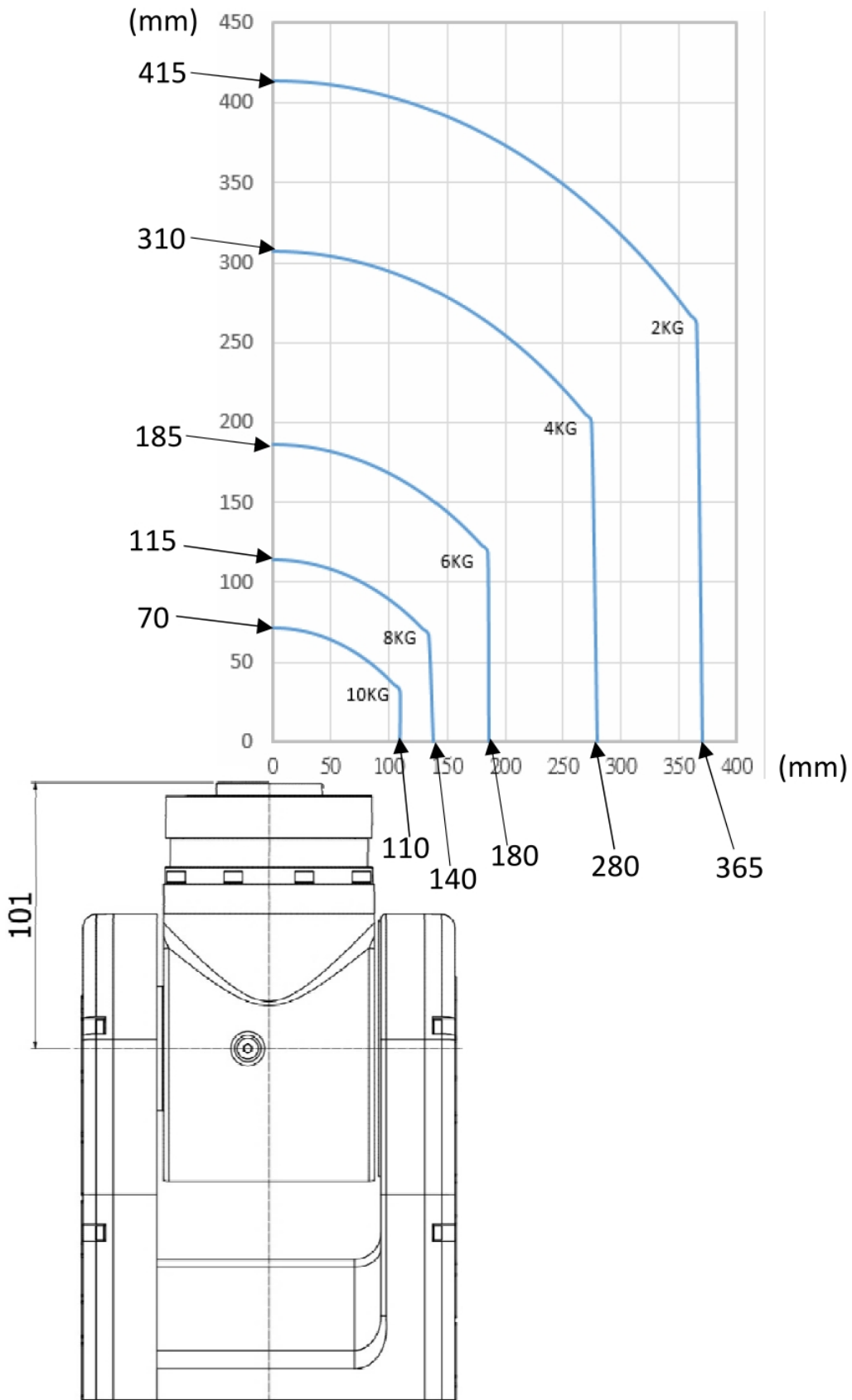


Figure 2-4(b) RA610-1476-GC Wrist moment diagram

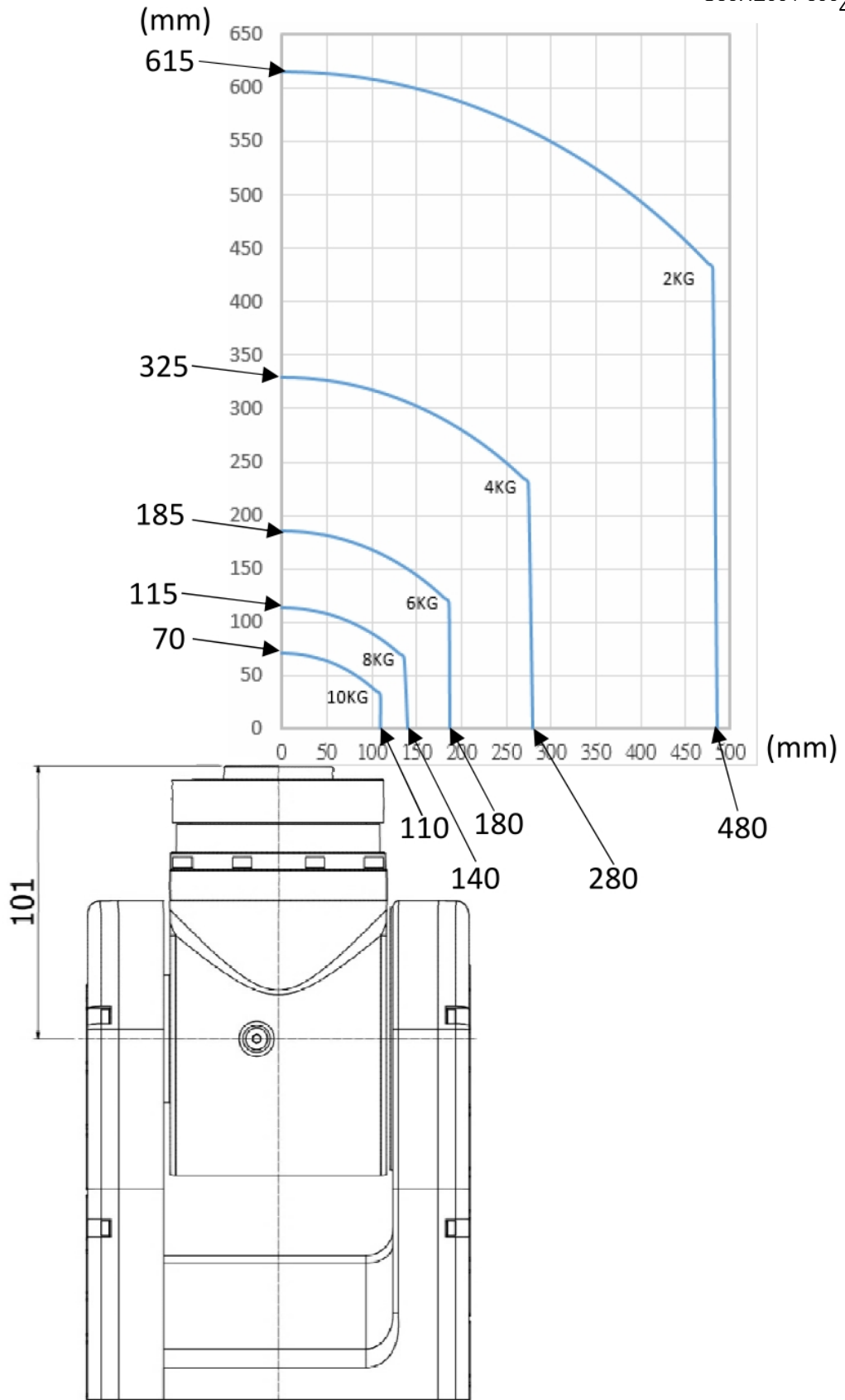


Figure 2-4(c) RA610-1672-GC Wrist moment diagram

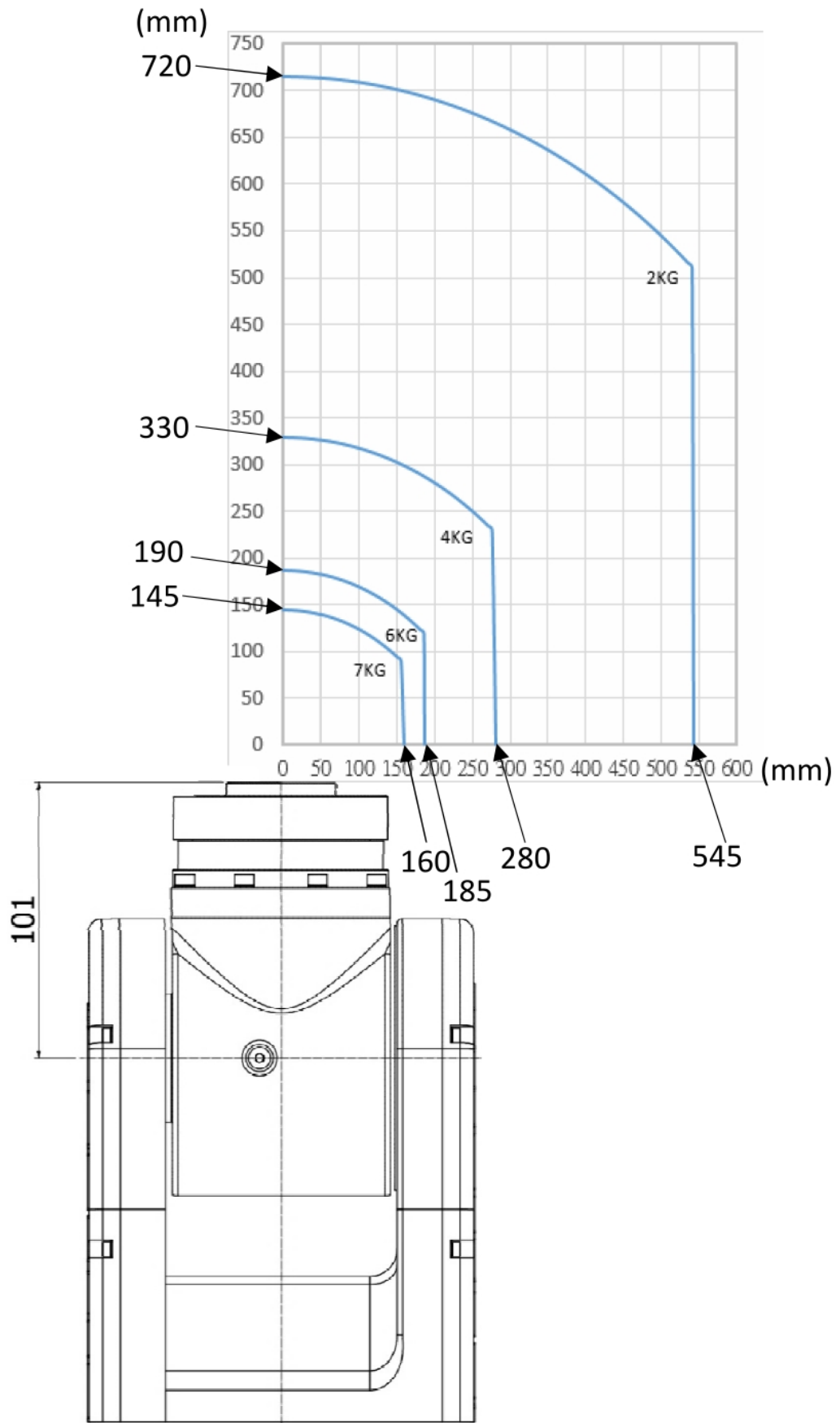


Figure 2-4(d) RA610-1869-GC Wrist moment diagram



### 3. Equipment Mounting Interface

#### 3.1 End-effector Interface

The end-effector interface is shown in Figure 3-1.

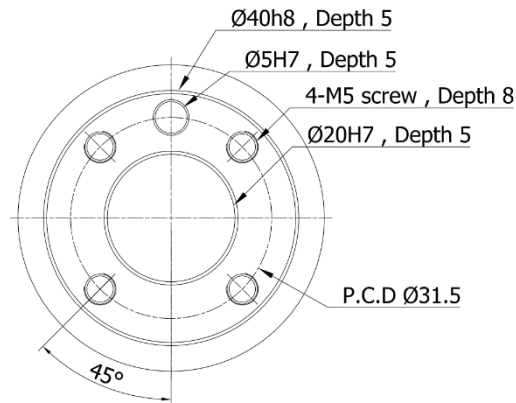


Figure 3-1 End-effector interface

#### 3.2 Mounting Surface on the Robot

Mounting surfaces for the peripheral equipment are shown in Figure 3-2(a)~(e).

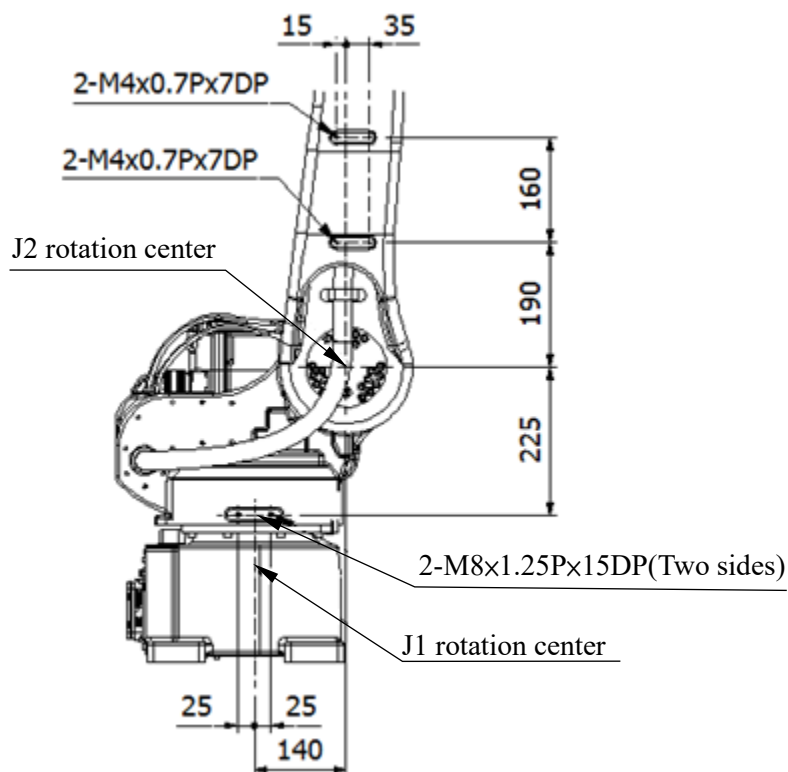


Figure 3-2(a) Mounting surfaces on the robot

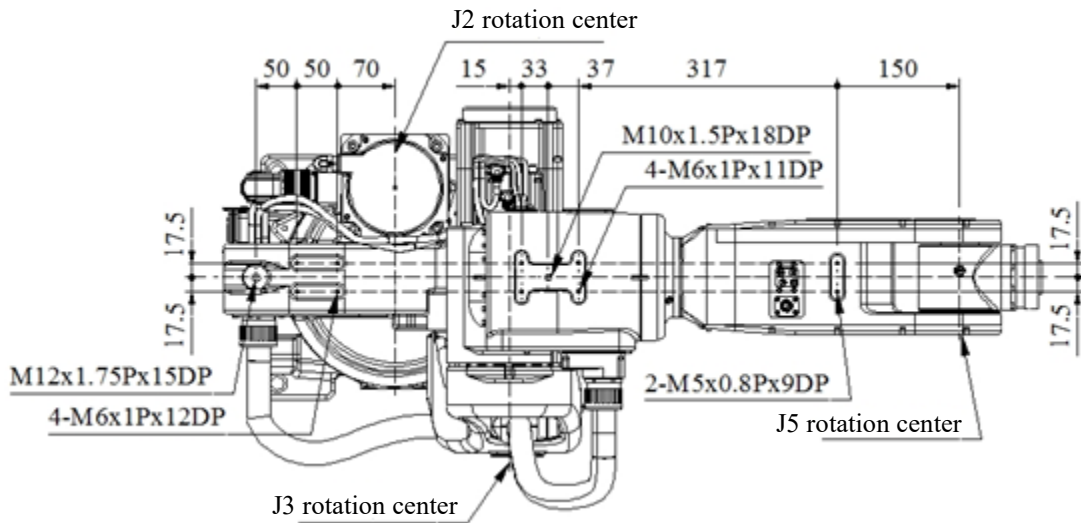


Figure 3-2(b) RA610-1355-GC Mounting surfaces on the robot

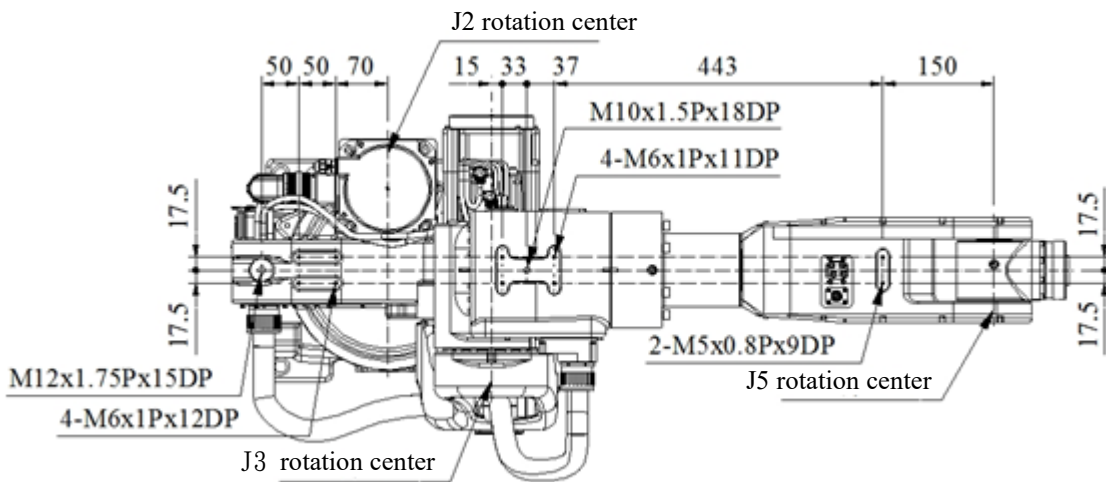


Figure 3-2(c) RA610-1476-GC Mounting surfaces on the robot

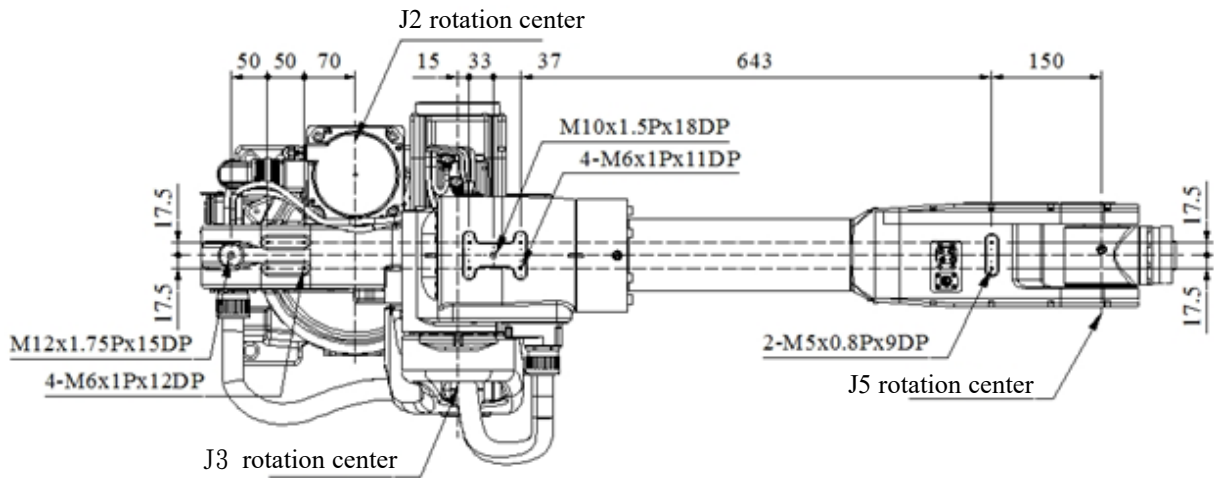


Figure 3-2(d) RA610-1672-GC Mounting surfaces on the robot

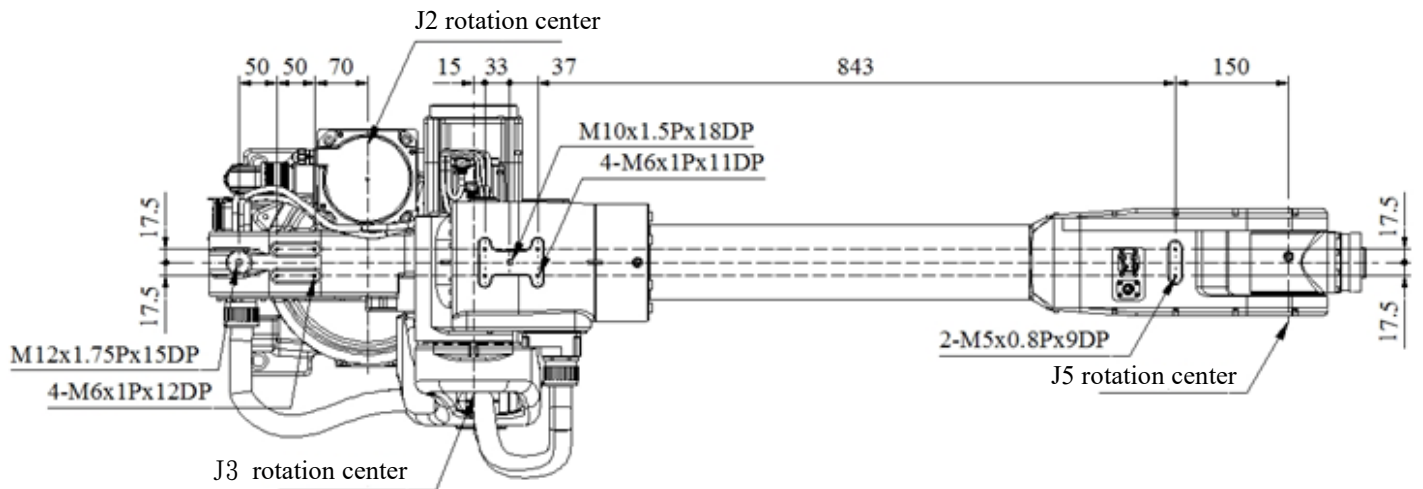



Figure 3-2(e) RA610-1869-GC Mounting surfaces on the robot

 <p><b>WARNING</b></p>	<ul style="list-style-type: none"> <li>❖ When other equipment is installed on the robot, be aware of the interference between robot and motor cable.</li> </ul>
---	---

### 3.3 Pneumatic Interface

Pneumatic holes (AIR IN & AIR OUT) of RA610-GC are installed on the rear of J1 as shown in Figure 3-3, and the outer diameter of the air tube in the robot is  $\phi 4\text{mm}$ . The secure holes for the nozzle are  $M5 \times 0.8P \times 8DP$ .

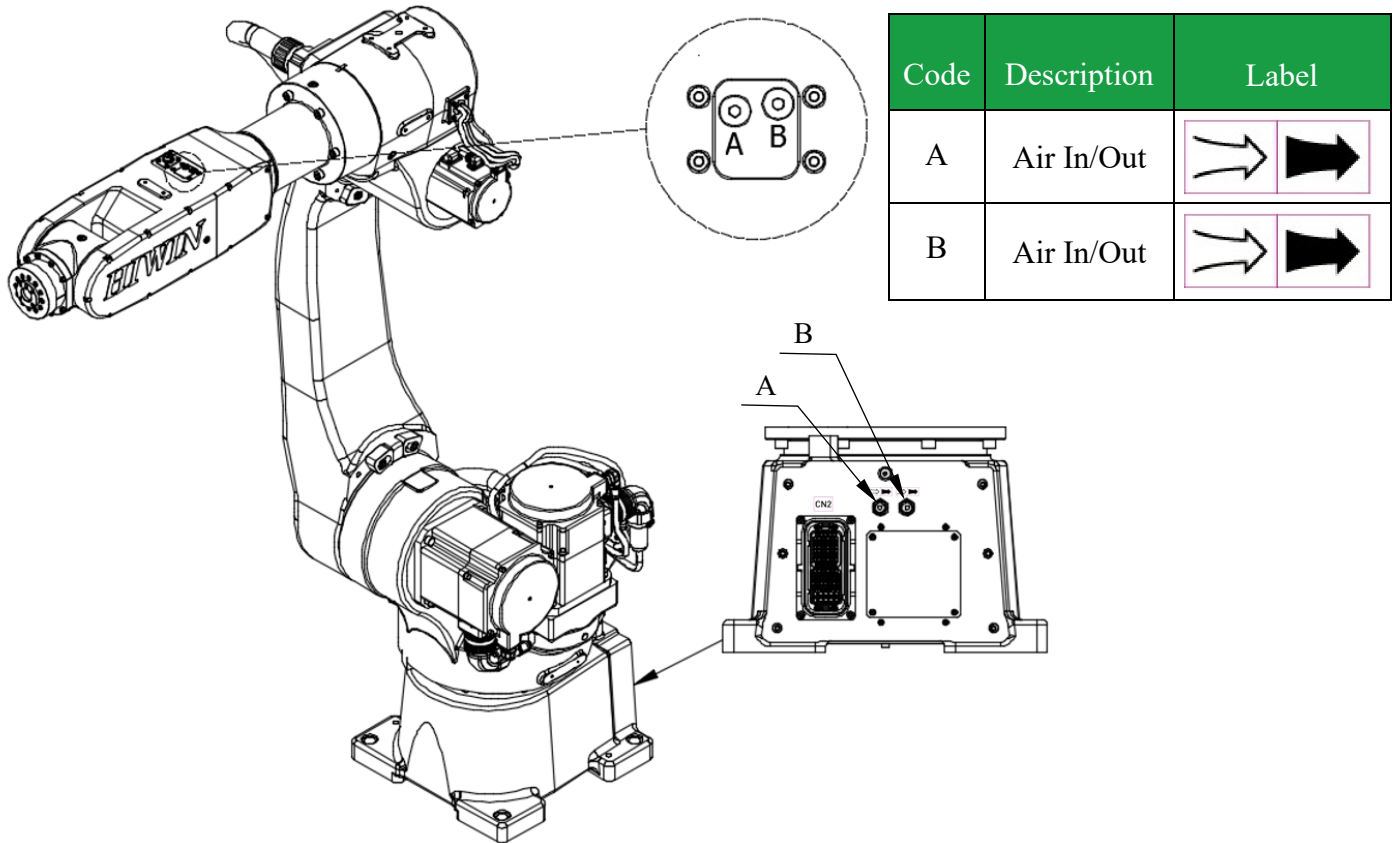
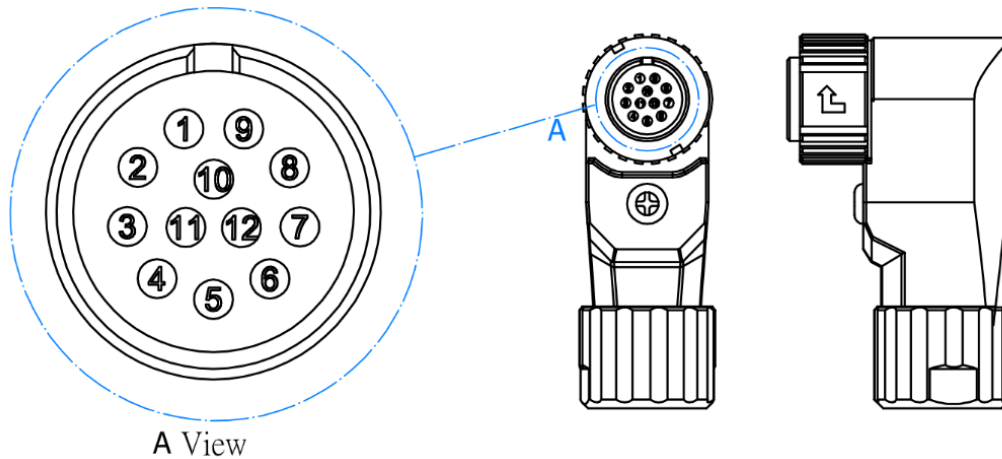


Figure 3-3 The interface for air supply

### 3.4 R-I/O Interface

R-I/O interface for end effector on J5 and the pin assignment of I/O connector are shown in Figure 3-3. Figure 3-4 to Figure 3-7 show the wiring diagram of I/O interface.

Figure 3-8 show the two-wire proximity switches connecting method for customers.



	1	24V	9	0V			
	2	RI[4]	10	RI[5]	8	RI[6]	
3	RO[1]	11	RO[2]	12	RO[3]	7	RO[4]
	4	RI[1]	5	RI[2]	6	RI[3]	

	1	Orange(Red-)	9	Pink(Blue-)			
	2	Orange (Blue -)	10	Pink(Blue-)	8	Yellow(Blue-)	
3	Gray (Red -)	11	Orange (Red - -)	12	Orange (Blue - -)	7	Yellow (Red-)
	4	Gray(Blue -)	5	White(Red-)	6	White(Blue-)	

Figure 3-3 Pin assignment of the I/O connector (Power output: 24V/1A)

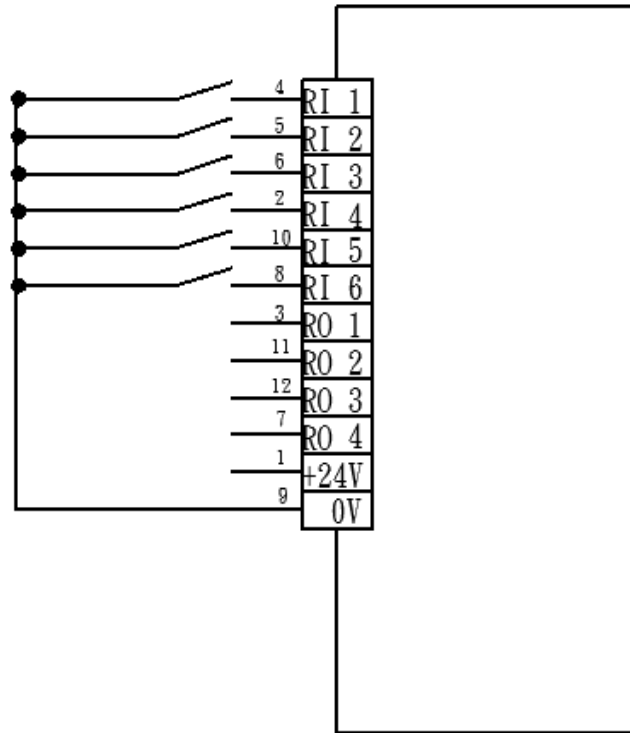


Figure 3-4 Wiring diagram of input (Standard: Sinking type)

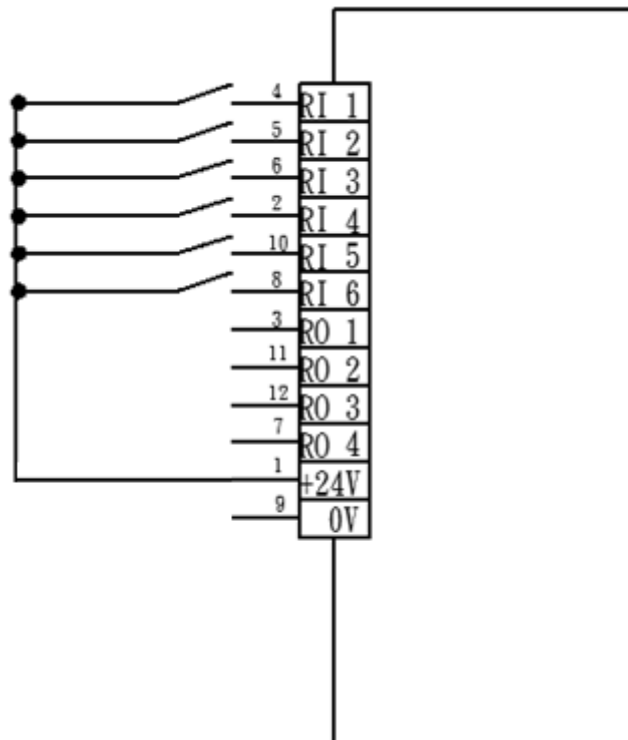


Figure 3-5 Wiring diagram of input (Optional: Sourcing type)

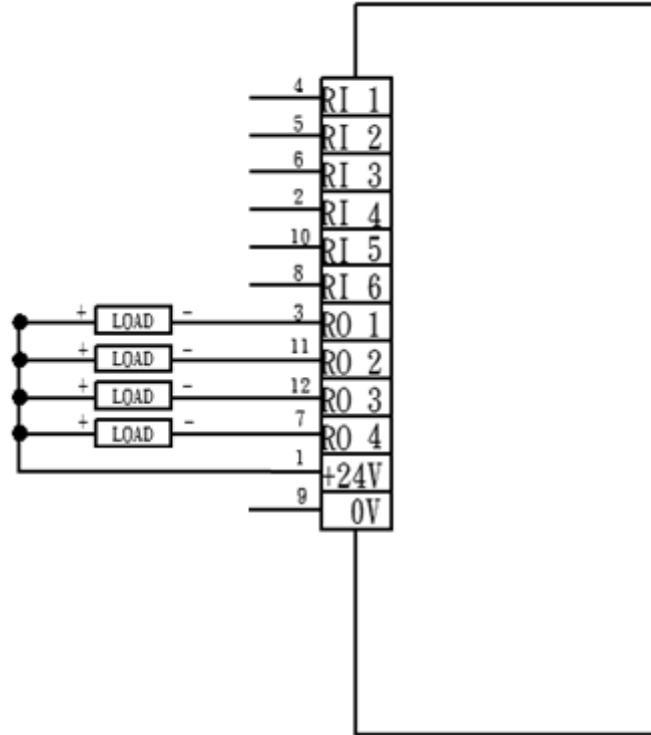


Figure 3-6 Wiring diagram of output (Standard: Sinking type)

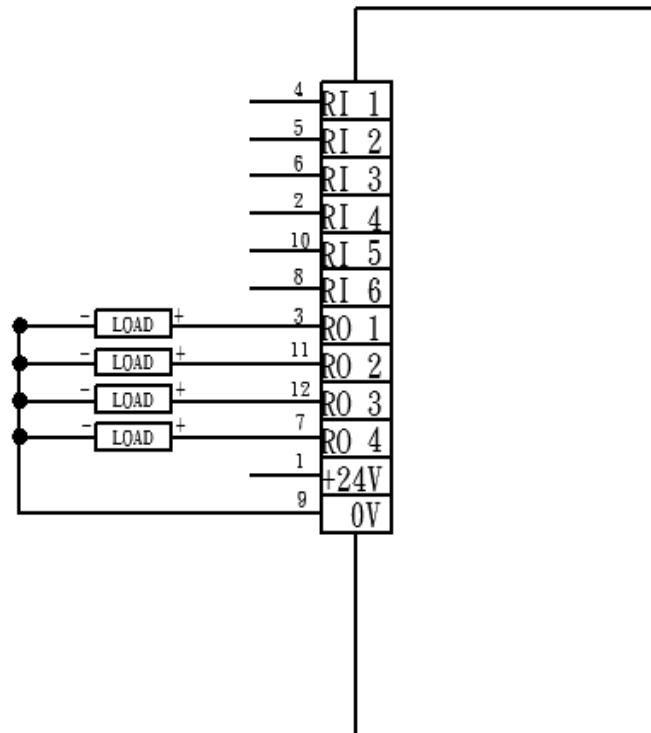


Figure 3-7 Wiring diagram of output (Optional: Sourcing type)

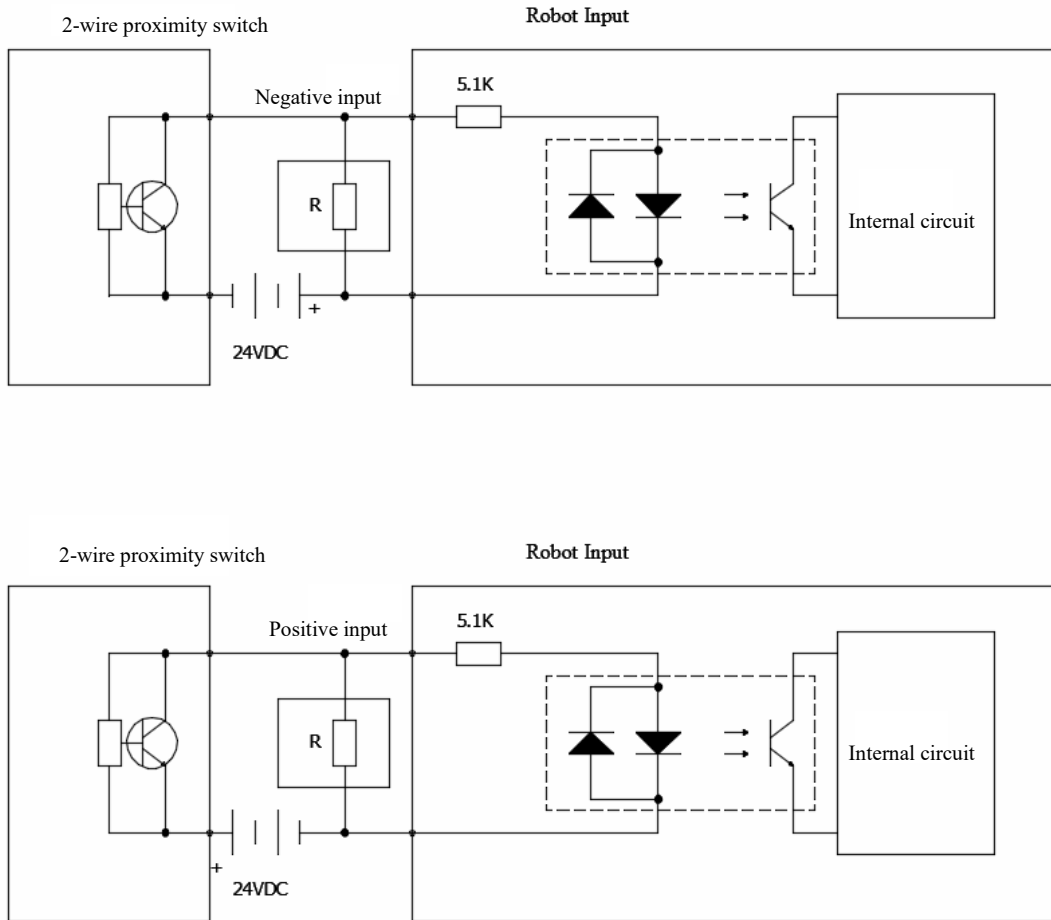


Figure 3-8 Two-wire proximity switch circuit diagram

	<p><b>CAUTION</b></p>	<ul style="list-style-type: none"> <li>❖ Pin 1 and pin 9 are used for signal (24V/1A), not for power input of end effector.</li> <li>❖ The maximum output current at each pin is 100mA.</li> <li>❖ The two-wire proximity switch might have residual voltage which can cause robot input error. So, it is suggested to choose a proper resistance and connect it by parallel connection as shown in Figure 3-8 while using two-wire proximity switch.</li> </ul>
--	-----------------------	--



## 4. Calibration

### 4.1 Zero-Position Setting

The calibration tools (HIWIN part No.: RA610Z231-3) for setting Zero-position are shown in Figure 4-1. The robot should be adjusted to the minimum speed during the calibration, and aligns the pinhole with the calibration tool to set up the Zero-position. The procedure of resetting Zero-position with the calibration tools is shown in Figure 4-2 to Figure 4-7 below.

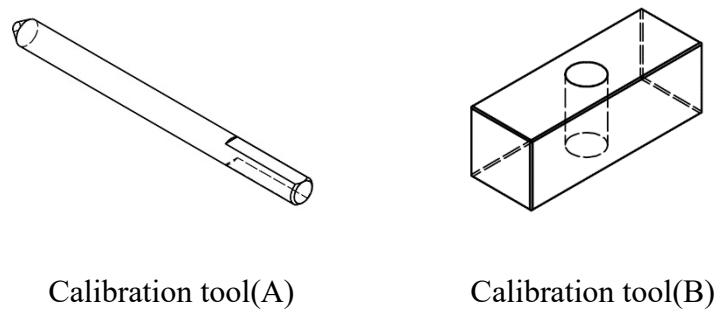


Figure 4-1 The calibration tool set

- J1-axis Zero-position setting

- Step1. Operate J1 at low speed to align the pinhole of J2 with the pinhole of J1.
- Step2. Insert the calibration tool(A) to the pinhole to calibrate Zero-position.
- Step3. Finish calibration and remove the calibration tool(A).
- Step4. Clear encoder by HRSS.
- Step5. Zero-position setting of J1 axis is completed.

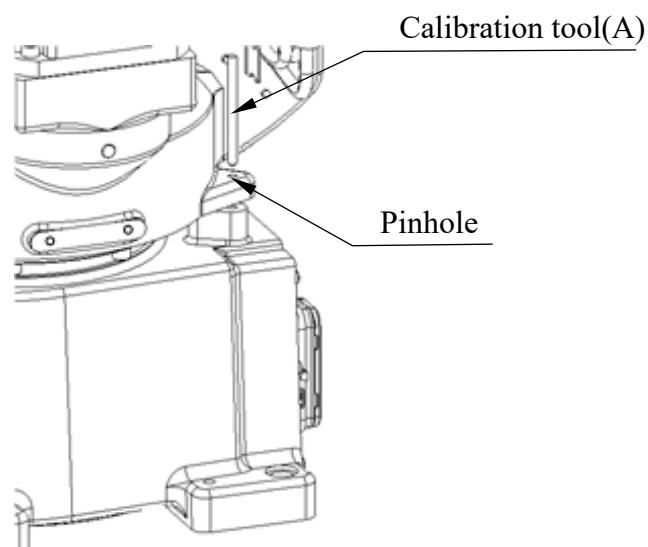


Figure 4-2 Illustration of J1-axis Zero- position setting

● J2-axis Zero-position setting

- Step1. Operate J2 at low speed to align the pinhole of J3 with the pinhole of J2.
- Step2. Insert the calibration tool(A) to the pinhole to calibrate Zero-position.
- Step3. Finish calibration and remove the calibration tool(A).
- Step4. Clear encoder by HRSS.
- Step5. Zero-position setting of J2 axis is completed.

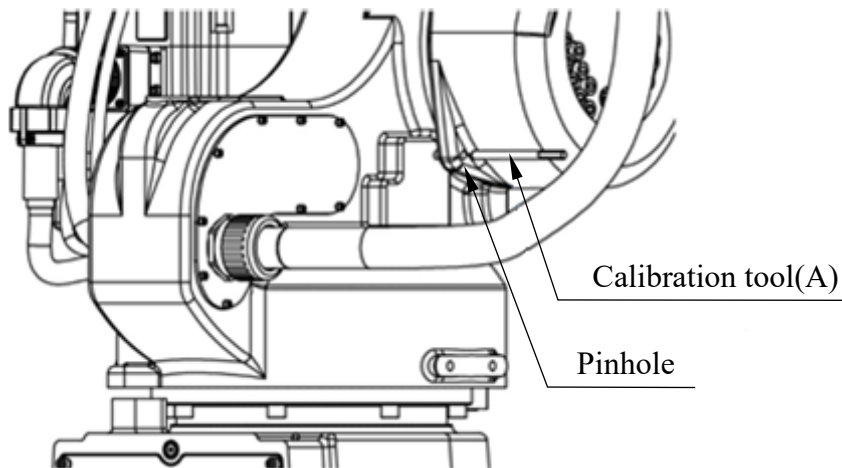


Figure 4-3 Illustration of J2-axis Zero- position setting

● J3-axis Zero-position setting

- Step1. Operate J3 at low speed to align the pinhole of J4 with the pinhole of J3.
- Step2. Insert the calibration tool(A) to the pinhole to calibrate Zero-position.
- Step3. Finish calibration and remove the calibration tool(A).
- Step4. Clear encoder by HRSS.
- Step5. Zero-position setting of J3 axis is completed.

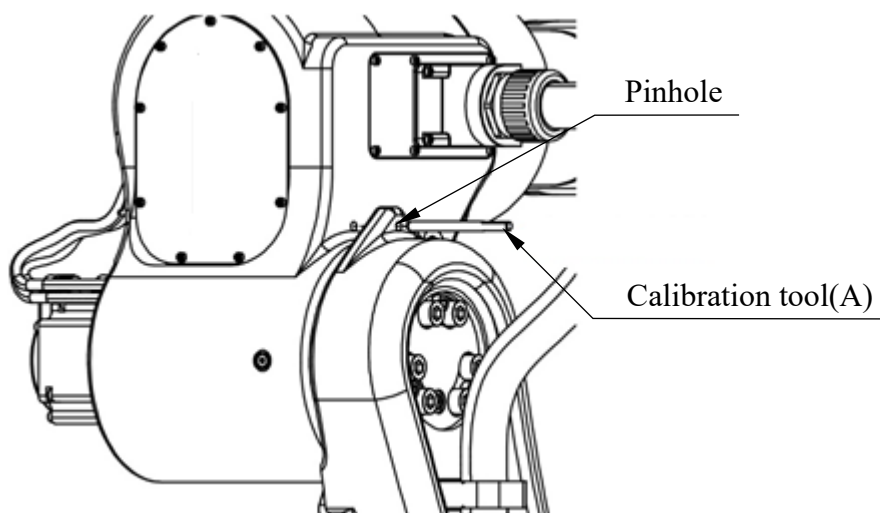


Figure 4-4 Illustration of J3-axis Zero-position setting

● J4-axis Zero-position setting

- Step1. Operate J4 at low speed to align the keyway of J5 with the keyway of J4.
- Step2. Insert the calibration tool(B) to the keyway to calibrate Zero-position. (The hexagon socket screw can be secured to the calibration tool(B) in advance.)
- Step3. Finish calibration and remove the calibration tool(B) by using the hexagon socket screw.
- Step4. Clear encoder by HRSS.
- Step5. Zero-position setting of J4 axis is completed.

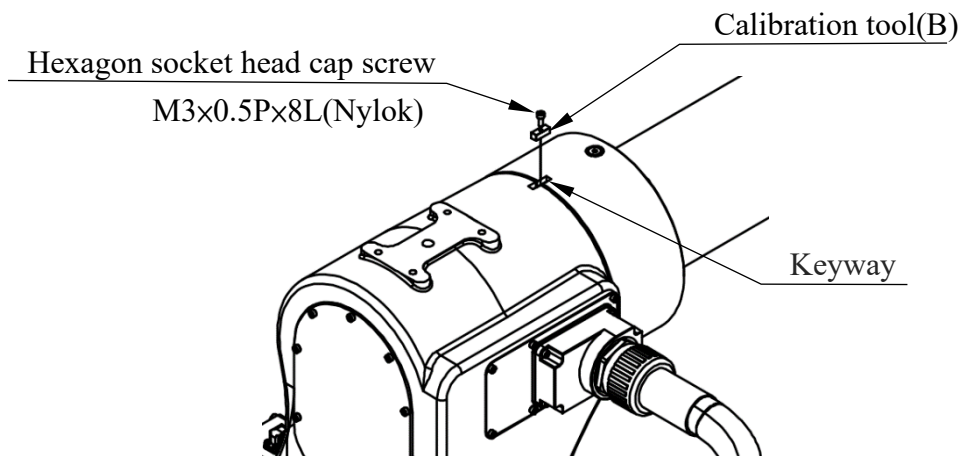


Figure 4-5 Illustration of J4-axis Zero- position setting

● J5-axis Zero-position setting

- Step1. Operate J5 at low speed to align the pinhole of J6 with the pinhole of J5.
- Step2. Insert the calibration tool(A) to the pinhole to calibrate Zero-position.
- Step3. Finish calibration and remove the calibration tool(A).
- Step4. Clear encoder by HRSS.
- Step5. Zero-position setting of J5 axis is completed.

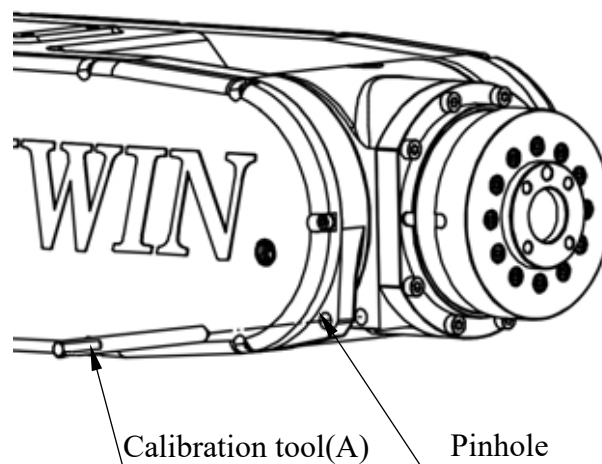


Figure 4-6 Illustration of J5-axis Zero- position setting

● J6-axis Zero-position setting

- Step1. Operate J6 at low speed to align the calibration mark with the keyway.
- Step2. Insert the calibration tool(B) to the keyway to calibrate Zero-position. (The hexagon socket screw can be secured to the calibration tool(B) in advance.)
- Step3. Finish calibration and remove the calibration tool(B) by using the hexagon socket screw.
- Step4. Clear encoder by HRSS.
- Step5. Zero-position setting of J6 axis is completed.

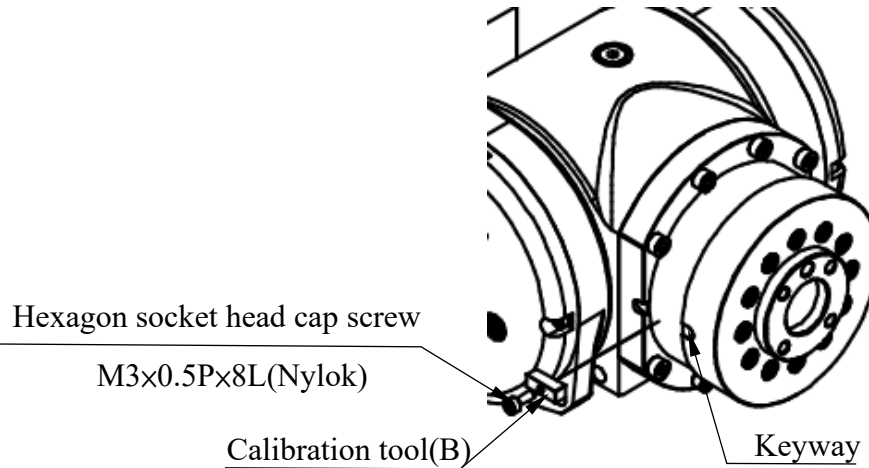


Figure 4-7 Illustration of J6-axis Zero- position setting

◎ Clear encoder by HRSS

- Step1. Select the “JOINT” as the coordinate system.
- Step2. Move the robot to the Zero-position.
- Step3. Click Main Menu>>Start-up>>Master>>Zero Position.
- Step4. Double click the axis to clear encoder. (As shown in Figure 4-8)

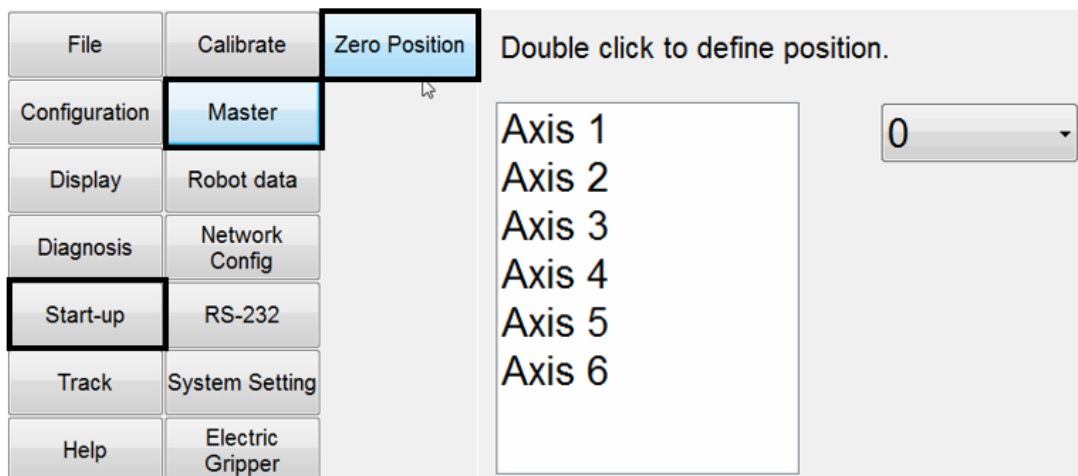



Figure 4-8 Clear encoder by HRSS

## 5. Manual Brake Release Device (optional)

### 5.1 Safety Precautions

Description:

In accordance with ISO 10218-1, the manual brake release device is a user-safety equipment for changing robot posture temporarily.

 <p><b>WARNING</b></p>	<ul style="list-style-type: none"><li>❖ This device can only be executed by trained staff.</li><li>❖ When the manual brake release device is executed, J4-axis must be securely fixed by a crane to prevent an unexpected drop of J2-axis and J3-axis. Please carefully read the section “Manual Brake Release Device” in this manual before using the brake release device.</li><li>❖ Please firmly secure the robot on smooth floor to prevent robot tilting, falling or an unexpected movement.</li><li>❖ Please use the socket with grounding and ensure the grounding is firmly connected. If not, there would be a risk of electric shock.</li></ul>
---	--

### 5.2 Confirmation before Using

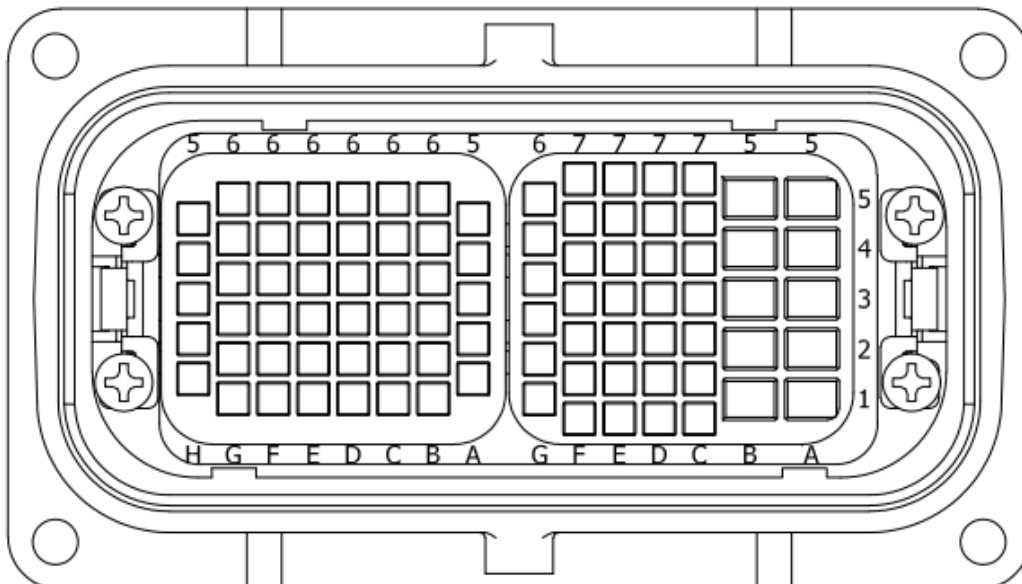
Please confirm the following items before using manual brake release device.

- (1) Please make sure CN2 connector is matched with the corresponding robot by checking the model name label affixed on the cover of this device.
- (2) Please do not use this device if the manual brake release device and the cable have damages on the appearance.
- (3) Please make sure the voltage of power source and the voltage requirement of the device are the same before connecting this device to the power. Connecting wrong voltage to the device will result in device damage.

Specifications:

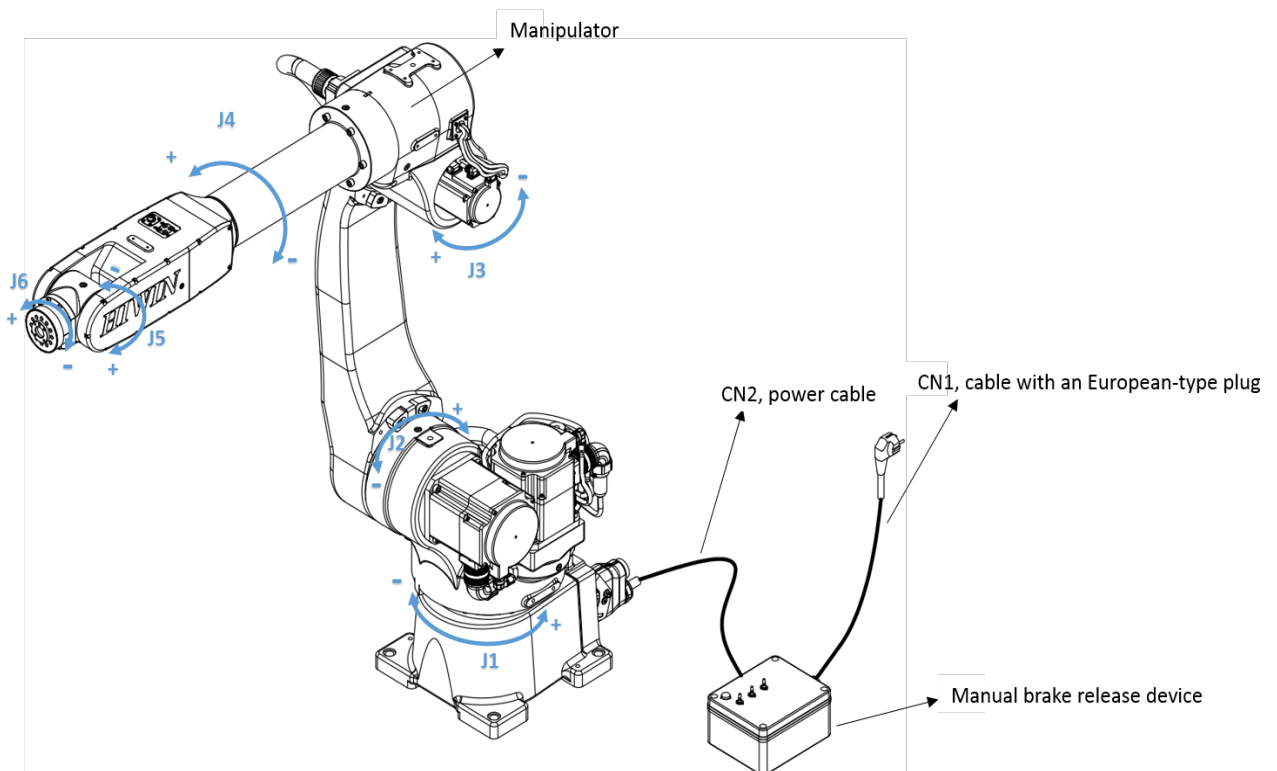
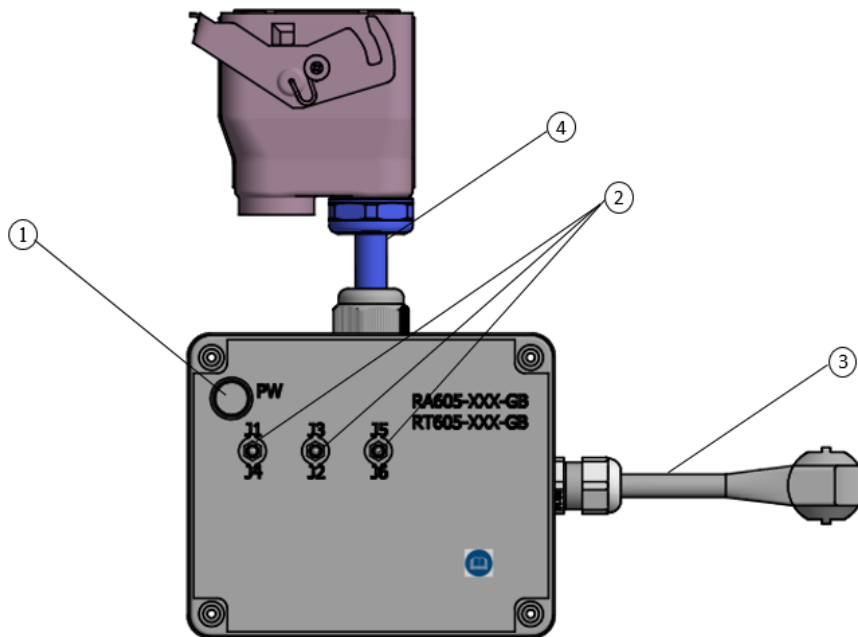
Item		HIWIN Manual Brake Release Device
Model name		RA610-XXX-GC
Power	Input voltage (VAC)	Single phase, 100-240
	Output voltage (VDC)	24
	Voltage frequency (Hz)	50/60
	Max. rated current (A)	2
Dimension		140x170x95 mm <sup>3</sup>
Weight		1.74kg
Protection rating		IP20
Ambient temperature (°C)		0-45
Relative humidity (%RH)		50~75 (non-condensing)

Corresponding connector for manual brake release:



### 5.3 Operation

Name descriptions of the manual brake release device and their functions.




Description:

No.	Item	Description
1	Green-light indicator	Power ON/OFF.
2	Three-stage revertible toggle switch (Note 1)	Toggle upward and downward of any switch and the robot will release the brake of corresponding axis. When the switch is released to the middle position, the brake will be executed.
3	CN1, cable with an European-type plug	1.5M
4	CN2, Power cable	1M

\*Note 1:

Normally, the three-stage revertible toggle switch should stay in the middle position, which means the brake is executed. When the switch is toggled upward and downward of any switch and the robot will release the brake of corresponding axis.

 <b>WARNING</b>	<p>❖ Please note that the axes of the switch are not in sequence due to the gravity comes from releasing particular axis' brake. Thus, J2 and J3 are bound together to prevent the unexpected falling when releasing there axis' brake simultaneously. Please confirm the axes before operation to prevent a risk of unexpected motion.</p>
---	---

Please follow the steps below to release the brake:

- (1) The J4-axis of manipulator must be securely fixed by a crane to prevent an unexpected drop of J2-axis and J3-axis.
- (2) Remove the original CN2 cable connected to controller on robot base, and change to the power cable (CN2) of manual brake release device to robot base.
- (3) Connect the cable with an European-type plug (CN1) to power source.
- (4) Based on the axis whose brake needs to be released, toggle the switch to the corresponding axis and the brake would be released immediately.



## 6. Maintenance and Inspection

This chapter presents 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] 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.

### 6.1 Maintenance Items

The daily inspection items before the robot operation are shown in Table 6-1.

Table 6-1 Daily Inspection Items

	Inspection item	Remedy
<b>Before turning power ON</b>		
1	any of the robot installation screws, cover installation screws and end effector installation screws loose?	Securely tighten the screws.
2	Are all the cables securely connected? Such as the power and signal cable, grounding cable, the cable for teach pendant and the cable connected the robot and other equipment.	Securely connect.
3	Is the pneumatic system normal? Are there any air leak, drain clogging or hose damage? Is the air source normal?	Drain the drainage system and replace the leaking component.
4	Depending on the motion condition and surrounding environment, there might be a few grease permeating through the outside of the rotatory oil seal of each axis. Please check if there is any grease permeating around the bearings of each axis?	Wipe it off when there is any grease permeating around the bearings of each axis.

After turning power ON		
1	Check whether the robot moves smoothly without vibration and noise.	<ol style="list-style-type: none"> <li>1. The robot installation screws might not be securely tightened to the installation surface. Securely tighten the screws.</li> <li>2. If the roughness of the installation surface is uneven, modify the installation surface to the reasonable surface roughness.</li> <li>3. The base might not be sufficiently rigid. Please replace the base to make it more rigid.</li> <li>4. There might be foreign material between the robot and the installation surface. Please remove it.</li> <li>5. Some operating positions might exceed the mechanism limit. Please reduce the load, speed or acceleration.</li> <li>6. The timing belt might loosen or not be in correct position. Please replace or adjust the timing belt. (Refer to section 6.2.2)</li> <li>7. If the grease of the reducer has not been changed for a long period. Please change the grease. (Refer to section 6.2.3)</li> <li>8. If the bearing or the reducer has been damaged by the rolling surface or the gear tooth surface. Please contact HIWIN directly.</li> </ol>
2	The repeatability is not within the tolerance.	<ol style="list-style-type: none"> <li>1. The Zero-position of the robot might be rewritten. Please set the Zero-position. (Refer to section 4.1)</li> <li>2. The Zero-position data will be lost if the backup batteries is dead. Please replace the backup batteries (Refer to section 6.2.1) and set the Zero-position. (Refer to section 4.1) The Robot J1 base retaining bolt might loosen. Please tighten it to the appropriate torque.</li> </ol>

The project and time of periodic inspection refer to Table 6-2.

Table 6-2 Periodic inspection items

	Inspection item	Remedies
<b>Inspection item A (1 month / 320 hours)</b>		
1	Clean and check each part of the robot.	Check if there are any cracks and flows on the robot.
<b>Inspection item B (3 months / 960 hours)</b>		
1	Check the ventilation system of the controller.	If it is dusty, turn off the power and clean the ventilation system of the controller
<b>Inspection item C (6 months / 1920 hours)</b>		
1	Check whether the timing belt is normal.	Adjust the tension of the timing belt. If the friction at the timing belt is severe, replace it. Refer to section 6.2.2.
<b>Inspection item D (1year / 3840 hours)</b>		
1	Replace the backup battery in the robot.	Replace the backup battery. Refer to section 6.2.1
<b>Inspection item E (3years/11520hours)</b>		
1	Change the lubrication grease of J1~J3 reducers.	Please contact HIWIN directly.
2	Change the cables inside the robot.	Please contact HIWIN directly.


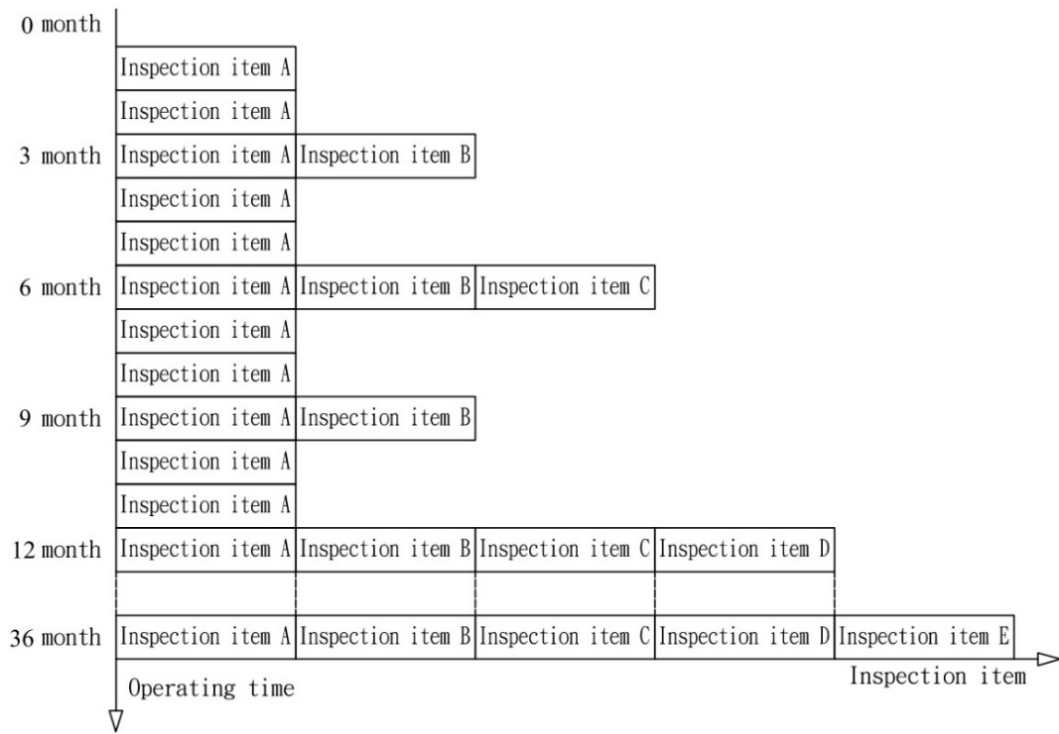
 <b>CAUTION</b>	❖ It is normal that the belt produces debris during operation, but if it happens right after cleaning the belt, it is recommended to replace the belt.
--	--

Table 6-3 Inspection schedule




## 6.2 Maintenance Methods

### 6.2.1 Backup Batteries Replacement

The absolute encoder of the motor is used to record the position of the robot. When the controller power is turned off, the position data of each -axis is preserved by the backup batteries. The batteries are installed when the robot is delivered 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 6-1 and described as below.

- Step1. Press the emergency stop button to prohibit the movement of the robot motion.
- Step2. Ensure the robot and controller are connected with the cables and keep the power on.
- Step3. Please loosen the hexagon socket screws (M3x0.5Px8L) and remove the battery cover.
- Step4. There are four 3.6V batteries. Replace the battery **one by one**. If all batteries are removed in the same time, the position data will be lost. If so, please resetting the robot to the Zero-position.
- Step5. After replacing the battery, ensure to install the battery cover to prevent the robot being damaged by dust and grease.

 <b>CAUTION</b>	<p>❖ All batteries should be changed at one time. If the old batteries are included, the service life of the batteries may be reduced.</p>
--	--

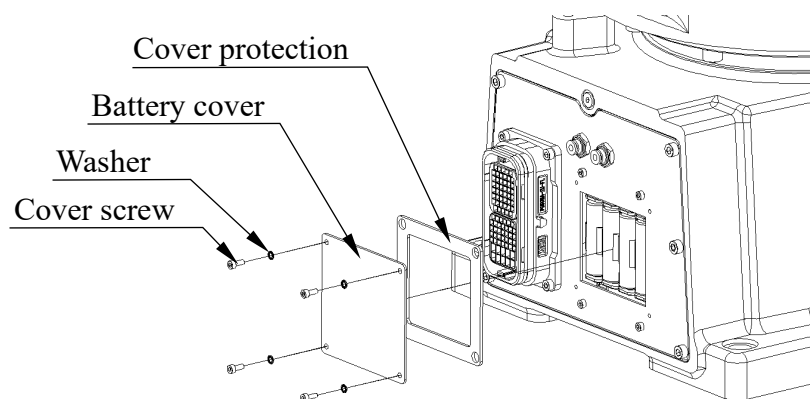



Figure 6-1 Backup batteries replacement

## 6.2.2 Timing Belt Replacement

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


### ⦿ Timing Belt replacement period

When the maintenance time is up to (six month), check the belt tension. If the tension is insufficient, adjust the belt tension. If the belt is excessively worn (wearing about half of the tooth width), the belt tooth is cracked or the belt is broken, replace the belt, but you are required to re-origin the points to correct the points.

 <b>CAUTION</b>	<p>❖ When replacing the belt, the robot system origin may deviate. In this case, the position data must be rechecked if the origin is offset. Please refer to section 4.1 for Zero-position setting.</p>
--	--

### ⦿ Belt Tension

It is very important to keep 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 of the belt by using fingers or tools are shown in Figure 6-2. The sonic tension meter is used to measure the belt tension. The specifications and standard tension of belt are shown in Table 6-4.

 <b>CAUTION</b>	<p>❖ It is normal that the belt produces debris during operation, but if it happens right after cleaning the belt, it is recommended to replace the belt.</p>
--	---

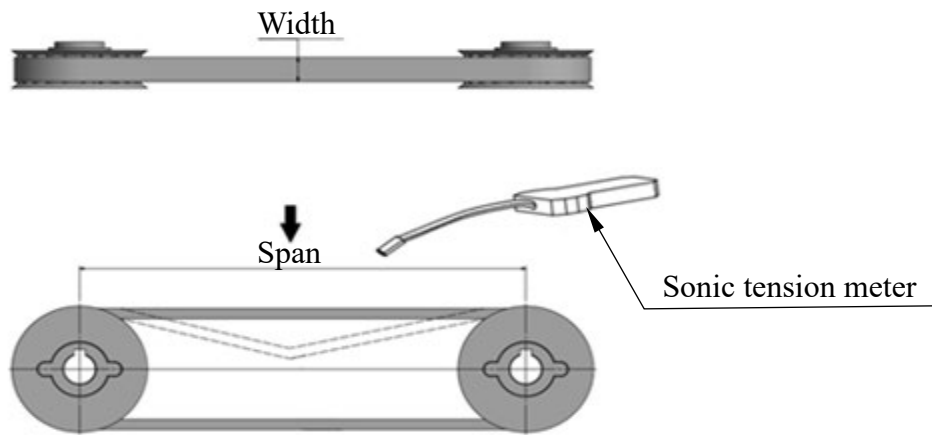


Figure 6-2 Measure belt tension

Table 6-4 The belt specifications

Axis	Belt type	Width (mm)	Span (mm)	Tension (N)
5	396-3GT-6	6	152.5	29~32
6	396-3GT-6	6	152.5	29~32

⊙ Removing the cover

Before replacing the belt, remove the cover of J5 and J6. The M3x0.5Px15L captive screws are used, as shown in Figure 6-3.

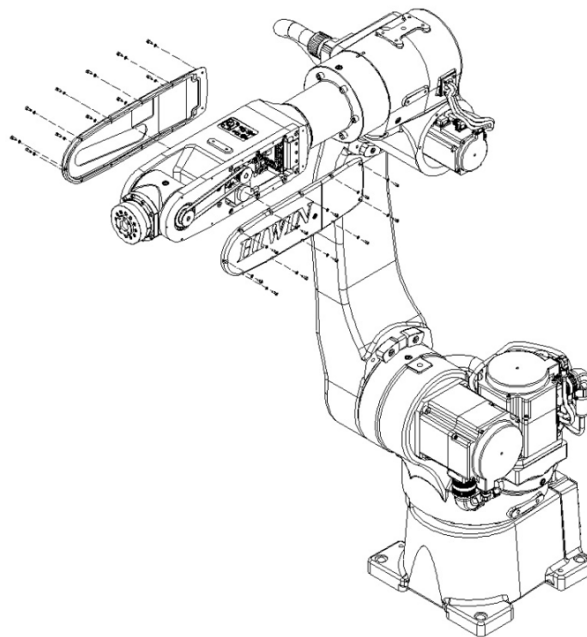


Figure 6-3 Removing the cover

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

Figure 6-4 shows the structure of J5-axis.

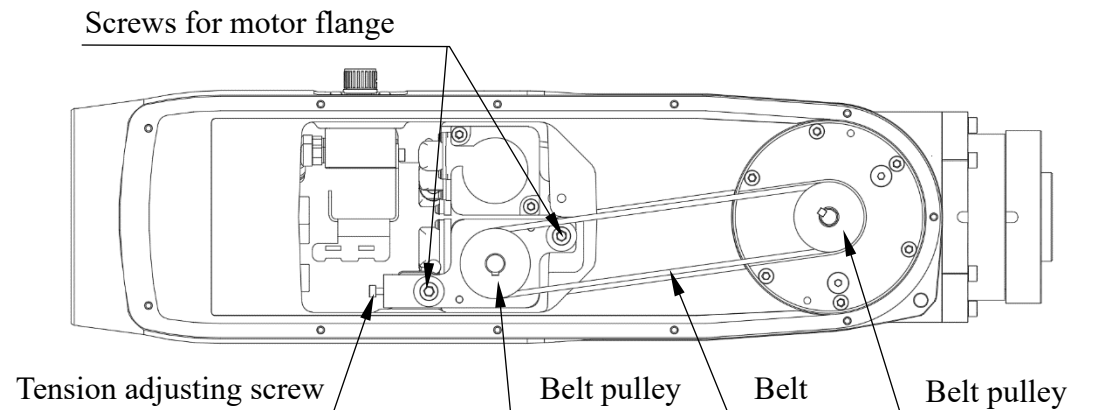


Figure 6-4 J5-axis structure diagram

- Inspect J5 -axis timing belt
  - Step1. Ensure the power of controller is switched off.
  - Step2. Remove the cover of J5.
  - 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 to the following paragraph to adjust the belt tension.
  
- Adjust J5 -axis timing belt
  - Step1. Loosen the two fixing screws on motor flange, so that the motor can be moved. (No need to remove the screws)
  - Step2. Refer to Table 6-4, loosen or tighten the adjusting screw to adjust the tension of the belt.
  - Step3. Tighten the two fixing screws on motor flange. (Screws tightening torque 4.7N-m)
  
- Replace J5 -axis timing belt
  - Step1. Remove the two fixing screws on motor flange.
  - Step2. Loosen the adjusting screw to replace the timing belt.
  - Step3. After replacing the belt, refer to the paragraph “Adjust J5 -axis timing belt” above to adjust the tension of the belt.



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

Figure 6-5 shows the structure of J5-axis.

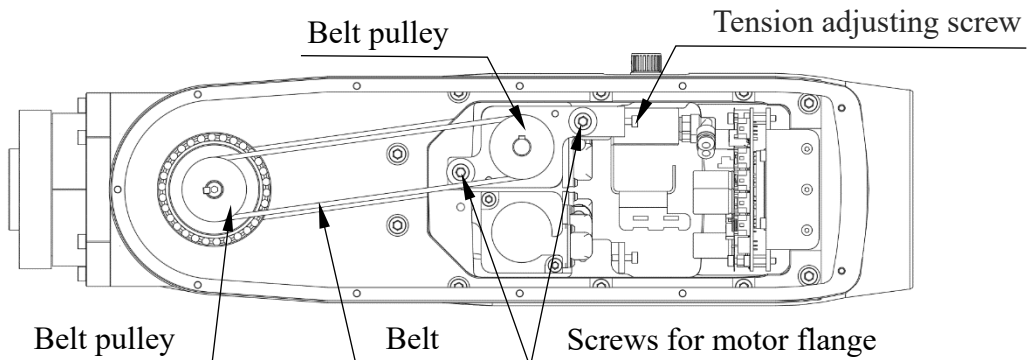


Figure 6-5 J6-axis structure diagram

- Inspect J6 -axis timing belt
  - Step1. Ensure the power of controller is switched off.
  - Step2. Remove the cover of J6.
  - 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 to the following paragraph to adjust the belt tension.
  
- Adjust J6 -axis timing belt
  - Step1. Loosen the two fixing screws on motor flange, so that the motor can be moved. (No need to remove the screws)
  - Step2. Refer to Table 6-4, loosen or tighten the adjusting screw to adjust the tension of the belt.
  - Step3. Tighten the two fixing screws on motor flange. (Screws tightening torque 4.7N-m)
  
- Replace J6 -axis timing belt
  - Step1. Remove the two fixing screws on motor flange.
  - Step2. Loosen the adjusting screw to replace the timing belt.
  - Step3. After replacing the belt, refer to the paragraph “Adjust J6 -axis timing belt” above to adjust the tension of the belt.

### 6.2.3 Grease Replacement

The J4~J6 Axes are designed with lifetime lubrication technology, and never needs a change of lubricant in the reducer unit. The robust and sealed design makes sure the stability of lubrication inside the robot.

The grease inlets and the air vents of J1~J3 are shown in Figure 6-6.

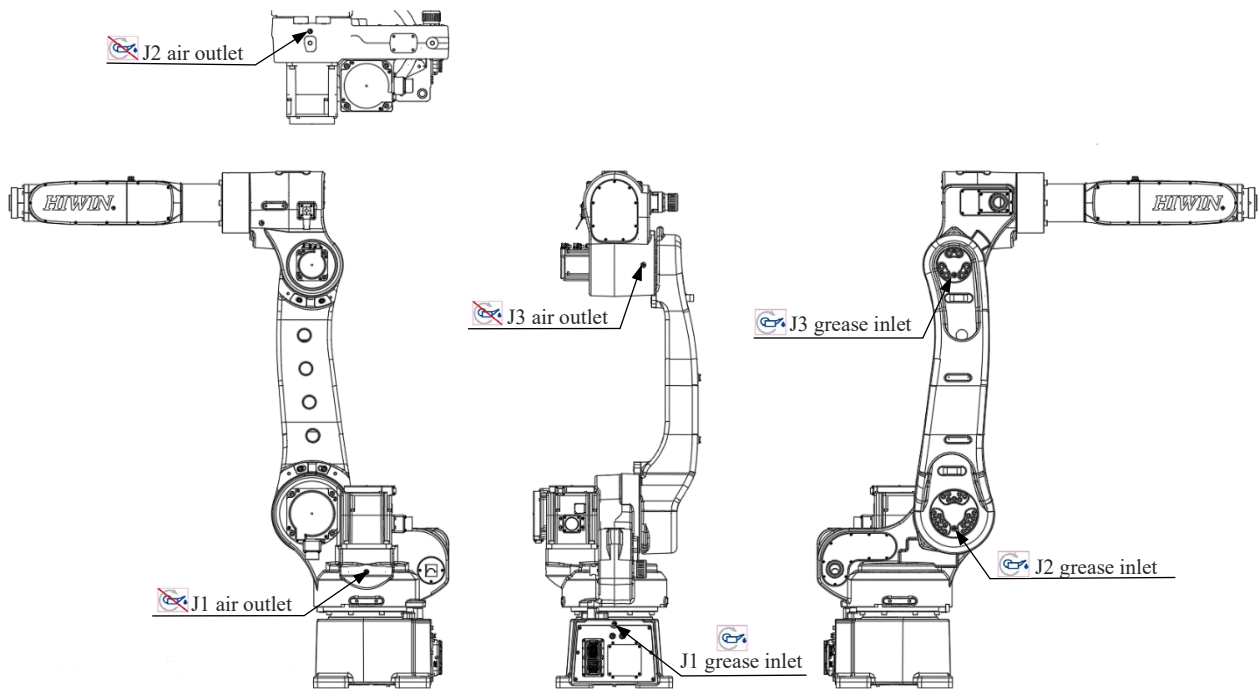


Figure 6-6 Lubrication and air inlet/outlet positions

⊙ Grease specification

Table 6-5 shows the grease specification.

Table 6-5 Grease specification

Part	Grease nipple	Lubrication grease	Quantity	Lubrication interval
J1 reduction gear	M6	VIGOGREASE REO	700 ml	3Year/ 11520Hr
J2 reduction gear	M6	VIGOGREASE REO	468 ml	
J3 reduction gear	M6	VIGOGREASE REO	241 ml	

[Note1] : If the robot is not used for 2 years, replace the grease of J1~J3 axis.

[Note2] : Please contact HIWIN directly for the grease replacement method.

## **Articulated Robot - RA610-GC** (Original Instruction) **User Manual**

Publication Date : April 2020

- 
1. HIWIN is a registered trademark of HIWIN Technologies Corp. For your protection, avoid buying counterfeit products from unknown sources.
  2. Actual products may differ from specifications and photos provided in this catalog. These differences may be the result of various factors including product improvements.
  3. HIWIN website for patented product directory: [http://www.hiwin.tw/Products/Products\\_patents.aspx](http://www.hiwin.tw/Products/Products_patents.aspx)
  4. HIWIN will not sell or export products or processes restricted under the "Foreign Trade Act" or related regulations. Export of restricted products should be approved by proper authorities in accordance with relevant laws and shall not be used to manufacture or develop nuclear, biochemical, missiles or other weapons.



## Subsidiaries / Research Center

### HIWIN GmbH

OFFENBURG, GERMANY  
[www.hiwin.de](http://www.hiwin.de)  
[www.hiwin.eu](http://www.hiwin.eu)  
[info@hiwin.de](mailto:info@hiwin.de)

### HIWIN Schweiz GmbH

JONA, SWITZERLAND  
[www.hiwin.ch](http://www.hiwin.ch)  
[info@hiwin.ch](mailto:info@hiwin.ch)

### HIWIN KOREA

SUWON · CHANGWON, KOREA  
[www.hiwin.kr](http://www.hiwin.kr)  
[info@hiwin.kr](mailto:info@hiwin.kr)

### HIWIN JAPAN

KOBE · TOKYO · NAGOYA · NAGANO ·  
TOHOKU · SHIZUOKA · HOKURIKU ·  
HIROSHIMA · FUKUOKA · KUMAMOTO,  
JAPAN  
[www.hiwin.co.jp](http://www.hiwin.co.jp)  
[info@hiwin.co.jp](mailto:info@hiwin.co.jp)

### HIWIN s.r.o.

BRNO, CZECH REPUBLIC  
[www.hiwin.cz](http://www.hiwin.cz)  
[info@hiwin.cz](mailto:info@hiwin.cz)

### HIWIN CHINA

SUZHOU, CHINA  
[www.hiwin.cn](http://www.hiwin.cn)  
[info@hiwin.cn](mailto:info@hiwin.cn)

### HIWIN USA

CHICAGO, U.S.A.  
[www.hiwin.com](http://www.hiwin.com)  
[info@hiwin.com](mailto:info@hiwin.com)

### HIWIN SINGAPORE

SINGAPORE  
[www.hiwin.sg](http://www.hiwin.sg)  
[info@hiwin.sg](mailto:info@hiwin.sg)

### Mega-Fabs Motion Systems, Ltd.

HAIFA, ISRAEL  
[www.mega-fabs.com](http://www.mega-fabs.com)  
[info@mega-fabs.com](mailto:info@mega-fabs.com)

### HIWIN Srl

BRUGHERIO, ITALY  
[www.hiwin.it](http://www.hiwin.it)  
[info@hiwin.it](mailto:info@hiwin.it)

### HIWIN TECHNOLOGIES CORP.

No. 7, Jingke Road,  
Taichung Precision Machinery Park,  
Taichung 40852, Taiwan  
Tel: +886-4-23594510  
Fax: +886-4-23594420  
[www.hiwin.tw](http://www.hiwin.tw)  
[business@hiwin.tw](mailto:business@hiwin.tw)