HIWIN®

Articulated Robot - RA605-GB, RT605-GB

User Manual

Original Instruction

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HIWIN® 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

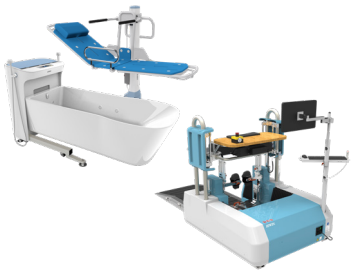
Precision Ground / Rolled

- 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

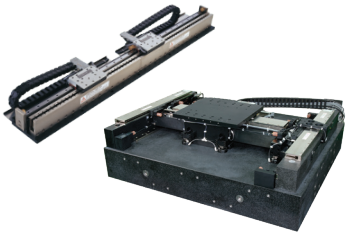
Semiconductor / Packaging machine
/SMT / Food industry / LCD

- Drives-D1, D1-N, D2T
- 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

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 technical stuff or the dealer who you purchased with.

⚠ WARNING	❖ Improper modification or disassemble the robot might reduce the robot function, stability or lifespan. ❖ 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. ❖ Please contact the technical stuff for special modification coming from production line set up. ❖ For the safety reason, any modification for HIWIN product is strictly prohibited.

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.
  - ⊙ In compliance with the safety information on industrial robot described in this manual can't guarantee that *HIWIN* robot will not occur any safety problems.
  - ⊙ This machine is defined as a partly completed machinery, the associated hazards must be handled by system integrator in accordance with ISO 102018-1/-2.
  - ⊙ A safety-related part of control system (SRP/CS) should conform to the requirement of performance level d and category 3 according to ISO 13849-1.
  - ⊙ The installation for emergency functions shall be defined by the system integrator in accordance with ISO 10218-1/2.

- Safety Operation Principle
  - ⊙ Emergency Stop button (on Teach Pendant or from external emergency stop switch) must be pressed before turning off the power, and then switch off the power switch.
  - ⊙ While connecting to the external I/O or the signal, please operate in the condition that the power switch is turned off to prevent from a shortcut caused by mistaken touch in the process, and resulting in damage.

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
 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 ON/OFF
  - Starts robot program from operator's panel
  - Reset system alarm
- ■ Programmer or teaching operator:
  - Turns robot controller ON/OFF
  - Starts robot program from operator's panel
  - Reset system alarm
  - Teaches robot
- ■ Maintenance engineer:
  - Turns robot controller ON/OFF
  - Starts robot program from operator's panel
  - Reset system alarm
  - Teaches robot
  - Does maintenance, adjustment, replacement

⊙ Programmer and the maintenance engineer must be trained for proper robot operation.

3. Precautions

3.1 Common Safety Issues

⚠ DANGER	❖ All operating procedures should be assessed by professional and in compliance with related industrial safety regulations. ❖ When operating robot, operator needs to wear safety equipment, such as workwear for working environment, safety shoes and helmets. ❖ When encountering danger or other emergency or abnormal situation, please press the emergency stop button immediately. After danger is eliminated, move the robot away with low speed in manual mode. ❖ 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. ❖ A safety zone should be established around the robot with an appropriate safety device to stop the unauthorized personnel from access. ❖ While installing or removing mechanical components, be aware of a falling piece which may cause injury to operator. ❖ Ensure the weight of workpiece does not exceed the rated load or allowable load moment at wrist. Exceeding these values could lead to the driver alarm or malfunction of the robot. ❖ Do not climb on manipulator. ❖ Do not store the machine in the environment with corrosion and flammable gas or close to the flammable object. ❖ Do not operate the machine in the environment with moisture, water or grease. ❖ Do not operate the machine at the place where vibration or the strong impact occurs. ❖ Do not immerse the electric wires into grease or water.

	❖ Do not connect or operate the machine with wet hands. ❖ Do not operate the machine in potentially explosive environment. ❖ Please ensure the controller is grounded. ❖ Keep hands away from the inner part of the controller while it is connecting to the power or during operating. ❖ Do not touch the heat sink, regenerative resistance, the power supply or the computer inside the controller while it is operating due to its high temperature. ❖ Be sure power is disconnected prior to repair and maintenance, and ensure to operate under the condition of no electrical shock risk. ❖ Do not disassembly the controller without permission. If there's any issues, please contact our engineers.
⚠ WARNING	❖ The personnel installing 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 deviation or malfunction. ❖ Using non-HIWIN spare parts to repair may cause robot damage or malfunction. ❖ Beware of the heat generated by the controller and servo motor. ❖ Do not overbend the cable to avoid poor circuit contact or unexpected damage. ❖ Do not stand on the controller or put heavy objects on it. ❖ Do not block the vent or put foreign objects into the controller. ❖ Please ensure the controller is fixed on the base.

	❖ Do not pull the connector violently or twist the electric wires excessively. ❖ Do not frequently switch ON/OFF the power switch and the control button. ❖ Please ensure that the robot, the emergency stop switch and the controller are functioning properly before performing any work. ❖ Do not shutdown the power switch during the operation. ❖ Do not open, modify, disassemble and maintain the machine without permission. ❖ The power must be disconnected when the machine does not operate in a long time. ❖ Do not turn off the power of the controller when modifying the program or parameter. Otherwise, the data stored in the controller will be damaged. ❖ After the brake of a servo motor is released, the robot will be moved due to gravity and it may injured the operator. ❖ The industrial robots can be applied for the different industrial environments. ❖ When the operating procedures are interrupted, the special attention should be paid during the troubleshooting.

3.2 Operation

⚠ DANGER	❖ Teaching, jogging or programming should be done outside of the safety fence. If it is inevitable to enter the safety fence, press the emergency stop button before entrance. Operation should be restricted at low speed and beware of surrounding safety. ❖ All operations shall be executed by trained staff.

3.3 Maintenance

⚠ DANGER	❖ Please contact us if the procedure not specified by HIWIN is needed. ❖ Please contact us if the replacement of the component not specified by HIWIN is needed. ❖ Be sure to carry out regular maintenance, otherwise it will affect the service life of the robot or other unexpected danger. ❖ Prior to repair and maintenance, please switch 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 and personal injury. ❖ When replacing the components, avoid foreign object going into the robot.

3.4 End Effector

The end effector can be classified as two types:

A. Gripper: Used to load and unload, such as pneumatic gripper, electric gripper and vacuum sucker.
B. Tool: Used to process, such as welding, cutting and surface treatment.

DANGER	❖ 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. ❖ 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. ❖ The end effector should be mounted firmly on the robot to avoid workpiece fall during operation which may cause personal injury or hazard.
WARNING	❖ The end effector may be equipped with its own control unit. During installation, pay attention to installed location. Ensure that the control unit does not interfere with robot operation. ❖ The gripper-type end effector should prevent the workpiece from dropping or damaging when the robot experiences a power error or other errors. If potential dangers or abnormal situations exist when using end effector, the associated hazards must be handled by the system integrator in accordance with the related standards.0

3.5 Pneumatic, Hydraulic System

DANGER	❖ When using the pneumatic or hydraulic system, the gripped workpiece may fall due to insufficient pressure or gravity. ❖ The pneumatic or hydraulic system must be equipped with the relief valve, so that it can be applied in an emergency.

⚠ WARNING	❖ More attention should be paid to the pressure remained in the pneumatic systems after the power is disconnected. ❖ The internal pressure must be released before the pneumatic systems are maintained. ❖ More attention should be paid to the pressure in the pneumatic system as it is several times more than the atmosphere pressure.

3.6 Emergency Stop Switch

⚠ DANGER	❖ The robot or other control component should have at least one device for immediate halt, such as an emergency stop switch. ❖ The emergency stop button must be installed in an easily accessible location for quick stop. ❖ 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. ❖ Avoid using emergency stop to replace a normal stop procedure. This could reduce the lifespan of the robot.
⚠ WARNING	❖ The drive power and the control system will be disconnected to stop all actions during the emergency stop. ❖ If you want to restart the procedures, you should reset the emergency stop switch. ❖ Emergency stop established an immediate stop: Immediately stop the robot system, and disconnect the driver power. ❖ The emergency stop switch is used for emergency stop only. ❖ The *HIWIN* robot is equipped with two emergency stop switches, where one is installed on the teach pendant and the other is directly connected to the controller via a cable. If additional emergency stop switches are required, other connecting method can

	be applied for the same purpose. ❖ Based on the relevant industrial safety regulations, the emergency stop switch is directly connected to the controller of the robot via the physical wires. ❖ If the version of the braking is not applied to the whole axis, once the emergency stop is executed and the heavy objects are loaded on the robot end, the axis without brake will move due to gravity. This attention must be paid for safety issue.

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 2.5 environmental conditions.

Use is not permitted under the following conditions:

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

5. Disposal

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

Content

Version	Date	Product	Note
1.0.0	2018.03.20	RA605-710-GB	First edition
2.0.0	2018.06.30	RA605-GB RT605-GB	RA605、RT605 manual merge
2.1.0	2018.08.30	RA605-GB RT605-GB	Added Chp.5 Manual break release device, Chp.7 Safety certification
2.1.1	2018.10.23	RA605-GB RT605-GB	Modified Chp.1.3 direction of motion

1. Transportation and Installation

1.1 Transportation

Sling can be used to transport the robot. The transportation procedure is as follows:

Step1. Move the robot into its transport posture and the angle of each joint is shown in the table of Figure 1-1.

Step2. Secure the suspension plate to the robot with four M8×1.25P×12L screws as shown in Figure 1-2. Make the sling go through the suspension plate to keep the center of gravity under the hanging point shown as Figure 1-3.，Please ensure the robot is in stable condition to avoid overturning.

Step3. Move the robot to the desired position by using sling.

Step4. Remove the suspension plate.

[Note] The transport suspension plate (4C201E41) is an optional part. Please refer to appendix for the dimensions.

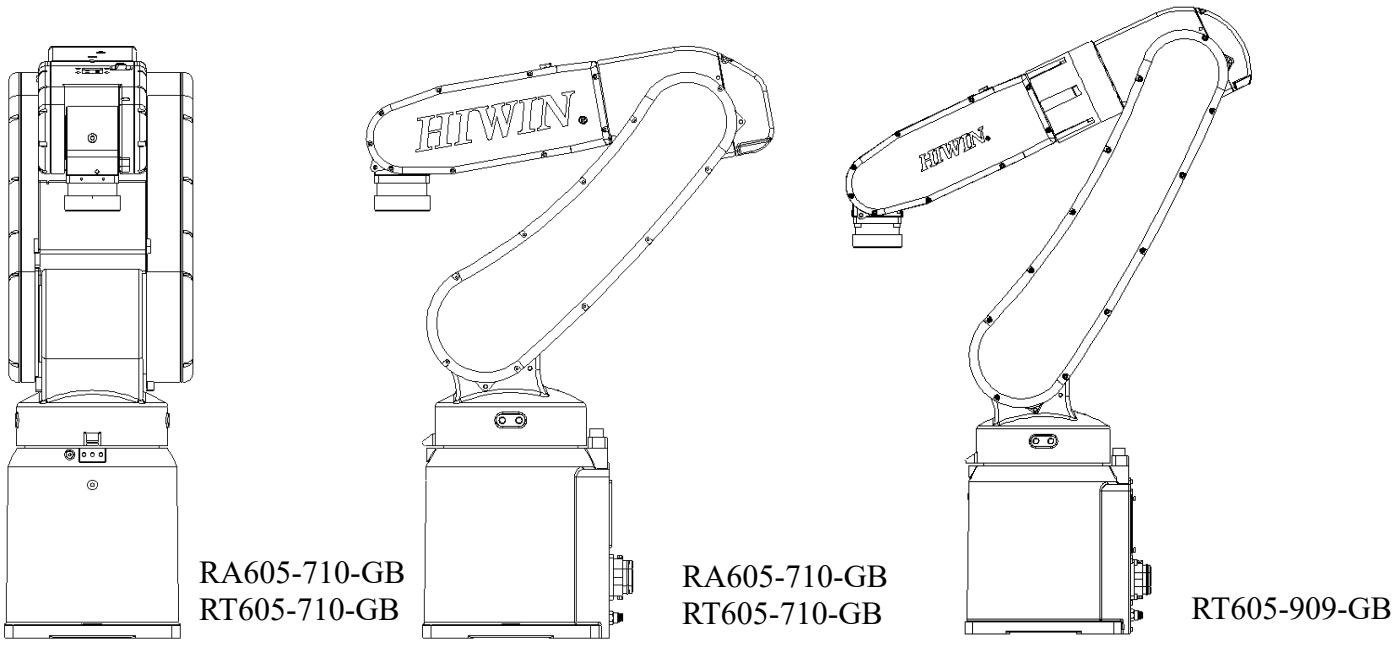


Figure 1-1 Transport posture

Transport Posture Degree		
	RA605-710-GB RT605-710-GB	RT605-909-GB
J1	0°	0°
J2	45°	30°
J3	-55°	-55°
J4	0°	0°
J5	-80°	-65°
J6	0°	0°

⚠ WARNING	❖ Before carrying the robot, be sure to remove the end effector which changes the center of gravity. ❖ Please keep stable, slow down and avoid excessive vibration or shock during transportation. ❖ While placing the robot be sure to avoid the robot and the installation surface collision. ❖ After removing the suspension plate, please maintain it properly for re-transportation. ❖ Before operation, remove the suspension plate to avoid danger.

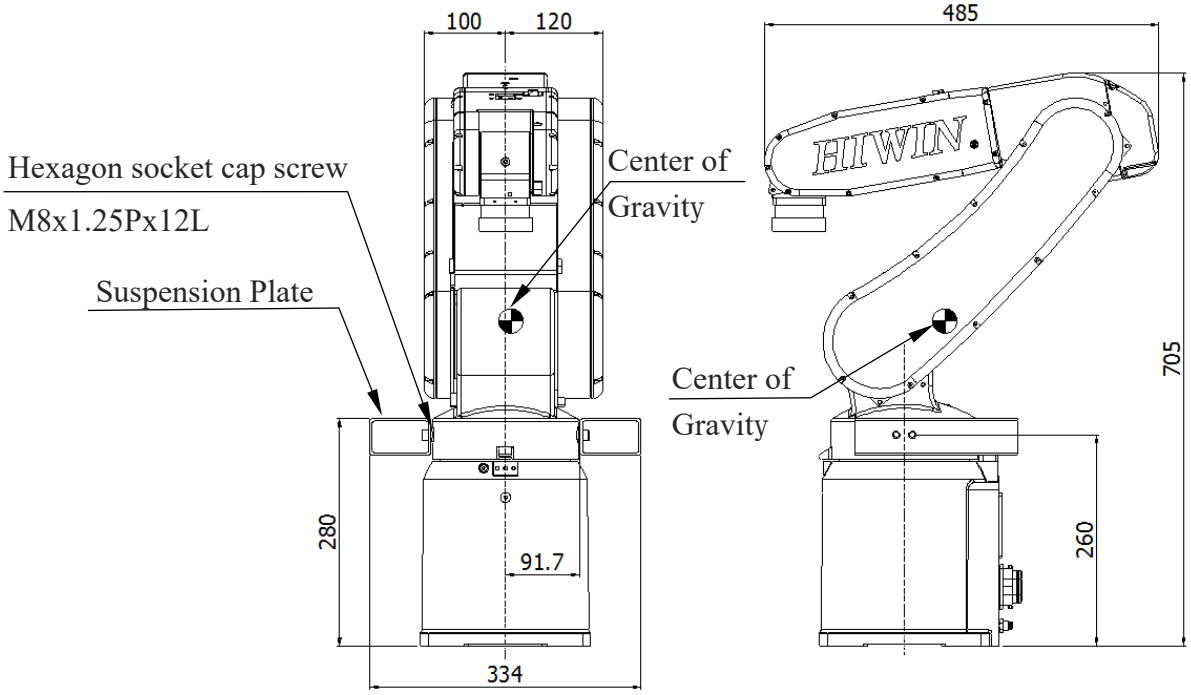


Figure 1-2(a) RA605-710-GB Transport dimensions

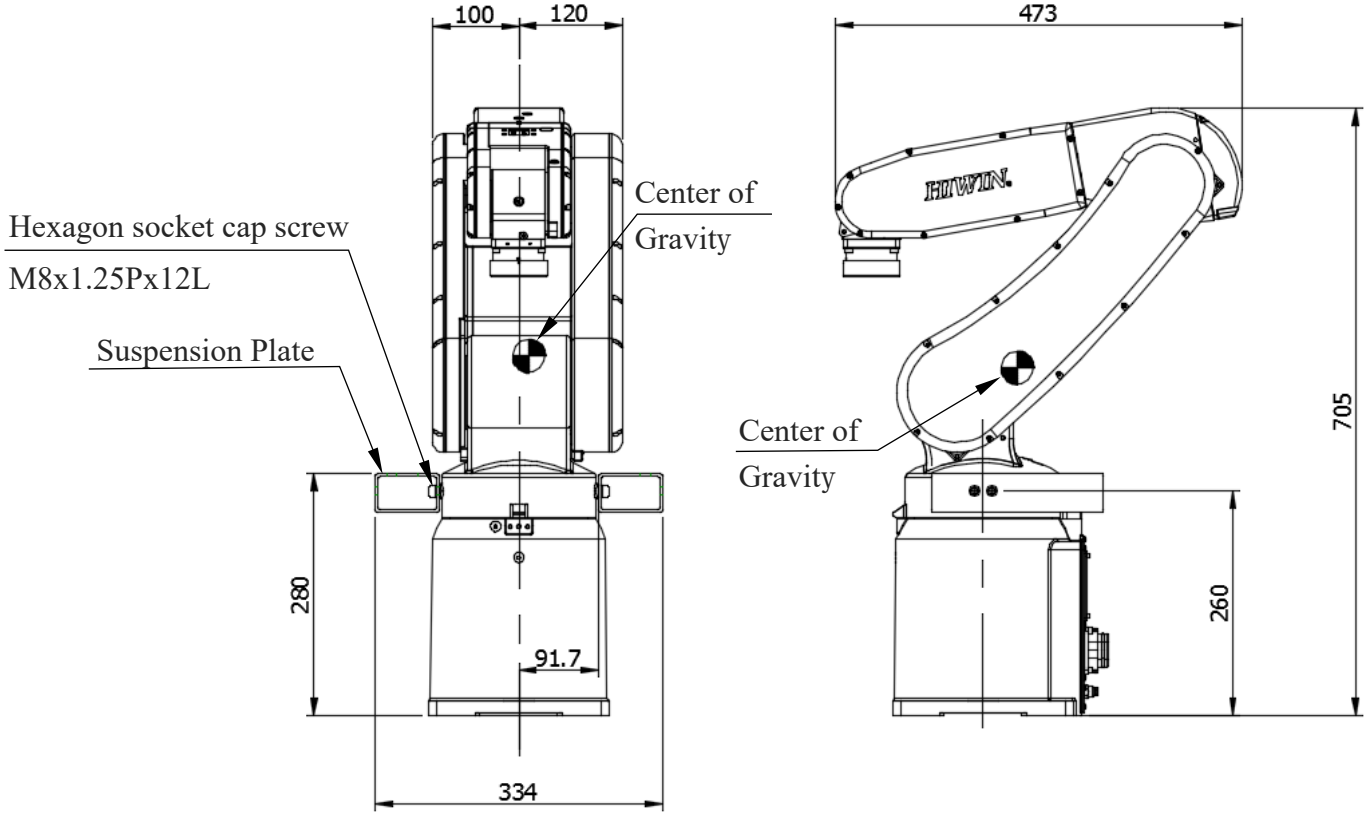


Figure 1-2(b) RT605-710-GB Transport dimensions

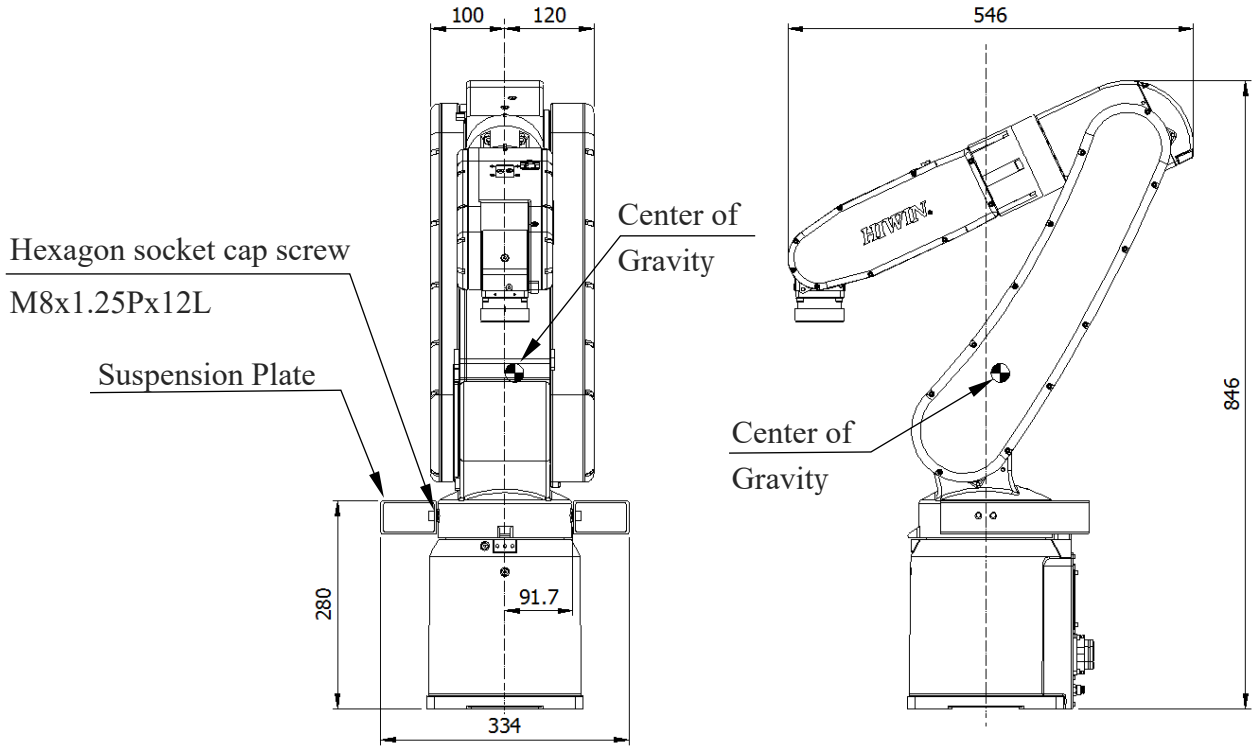


Figure 1-2(c) RT605-909-GB Transport dimensions

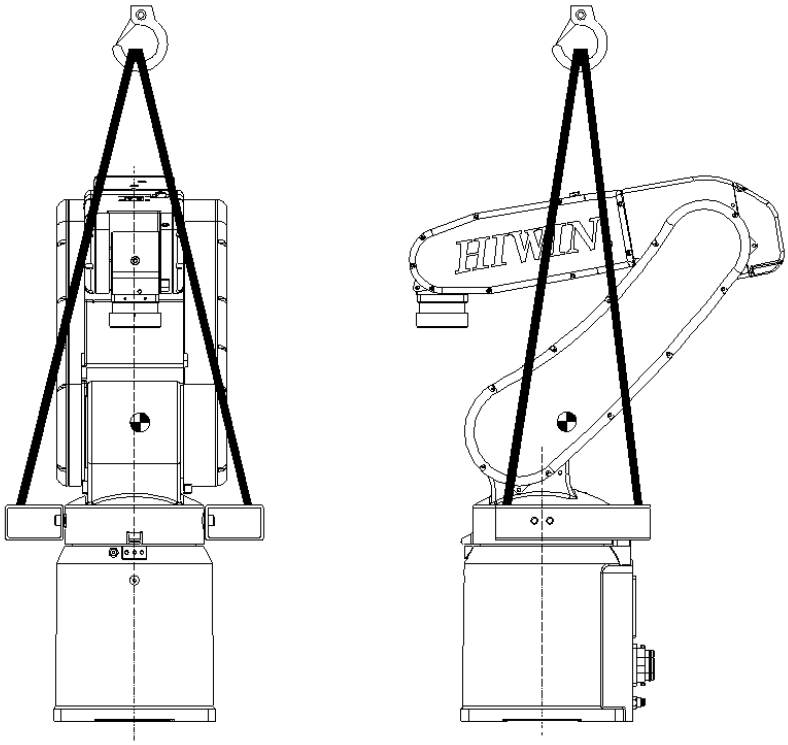


Figure 1-3(a) Crane lifting transportation

RA605-710-GB Transport method

RT605-710-GB Transport method

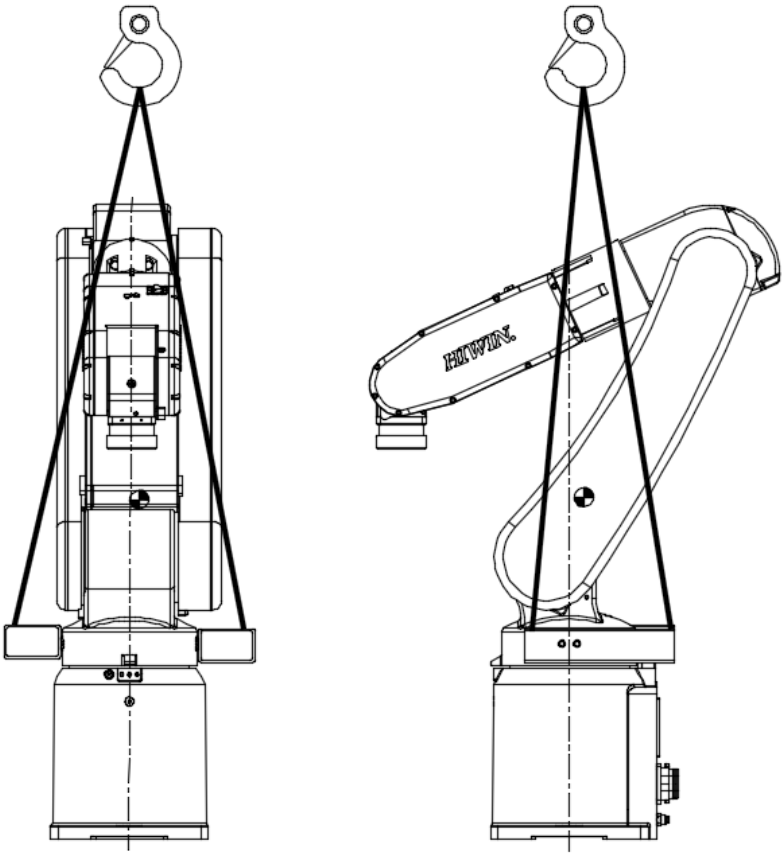


Figure 1-3(b) Crane lifting transportation
RA605-909-GB Transport method

DANGER	❖ After removing the suspension plate, please keep it properly for re-transportation. ❖ Please always follow the above instructions and method to transport the robot for subsequent transportation. The angle of the suspended robot; J1 is for 0°, J2 is for 45°, J3 is for -55°, J4 is for 0°, J5 is for -80°, J6 is for 0°. ❖ If the robot is directly suspended without using the specified suspension plate, it will cause danger due to an incorrect center of gravity position. ❖ Please always stay in stable condition and avoid excessive vibration or shock during transportation.

1.2 Installation

Figure 1-4 shows the installation dimensions of the robot. According to the dimensions, fix the robot on the installation surface with M10 screws, spring washer and flat washer shown as Figure 1-5. Figure 1-6 and table 1-1 show the forces and moments acting on the installation surface during operation. The strength of surface must be considered when installing the robot. It is recommended to use screws bigger than M10X20L.

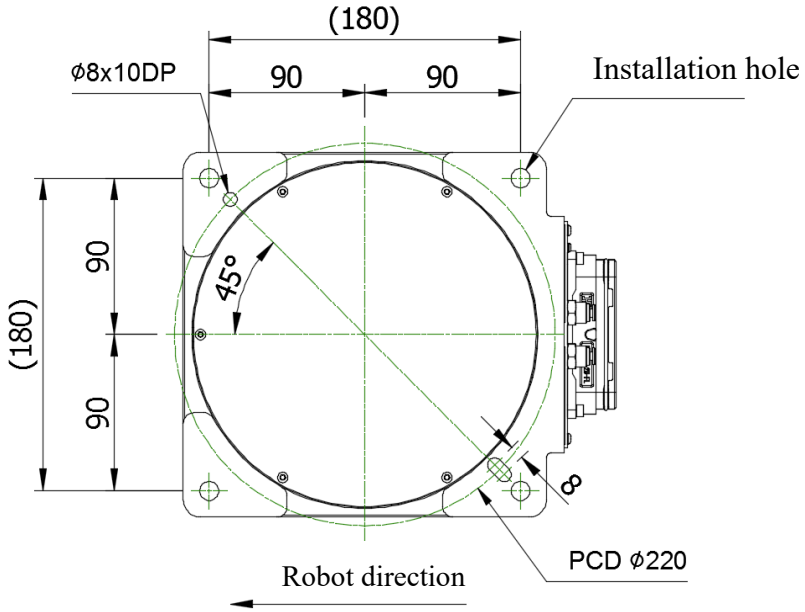


Figure 1-4 Base dimensions

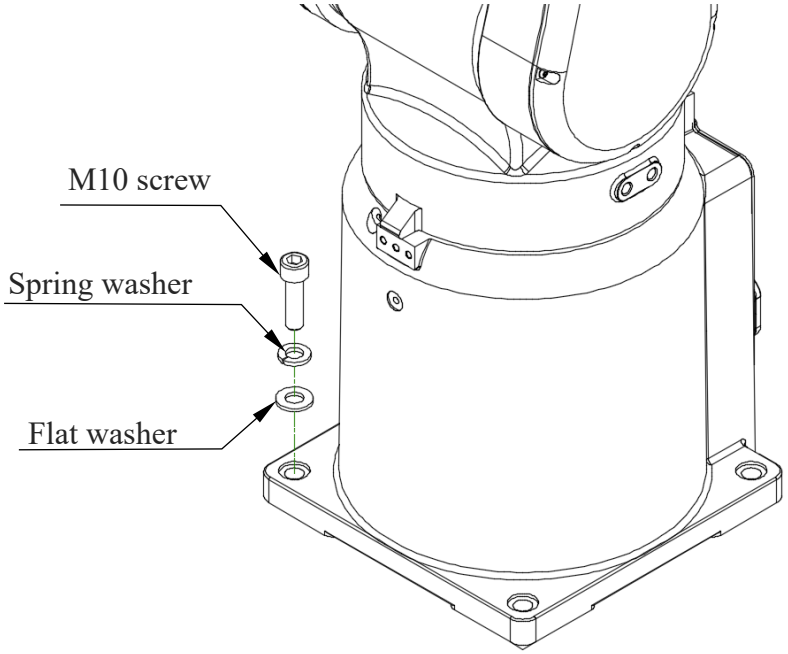


Figure 1-5 Installation diagram

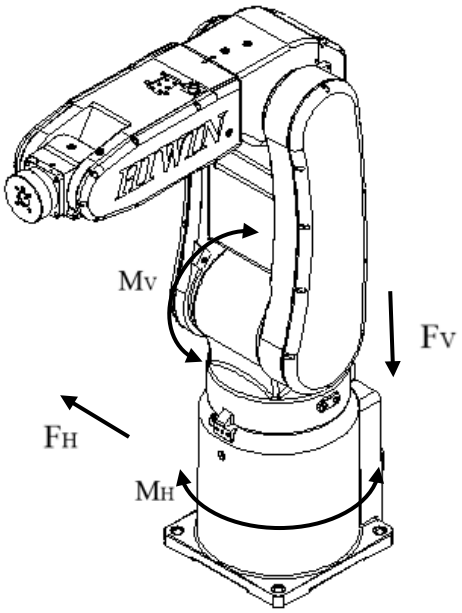


Figure 1-6 Forces and moments acting on the installation surface

Table 1-1 (RA/RT)605-710-GB 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	144	441	0	0
Acceleration /Deceleration	382	1009	149	456
Power cut stop	462	1199	248	760

Table 1-2 RT605-909-GB 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	160	490	0	0
Acceleration /Deceleration	526	1205	244	748
Power cut stop	660	1467	407	1246

⚠ WARNING	❖ 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. ❖ Ensure the position of the installation surface for the robot will not shift while in operation. ❖ Ensure the strength of the installation surface for the robot will not be damaged due to the movement. ❖ Do not install the robot at the place with direct sunlight or light. If the temperature on the cover is too high, it may cause poor performance. ❖ When the robot is installed on the ceiling or the wall, the parameters must be changed. If you have any inquiry, please contact *HIWIN*.

1.3 Connection with the Controller

Figure 1-7 shows the structure drawing of the robot.；Figure 1-8 shows the connection between robot, controller, teach pendant and power source. Figure 1-9 and Figure 1-10 show the interface of J1 and the pin assignment of CN2 connector.

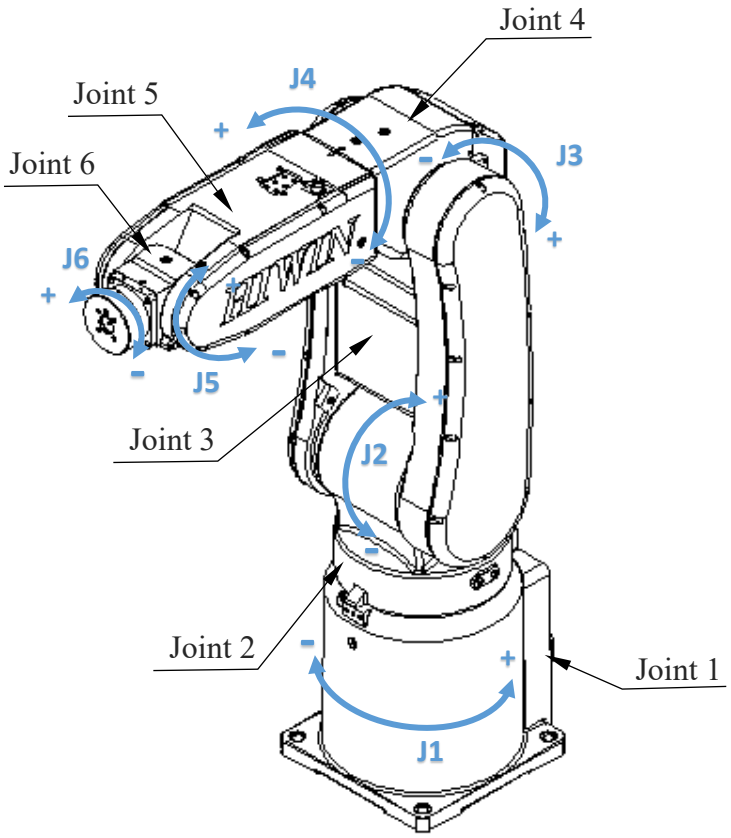


Figure 1-7 Drawing of robot structure

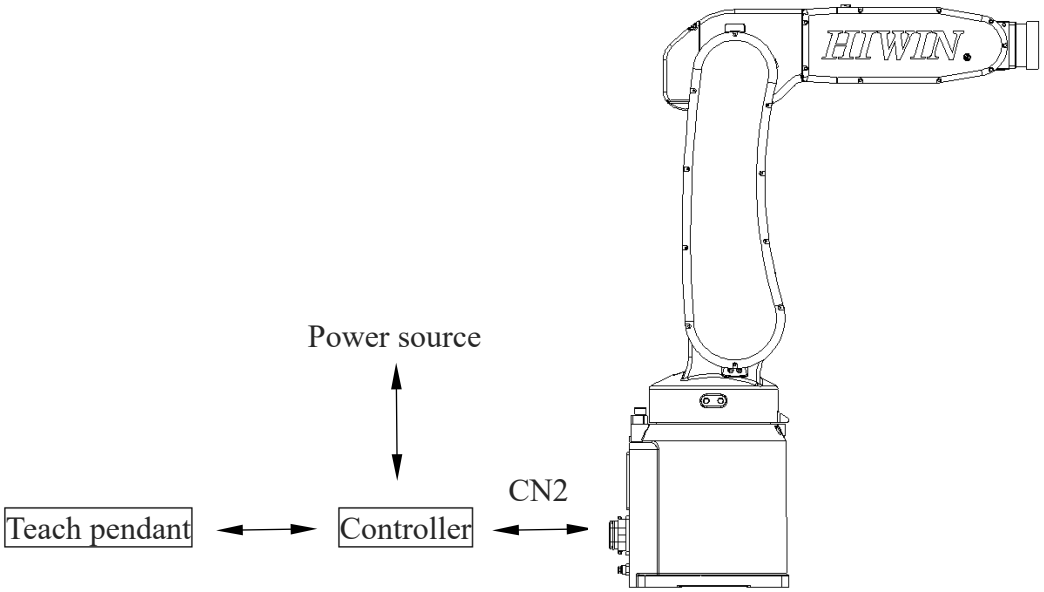
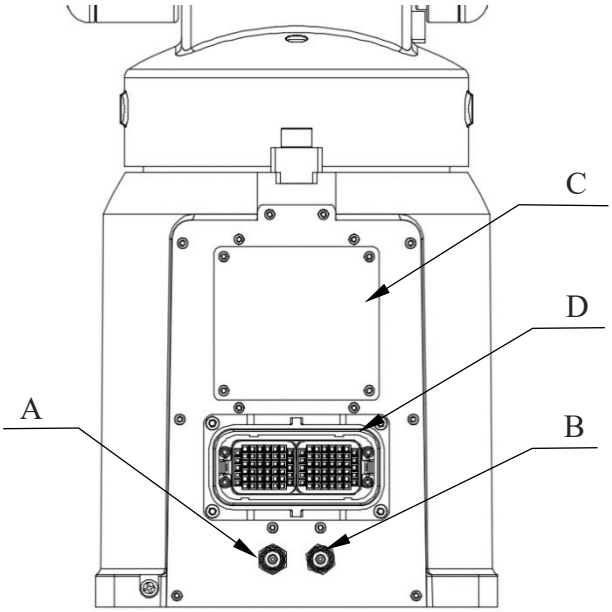
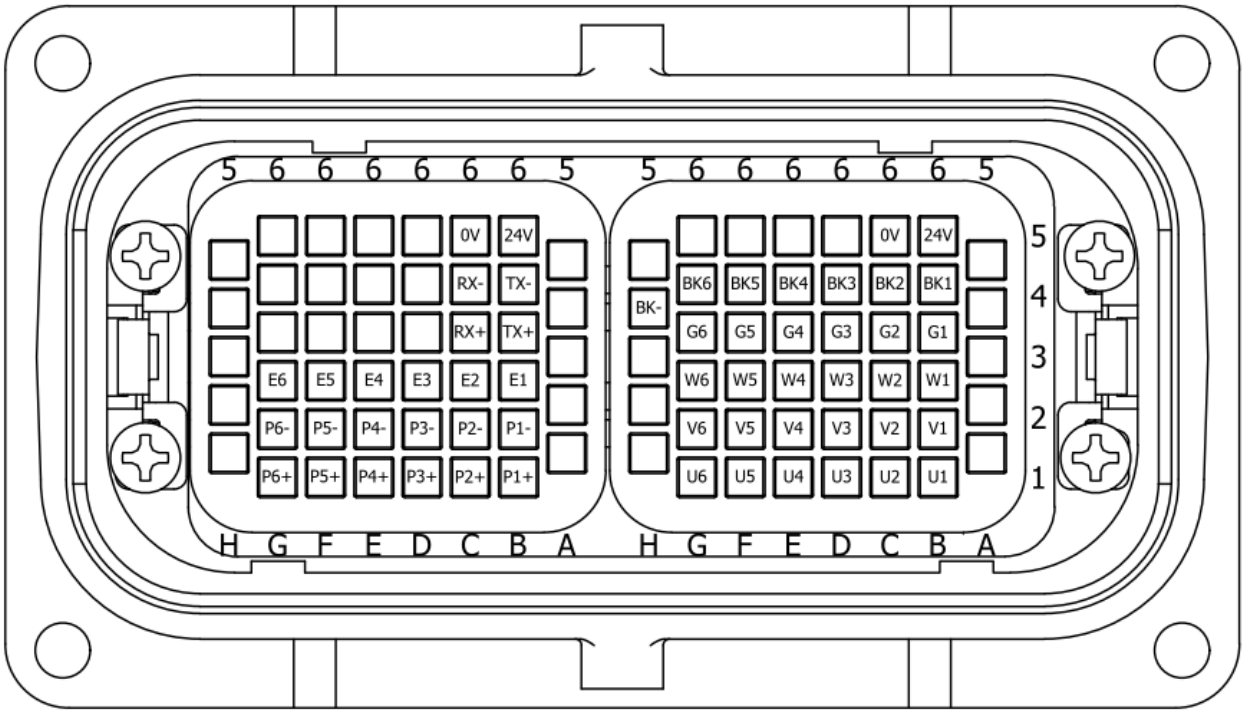


Figure 1-8 Robot and controller connection



Code	RA605-GB	RT605-GB
A	Air out socket	Air in/out socket
B	Air in socket	Air in/out socket
C	Battery box	Battery box
D	Power/signal socket	Power/signal socket

Figure 1-9 Interface at the rear of J1



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

Figure 1-10 Pin assignment of CN2 connector

1.4 Grounding

Figure 1-11 shows the grounding connection of the robot with the screw (M5×0.8P×8L).

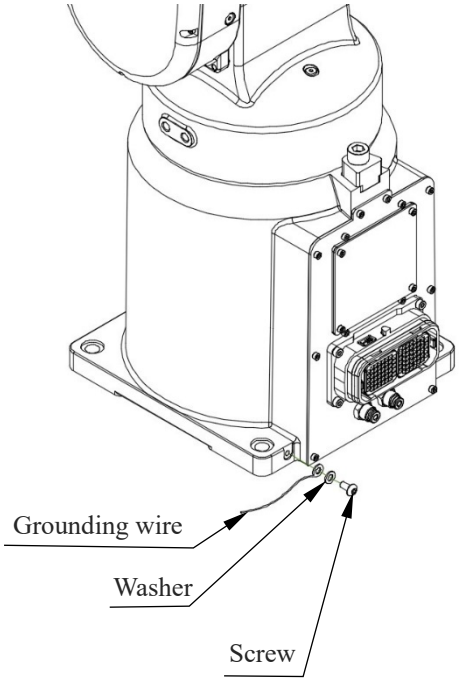


Figure 1-11 Grounding method

⚠ CAUTION	❖ The length of a grounding cable should not be too long. ❖ The grounding cable of the robot should be separated from those for other equipment.

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 ℃ [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℃, 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.

Item	HIWIN Part No.	Standard	Optional RA605-710-GB	Optional RT605-710-GB	Optional RT605-909-GB	Remark
Manipulator accessory kit	4C2016Z2	●	○	○	○	Include calibration tool set, end effector I/O connector
Calibration tool set	4C201EK2		○	○	○	Refer to section 4.1
End effector I/O connector	4CA30008		○	○	○	Refer to section 3.3
R-I/O cover	46170099	●	○	○	○	
Suspension plate set	4C201E41		○	○	○	Refer to section 1.1
Robot base(GB)	4C300F42		○	○	○	Refer to official website
J2 belt	45310141		○	○		Refer to section 6.2.2
J2 belt	453100X8				○	Refer to section 6.2.2
J3 belt	453100QN		○	○		Refer to section 6.2.2
J3 belt	453100X9				○	Refer to section 6.2.2
J5、J6 belt	453100MY		○	○	○	Refer to section 6.2.2
J1~J4 grease(16KG)	47110035		○	○	○	Refer to section 6.2.3
J5~J6 grease(16KG)	47110037		○	○	○	Refer to section 6.2.3
Encoder battery	462600LN		○	○	○	Refer to section 6.2.1
Sealants	47300061		○			Refer to section 6.2.2
Manual brake release device	4C704WQ1		○	○	○	Refer to section 5.1

Table 1-4 Standard and optional equipment list

2. Basic Specifications

2.1 Description of Model Name

There is a model name on the specification label of RA605-GB and RT605-GB. The explanation of model name is shown below.

Model

Model example

RA605 – 710 – GB

	Identification Code
GB	Version

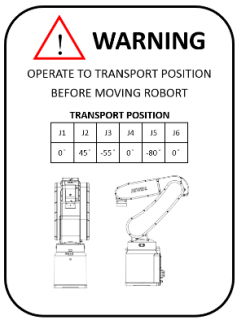
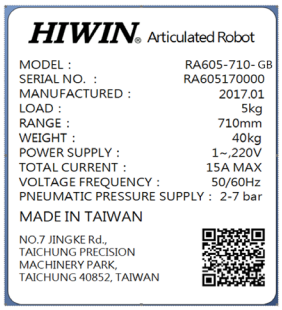
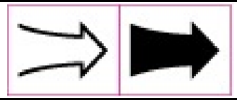
	Maximum Reach Radius
710	710 mm
909	909 mm

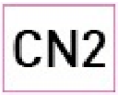
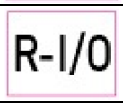
	Series
RA605	RA605 Series articulated robot controller
RT605	RT605 Series articulated robot controller

2.2 Labels

The labels on the robot are 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.
	Read manual	Read manual before operating the robot
	Electric shock	Pay more attention that the robot may have a risk of electric shock.
	Transport position	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 RA605-GB air input.
	Air Out	The connection port of air tube for RA605-GB air output.
	Air In/Out	The connection port of air tube for RT605-GB air input/output.

	Grease in	The hole for grease in.
	Grease out	The hole for grease out.
	CN2	CN2 power & signal cable
	R-I/O	End effector control input/output cable

2.3 Robot Specifications

The robot specifications are shown in Table 2-2.

Table 2-2 Robot specification

Specification				
Item		RA605-GB	RT605-GB	
Model Name		RA605-710-GB	RT605-710-GB	RT605-909-GB
Optional EU CE Certification		●	N/A	N/A
Degrees of Freedom		6		
Installation		Floor、slope (wall mounting, ceiling mounting) [Note 1]		
Nominal Load Capacity		5kg [Note 2]		
Cycle Time		0.5 s [Note 3]		
Maximum Reach Radius		710 mm	710mm	909mm
Position Repeatability		±0.02 mm	±0.03 mm	±0.04 mm
Motion Range	J1	±165°		
	J2	+85°~ -125°		
	J3	+185°~ -55°		
	J4	±190°		
	J5	±115°		
	J6	±360°		
Maximum Speed	J1	360°/ s		250°/ s
	J2	288°/ s		200°/ s
	J3	420°/ s		300°/ s
	J4	444°/ s		444°/ s
	J5	450°/ s		450°/ s
	J6	720°/ s		720°/ s
Allowable Load Moment at Wrist	J4	8.40 N-m		
	J5	8.40 N-m		
	J6	5.56 N-m		
Allowable Load Inertia at Wrist	J4	0.36 kg- m^2		
	J5	0.36 kg- m^2		
	J6	0.13 kg- m^2		
Weight (Manipulator only)		40 kg		45 kg
Tool wiring		6 Input / 4 Output		
Tool pneumatic pipes		Three channels of tracheal connection [Note 5]	Two channels of tracheal connection [Note 5]	

Power supply	1/3~, 220V (+/-10%)	
Voltage frequency	50/60Hz(+/-1%)	
Total current	15A Max	
Protection rating	IP 65	IP32
Noise level	Less than 75 dB [Note 4]	

[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 robot moves forward and backward in the vertical height 25mm and the horizontal distance 300mm with 1 kg load, as shown in Figure 2-1.

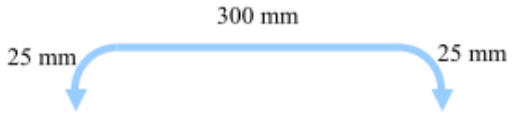


Figure 2-1 Cycle time trajectory

[Note 4]: The noise level is measured at maximum speed and maximum load according to ISO11201.

[Note 5]: Apply with M5 thread Ø4 tracheal caliber connector.

2.4 Outer Dimensions and Motion Range

The motion range is shown in Figure 2-2(a)~(b).

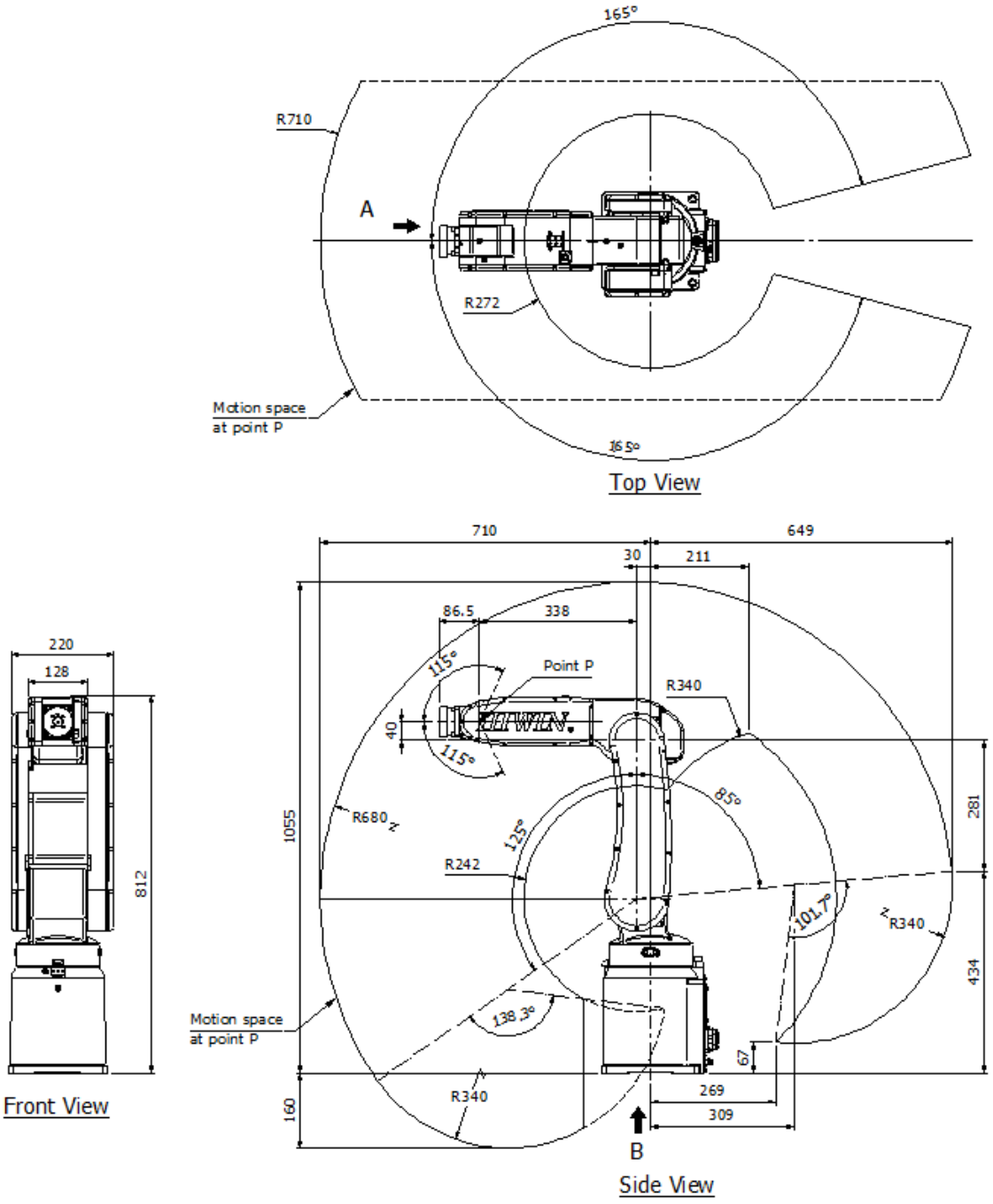


Figure 2-2(a) RA605-710-GB Motion range

RT605-710-GB Motion range

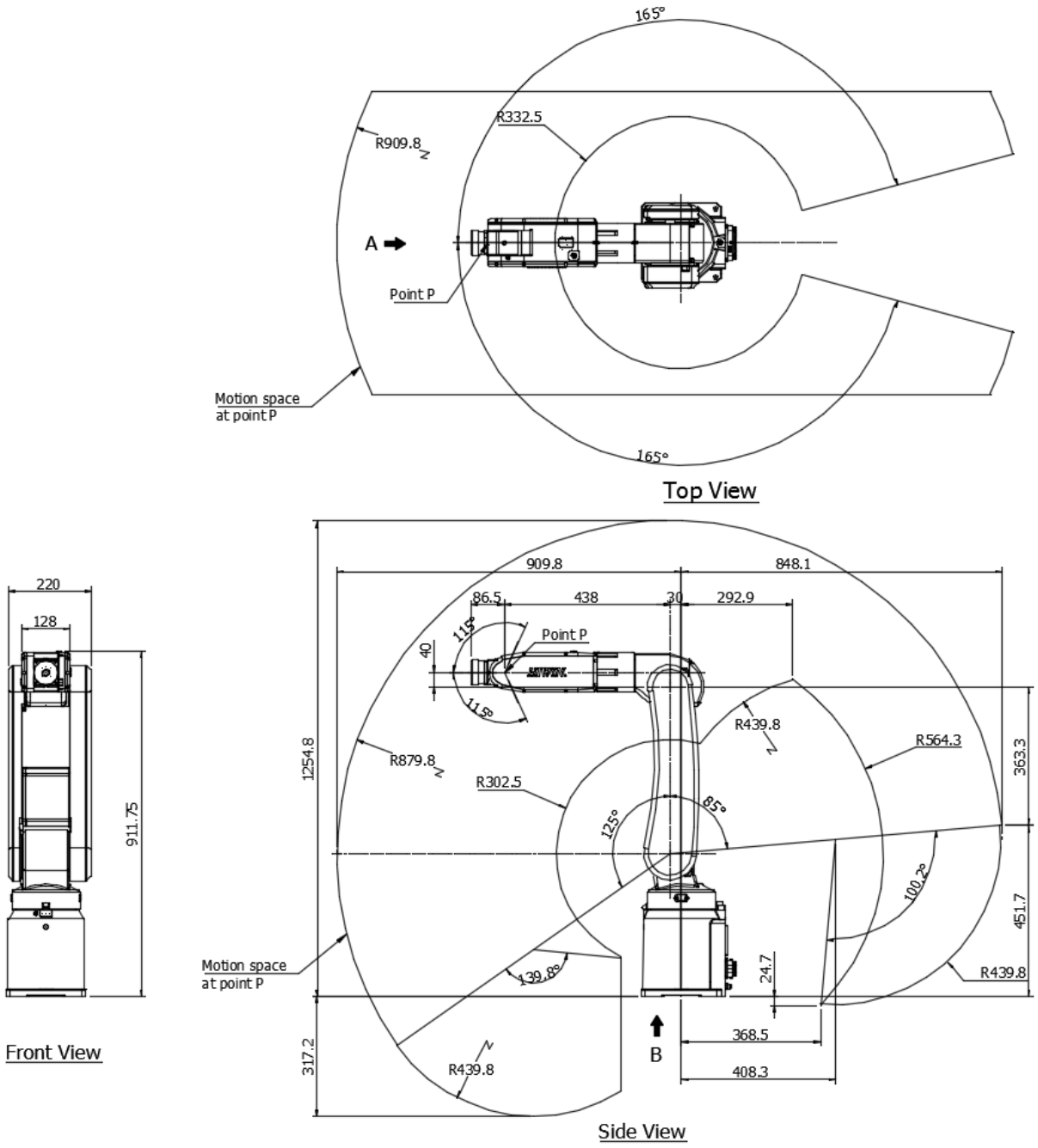
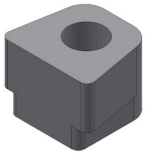
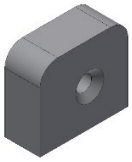
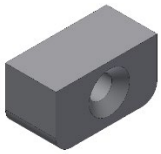
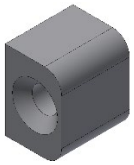
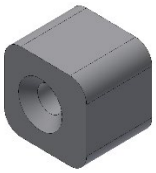


Figure 2-2(b) RA605-909-GB Motion range

2.5 Mechanical Stopper

Mechanical stoppers are installed at J1-axis to J3-axis to limit the motion range to a minimum value. Please refer to Table 2-3 and Figure 2-3 to Figure 2-7.

Table 2-3 Description of mechanical stoppers

Illustration	Axis applied	Motion range limited
	J1	-170°～+170°
	J2	-126°
	J2	86°
	J3	-56°
	J3	186°

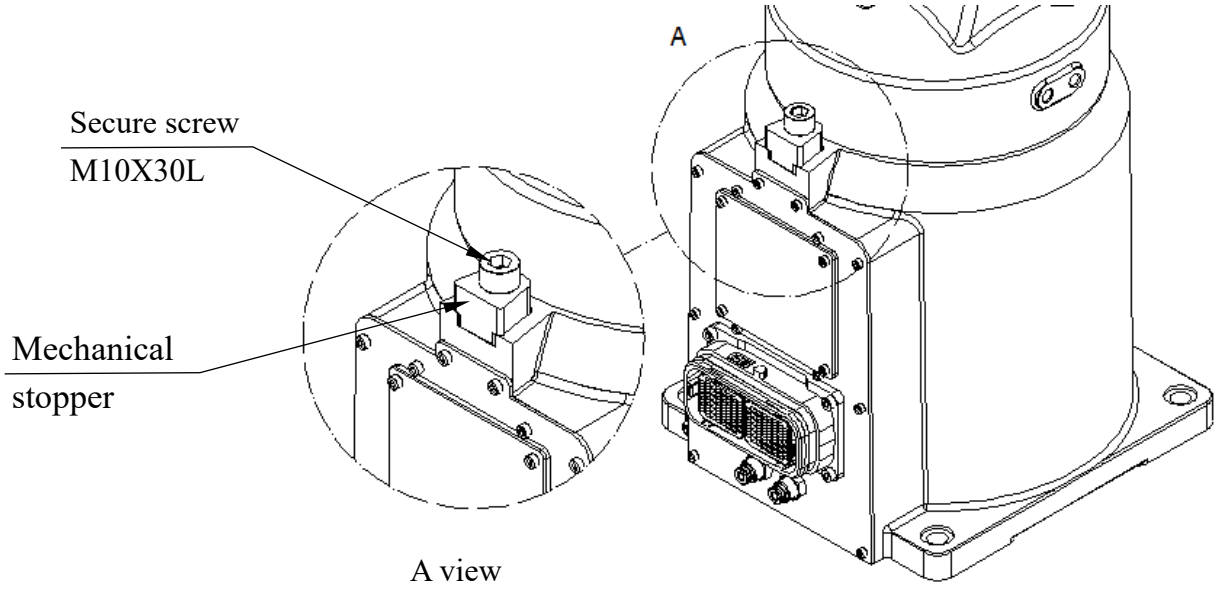


Figure 2-3 J1-axis positive/negative limit

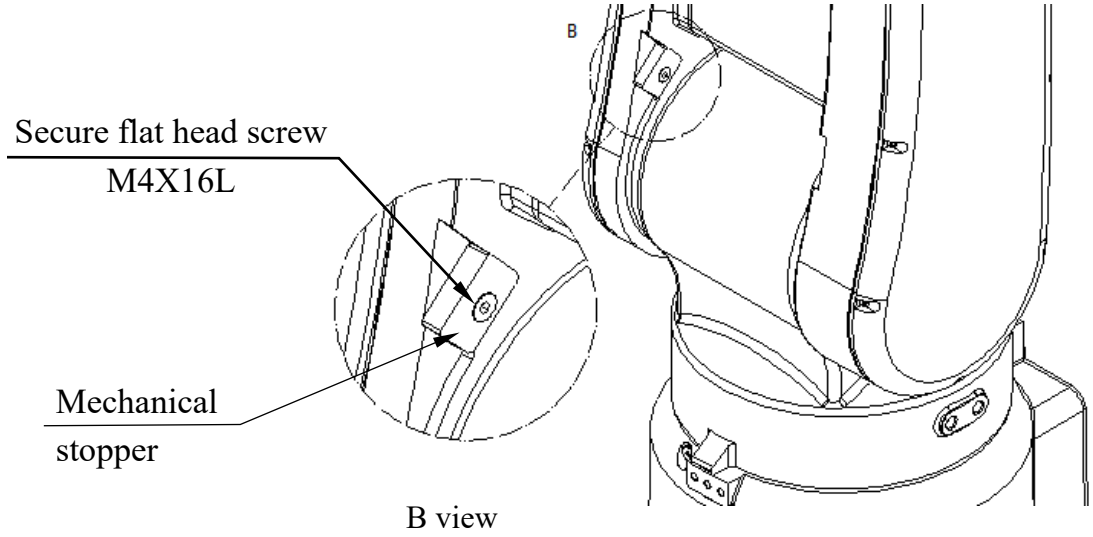


Figure 2-4 J2-axis negative limit

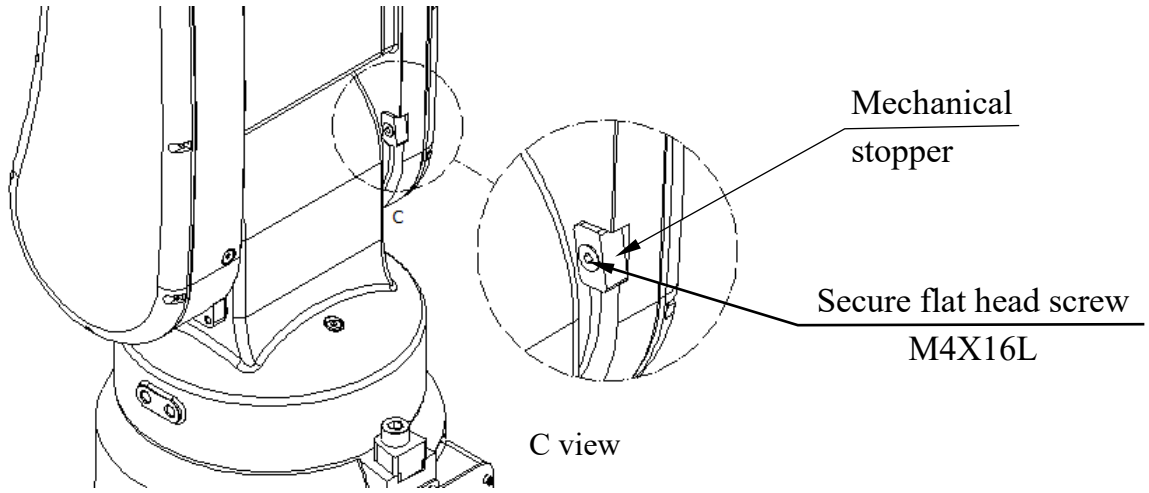


Figure 2-5 J2-axis positive limit

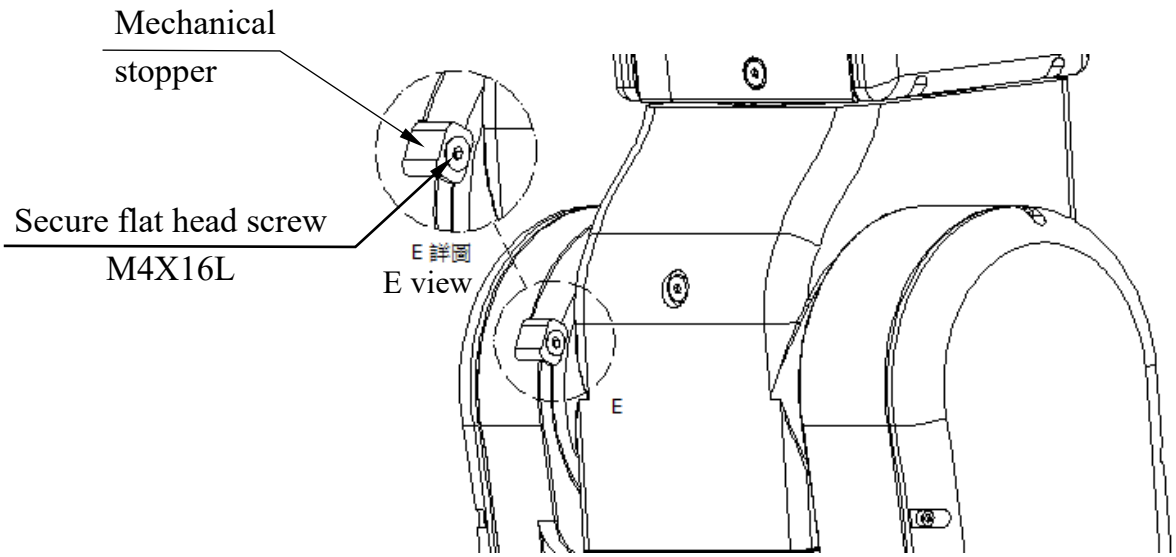


Figure 2-6 J3-axis negative limit

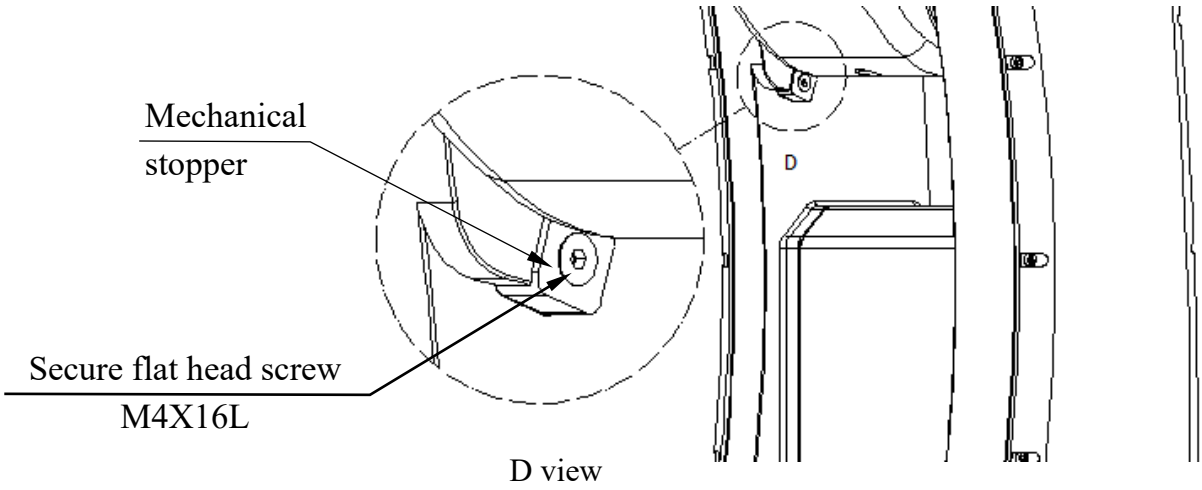


Figure 2-7 J3-axis positive limit

2.6 Wrist Moment Diagram

The load capacity of the robot is not only limited by the weight of the load, but also limited by the center of gravity of the load. Figure 2-8 shows allowable center of gravity of the load when the robot is loaded 1~5kg.

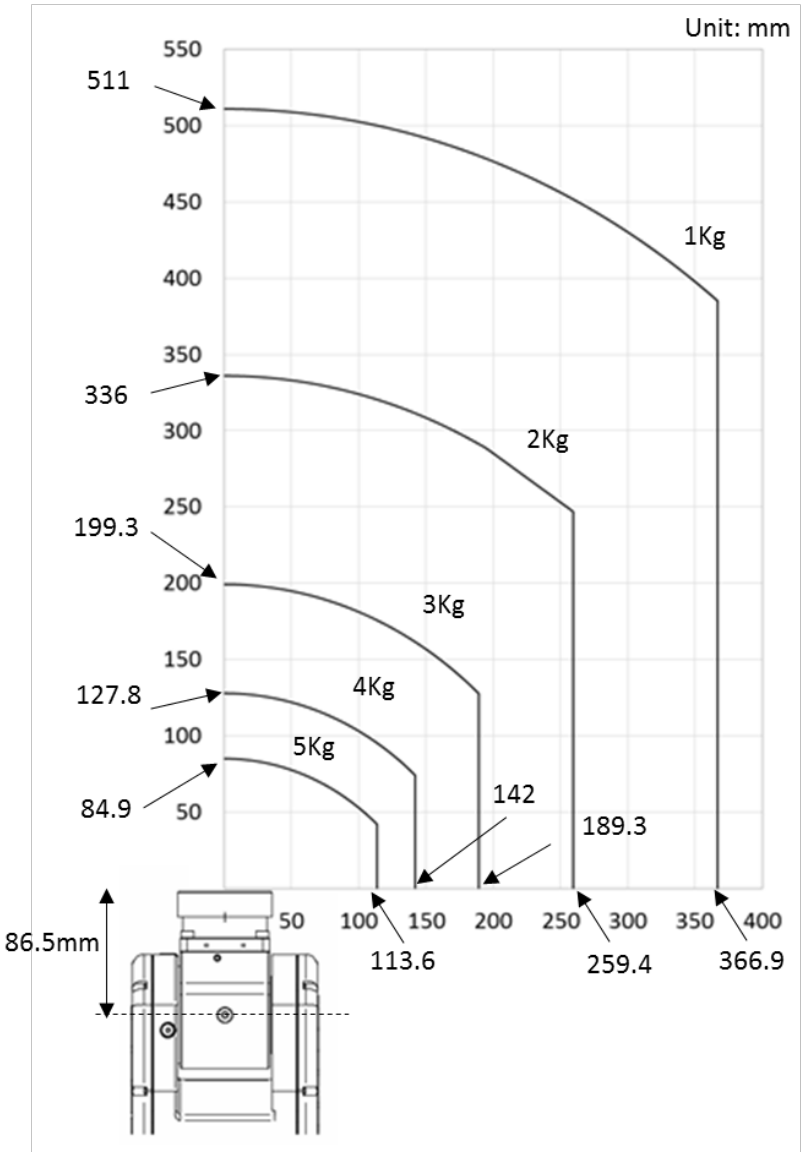


Figure 2-8 Wrist moment diagram

⚠ WARNING	❖ The transportable load weight will be greatly related to the motion posture and speed of the robot. Therefore, over-current could happen even if the load is under the allowable range. When this situation occurs, the posture and speed of robot must be changed.

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.

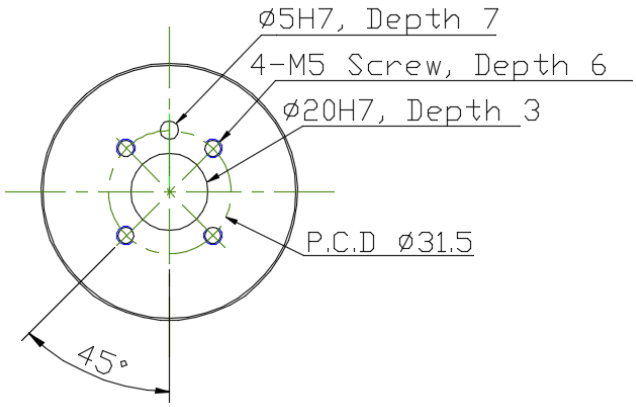
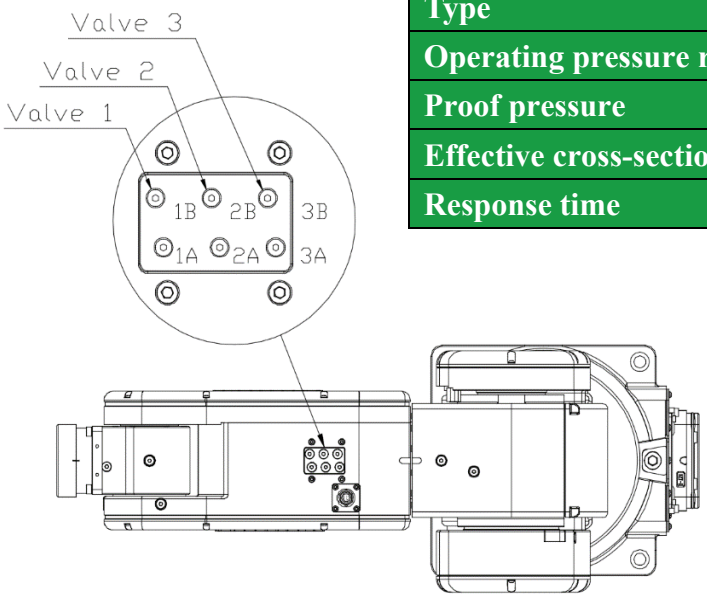


Figure 3-1 Mounting surface for end effector

3.2 Pneumatic Interface

Pneumatic holes (AIR IN & AIR OUT) are installed on the rear of J1 as shown in Figure 3-2(a), and the outer diameter of the air tube in the robot is ϕ4mm. The robot has three 5/2-way solenoid valves for end effector on J5 and the secure holes for the nozzle are M5×0.8P. The schematic diagram of pneumatic circuit is shown in Figure 3-2(b).



Type	5/2
Operating pressure range	2~7kgf/cm^2(0.2~0.7MPa)
Proof pressure	10kgf/cm^2(1MPa)
Effective cross-sectional area	4mm^2
Response time	12ms

Figure 3-2(a) RA605-GB Pneumatic interface

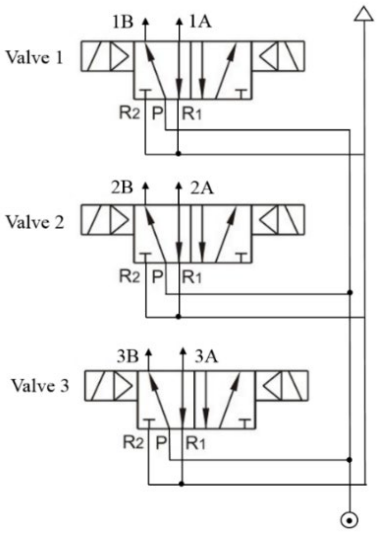
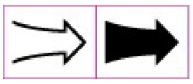
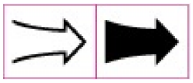


Figure 3-2(a) RA605-GB Pneumatic circuit diagram

Pneumatic holes (AIR IN & AIR OUT) of RT605-GB 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 ϕ4mm. The secure holes for the nozzle are M5×0.8P.

Code	Name	Label
A	Air in/out socket	
B	Air in/out socket	

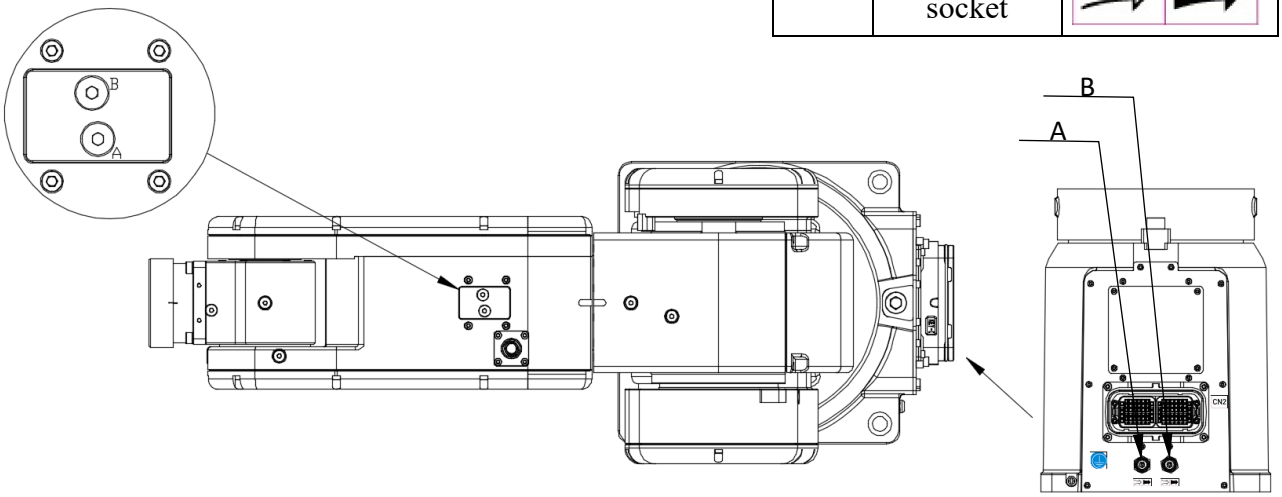


Figure 3-3 RT605-GB Pneumatic interface

3.3 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 3-4. Figure 3-5 to Figure 3-8 show the wiring diagram of I/O interface. Figure 3-9 show the two-wire proximity switches connecting method for customers.

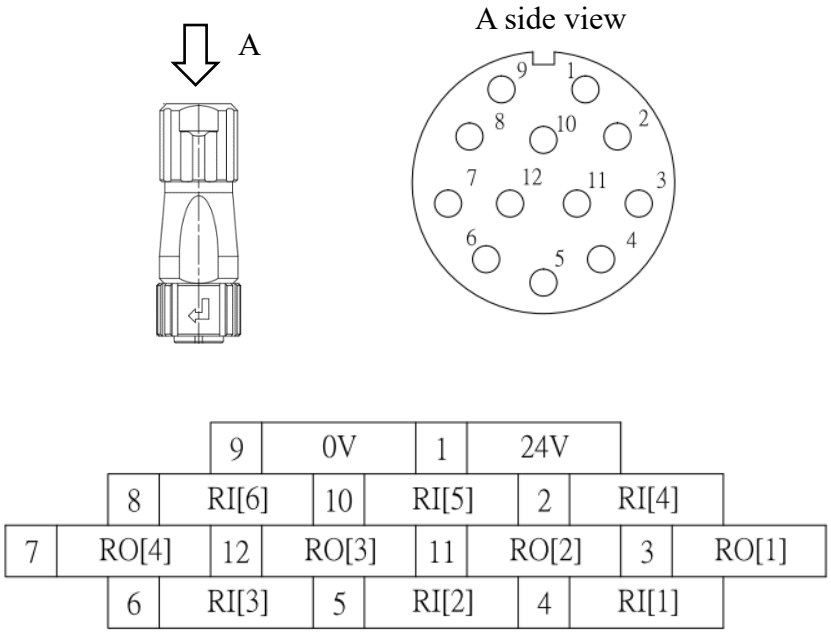


Figure 3-4 Pin assignment of the I/O connector (Power output: 24V/1A)

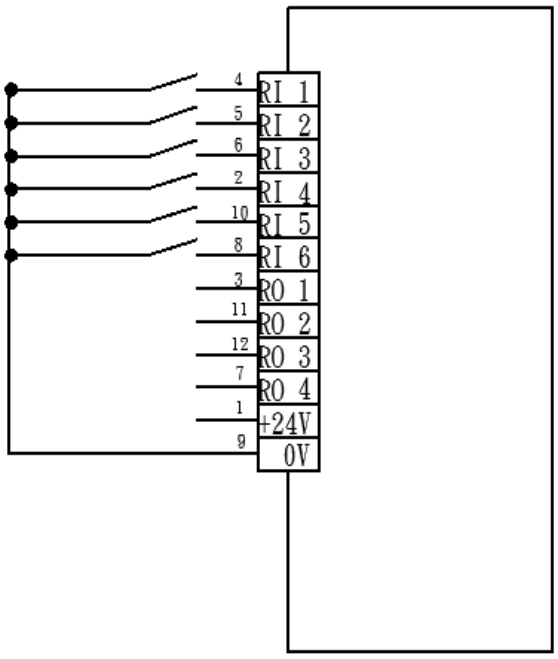


Figure 3-5 Wiring diagram of input (Standard: Sinking type)

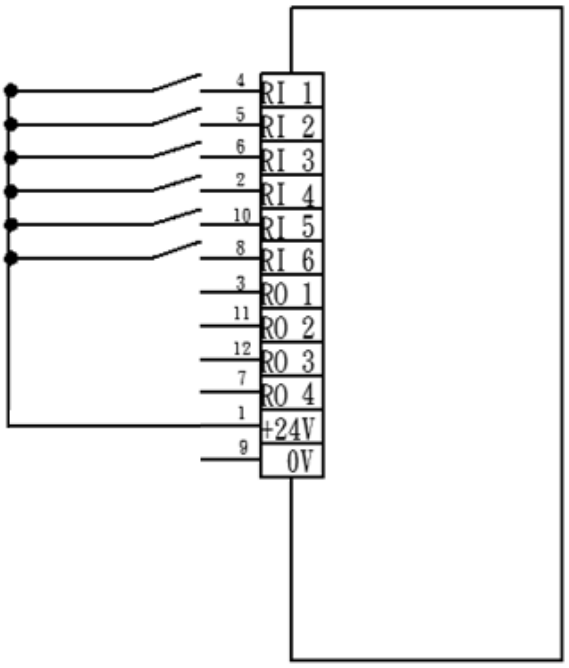


Figure 3-6 Wiring diagram of input (Optional: Sourcing type)

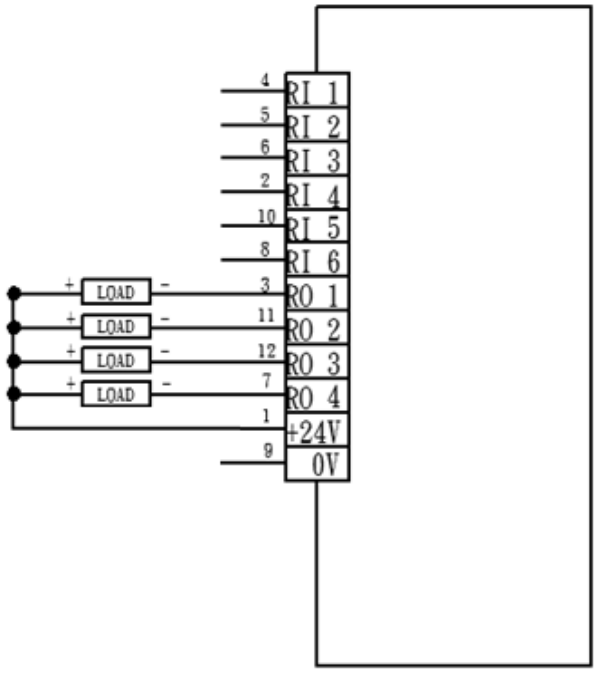


Figure 3-7 Wiring diagram of output (Standard: Sinking type)

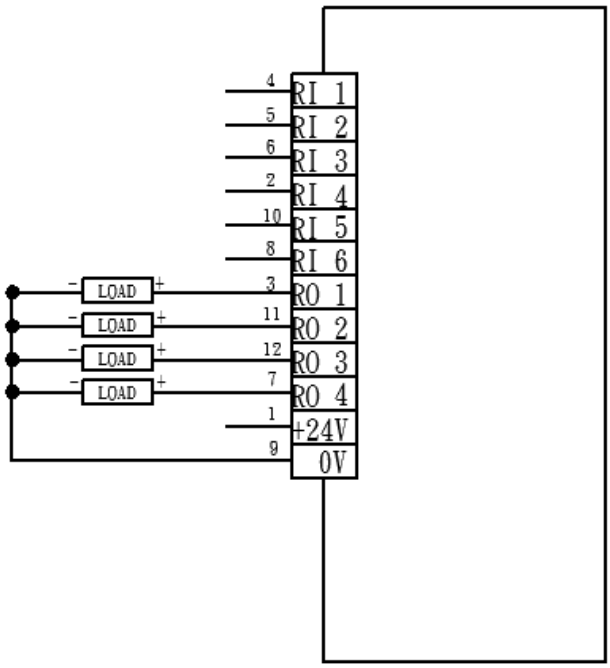


Figure 3-8 Wiring diagram of output (Optional: Sourcing type)

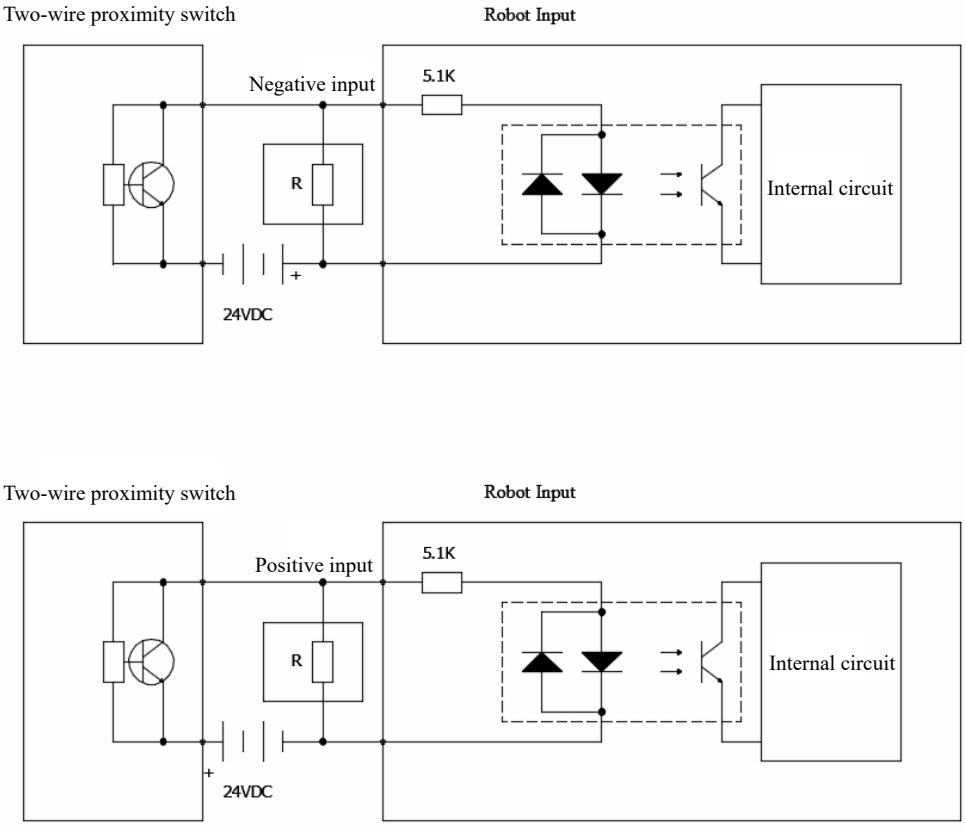


Figure 3-9 Two-wire proximity switch wiring diagram

⚠ CAUTION	❖ Pin 1 and pin 9 are used for signal, not for power input of end effector. ❖ The maximum output current at each pin is 100mA. ❖ Two-wire proximity switch may cause Robot Input error action occur due to residual voltage. Therefore, if you want to use two-wire proximity switch, you should connect it according to Figure 3-9 and select the matching R value.

4. Zero-Position

4.1 Zero Position Setting

The calibration tools (HIWIN part no.: 4C201EK2) for setting Zero-position are shown in Figure 4-1. The robot is 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.

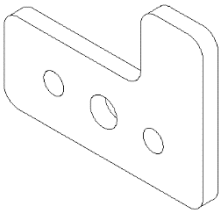
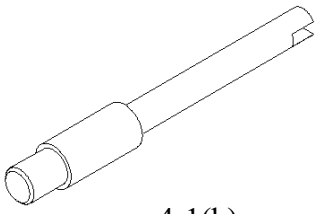


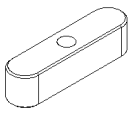
Figure 4-1(a)

Calibration tool (A)



4-1(b)

Calibration tool (B)



4-1(c)

Calibration tool (C)

Figure 4-1 The calibration tool set

- J1-axis Zero-position setting
  - Step1. Secure the calibration tool (A) on J1-axis by using positioning pin and screws.
  - Step2. Operate J1 at low speed to align the positioning surface of J2 with the calibration tool (A).
  - Step3. Finish calibration and remove the calibration tool (A).
  - Step4. Record origin position through HRSS.
  - Step5. Zero-position setting of J1-axis is completed.

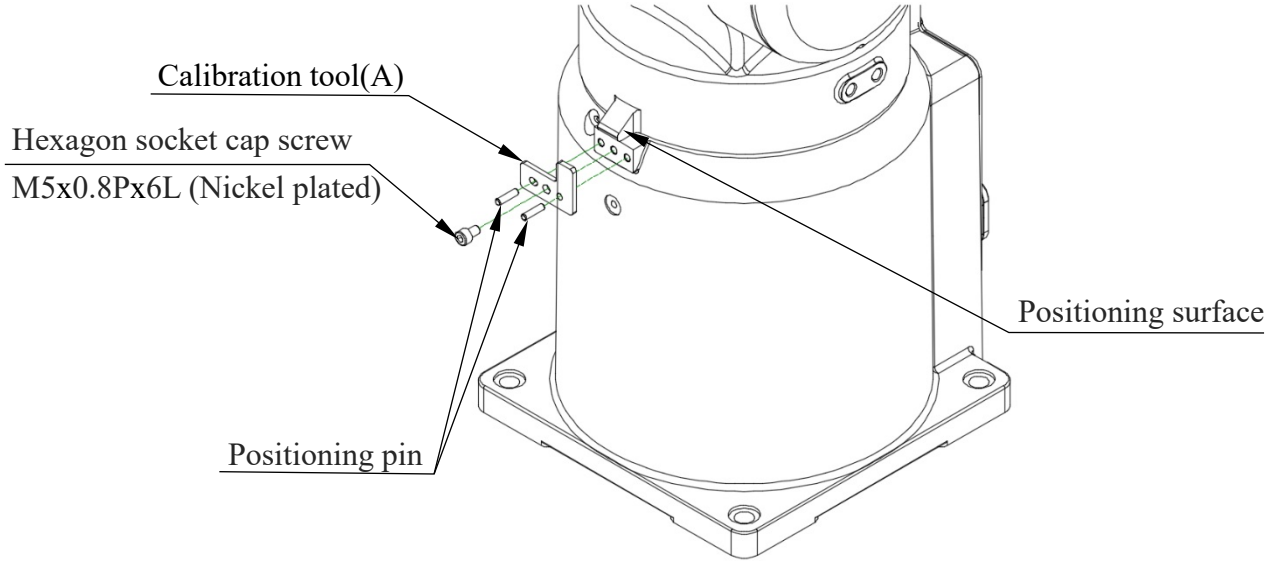


Figure 4-2 Illustration of J1-axis Zero-position setting

- 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 (B) to the pinhole to calibrate Zero-position.
  - Step3. Finish calibration and remove the calibration tool.
  - Step4. Record origin position through HRSS.
  - Step5. Zero-position setting of J2-axis is completed.

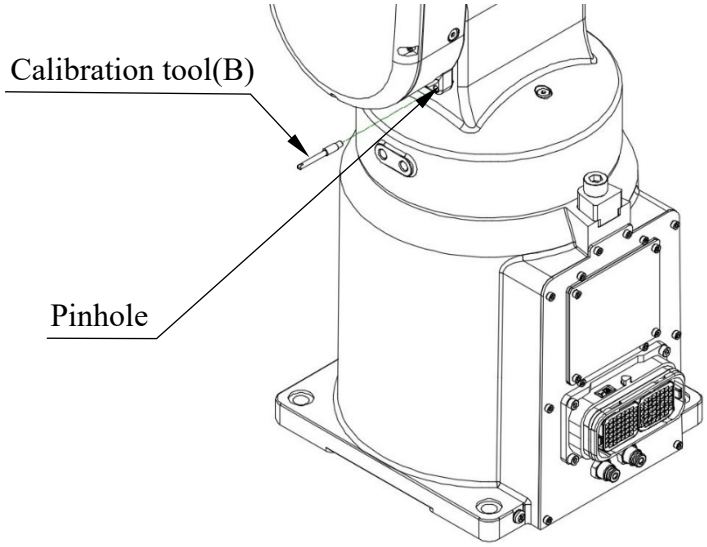


Figure 4-3 Illustration of J2-axis Zero-position setting

- 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 (B) to the pinhole to calibrate Zero-position.
  - Step3. Finish calibration and remove the calibration tool.
  - Step4. Record origin position through HRSS.
  - Step5. Zero-position setting of J3-axis is completed.

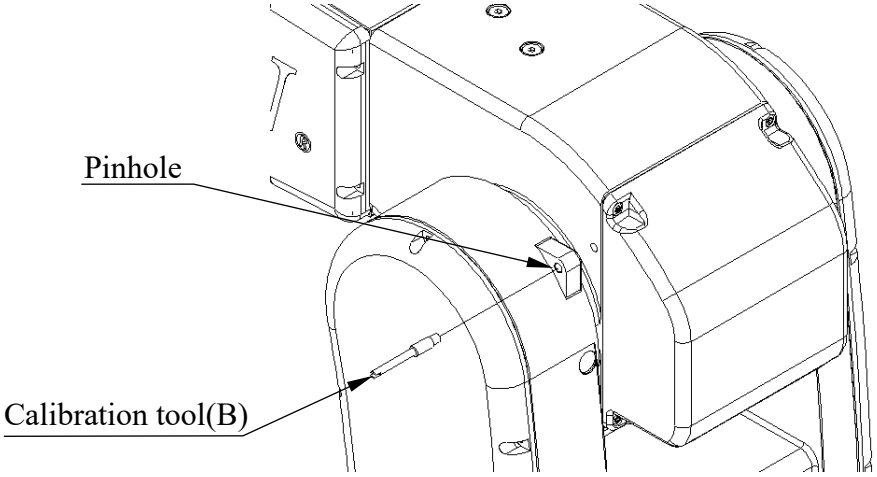


Figure 4-4 Illustration of J3-axis Zero-position setting

- 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 (C) to the keyway to calibrate Zero-position. (hexagon socket cap screw can be screwed first in calibration tool)
  - Step3. Finish the calibration and remove the calibration tool using hexagon socket cap screw.
  - Step4. Record origin position through HRSS.
  - Step5. Zero-position setting of J4-axis is completed.

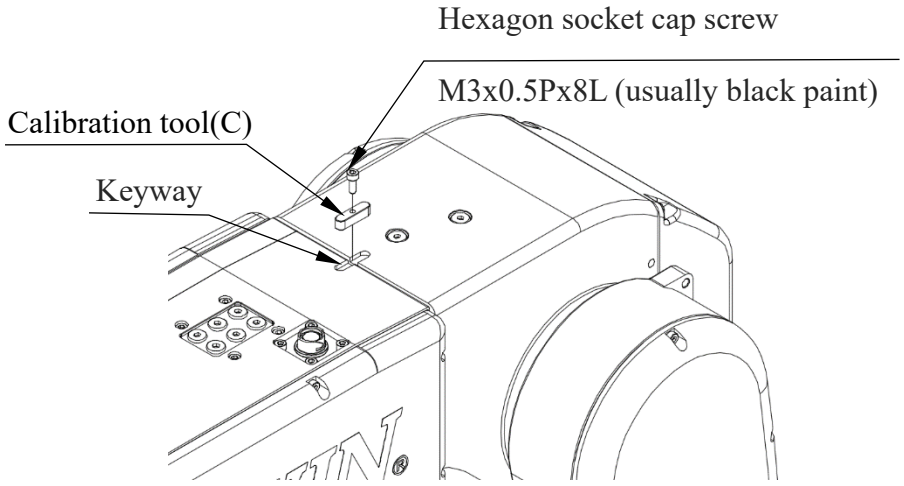


Figure 4-5(a) Illustration of J4-axis Zero-position setting

- RT605-909-GB 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 (C) to the keyway to calibrate Zero-position. (hexagon socket cap screw can be screwed first in calibration tool)
  - Step3. Finish the calibration and remove the calibration tool using hexagon socket cap screw.
  - Step4. Record origin position through HRSS.
  - Step5. Zero-position setting of J4-axis is completed.

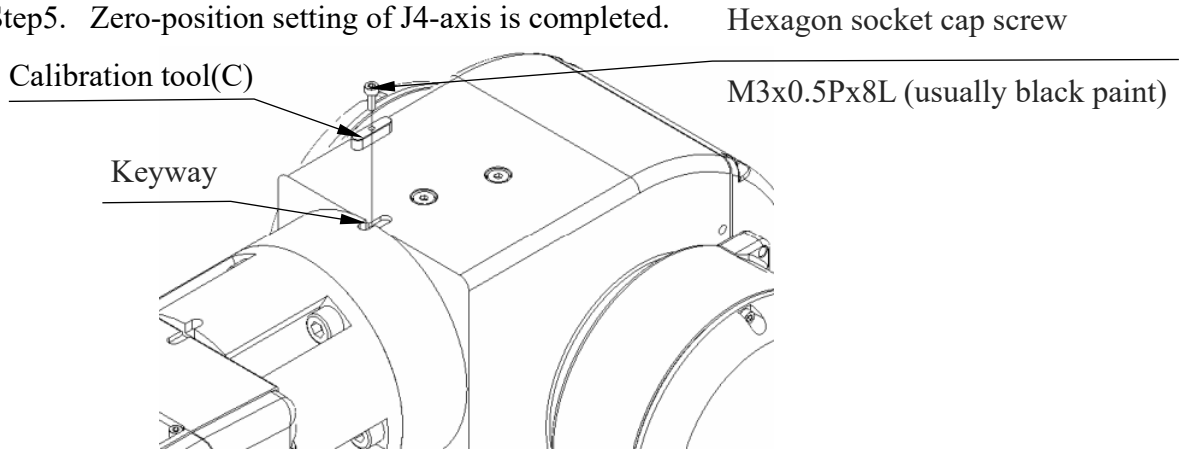


Figure 4-5(b) Illustration of RT605-909-GB J4-axis Zero-position setting

- 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 (B) to the keyway to calibrate Zero-position.
  - Step3. Finish the calibration and remove the calibration tool.
  - Step4. Record origin position through HRSS.
  - Step5. Zero-position setting of J5-axis is completed.

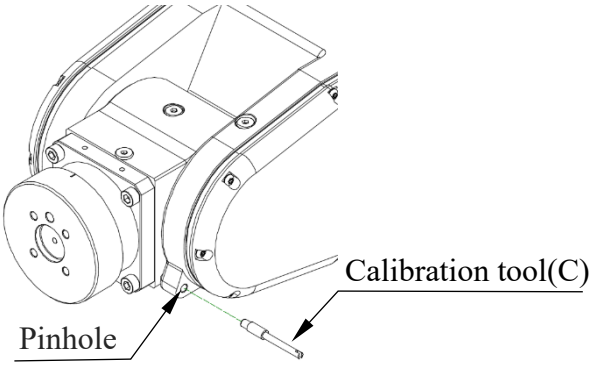


Figure 4-6 Illustration of J5-axis Zero-position setting

- J6-axis Zero-position setting
  - Step1. Operate J6 at low speed to align the calibration mark of end effector with the mark of J6.
  - Step2. Record origin position through HRSS.
  - Step3. Zero-position setting of J5-axis is completed.

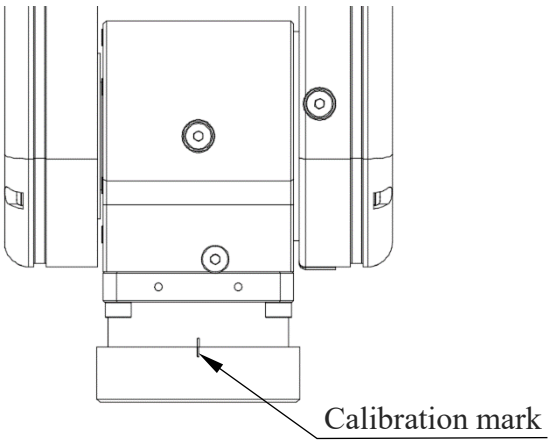


Figure 4-7 Illustration of J6 -axis Zero-position setting

⊙ Clear encoder by HRSS

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

Step2. Move the robot to the Zero-position. (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)

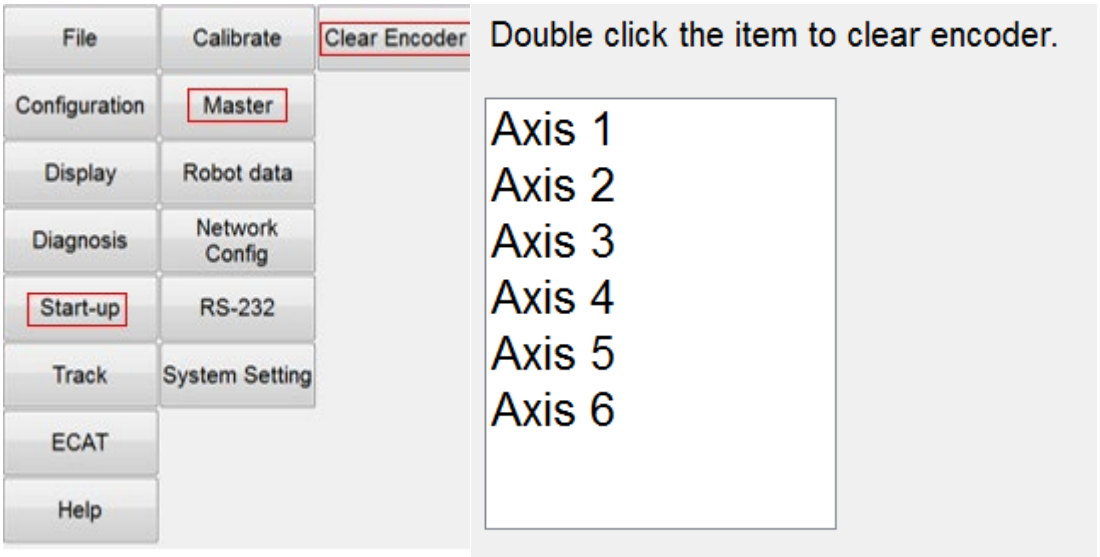


Figure 4-8 Clear encoder by HRSS

5. 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. If necessary, please purchase this device to comply with CE.

 **WARNING**	❖ This device can only be executed by trained staff. ❖ 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. ❖ Please firmly secure the robot on smooth floor to prevent robot tilting, falling or an unexpected movement. ❖ Please use the socket with grounding and ensure the grounding is firmly connected. If not, there would be a risk of electric shock.

5.2 Confirmation before Using

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

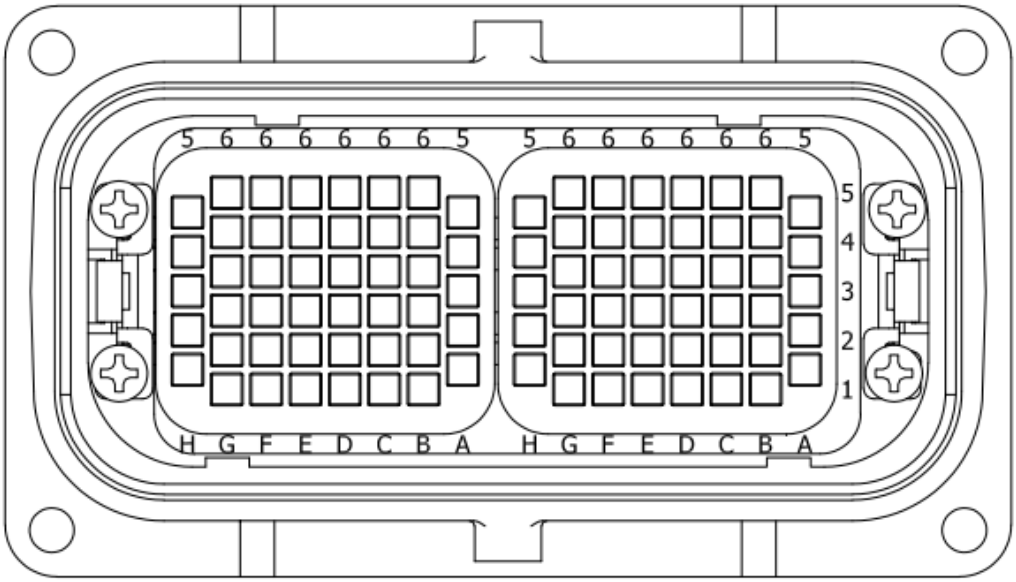
(1) Please make sure CN2 connector is matched with the corresponding robot by checking the model name label affixed on the cover of this device.
(2) Please do not use this device if the manual brake release device and the cable have damages on the appearance.
(3) Please make sure the voltage of power 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:

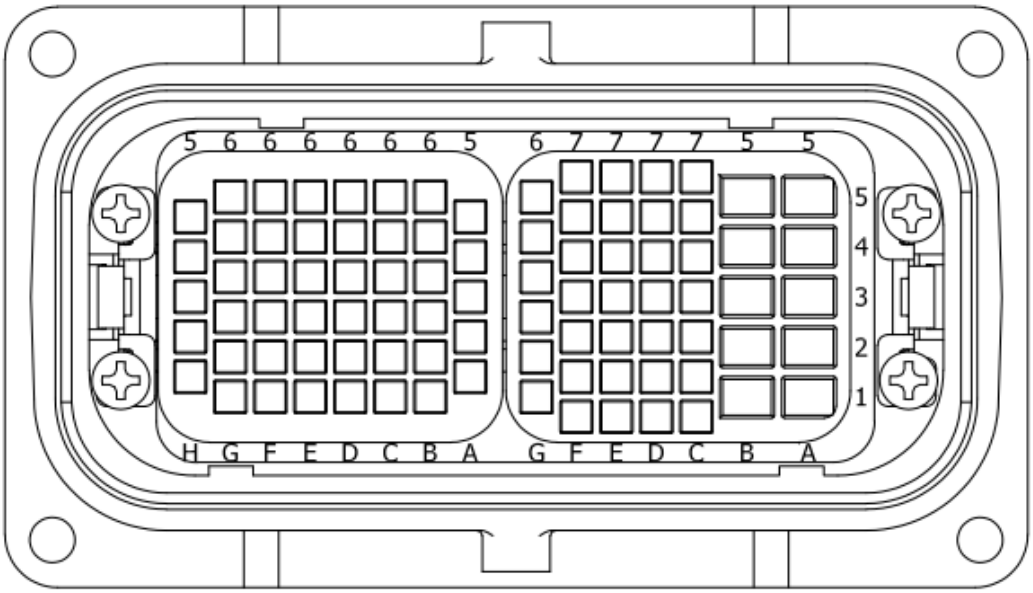
Item		HIWIN Manual Brake Release Device
Model name		RA605-XXX-(CE)-GB RT605-XXX-(CE)-GB
Power	Input voltage (VAC)	Single phase, 100-240
	Output voltage (VDC)	24
	Voltage frequency (Hz)	50/60
	Max. rated current (A)	2
Dimension		140x170x95 mm^3
Weight		1.74kg
Protection rating		IP20
Ambient temperature (°C)		0-45
Relative humidity (%RH)		50~75 (non-condensing)

Corresponding manipulator model name:

1. RA605-XXX-(CE)-GB 、 RT605-XXX-(CE)-GB:

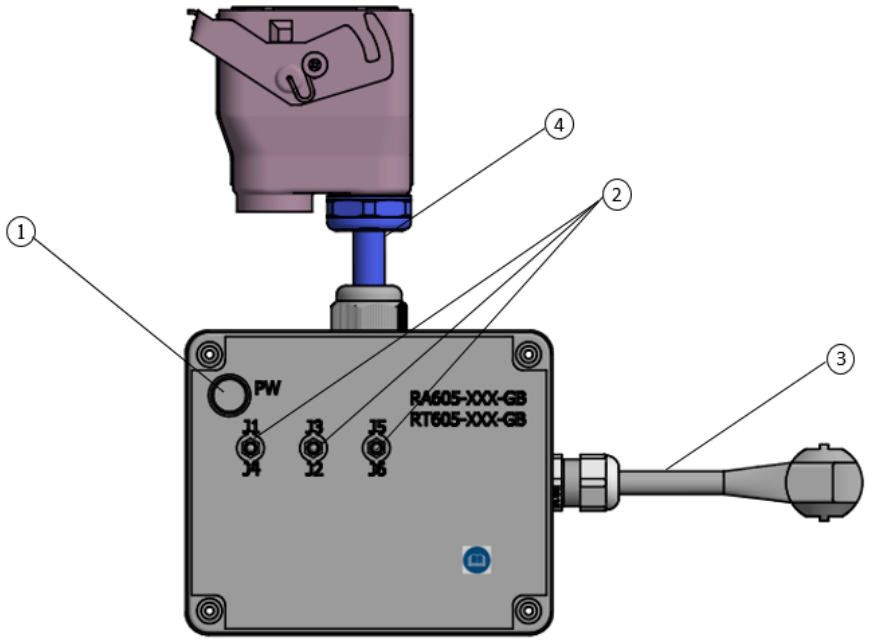


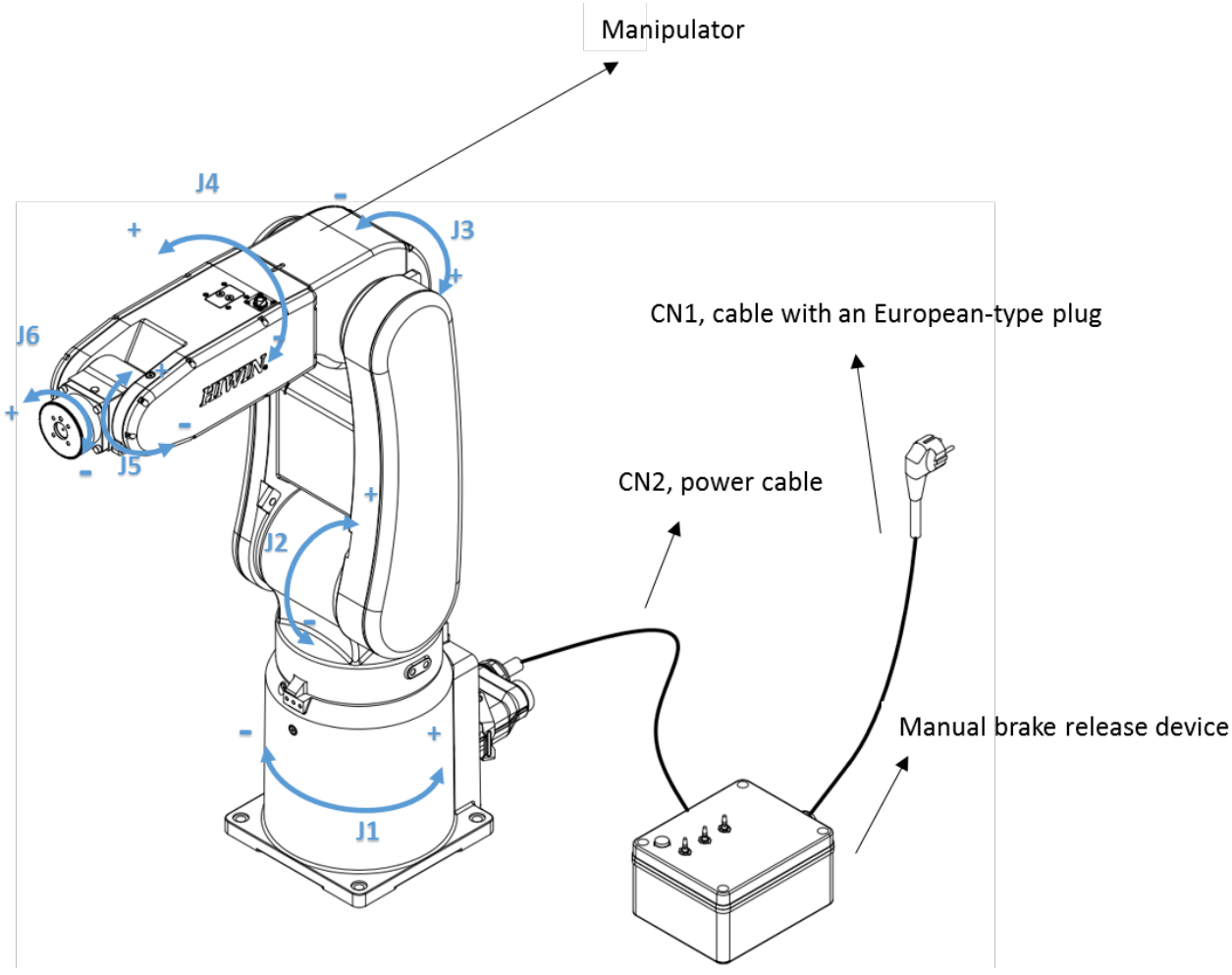
2. RA610-XXXX-GB 、 RT610-XXXX-GB



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.

WARNING	❖ 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.

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 as well as internal maintenance, 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.

6.1 Maintenance and Check Interval

The maintenance and check can be classified as the daily and periodical inspection procedures, where the items in the daily inspection include the power on/off and operation, representing those before the power on/off and programming respectively, as shown in Table 6-1. The items in the periodical inspection includes those for the routine check A,B,C,D and E. The check contents are shown in Table 6-2. The timetable can be worked out according to periodical inspection, as shown in Table 6-3. By well doing the inspection items, it can ensure the product safety in the reasonable product life time and avoid risk of product malfunction.

Table 6-1 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 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. If loosen, please ensure the cables are securely connected.
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. If needed, please contact HIWIN directly.
After turning power ON		
1	Is there any unusual motion or unusual noise when power is ON?	1. The robot installation screws might not be securely tightened to the installation surface. Securely tighten the screws to appropriate torque.

		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 replace the base to make it more rigid. 4. There might be foreign material between the robot and the installation surface. Please remove it. 5. Some operating positions might exceed the mechanism limit. Please reduce the load, speed or acceleration. 6. The timing belt might loosen or not be in correct position. 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 period of time. Please change the grease. (Refer to section 5.2.3) 8. If the above situations has been excluded, it is likely that the rolling surface of bearing or the gear tooth surface of reducer has been damaged. Please contact HIWIN directly.
2	The repeatability is not within the tolerance.	1. The Zero-position of the robot might be rewritten. Please set the Zero-position. (Refer to section 4.1)。 2. The Zero-position data will be lost if the backup batteries is dead. Please replace the backup batteries (Refer to section 5.2.1) and set the Zero-position. (Refer to section 4.1)。 3. The Robot J1 base retaining bolt might loosen. Please apply LOCTITE and tighten it to the appropriate torque.

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

Table 6-2 Periodic inspection items

	Inspection item	Remedies
Inspection item A (1 month / 320 hours)		
1	Check if there are any cracks and flows on the robot.	Clean and check each part of the robot.
2	Are any of the screws on the manipulator loose?	Securely tighten the screws.
3	Are any of the connector fixing screws or terminal block terminal screws loosen?	Securely tighten the screws.
Inspection item B (3 months / 960 hours)		
1	Check the ventilation system of the controller.	If it is dusty, turn off the power and clean the ventilation system of the controller
Inspection item C (6 months / 1920 hours)		
1	Check whether the friction at the timing belt teeth is severe.	If the teeth are missing or the friction at the timing belt is severe, replace it. Refer to section 5.2.2.
2	Check whether the tension of timing belts at each axis is abnormal or deviated.	Refer to 5.2.2 Adjust the tension to the standard value, and avoid over tightness or looseness.
Inspection item D (1year / 3840 hours)		
1	Replace the backup battery in the manipulator.	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	❖ 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.

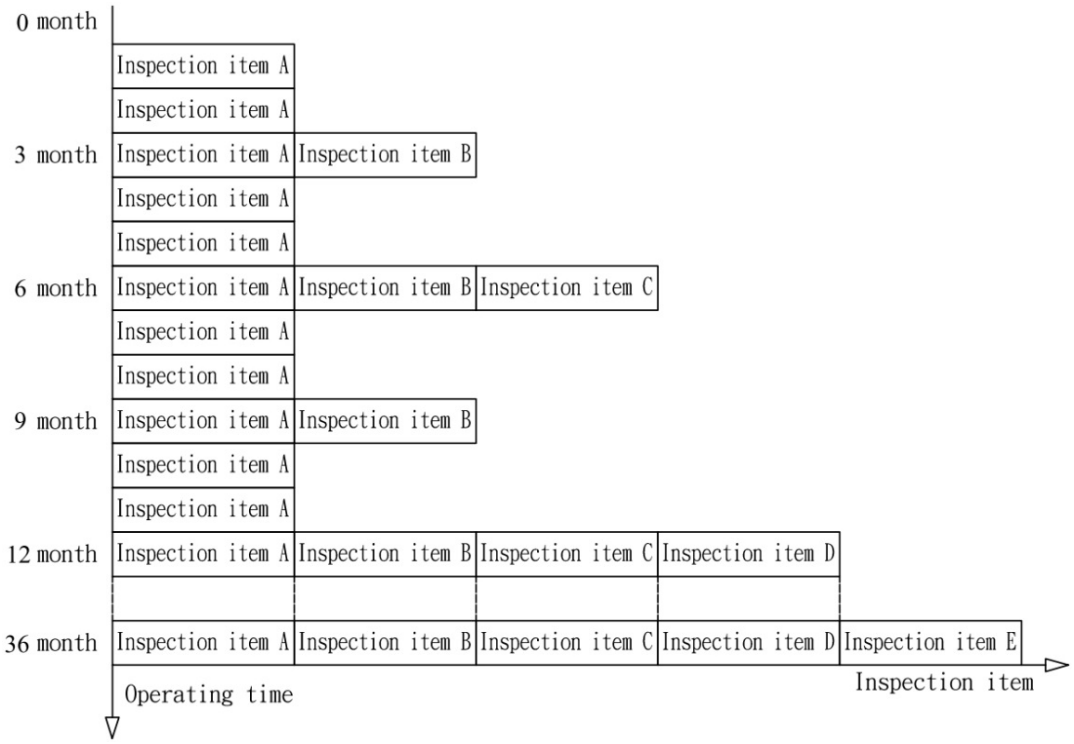


Table 6-3 Inspection schedule

6.2 Repair

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. Keep the power ON.
Step3. Please remove the battery cover. The screws for battery cover are hexagon head screws (M3×0.5P×6L) and the four batteries are 3.6V.
Step4. Replace the battery one by one. If all batteries are removed at the same time, the position data will be lost. If so, please reset the robot to the Zero-position. All batteries should be changed one at a time.
Step5. After replacing the battery, ensure to install the battery cover to prevent the robot being damaged by dust and grease.

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

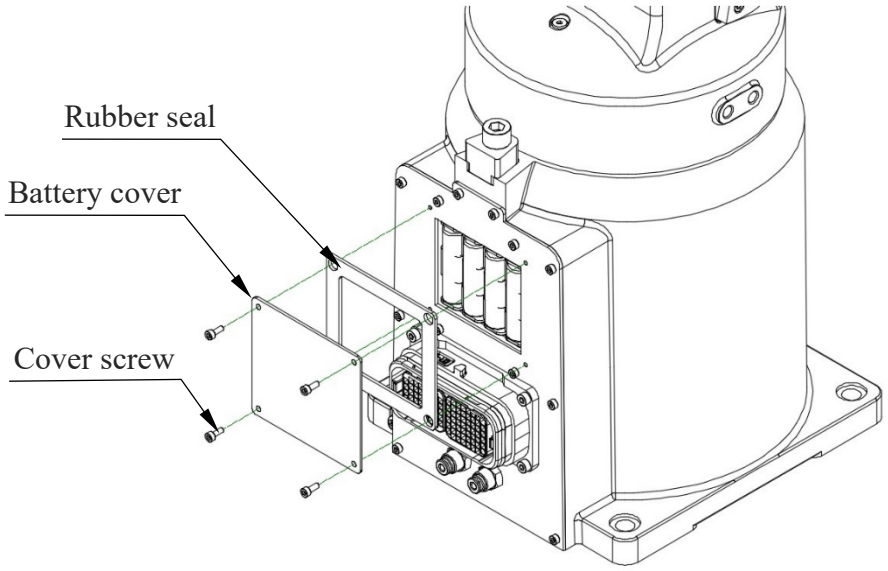


Figure 6-1 The backup batteries replacement

6.2.2 Timing Belt Replacement

The timing belt is used in the robot for the driver system of the J2, J3, 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.
(RA605-GB, RT605-GB replacement of the timing belt are similar, take RA605-GB as an example)

⊙ Timing Belt replacement period

Check the timing belt about every 6 months. The timing belt must be replaced if the belt teeth is found cracked, worn to approximately half of the tooth width, or broken.

CAUTION	❖ 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-point setting.

⊙ 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. When the belt is adjusted to the certain extent, you can feel the tension by your finger. If belt is too loose, it will vibrate; on the contrary, you will hear the sharp sound if it is too tight, and the belt is excessively worn. The sonic tension meter is used to measure the belt tension. The specifications and standard tension of belt are shown in Table 6-4.

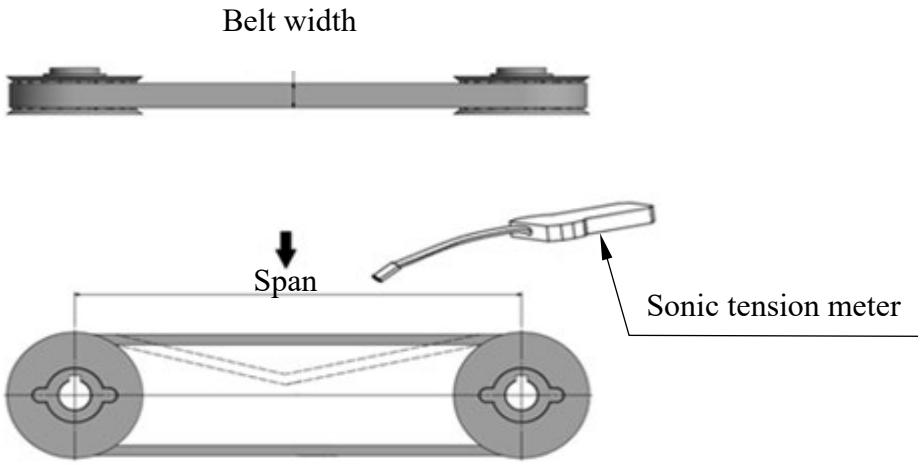


Figure 6-2 Belt tension measurement

⚠ CAUTION	❖ 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. ❖ After the robot is operated about 300 hours, the rubbers worn by the belt will be accumulated on the cover. Those rubber come out due to the friction, not the broken. Please use cleaning rag to wipe them out and let the robot continue the work. If the rubbers appear soon after cleaning it, please wipe them again and replace the belt.

Table 6-4 The belt specifications

Axis	Applicable model	Belt type	Width(mm)	Span(mm)	Tension(N)
2	RA605-710-GB	365-5GT-9	9	117.5	55
	RT605-710-GB				
	RT605-909-GB	375-5GT-9		116.9	
3	RA605-710-GB	440-5GT-9	9	154.9	55
	RT605-710-GB				
	RT605-909-GB	635-5GT-9		254.9	
5	Share	285-3GT-6	6	100.3	29
6	Share	285-3GT-6	6	100.3	29

⚠ CAUTION	❖ If the belt of J1 and J4 need to be replaced, please contact HIWIN.

⊙ Cover removal

Before replacing the belt, remove the cover of J3 and J5 as shown in Figure 6-3. (RA605-710-GB has protection rating of IP65, sealing gasket is provided inside the cover. When removing the cover, if the gasket is peeled off, sealant can be used to re-tighten the seal on the cover.)

Model	Screw Type	Screw Specification
RA605-710-GB	Tethered screw	M3x0.5Px10L
RT605-710-GB	Hexagon socket head cap screw	M3x0.5Px10L
RT605-909-GB	Hexagon socket head cap screw	M3x0.5Px10L

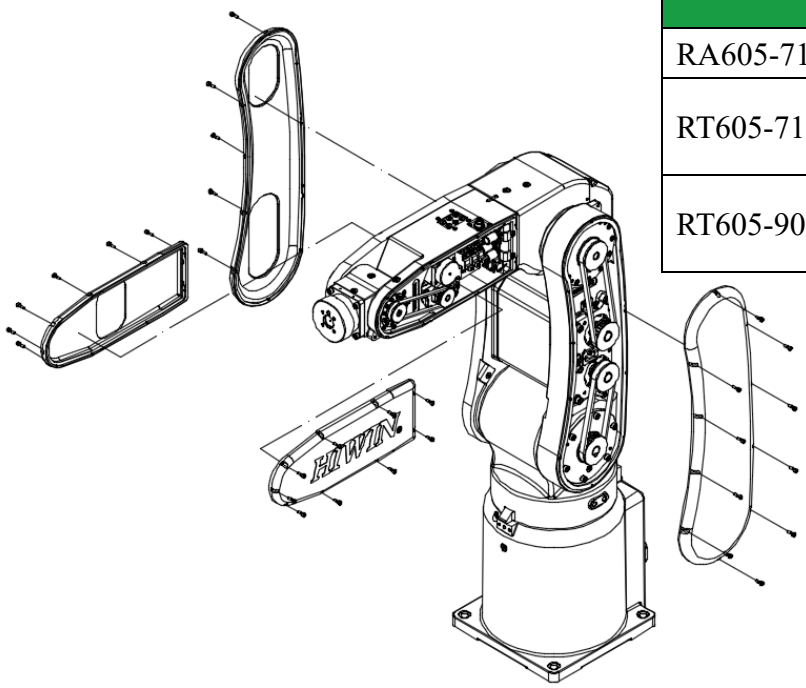


Figure 6-3 Cover removal diagram

⊙ Inspection, maintenance and replacement of timing belt in J2-axis.

Figure 6-4 shows the structure of J2-axis.

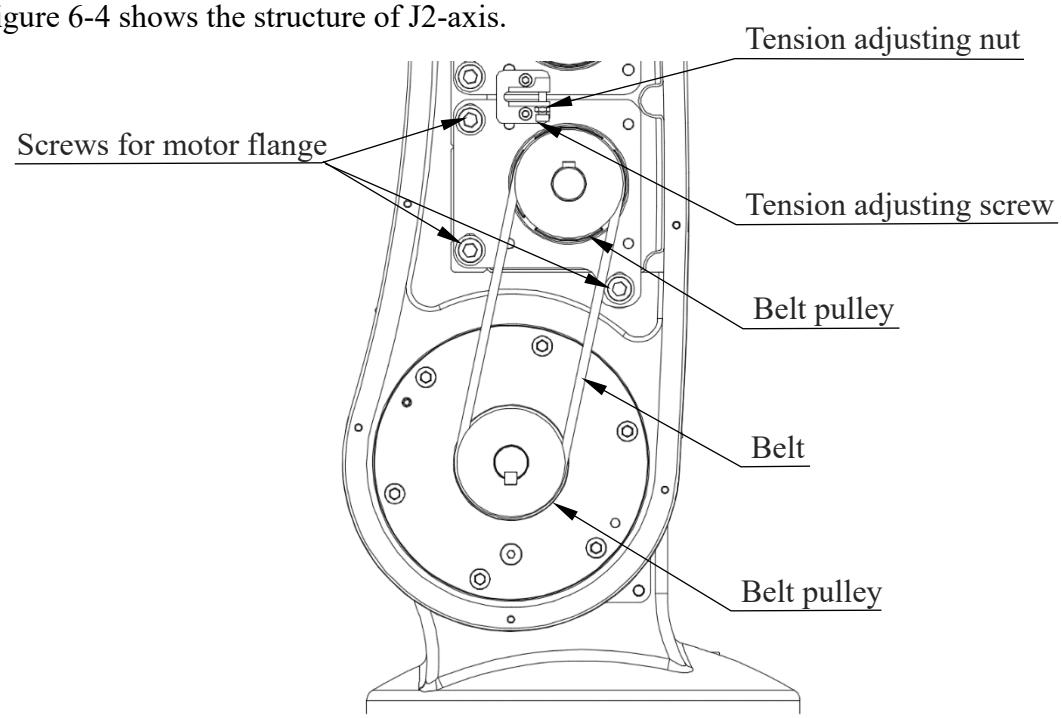


Figure 6-4 J2-axis structure diagram

- Inspect J2-axis timing belt
  - Step1. Ensure the power of controller is switched off.
  - Step2. Remove the cover of J3.
  - 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 J2-axis timing belt
  - Step1. Loose the two fixing screws on motor flange, so that the motor can be move. 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. (Screw pounds 2.2N-m)
- Replace J2-axis timing belt
  - Step1. Remove the two fixing screws on motor plate.
  - Step2. Loose the adjusting screw to replace the timing belt.
  - Step3. After replacing the belt, refer to the paragraph “Adjust J2-axis timing belt” above to adjust the tension of the belt.

⊙ Inspection, maintenance and replacement of timing belt in J3-axis.

Figure 6-5 shows the structure of J3-axis.

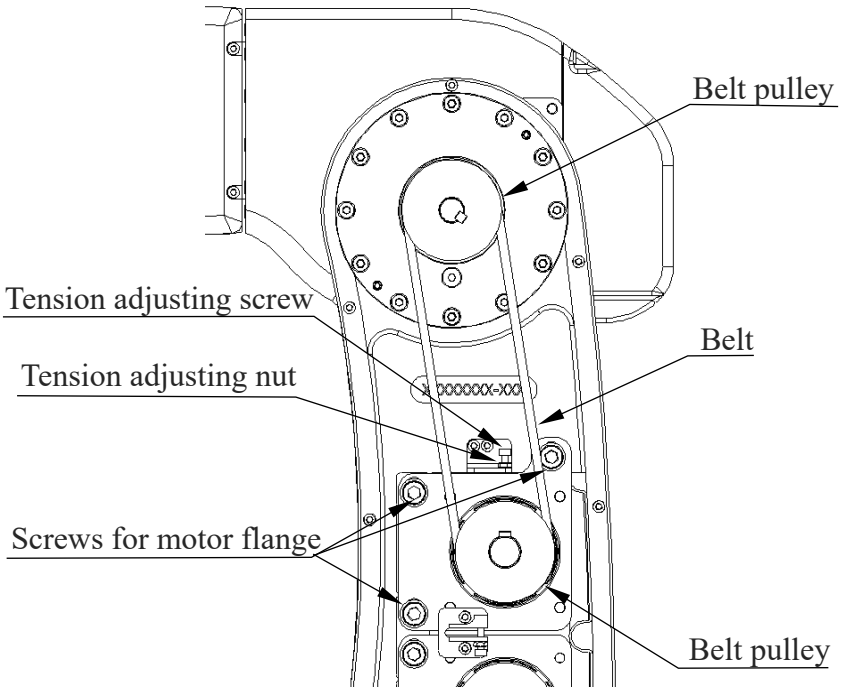


Figure 6-5 J3-axis structure diagram

- Inspect J3-axis timing belt
  - Step1. Ensure the power of controller is switched off.
  - Step2. Remove the cover of J3.
  - 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 J3-axis timing belt
  - Step1. Loose the two fixing screws on motor flange, so that the motor can be move. 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.
- Replace J3-axis timing belt
  - Step1. Remove the two fixing screws on motor plate.
  - Step2. Loose the adjusting screw to replace the timing belt.
  - Step3. After replacing the belt, refer to the paragraph “Adjust J3-axis timing belt” above to adjust the tension of the belt.

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

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

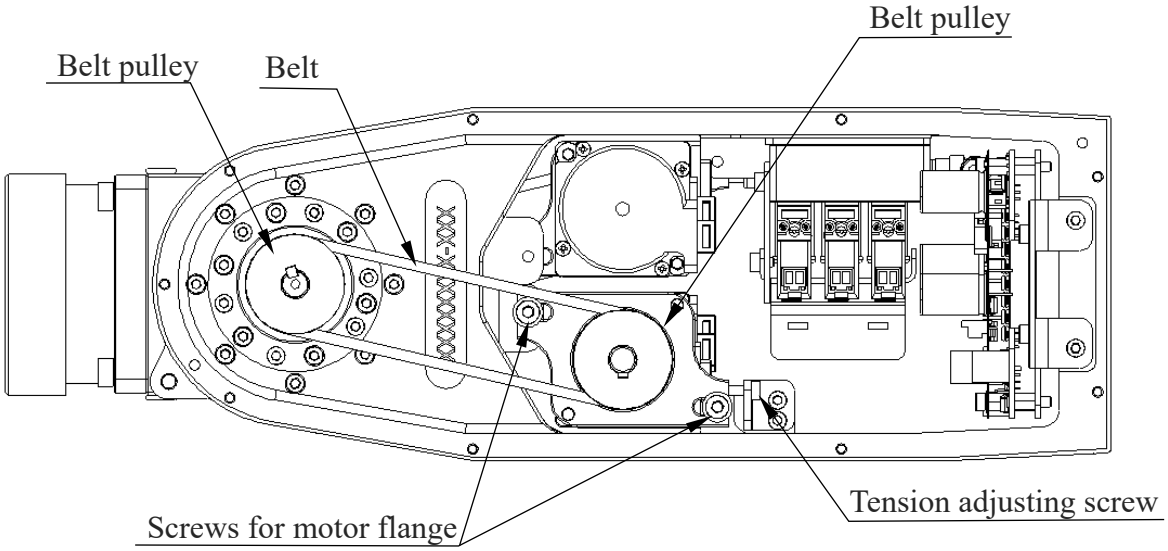


Figure 6-6 J5-axis structure diagram

- 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. Loose the two fixing screws on motor flange, so that the motor can be move. 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.
- Replace J5-axis timing belt
  - Step1. Remove the two fixing screws on motor plate.
  - Step2. Loose 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 timing belt in J6-axis.

Figure 6-7 shows the structure of J6-axis.

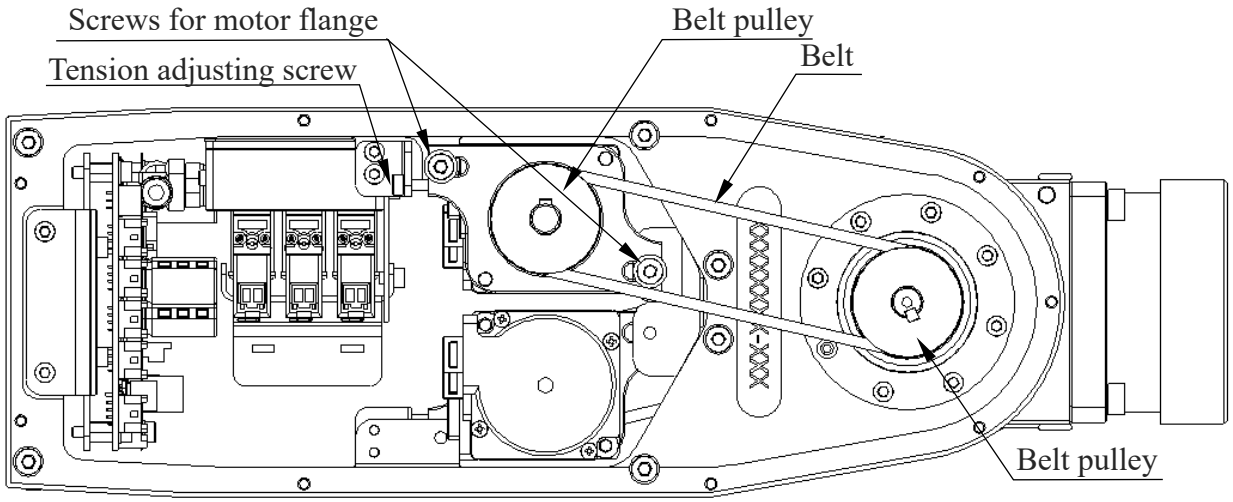


Figure 6-7 J6-axis structure diagram

- Inspect J6-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 J6-axis timing belt
  - Step1. Loose the two fixing screws on motor flange, so that the motor can be move. 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.
- Replace J6-axis timing belt
  - Step1. Remove the two fixing screws on motor plate.
  - Step2. Loose 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 Replenishment

⊙ The grease inlets and outlet are shown in Figure 6-8.

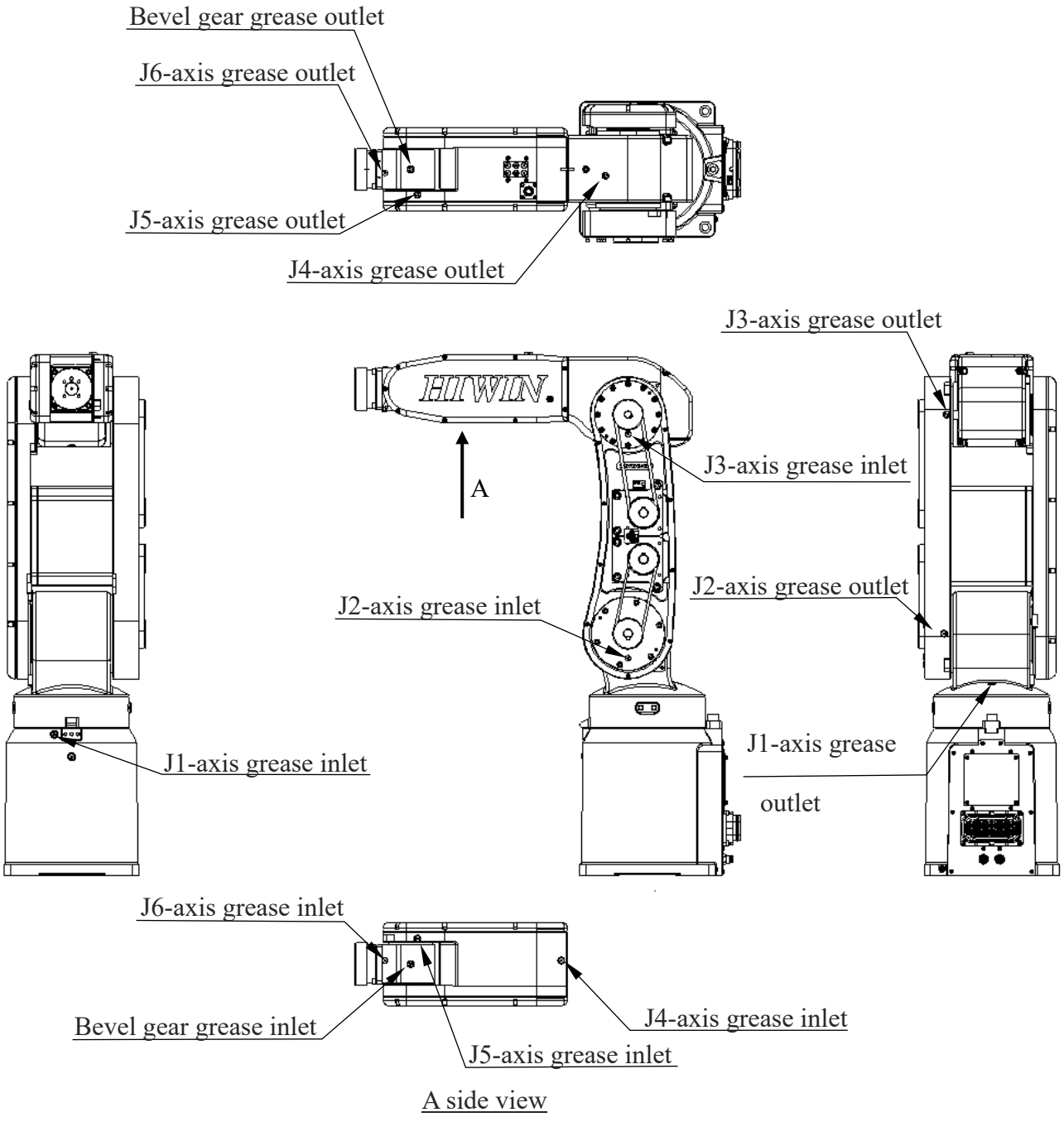


Figure 6-8 Lubrication and air inlet/outlet positions

⊙ Grease specification

Table 6-5 shows the specification of grease.

Table 6-5 Grease specification

Part	Grease nipple	Lubrication grease	Quantity	Lubrication interval
J1 reduction gear	M6	SK-1A	93.3 ml	3Year /11520Hr
J2 reduction gear	M5	SK-1A	66.6 ml	
J3 reduction gear	M5	SK-1A	33.3 ml	
J4 reduction gear	M5	SK-1A	20 ml	
J5 reduction gear	M5	SK-2	6.1 ml	
J6 reduction gear	M5	SK-2	6.1 ml	
Bevel gear	M5	SK-2	11.2 ml	

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

[Note2]：The J3 cover needs to be removed for J2 grease replacement.

⊙ Procedure of grease replenishment

Step1. The grease inlets and the outlets of the robot are shown in Figure 6-9.
Step2. Remove the screw of the grease inlet, and install the grease nipple.
Step3. Remove the screw of the grease outlet.
Step4. Replenish the grease from the grease inlet by the grease gun.
Step5. Refer to Table 6-5 for the amount of grease.
Step6. Install the screw of the grease outlet.
Step7. Remove the grease nipple, and install the screw of the grease inlet.

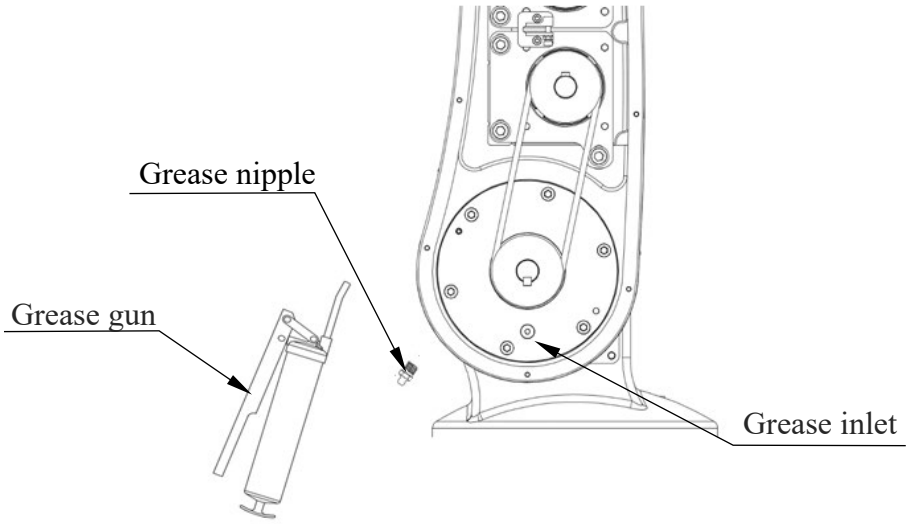


Figure 6-9 Grease replenishment

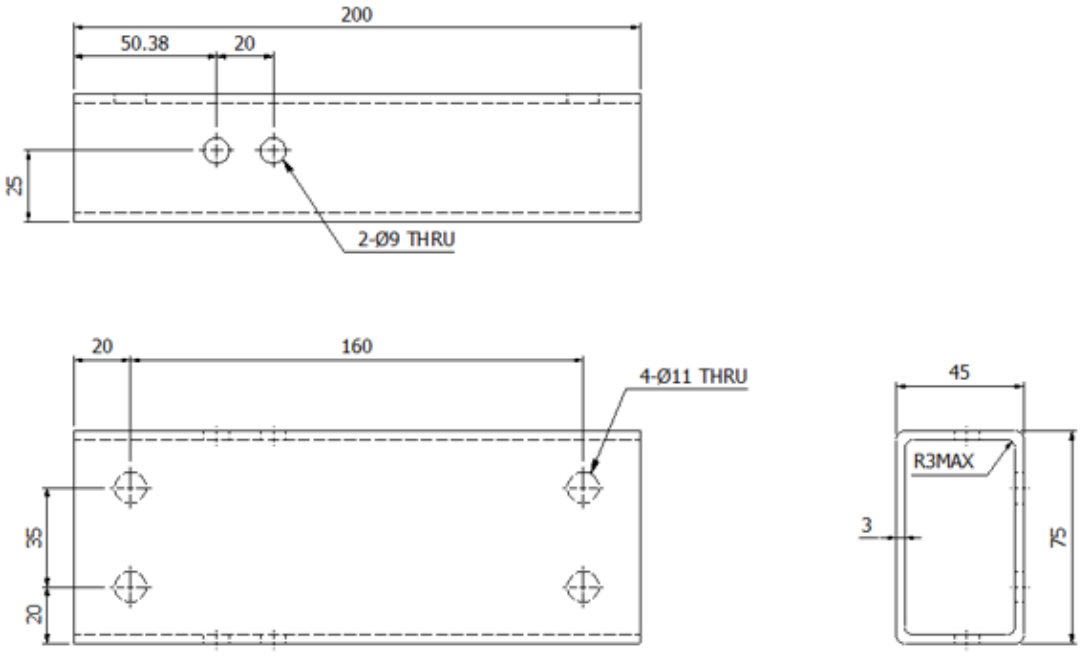
7. Safety Certification

RA605 achieve CE certification.

CE Compliance	
Machinery Directives	2006/42/EC
Low Voltage Directives (LVD)	2014/35/EU
Robots for Industrial Environment	EN ISO 10218-1:2011
Safety of Machinery	EN ISO 12100:2010
	EN ISO 13849-1:2015
	EN 60204-1:2006+AC:2010
Electromagnetic Compatibility Directives (EMC)	EN 61000-6-2:2005
	EN 61000-6-4:2007+A1:2011

8. Appendix

Suspension plate (refer to section 1.1)



Articulated Robot - RA605-GB, RT605-GB (Original Instruction)
User Manual

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