SCARA Robot Syetem User Manual

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Smarter. Greener. Together.

Foreword

Thank you for using this product. This manual provides users with contents that must be followed in order to safely operate the robot. It contains information related to the Delta SCARA industrial robot series. Before operating the robot, please read this manual carefully in order to ensure your safety and proper usage. In addition, please keep it at a safe location to read at any time.
This manual applies to robots DRS40L/50L/60L/70L/60H CE series
This manual applies to the robot controller DCS-1B00-CA.
The robots DRS40L/50L/60L/70L/60H CE series can only work with our company's controller DCS-1B00-CA. Please do not modify the robot and controller on your own or use it with other robots and controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.

The following are the robot models and document numbers and versions that this manual applies to.

Published by: Delta Electronics Inc.
Applicable robot system: DRS40L/50L/60L/70L/60H CE series
Document number: DRS-CE-01
Version: V0.0

Contents of this manual include:

- Usage safety precautions.
- Transportation and installation.
- Safety protection.
- Robot and controller installation and operations.
- Operations and instructions.
- Testing and maintenance.

Due to operating environment and operator safety considerations, our company will provide dedicated training according to the different robot application staff; please contact your local dealer if related training courses are needed.

This operating manual is suitable as reference for the following users:

- System integrator and designer.
- Installation or wiring staff.
- Testing and tuning staff.
- Maintenance or inspection staff.

Please read this manual carefully before operating in order to ensure proper usage. The following steps must be followed before you start reading this manual:

- Please set the robot in a safe and protected location such as a place with railings and gratings, etc. and do not operate the robot outside the safety protection, otherwise it may cause injuries to the operator.
- The installation environment must have no steam, corrosive gas or flammable gas as it may cause accidents such as malfunctions or explosions.
- Wiring must be done as it might cause damage to the robot controller
- Grounding works must be implemented properly.
- Do not dismantle or change the wiring while powered on, otherwise it may result in electrical shocks.
- Please ensure that the emergency stop device can be enabled at any time before powering it on for operations.
- The power of the controller must be turned off before repairs or maintenance.
- Do not get close to the operating range of the robot before or after powering on for operations, and leave a warning at an obvious place to prevent injuries or fatalities to the staff.

If you still have questions concerning the usage, please contact a dealer or our company's customer service center.

No further notifications will be given for any changes in the contents or specifications of this manual. Please download the latest version from the Delta website.

Model name：

Series	Model Name	Controller	TP
DRS40L	DRS40L3SSADF003	DCS-1B00-CA	DTS-2FM
	DRS40L3SSADN003		
	DRS40L3SOADF003		DTS-2FM
	DRS40L3SOADN003		
DRS50L	DRS50L6SSADF003		DTS-2FM
	DRS50L6SSADN003		
	DRS50L6SOADF003		DTS-2FM
	DRS50L6SOADN003		
	DRS50L6OSADF003		DTS-2FM
	DRS50L6OSADN003		
DRS60L	DRS60L6SSADF003		DTS-2FM
	DRS60L6SSADN003		
	DRS60L6SOADF003		DTS-2FM
	DRS60L6SOADN003		
	DRS60L6OSADF003		DTS-2FM
	DRS60L6OSADN003		
	DRS60L3SSADF003		DTS-2FM
	DRS60L3SSADN003		
	DRS60L3SOADF003		DTS-2FM
	DRS60L3SOADN003		
DRS70L	DRS70L6SSADF003		DTS-2FM
	DRS70L6SSADF003		
	DRS70L6SOADF003		DTS-2FM
	DRS70L6SOADN003		
	DRS70L6OSADF003		DTS-2FM
	DRS70L6OSADN003		
DRS60H	DRS60H6SSADF003		DTS-2FM
	DRS60H6SSADN003		

Safety Notice

This manual includes safety precautions on user safety and how to prevent the robot from getting damaged, warnings and notes are used in this manual to describe how important these safety precautions are. Warnings are used to describe supplementary explanations, users must read the items in the warning, danger and stop carefully in order to prevent accidents or causing injuries to the staff.
The installation and transportation of the robot should be executed by qualified personnel and should comply with the regional / country and local laws and regulation requirements.
The integration of the robot and the robot's peripherals as well as the construction of the safety protection device should be executed by the final system integrator in order to ensure the overall safety of the system.
This robot was designed only as an accessory for specific applications. We strongly suggest that this robot should not be modified and / or used for any application processes other than what it was designed for. If you have any application problems, please do not use the robot until you have received detailed explanations from your dealer.

Definition of operators

The definition of robot operators is as follows.

Operator

- Able to perform operations such as powering the controller ON/OFF.
- Able to start the robot from the final system integrated operation panel.

Program editor

- Performs the operations on the robot.
- Uses manual mode to operate the robot or teach points, etc. outside the safety railings.

Repair or inspection personnel

- Perform simple operations of the robot.
- Uses manual mode to operate the robot outside the safety railings.
- Performs operations such as maintenance, repairs, adjustment and replacement, etc. to the robot and controller.

FIRST RUN,

Product conforms to the Machinery Directive 2006/42/EC, Low Voltage Directive 2014/35/EU, EMC Directive 2014/30/EU and related standards EN ISO 12100, EN ISO 10218-1, EN ISO 13857, EN ISO 4414, EN ISO 13849-1, EN60204-1, EN 61000-6-2, EN 61000-6- 4, EN 61000-3-2, EN 61000-3-3.

Note: Please read the manual carefully before operating, maintaining or inspecting the robot and controller, and make sure to follow the safety regulations. Please contact our company for details if you have any questions.

Definitions of stop, Danger and Warning

For your safety, please read this manual before using the robot and have a clear understanding of all contents related to safety and warnings.
Robot operators must receive training, read and understand how to use the safety measures, also to follow and execute all the rules described in this manual.

Meanings of the symbols “Danger”, “Warning” and “Prohibited”.

Danger 	Means that danger is about to happen and may result in fatalities or severe injuries to the staff, if not prevented.
Warning 	Means that there is potential danger and may result in fatalities or severe injuries to the staff, if not prevented.
Stop 	Refers to activities that are absolutely prohibited; failure to comply may result in damage or malfunctions to the product causing the product to be unusable or it may result in injuries to the staff.
Noise prevention 	There is excessive noise that may affect the hearing when the robot is operating; operators should wear earmuffs if feeling any discomfort.

Installation safety

- Please read this manual carefully before installing in order to make sure that the robot and controller are installed at suitable usage locations and environments, to avoid affecting the mechanisms and usage life of the electronic components or encountering other safety problems.
- This robot DRS40L/50L/60L/70L/60H CE series can only be used with our company’ s controller DCS-1B00-CA. Please do not modify the machine or wiring by yourself or use with other controllers or robots. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.
- Please follow the instructions in this manual properly to transport and install the robot and controller correctly; otherwise it might result in damage to the robot or controller.
- Related licenses are required to operate stackers or fork lifts etc.
- Please wear proper safety work clothes, helmets, gloves and shoes when installing the robot and controller in order to ensure the safety of personnel.
- On automated production lines, the operating range of multiple robots may overlap; please make sure they do not interfere with one another otherwise there might be impacts causing damages to the robots.
- Do not add additional cables or hoses etc. inside the robot. When installing the exterior cables of the robot, make sure to assess whether the cables and mechanisms will interfere with one another during operations.
- Only clean dry air (CDA) can be used for the installation of the air source at the input terminal of the robot air hose; oil or steam must not exist in the air source otherwise it may cause the mechanisms inside the robot to rust or get damaged.
- The robot itself is applicable for environment IP20 and is able to resist solid matters with diameters over 12mm and lengths not exceeding 80mm, such as fingers; it is not protected against any liquid matter.
- Please follow the manual to install the safety protection devices such as railings, gratings, regional laser or pressure pads, etc. in order to prevent injuries or other dangers caused to the staff arising from impact by the robot within the operating range of the robot.
- Please install the final system integration of the user operating buttons and warning lights etc. outside the railings in order to ensure usage safety. The height of the operating interface should be a suitable (0.6m to 1.7m) range for operators to touch.

	■ Please do not turn the power on and off frequently as doing so may result in damage to the controller. ■ The robot system should be installed under the specified conditions; in the foreseeable usage period, the robot cannot be tilted or moved with uncontrolled methods during transportation, assembly, dis-assembly, suspended or discarded periods. ■ Please properly ground all robot systems; they should all be grounded before connecting the power. ■ The final system integrator should install protection devices in order to prevent users from getting close to the danger area.
	■ Removing or changing the locations of any safety warning labels is strictly prohibited as doing so may cause danger to the staff and to cause injuries. ■ Performing any unsafe actions at the safety warning locations is strictly prohibited as doing so may cause injuries to the staff. ■ Personnel must not stand beneath when stackers or fork lifts, etc. are used to move the robot as doing so may result in injuries or other dangers. ■ Stacking objects on top of the robot, controller or cables is strictly prohibited as doing so may cause damage to the robot, controller or cables. ■ Changing or modifying the robot and controller is strictly prohibited as doing so may result in damages to the robot or controller and danger to the staff. Our company will not be held responsible for any work accidents. ■ Installing and wiring of the robot by people without related professional knowledge or licenses is strictly prohibited.

Usage and operating safety

- Please read this manual carefully before usage in order to ensure proper usage and the safety of the maintenance staff.
- Due to operational environment and operator safety considerations, our company will provide dedicated training for the operators of different robot applications in order to ensure usage safety. Please contact our company or your local dealers if training is needed.
- Please perform wiring properly according to this manual; wiring must be performed by personnel with related professional knowledge or licenses.
- Please use our company's handheld teaching pendant (DTS-2FM) and install it on the controller DCS-1B00-CA to perform manual operations and edit programs.
- Cannot be used on production lines that are flammable, explosive, toxic or has the risk of being sprayed by liquids.
- Please select a suitable model according to the load capability; do not overuse specifications that exceed the machine model specifications.
- The robot is a partially completed machine; the assembly and construction of the protection and safety circuit should be the responsibility of the final system integrator.
- All children and visitors should keep a safe distance from the processing area.
- Do not wear loose clothes, ties, rings or bracelets and wear protective nets to protect long hair as these things can easily get caught in the machine by accident and cause injuries to the staff or cause other dangers during operation.
- Please turn off the power, isolate the power properly and wait for the robot to stop completely when the robot is no longer used before you leave.
- Please confirm that there is no one along the railings before operating the robot and performing operations.
- Do not laugh or talk to other workers while operating the robot; such wrong behaviors may result in collision of the robot or injuries to other workers.
- Please use the two-stage key selection switch to change between T1 and Auto mode; the keys must be able to be unplugged in both modes .
- Please have the senior supervisor keep the T1/Auto mode selection switch key; do not place it randomly or leave it inserted on the selection switch as doing so may result in other personnel activating the robot accidentally, causing injuries to the workers.

	■ Please do not stand within the moving range of the robot when teaching the robot manually for the first time in order to prevent danger from occurring due to your being unfamiliar with the operations. ■ Please use slow speed operations when operating the robot manually for the first time, otherwise being unfamiliar with the operations may result in damage to the robot due to impact or cause injuries to other workers. ■ Please do not turn the power on and off frequently as doing so may result in damage to the controller. ■ Improper operations might damage the robot. ■ When collisions happen to the robot, please turn off the power of the robot first and then check the components and cables of the robot to make sure they were not damaged before turning the power back on to perform operations again. ■ Please use a safety lock on the railings switch when entering the railings to operate the robot in order to prevent the railings from closing suddenly causing the robot to be activated accidentally. ■ If the teaching pendant cable on the controller needs to be removed, please do so when power is completely cut, otherwise the teaching pendant might get damaged. ■ The location of the interlock switch between the structure of the safety protection device and the protection device should comply with EN ISO 14120 and EN ISO 14119 standards, and the safety distance should be designed according to EN ISO 13857 standards.
	■ Do not randomly make any changes to any components on our company's handheld teaching pendant, including the emergency stop and Enable switch; doing so will lower the safety performance and level, even lose the safety protection. ■ Short-circuiting of any safety protection signals on the controller is strictly prohibited, otherwise our company will not be held responsible for any work accidents that may occur. ■ When operating the robot all personnel are prohibited from standing close or within the robot working range; doing so will cause injuries to the other workers. ■ Do not unplug any cables on the controller while the robot is operating; doing so will cause damage to the controller. ■ Do not open the protective cover or protection device while the machine and robot are operating.

Maintenance safety

	■ Please perform maintenance and inspection work properly according to the manual in order to prolong the usage life of the robot. ■ Please add a safety lock on the power switch of the power box when performing maintenance or repair operations on the robot, and place a “Do not power on” safety warning at an obvious place. ■ Make sure foreign objects do not get attached or enter the robot when performing maintenance or inspection. ■ Making random oil changes during maintenance may result in damaging the performance of the robot or to the mechanical components. ■ Protection devices and repair doors in the danger areas that need to be opened or removed regularly for the purpose of operations, maintenance, cleaning and configuration should be interlocking. ■ Personnel performing maintenance or repairs on the robot or robot system should receive the necessary process training in order to execute the tasks required. Also use only genuine materials, or else it might cause grave danger to the users. ■ The processing of waste materials should comply with local laws and regulations, and should be treated carefully.
	■ Random changes to the maintenance schedule of the robot and maintenance oil are strictly prohibited. ■ Maintenance and inspection to the controller and robot are prohibited while power is being supplied or else it may cause electrical shocks or injuries to the workers. ■ When a robot component is damaged, replacing with other brand components is prohibited as doing so many result in damaging the performance of the robot or the components. ■ When internal components of the controller are damaged, replacing them with other brand components is prohibited; doing so may cause accidents or result in decreasing the safety performance levels. ■ The power control box must not be opened within 10 minutes of powering off because the residual voltage in the driver may cause electrical shocks.

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1. Warning label explanations

The description to the location and explanation of the safety warning stickers are as follows; operators should get familiar with the locations of the safety warning labels before use and know the meanings of each safety warning in order to prevent accidents from occurring.

	■ Please be aware of the locations of the safety warning labels during operations, or else it may result in workers sustaining injuries. ■ Operators should get familiar with the locations of the safety warning labels before use and know the meanings of each safety warning in order to avoid risks.
	■ Removing or changing the locations of any safety warning labels is strictly prohibited as doing so may cause danger to the staff and to cause injuries. ■ Performing any unsafe actions at the safety warning locations is strictly prohibited as doing so may cause injuries to the staff.

1.1 DRS40L/50L/60L/70L/60H CE series sticker label location

Figure 1.1 shows all warning sticker locations of DRS40L/50L/60L/70L CE series.

Figure 1.2 shows all warning sticker locations of DRS60H CE series.

Table 1.1 shows the contents of each warning sticker.

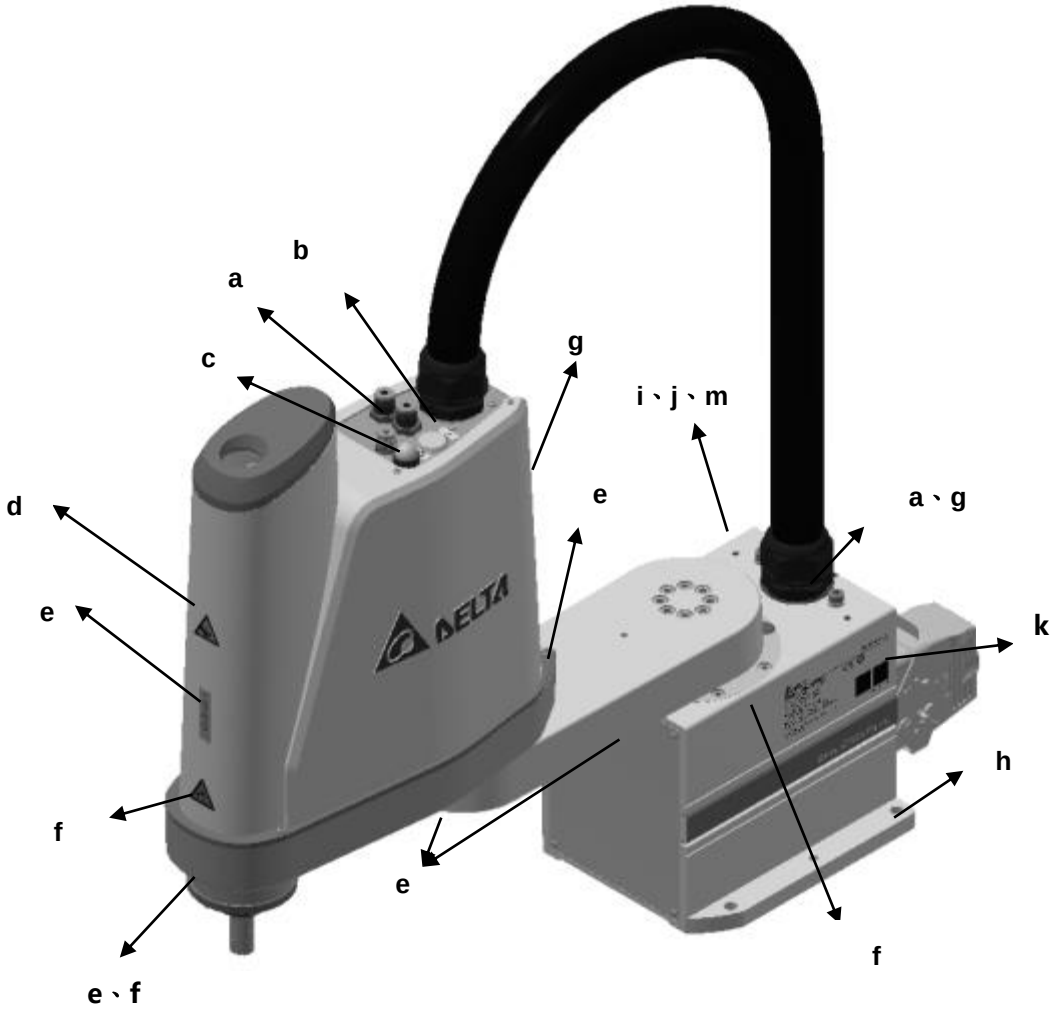


Figure1. 1 DRS40/50/60/70L CE series warning sticker locations

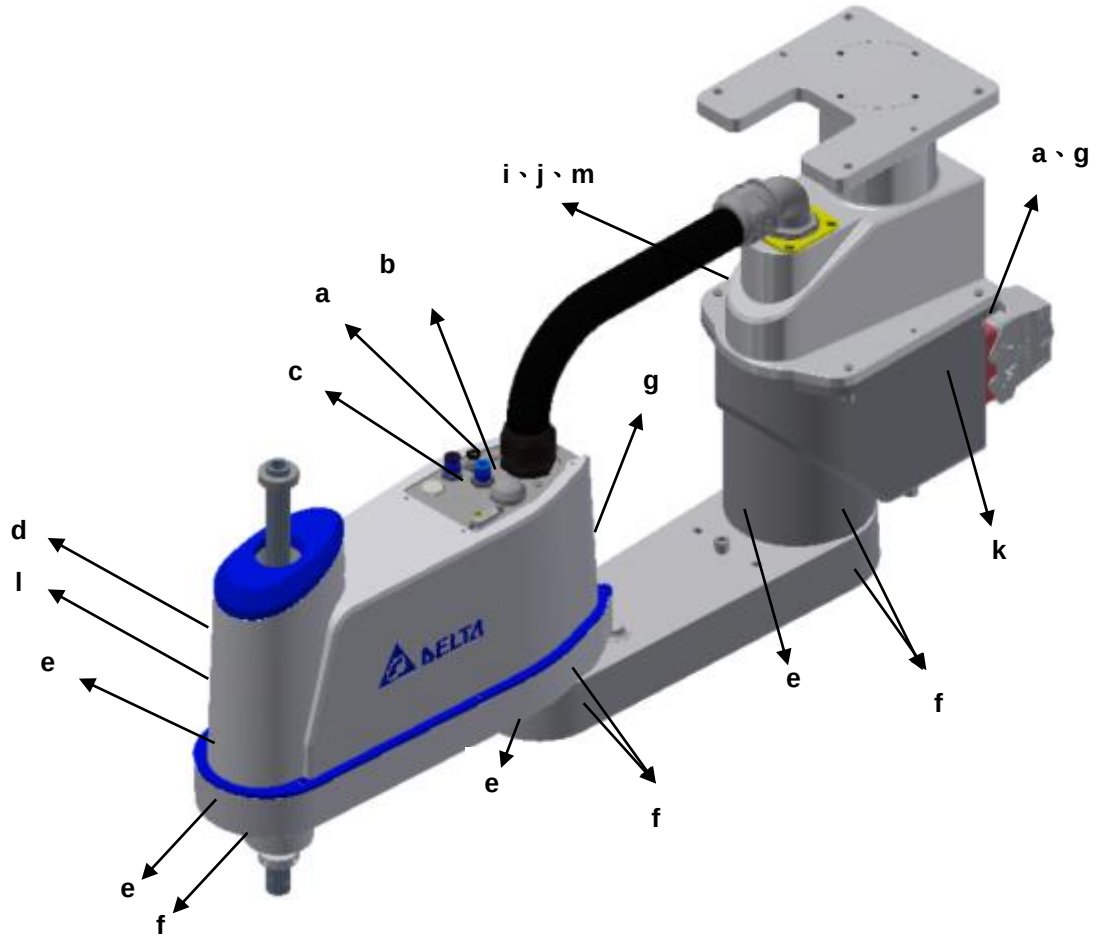


Figure1. 2 DRS60H CE series warning sticker locations

Table1. 1 DRS CE series Warning sticker content descriptions

Item	Part No.	Name	Flag	Note	Qty
1	a	Air hose sticker 1	AIR 1	The first air hose provided inside the mechanical arm.	2
2		Air hose sticker 2	AIR 2	The second air hose provided inside the mechanical arm.	2
3		Air hose sticker 3	AIR 3	The third air hose provided inside the mechanical arm.	2
4	b	Brake release button		Pressing this button while the conductive SERVO is OFF will release the brakes. DRS40L3: Release 3rd axis brakes. DRS60L6: Release 3rd and 4th axis brakes.	1

5	c	Servo ON		When the indicator lights up, the machine is in Stand by status; workers should not get close because the machine might start operating at any time.	1
6	d	Anti-pressing sticker		Movable Z axis part; please be aware and do not let your hands get caught by the machine while operating.	1
7	e	J1~J4 axis moving direction sticker		Please be aware while operating in order to prevent workers from getting bruised.	4
8	f	Origin correction		Used for rough origin correction; a quick visual inspection can also be made during activation to check whether the original setting is incorrect.	5
9	g	Electric shock hazardous		Do not touch it.	2
10	h	Ground sticker		Ground.	1
11	i	Anti-collision sticker		Do not enter the working range of the machine while the machine is operating or else workers might bump onto the robot; it may even cause fatalities when severe!!!	1
12	j	Read sticker		Read the manual carefully before use in order to ensure proper usage, otherwise it may cause an accident.	1
13	k	Product sticker		Product related model and specification explanations, etc.	1
14	l	J3 axis fall warning		When the brake release button is pressed, the z axis will fall warning label. Workers please beware in order to prevent getting pinched.	1
15	m	Transport sticker		Manual transporting method of the mechanical arm sticker. *DRS40L/50L/60L/70L series	1
				Manual transporting method of the mechanical arm sticker. *For DRS60H series	1

Figure 1.3 below is the DRS CE series robot head details sticker location

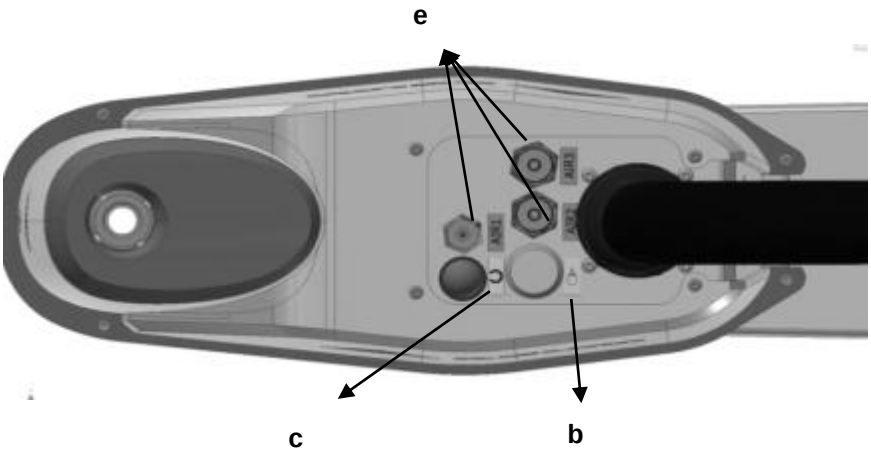


Figure1. 3 DRS CE series robot head sticker location

Figure 1.4 below is the DRS CE series robot rear and base details sticker location

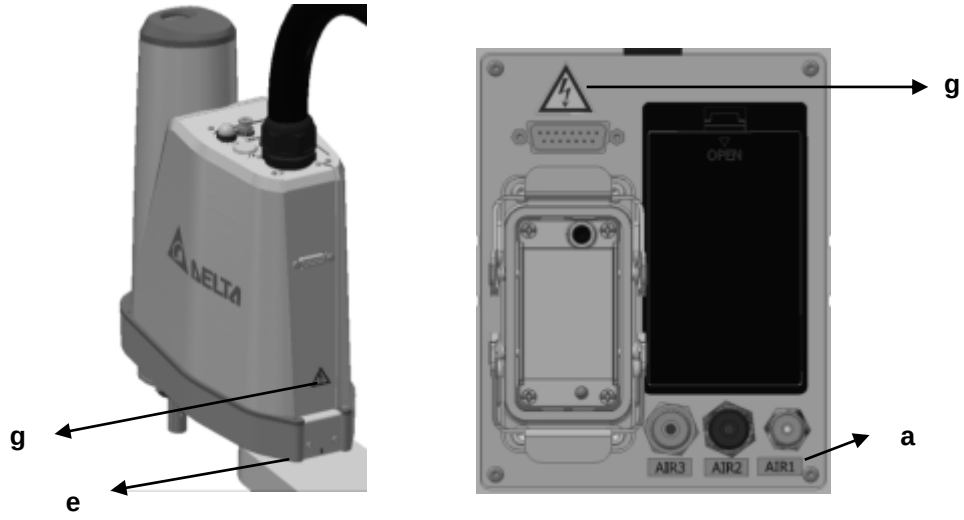


Figure1. 4 DRS CE series robot rear and base details sticker location

1.2 DCS controller sticker mark location

Figure 1.5 shows the DCS controller warning sticker location; Table 1.2 shows the contents of each warning sticker.

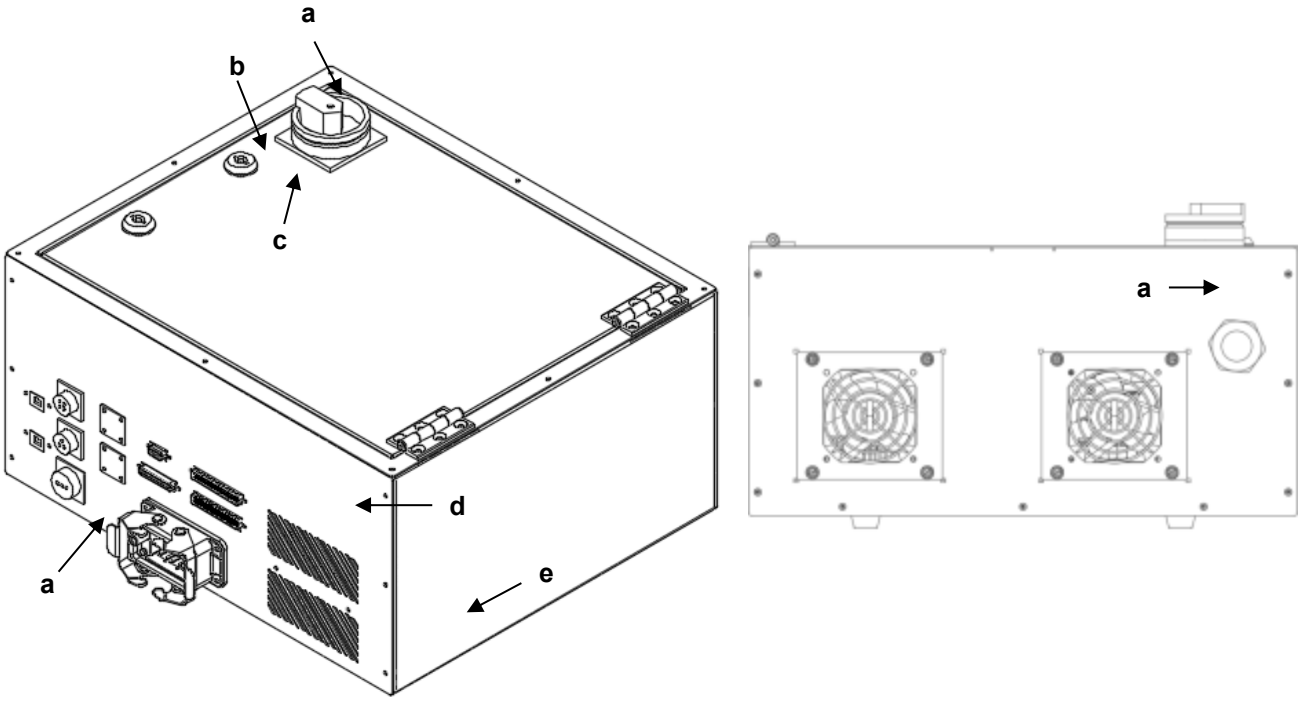


Figure1. 5 DCS controller warning sticker location

Table1. 2 Warning sticker content explanation

Item	Part No.	Name	Flag	Note	Qty
1	a	Electrification danger		Electric shock hazardous. Do not touch it.	3
2	b	Isolation switching switch		Main electrical switch	1
3	c	Lockout the energy		Turn power supply OFF before inspection, maintenance, adjustment and cleaning.	1
4	d	Read sticker		Read manual before use	1
5	e	Product sticker		Product related model and specification explanations etc.	1

1.3 DRS CE series Robot nameplate description

SCARA DRS CE series robot nameplate description contents are as shown in Figure 1.6 and Table 1.3 below.

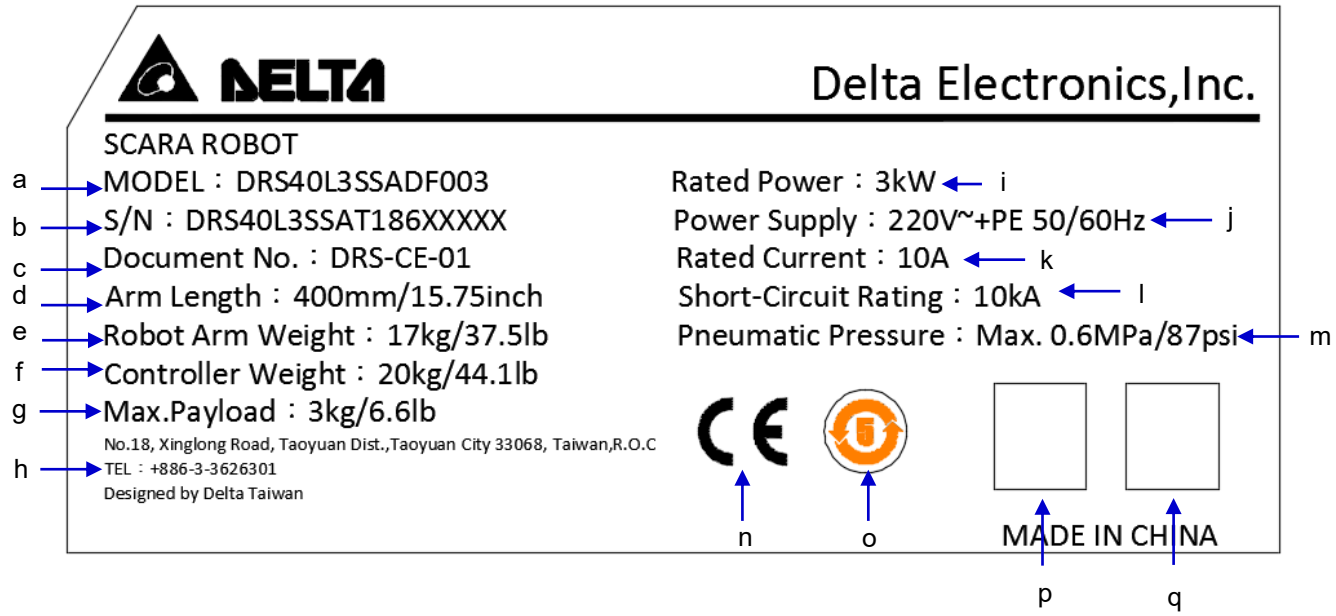


Figure1. 6 DRS CE series Robot nameplate figure

Table1. 3 DRS CE series Robot nameplate description

Item	Part No	Note
1	a	Robot system model name
2	b	Product serial number, including manufacturing year, month, manufacturing origin and other related messages
3	c	Robot user manual document number
4	d	Mechanical arm length
5	e	Robot arm weight
6	f	Controller weight
7	g	Robot flange maximum installation load weight
8	h	Contact number and address of our company
9	i	Controller rated power
10	j	Controller input power information, voltage and frequency
11	k	Controller current capacity
12	l	Controller short-circuit capacity
13	m	Maximum pressure that can be tolerated by the air hose inside the robot
14	n	CE mark
15	o	Recycling years of battery inside the robot, 5 years
16	p	after-sales service QR CODE
17	q	Serial Number QR CODE

2. Transport and Installation

Please execute the transportation and installation according to the instructions in the manual properly; otherwise it may result in the dropping and damaging of the robot.

	■ Related licenses are required to operate stackers and fork lifts etc. when transporting the robot. ■ There are electronic components and precision components inside the robot device, therefore please be very careful not to allow the devices to collide due to the sharp movements during transportation. ■ Workers must not stand below the transporting object when operating a lift; there must be workers directing from the side in addition to the lift operator in order to prevent accidents from occurring. ■ Please be careful not to tilt the robot device when using the lift, otherwise it may result in injuries. ■ Please remember to wear safety shoes and safety gloves when moving the power control box manually in order to prevent getting crushed.

2.1 Transportation

There are 3 methods to transport the robot: using fork lift, stacker or lift, as shown in Figure 2.1 below.

Fork lift

Stacker

Lift

Figure2. 1 Transportation device type

Note:

Operators must have related licenses when using fork lifts or stackers, or have equal number of training hours before performing operations and to ensure that no damage will be caused to the robot and no injuries will be caused to workers.

Transportation steps:

1. Please extend the fork lift under the wooden pallets properly; otherwise it may cause tilting injuries as shown in Figure 2.2 below.

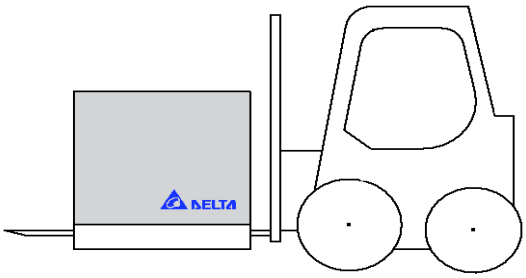


Figure2. 2 Fork lift transportation illustration

2. Elevate the fork lift or lift until it is off the ground and make sure they are not tilted; otherwise the product might drop during the transport process. When faced with uphill or downhill roads, please adjust the height or tilt angle of the fork lift accordingly so that the product will not tilt otherwise tie down the product properly.
3. Confirm whether there is anyone close by during transport; there should be workers on the side responsible for guiding and directing in addition to the stacker operator. Please operate the stacker with the speed set according to the company rules; do not operate the stacker at a high speed.
4. Once the robot is transported to the installation location, please open the carton and remove the

robot, controller, cables and handheld teaching pendant (optional) carefully, as shown in Figure 2.3 and Figure 2.4 below.

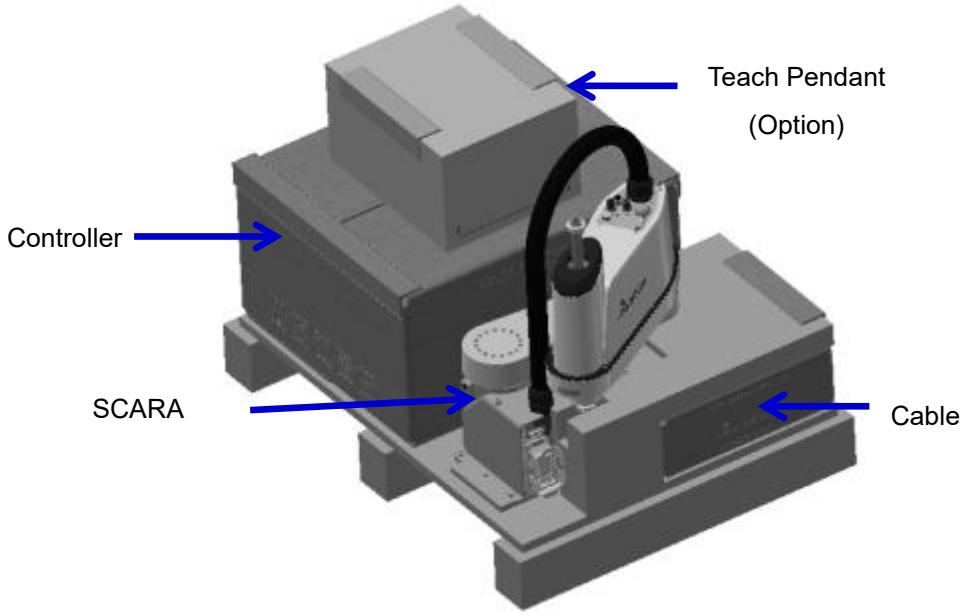


Figure2. 3 DRS40L/50L/60L/70L series package removal figure

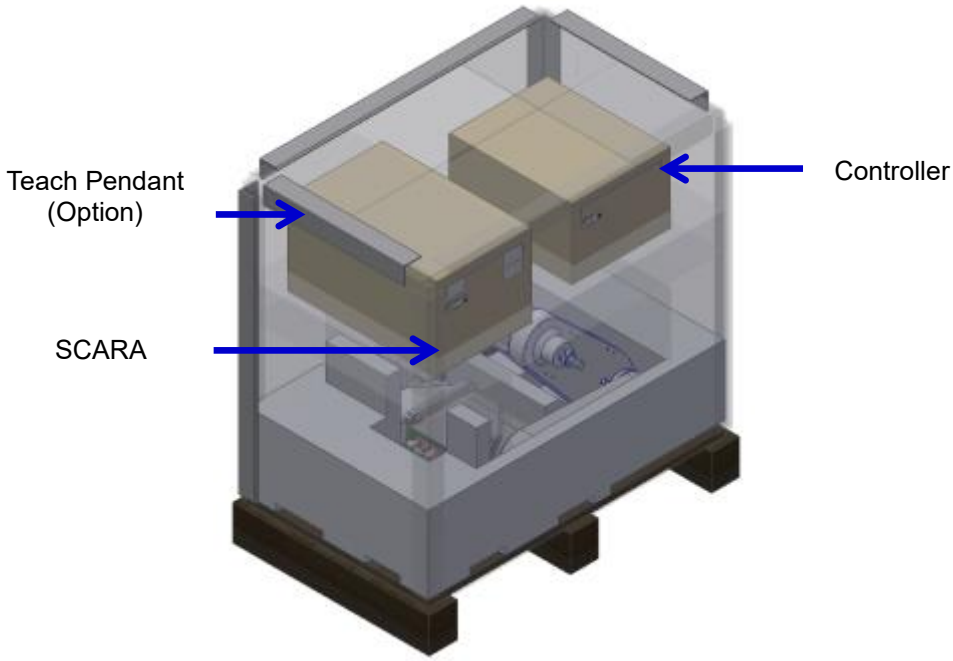


Figure2. 4 DRS60H series package removal figure

5. Please refer to the transportation sticker before transporting the robot; first remove the cables

connected to the heavy load connector of the arm and then bend the first and second arm manually until they touch the point position, and then place one hand under the robot base and use the other hand to hold under the front of the first arm, as shown in Figure 2.5 and Figure 2.6 below, to perform the transportation.

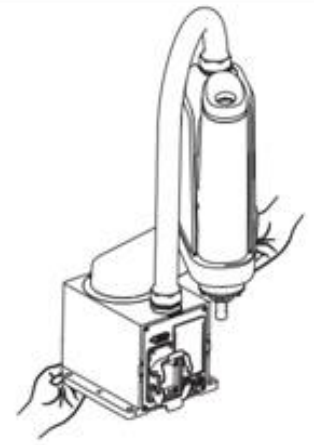


Figure2. 5 DRS40L/50L/60L/70L series transportation method

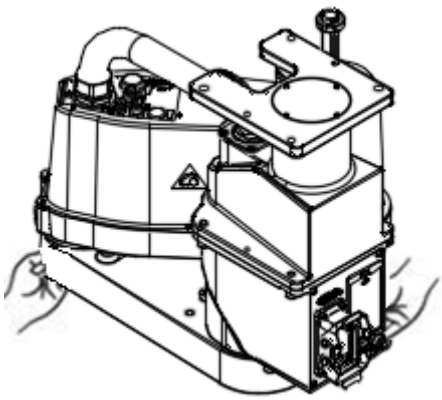


Figure2. 6 DRS60H series transportation method

6. Remove the controller and put both hands around the bottom of the controller to transport it. Or, use a cart for transportation; please consider whether the road is bumpy when using a cart, or else the electronic components and precision components inside the controller device might get damaged.

2.2 Installation

- Please read this manual carefully before installing in order to make sure that the robot is installed at a suitable usage location and environment, avoid affecting the mechanisms and usage life of the electronic components, or encounter other safety problems.
- This robot DRS CE series can only be used with our company's controller DCS-1B00-CA; please do not modify the machine or wiring by yourself or use with other controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that result from doing so.
- The robot system should be installed under the specified conditions; in the foreseeable usage period, the robot cannot be tilted or moved with uncontrolled methods during transportation, assembly, dis-assembly, suspended or discarded periods.
- Please wear proper safety work clothes, helmets, gloves and shoes when installing the robot in order to ensure the safety of personnel.
- On automated production lines, the operating range of multiple robots may overlap; please make sure they do not interfere with one another otherwise there might be impacts causing damages to the robots.
- Please do not add additional cables or hoses etc. inside the mechanism. When installing cables outside the mechanism, make sure to assess whether the cables and mechanisms will interfere with one another during operations.
- When performing peripheral equipment adjustments, the power must first be cut off before performing adjustments.
- Only clean dry air (CDA) can be used for the installation of the air source at the input terminal of the robot air hose.
- Since the mechanical arm is a semi-finished product, if other operating modules are added or modifications are made, the original manufacturer will not be held responsible for any problems that result from them.
- The robot itself is applicable for environment IP20 and is able to resist solid matter with diameters over 12mm and lengths not exceeding 80mm, such as fingers; it is not protected against any liquid matter.
- The working range of the robot should be kept clean and ensure that it will not be used under environments affected by oil, water and dusts, etc.

	■ Please follow the manual to install the safety protection devices such as railings, gratings, regional laser or pressure pads, etc. in order to prevent injuries or other dangers caused to the staff arising from impact by the robot within the operating range of the robot. ■ Please install the user operating buttons and alarm indicators outside the railings in order to ensure safe usage. ■ Please properly ground all robot systems; they should all be grounded before connecting the power. ■ The final system integrator should install protection devices in order to prevent users from getting close to the danger area.
	■ The robot does not have explosion-proof or splash-proof structures, so do not place it at locations that are too humid or can be easily splashed by liquids. ■ Do not randomly stack objects on top of the robot and do not bump into the robot. ■ Placing any objects on top of the cables connecting the power control box and robot is prohibited, otherwise it may cause damage to the cables and result in injuries.

2.2.1 SCARA robot main body installation

The installation of the SCARA robot should be as shown in Figure 2.7 below; the base should be locked on a flat surface and when locking it in place, M8 screws + flat gaskets should be used as shown in Table 2.1, then lock it in properly with the locking torque.

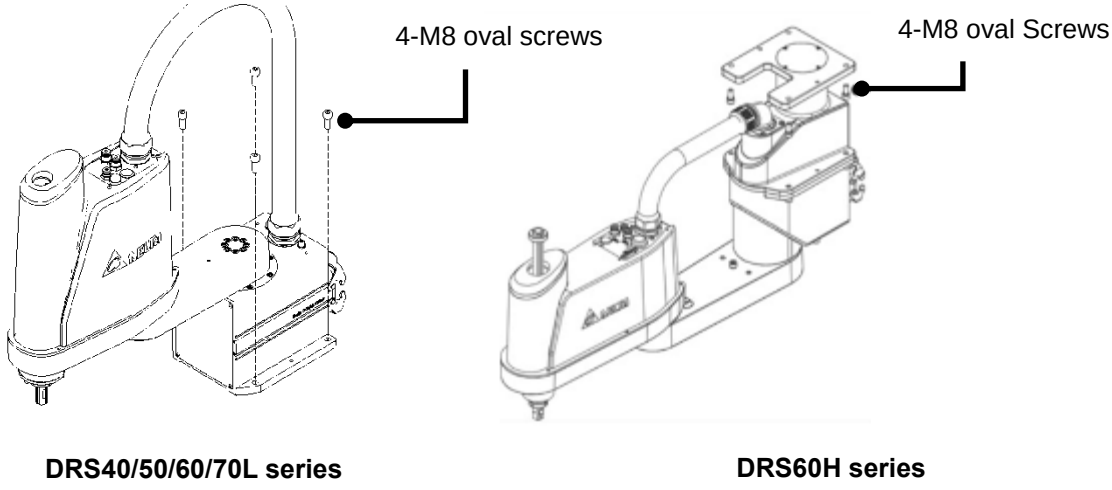


Figure2. 7 Robot installation screw lock position

Table2. 1 Robot installation lock torque table

	Tools	Screw type	Quantity	Screw torque
DRS40/50/60/70L/60H6 series	#6 hex wrench	M8 oval screw + M8 flat gasket	4	20 to 20.3 N-m

DRS60H series installation as shown in Figure 2.8 below and Table 2.2

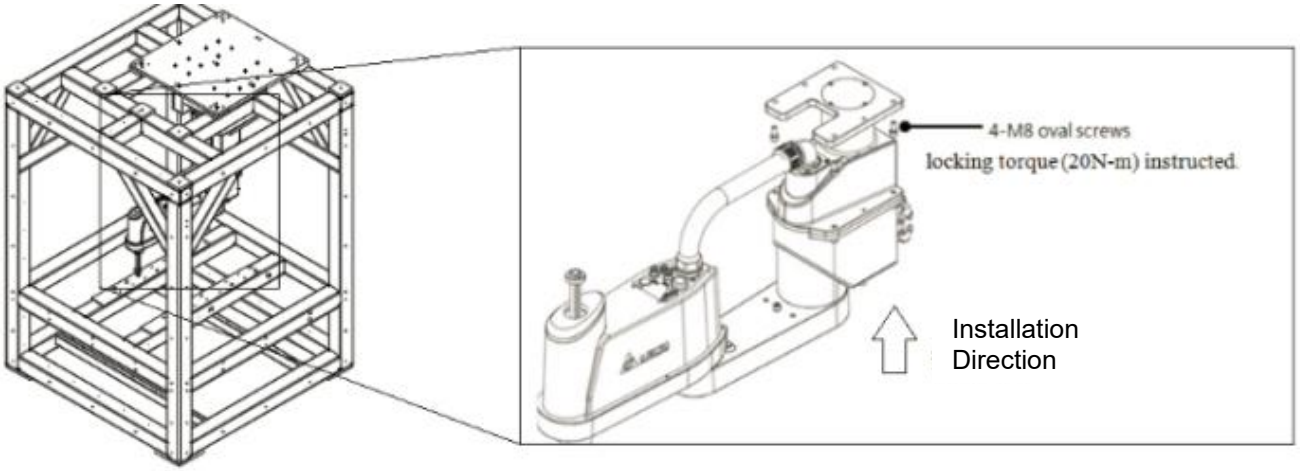


Figure2. 8 DRS60H installation

General structure carbon steel- rectangle

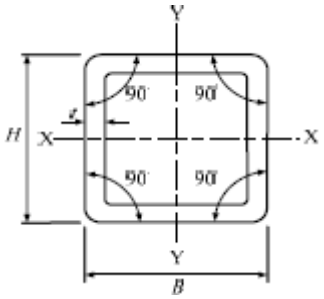


Table2. 2 Installation conditions

H x B mm x mm	t mm	Area A cm^2	Specific mass kg/m	moment of inertia cm^4		radius of gyration cm		modulus of section cm^3	
				I_x	I_y	r_x	r_y	S_x	S_y
100 x 100	2.3	8.85	6.95	140		3.97		27.9	
100 x 100	3.2	12.1	9.52	187		3.93		37.5	
100 x 100	4.0	14.9	11.7	226		3.89		45.3	
100 x 100	4.5	16.6	13.1	249		3.87		49.9	
100 x 100	6.0	21.6	17.0	311		3.79		62.3	
100 x 100	9.0	30.6	24.1	408		3.65		81.6	
100 x 100	12	38.5	30.2	471		3.50		94.3	

2.2.2 Controller installation

Controller installation notes:

1. The power control box uses forced fan cooling; in order to keep the cooling cycle working well, when installing the robot power control box, sufficient room must be left with neighboring objects and the baffle (wall), or else it may cause malfunctioning. Please refer to the power control box installation space shown in Figure 2.9.
2. The ventilation holes must not be blocked during installation; please keep a distance of 150mm or above.
3. Do not topple over the power control box as doing so will cause it to malfunction.
4. Controller power switch and other locations should be from the ground 0.6m to 1.7m between to make it easier for users to operate.

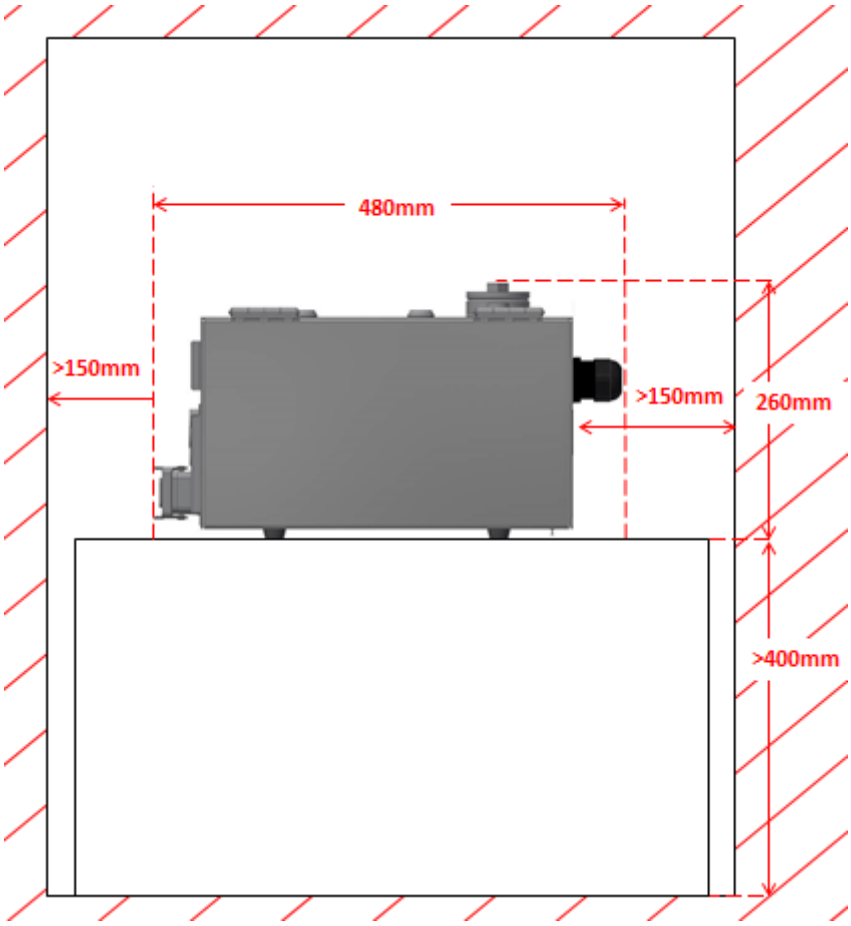


Figure2. 9 Power control box installation space

5. Please note the space required to open the power control box door; the installation space is as shown in Figure 2.10 below, or else it will be very difficult to perform repairs.

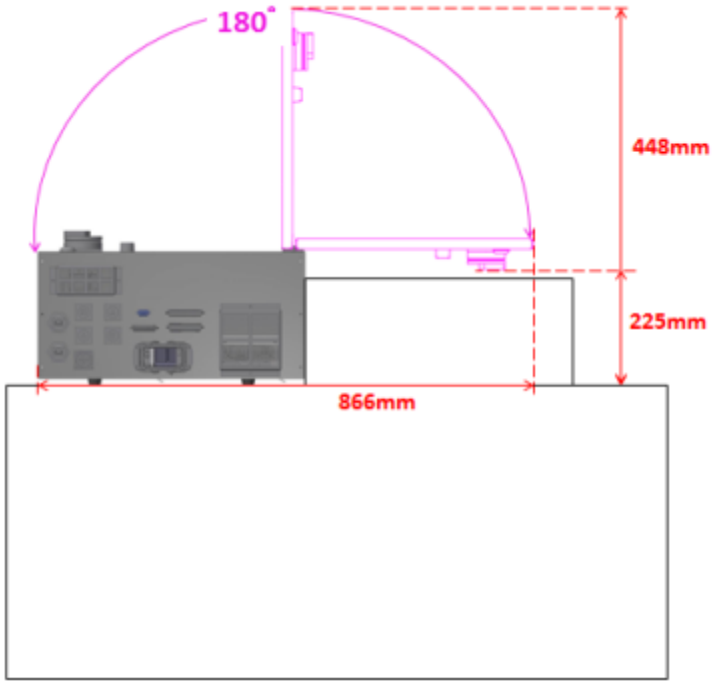


Figure2. 10 Power control box door open space

6. When fixing the power control box in place, please do as shown in Figure 2.11 below and use 2 L-shaped plates to fix the power control box tightly in place.

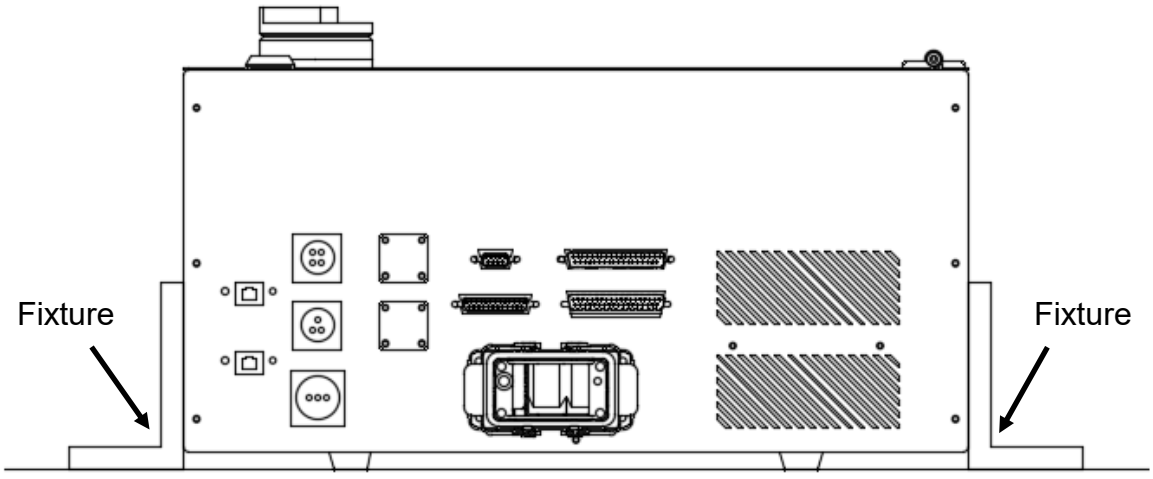


Figure2. 11 Power control box fixture method

3. Robot safety protection

	■ The final system integrator must follow this manual properly to construct a safe overall protection system for the robot, otherwise it may result in injuries or fatalities to workers. ■ Once the safety protection system and wiring are completed, then power can be connected to the power control box and the robot can be operated. ■ Please follow this manual to perform the construction of the safety protection and wiring, or else our company will not be held responsible for any injuries sustained by the workers.
	■ Do not perform any operations to the robot before the safety protection system construction is complete. ■ Do not use any method to bypass the safety protection system; the safety protection system includes the emergency stop signal, railings, pressure pad, gratings, laser scanner and any safety device signals used to protect the workers.

3.1 Robot safety protection

The robot safety protection refers to the protection equipment set up around the robot, they are used to prevent workers from getting close while the robot is operating and causing an accident of getting hit. The final system integrator should construct the safety protection device properly in order to ensure that the workers will not get hit by the robot and undergo injuries.

Complete robot safety protection should include:

1. **Emergency stop device**
   Must be dual-channel NC contact mechanical type emergency stop device.
   This type of device can be an emergency stop button or pull-rope switch etc.

2. **Railings, gratings, pressure pads or laser scanners**
   Use railings, gratings, pressure pads or laser scanners within the working range of the robot to prevent workers from getting close and sustaining injuries.The maximum working range of the robot must be considered for the protection range.

3. **Teaching pendant enable switch**
   The 3-position switch on the back of the teaching pendant; this enable switch must be pressed when performing teaching point operations manually in order to teach. Releasing the switch or pressing the switch all the way to the bottom must be able to stop both robot operations.

3.2 Robot safety protection construction and installation

3.2.1 Emergency stop device installation

Must be dual-channel NC contact mechanical type emergency stop device.

When the emergency stop button is used:

1. It must be a red type and has yellow background (the area of the yellow background must be greater than the red), as shown in Figure 3.1.

Figure3. 1 Emergency stop button

2. Equipped with a manual re-set function, as shown in Figure 3.2.

Figure3. 2 Emergency stop switch re-set method

3. Equipped with a disconnect function so that when the contacts are fused, the force used to press the button can be used to disconnect the fused contacts. This function symbol is as shown in Figure 3.3

Figure3. 3 Emergency stop safety disconnect symbol

4. Please install multiple emergency stop devices according to the actual overall system, and take into consideration not to make the installation distance between each emergency stop too far in

order to avoid not being able to press this button when emergency events occur. Make sure the height of the emergency stop button installation is not too high or low; install it at a height that is accessible to workers. The emergency stop buttons must be installed at obvious places and cannot be blocked by other devices.

3.2.2 Emergency pull-rope device installation

Must be dual-channel NC contact mechanical device, must have a re-set button and the pull-rope must be able to be triggered from any position.
The installation height of the pull-rope must comply with average height and an accessible height; installing it too high will result in workers being unable to reach it.
It's not that railing protection is no longer needed once pull-rope switches are installed around the robot; the installation of the pull-rope is just so that the emergency stop function can be triggered from any position.
When using the emergency pull-rope device, they can be configured around the entire safety protection railing as shown in Figure 3.4 below.

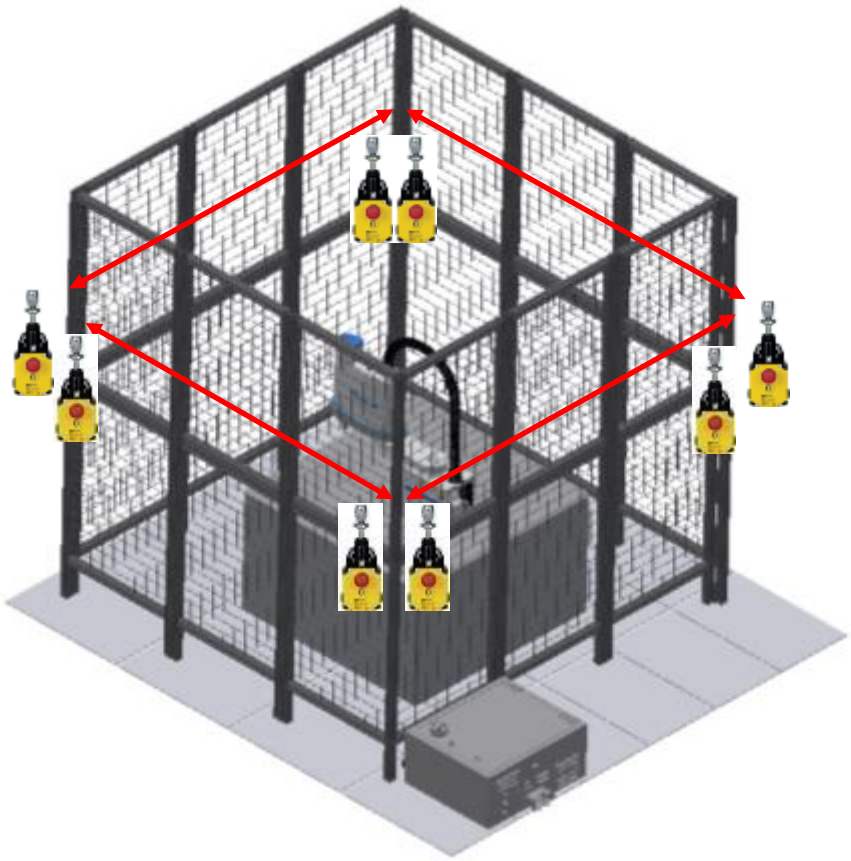


Figure3. 4 Safety pull-rope switch construction example

3.2.3 Railings installation

The power of the power control box must be disconnected when performing adjustments to surrounding devices and confirm that the mechanical arm has stopped operating completely before performing adjustments, according to EN ISO 13857 (EN294 & EN811) safety distance for upper and lower limbs.

Not only should the working range of the robot be taken into consideration for the installation of the railings, the length of the worker's arm must also be considered so that they cannot touch the robot. Figure 3.5 below shows a right railings installation height; the worker's arm can not still reach inside the railings.
Please construct the railings properly and take into consideration whether the worker's arm can reach inside the railings and touch the robot.

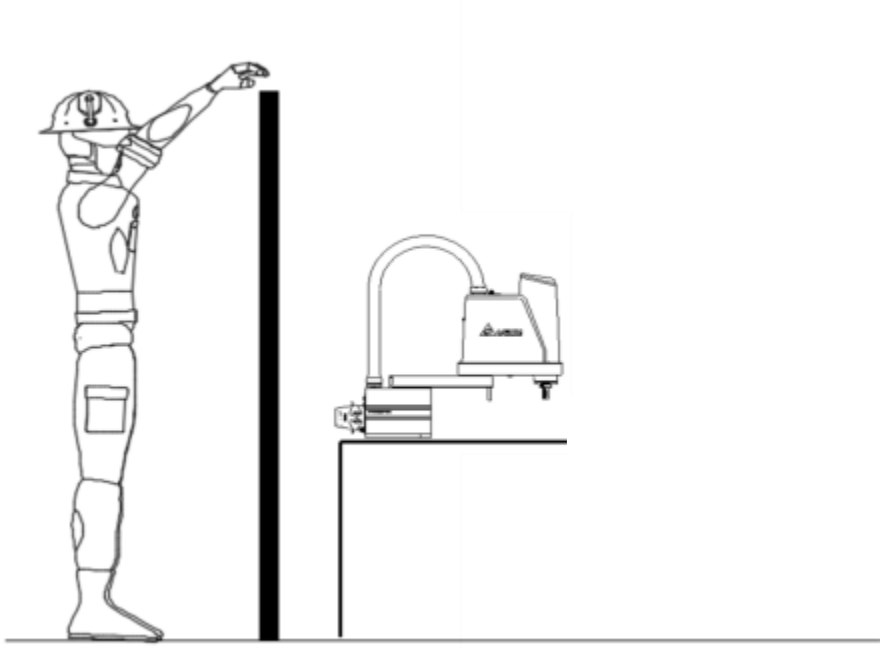


Figure3. 5 Correct railings installation height

3.2.4 Safety gratings installation

The safety grating system shall comply with IEC 61496-1 and -2.

Improper installation and usage will also cause the risk of workers getting hit by the robot arm.

Please set up grating systems around the robot so that the grating system can detect workers no matter where they entered from.

DRS40L/50L/60L/70L CE series safety grating protection area

Figure 3.6 shows the DRS40L/50L/60L/70L CE series safety grating installation distance.

X：Robot arm length.

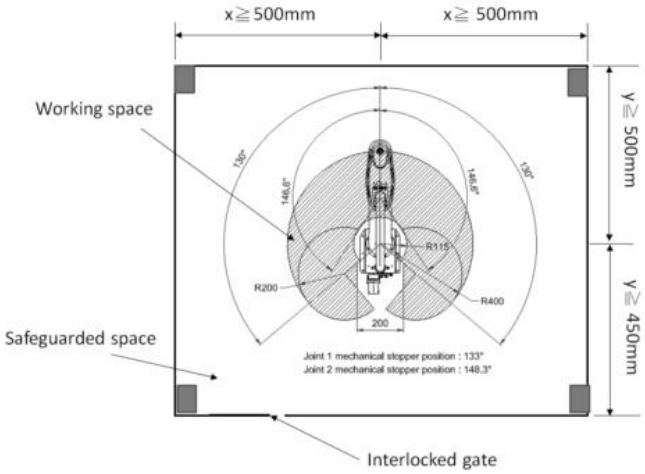


Figure3. 6 DRS40L./50L/60L/70L CE series safety grating installation distance

DRS60H6 CE series safety grating protection area

Figure 3.7 shows the DRS60H6 CE series safety grating installation distance.

X：Robot arm length .

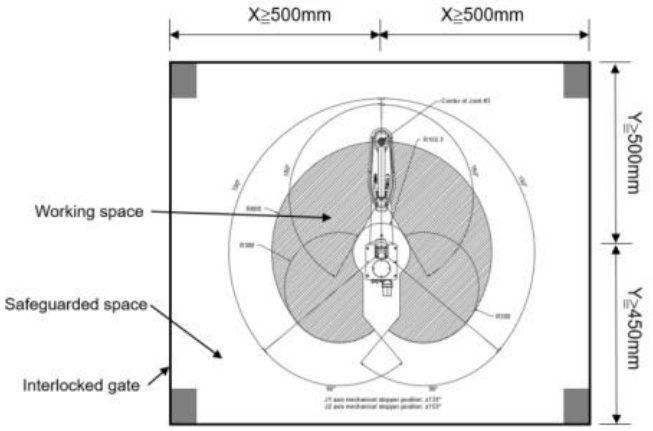


Figure3. 7 DRS60H6 CE safety grating installation distance

3.2.5 Safety mat installation

The safety mat shall comply with EN 1760-1 (ISO 13856-1), and shall be able to detect operators over 35kg.

Installation mat is another type of protection system installed around the robot, and since safety mats are laid on the floor, it does not have height protection like railings; so the laying of the safety mat shall be calculated using the total moving range of the robot arm.

Safety mats shall not be laid only around the robot when used; it shall be laid at the entire working area.

DRS40L/50L series safety mat laying range

Figure 3.8 below shows the safety mat installation area for DRS40L/50L series; in addition to calculating the maximum work plan of the robot, an average of 1m of worker arm length shall also be added in order to prevent the workers' arms from hitting the robot. So the actual installation shall take the arm length of most workers in that area into consideration.

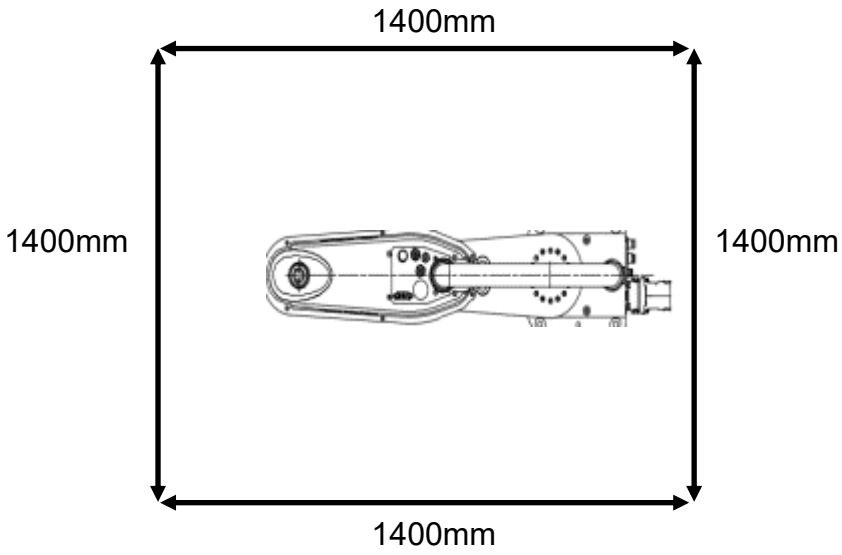


Figure3. 8 DRS40L/50L series safety mat laying range

DRS60L/70L series safety mat laying range

Figure 3.9 below shows the safety mat installation area for DRS60L/70L series; in addition to calculating the maximum work plan of the robot, an average of 1m of worker arm length shall also be added in order to prevent the workers' arms from hitting the robot. So the actual installation shall take the arm length of most workers in that area into consideration.

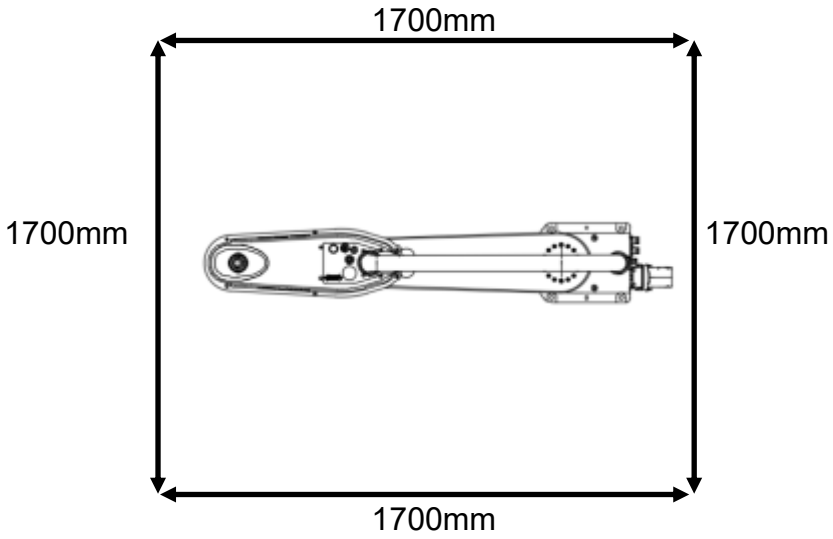


Figure3. 9 DRS60L/70L series safety mat laying range

DRS60H series safety mat laying range

Figure 3.10 below shows the safety mat installation area for DRS60H series; in addition to calculating the maximum work plan of the robot, an average of 1m of worker arm length shall also be added in order to prevent the workers' arms from hitting the robot. So the actual installation shall take the arm length of most workers in that area into consideration.

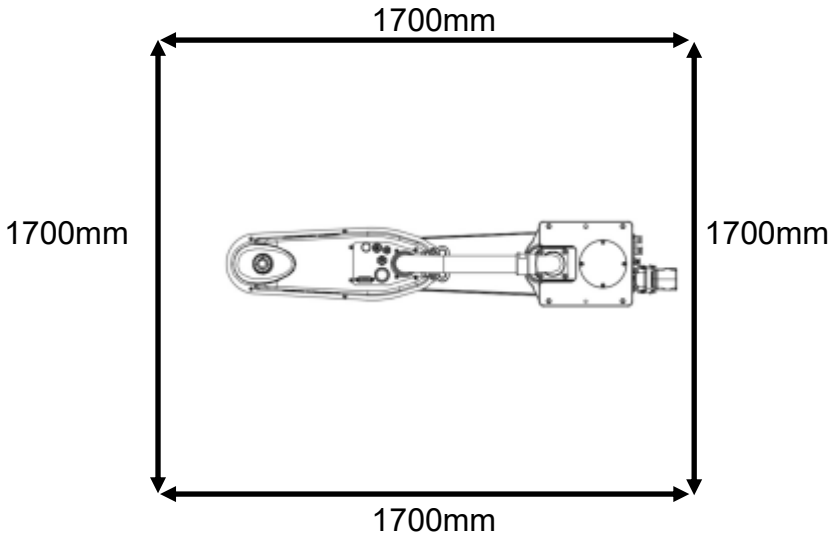


Figure3. 10 DRS60H series safety mat laying range

3.2.6 Laser scanner

The selected laser scanner shall comply with IEC 61496-1 & -3.

Laser scanner safety protection area

Not only shall the operating range of the robot be considered for the installation of the laser scanner, the distance that the worker's arm reaches into the robot shall also be considered.
The laser scanner shall not detect 360°, so please install another laser scanner for blind spots or where there are safety concerns. Figure 3.11 below is an illustration of laser scanner installation.

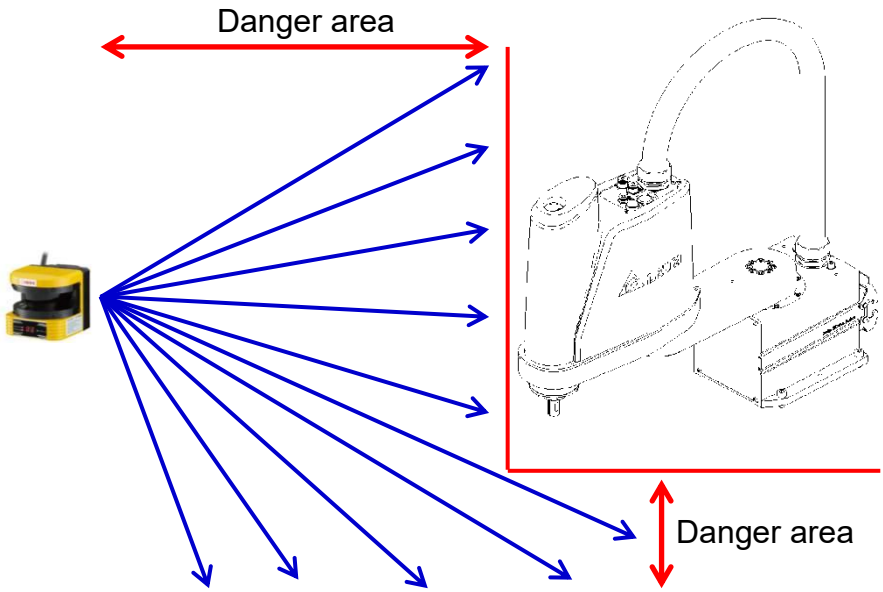


Figure3. 11 Laser scanner installation illustration

4. Specifications and dimensions

This chapter introduces the specifications and dimensions of the robots and controllers; please use according to the specifications properly.

	■ Please use the robot according to the specified methods, otherwise it may result in fire or equipment failures, even injuries or fatalities of workers and other dangers. ■ Use of this product at locations exposed to substances such as steam, corrosive gas and flammable gas etc. is prohibited, which may cause electrical shocks or fire. ■ Please read this manual carefully before use in order to ensure the robot is used in suitable locations and environments in order to prevent its affect in the usage life of the mechanisms and electronic components, or get involved in other safety problems. ■ The robots DRS CE series can only work with our company's controller DCS-1B00-CA; please do not modify the robot and wiring on your own, or use it with other controllers. Our company will not be responsible for any injuries or fatalities caused by accidents that resulted from doing so. ■ The robot itself is applicable for environment IP20 and is able to resist solid matters with diameters over 12mm and lengths not exceeding 80mm, such as fingers; it is not protected against any liquid matters. ■ The working range of the robot shall be kept clean and ensure that it will not be used under environments affected by oil, water and dust etc. ■ Only clean dry air (CDA) can be used for the installation of the air source at the input terminal of the robot air hose.
	■ Use of this robot in non-specified environments is prohibited, otherwise it may cause damages to the robot or reduce the usage life of the robot. ■ Random changes to the specification table of the robot is prohibited. ■ Random changes or modifications of the robot is prohibited; our company will not be held responsible for any safety problems resulted from doing so. Please contact our company if other specifications are needed.

4.1 DRS40L series Robot Specifications

Specifications of the DRS40L series robot are as shown in Table 4.1 below.

Table4. 1 DRS40L series robot specification table

Specifications of the SCARA Robot DRS40L3SSADF003、DRS40L3SOADF003		
Number of Axes 4		4
Arm Length (X+Y)		400mm / 15.75inch
Rated / Max. Payload		1kg / 3kg
Maximum Speed	J1+J2	4710 mm / sec
	J3	1250 mm / sec
	J4(SS type)	1875° / sec
	J4(SO type)	625° / sec
Range of Motion	J1	±130°
	J2	±146.6°
	J3	150 mm
	J4	±360°
Standard Cycle Time*		0.42sec
Repeatability	X-Y	±0.01 mm
	Z	±0.01 mm
	RZ	±0.01°
Motor power	J1	200W
	J2	200W
	J3	100W (With Brake)
	J4	100W
Rated / Max. Push Force (J3)		100 / 250N
Rated/ Max. Allowable Inertia Moment (J4) SS type		0.0091 kg-m^2
Rated/ Max. Allowable Inertia Moment (J4) So type		0.055 kg-m^2
User Wiring		15Pin D-Sub
User Tubing		ø4 mm x 1, ø6 mm x 2
Pneumatic pressure		Max 0.6MPa / 87psi
Weight		17kg / 37.5lb
Power supply		220V ~ +PE, 50 / 60Hz
Environment	Ambient Temperature	+5ºC to +40ºC
	Storage Temperature	-20ºC to +55ºC
	Humidity	not exceed 50% at a maximum temperature of +40°C

Note:

1. 25mm-300mm-25mm & Payload: 1Kg, testing environmental temperature 25ºC, environmental relevant humidity 45% to 65% RH.
2. Guaranteed that the accuracy is at the end point of the spline shaft; load tool extension arm not in this definition range.
3. Maximum down force holding time shall not exceed 2.5 seconds.

4.2 DRS50L series Robot Specifications

Specifications of the DRS50L series robot are as shown in Table 4.2 below.

Table4. 2 DRS50L series robot specification table

Specifications of the SCARA Robot DRS50L6SSADF003、DRS50L6SOADF003、DRS50L6OSADF003		
Number of Axes 4		4
Arm Length (X+Y)		500mm / 19.69inch
Rated / Max. Payload		2kg / 6kg
Maximum Speed	J1+J2	4400 mm / sec
	J3	1100 mm / sec
	J4(SS/OS type)	2000° / sec
	J4(SO type)	600° / sec
Range of Motion	J1	±133°
	J2	±153°
	J3(SS/SO type)	200 mm
	J3(OS type)	300 mm
	J4	±360°
Standard Cycle Time*		0.39sec
Repeatability	X-Y	±0.015 mm
	Z	±0.01 mm
	RZ	±0.01°
Motor power	J1	400W
	J2	200W
	J3	100W (With Brake)
	J4	100W (With Brake)
Rated / Max. Push Force (J3)		150 / 350N
Rated/ Max. Allowable Inertia Moment(J4) SS/OS type		0.01 / 0.08 kg-m^2
Rated/ Max. Allowable Inertia Moment(J4) SO type		0.07 / 0.9 kg-m^2
User Wiring		15Pin D-Sub
User Tubing		ø4 mm x 1, ø6 mm x 2
Pneumatic pressure		Max 0.6MPa / 87psi
Weight		18.5kg / 40.79lb
Power supply		220V ~ +PE, 50 / 60Hz
Environment	Ambient Temperature	+5ºC to +40ºC
	Storage Temperature	-20ºC to +55ºC
	Humidity	not exceed 50% at a maximum temperature of +40°C

Note:

1. 25mm-300mm-25mm & Payload: 1Kg, testing environmental temperature 25ºC, environmental relevant humidity 45% to 65% RH.
2. Guaranteed that the accuracy is at the end point of the spline shaft; load tool extension arm not in this definition range.
3. Maximum down force holding time shall not exceed 2.5 seconds.

4.3 DRS60L3 series Robot Specifications

Specifications of the DRS60L3 series robot are as shown in Table 4.3 below.

Table4. 3 DRS60L3 series robot specification table

Specifications of the SCARA Robot DRS60L3SSADF003、DRS60L3SOADF003		
Number of Axes 4		4
Arm Length (X+Y)		600mm / 23.62inch
Rated / Max. Payload		1kg / 3kg
Maximum Speed	J1+J2	4050 mm / sec
	J3	1250 mm / sec
	J4	1875° / sec
Range of Motion	J1	±114°
	J2	±148°
	J3	150 mm
	J4	±360°
Standard Cycle Time*		0.72sec
Repeatability	X-Y	±0.015 mm
	Z	±0.01 mm
	RZ	±0.01°
Motor power	J1	400W
	J2	200W
	J3	100W (With Brake)
	J4	100W (With Brake)
Rated / Max. Push Force (J3)		100 / 250N
Rated/ Max. Allowable Inertia Moment(J4)		0.009 kg-m^2
User Wiring		15Pin D-Sub
User Tubing		ø4 mm x 1, ø6 mm x 2
Pneumatic pressure		Max 0.6MPa / 87psi
Weight		22kg / 48.5lb
Power supply		220V ~ +PE, 50 / 60Hz
Environment	Ambient Temperature	+5ºC to +40ºC
	Storage Temperature	-20ºC to +55ºC
	Humidity	not exceed 50% at a maximum temperature of +40°C

Note:

1. 25mm-300mm-25mm & Payload: 1Kg, testing environmental temperature 25ºC, environmental relevant humidity 45% to 65% RH.
2. Guaranteed that the accuracy is at the end point of the spline shaft; load tool extension arm not in this definition range.
3. Maximum down force holding time shall not exceed 2.5 seconds.

4.4 DRS60L6 series Robot Specifications

Specifications of the DRS60L6 series robot are as shown in Table 4.4 below.

Table4. 4 DRS60L6 series robot specification table

Specifications of the SCARA Robot DRS60L6SSADF003、DRS60L6SOADF003、DRS60L6OSADF003		
Number of Axes 4		4
Arm Length (X+Y)		600mm / 23.62inch
Rated / Max. Payload		2kg / 6kg
Maximum Speed	J1+J2	5000 mm / sec
	J3	1100 mm / sec
	J4(SS/OS type)	2000° / sec
	J4(SO type)	600° / sec
Range of Motion	J1	±133°
	J2	±153°
	J3(SS/SO type)	200 mm
	J3(OS type)	300 mm
	J4	±360°
Standard Cycle Time*		0.39sec
Repeatability	X-Y	±0.015 mm
	Z	±0.01 mm
	RZ	±0.01°
Motor power	J1	400W
	J2	200W
	J3	100W (With Brake)
	J4	100W (With Brake)
Rated / Max. Push Force (J3)		150 / 350N
Rated/ Max. Allowable Inertia Moment(J4) SS/OS type		0.01 0.08 kg-m^2
Rated/ Max. Allowable Inertia Moment(J4) SO type		0.07 / 0.9 kg-m^2
User Wiring		15Pin D-Sub
User Tubing		ø4 mm x 1, ø6 mm x 2
Pneumatic pressure		Max 0.6MPa / 87psi
Weight(DRS60L6 type)		20kg / 40.79lb
Power supply		220V ~ +PE, 50 / 60Hz
Environment	Ambient Temperature	+5ºC to +40ºC
	Storage Temperature	-20ºC to +55ºC
	Humidity	not exceed 50% at a maximum temperature of +40°C

Note:

1. 25mm-300mm-25mm & Payload: 1Kg, testing environmental temperature 25°C, environmental relevant humidity 45% to 65% RH.
2. Guaranteed that the accuracy is at the end point of the spline shaft; load tool extension arm not in this definition range.
3. Maximum down force holding time shall not exceed 2.5 seconds.

4.5 DRS70L series Robot Specifications

Specifications of the DRS70L series robot are as shown in Table 4.5 below.

Table4. 5 DRS70L series robot specification table

Specifications of the SCARA Robot DRS70L6SSADF003、DRS70L6SOADF003、DRS70L6OSADF003		
Number of Axes 4		4
Arm Length (X+Y)		700mm / 27.56inch
Rated / Max. Payload		2kg / 6kg
Maximum Speed	J1+J2	5500 mm / sec
	J3	1100 mm / sec
	J4(SS/OS type)	2000° / sec
	J4(SO type)	600° / sec
Range of Motion	J1	±133°
	J2	±153°
	J3(SS/SO type)	200 mm
	J3(OS type)	300 mm
	J4	±360°
Standard Cycle Time*		0.4sec
Repeatability	X-Y	±0.015 mm
	Z	±0.01 mm
	RZ	±0.01°
Motor power	J1	400W
	J2	200W
	J3	100W (With Brake)
	J4	100W (With Brake)
Rated / Max. Push Force (J3)		150 / 350N
Rated / Max. Allowable Inertia Moment(J4) SS/OS type		0.01 / 0.08 kg-m^2
Rated/ Max. Allowable Inertia Moment(J4) SO type		0.07 / 0.9 kg-m^2
User Wiring		15Pin D-Sub
User Tubing		ø4 mm x 1, ø6 mm x 2
Pneumatic pressure		Max 0.6MPa / 87psi
Weight		20kg/40.79lb
Power supply		220V ~ +PE, 50 / 60Hz
Environment	Ambient Temperature	+5ºC to +40ºC
	Storage Temperature	-20ºC to +55ºC
	Humidity	not exceed 50% at a maximum temperature of +40°C

Note:

1. 25mm-300mm-25mm & Payload: 1Kg, testing environmental temperature 25°C, environmental relevant humidity 45% to 65% RH.
2. Guaranteed that the accuracy is at the end point of the spline shaft; load tool extension arm not in this definition range.
3. Maximum down force holding time shall not exceed 2.5 seconds

4.6 DRS60H series Robot Specifications

Specifications of the DRS60H series robot are as shown in Table 4.6 below.

Table4. 6 DRS60H series robot specification table

Specifications of the SCARA Robot DRS60H6SSADF003		
Number of Axes 4		4
Arm Length (X+Y)		600mm / 23.62inch
Rated / Max. Payload		2kg / 6kg
Maximum Speed	J1+J2	5000 mm / sec
	J3	1100 mm / sec
	J4	2000° / sec
Range of Motion	J1	±130°
	J2	±150°
	J3	200 mm
	J4	±360°
Standard Cycle Time*		0.39 sec
Repeatability	X-Y	±0.015 mm
	Z	±0.01 mm
	RZ	±0.01°
Motor power	J1	400W
	J2	200W
	J3	100W (With Brake)
	J4	100W (With Brake)
Rated / Max. Push Force (J3)		150 / 350N
Rated/ Max. Allowable Inertia Moment(J4) SS/OS type		0.01 / 0.08 kg-m^2
User Wiring		15Pin D-Sub
User Tubing		ø4 mm x 1, ø6 mm x 2
Pneumatic pressure		Max 0.6MPa / 87psi
Weight		23kg / 46.90lb
Power supply		220V ~ +PE, 50 / 60Hz
Environment	Ambient Temperature	+5ºC to +40ºC
	Storage Temperature	-20ºC to +55ºC
	Humidity	not exceed 50% at a maximum temperature of +40°C

Note:

1. 25mm-300mm-25mm & Payload: 1Kg, testing environmental temperature 25ºC, environmental relevant humidity 45% to 65% RH.
2. Guaranteed that the accuracy is at the end point of the spline shaft; load tool extension arm not in this definition range.
3. Maximum down force holding time shall not exceed 2.5 seconds.

4.7 DCS controller Specifications

DCS controller specifications are as shown in Table 4.7 below.

Table4. 7 DCS controller specifications

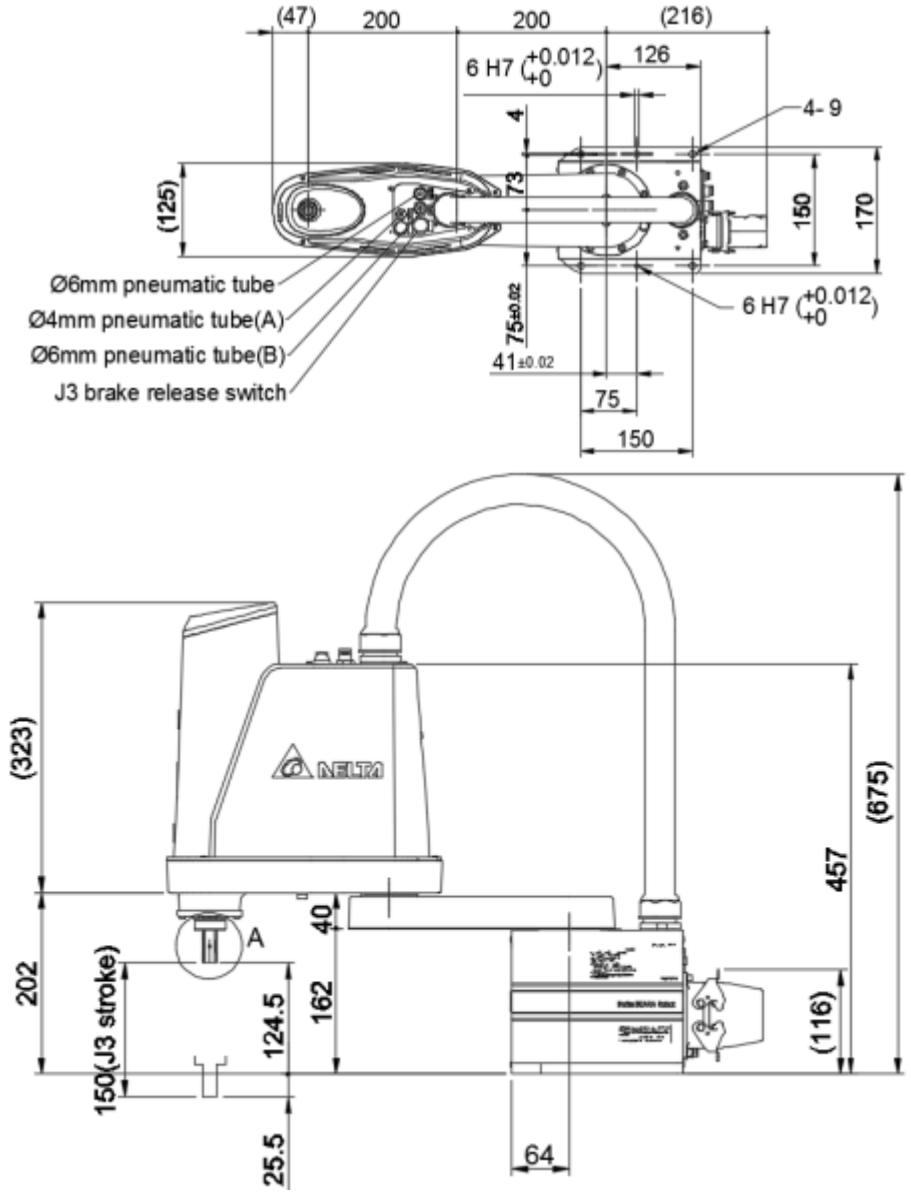
DCS-1B00-CA		
Power	Phase / Voltage	220V ~ +PE, 10A, 50 / 60Hz
	Rated power	3kW
Dimensions W x H x D (mm)		453 x 268 x 381 (mm)
Weight (kg)		20 (kg)
Cooling method		Fan cooling
Robot control	Program language	Delta Robot Language
	Movement mode	Point-to-point movement, linear interpolation, circular interpolation
	Memory capacity	20MB: For user to edit program and data 1K position points for global variable use (can be shared in different programs) 30K position points for all users to edit program
Input / output	Standard Input / output	24 sets of input; 12 sets of output
	System Input / output	5 sets of input; 7 sets of output
	Safety input	2 sets of emergency stop signal: NC contact 2 sets of functional pause signal: NC contact
Communication interface	Ethernet	1 channel
	RS-232 / RS-485	1 connection port (the 1 connection port can switch between two communication functions)
	DMCNET	1 channel
Environmental specifications	Installation location	Indoor (avoid exposure to direct sunlight), no corrosive fog (avoid fumes, flammable gas and dust)
	Elevation	1000m below sea level
	Atmospheric pressure	86kPa to 106kPa
	Environmental temperature	0ºC to +40ºC (if the environmental temperature exceeded 40ºC, please force surrounding air circulation)
	Storage temperature	-20ºC to +55ºC
	Humidity	not exceed 50% at a maximum temperature of +40°C
	Vibration	Under 20Hz 9.80665 m/s2 (1G), 20 to 50Hz 5.88 m/s2 (0.6G)
	IP level	IP20
	Power system	*TN system

- TN system: The neutral point of the power system is connected to ground directly, metal components exposed outside are connected to ground through protective ground conductors.

4.8 Dimensions

4.8.1 DRS40L series robot arm dimensions

Figure 4.1 below is the dimensions figure of DRS40L series; the unit is mm.



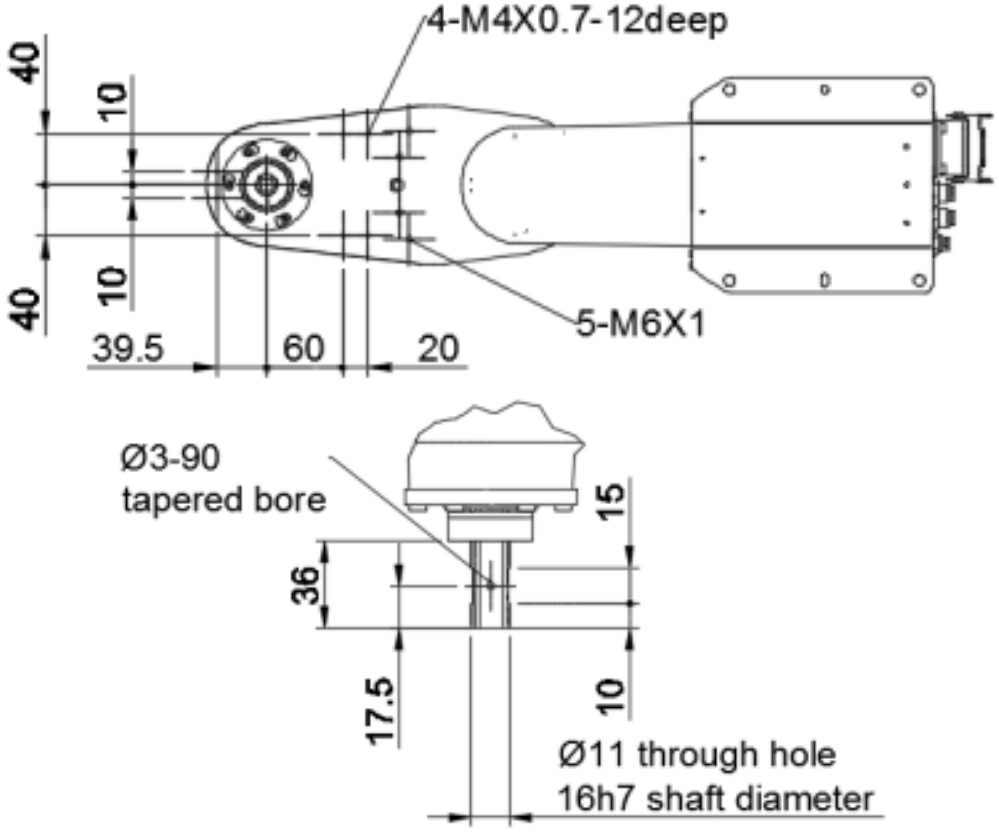
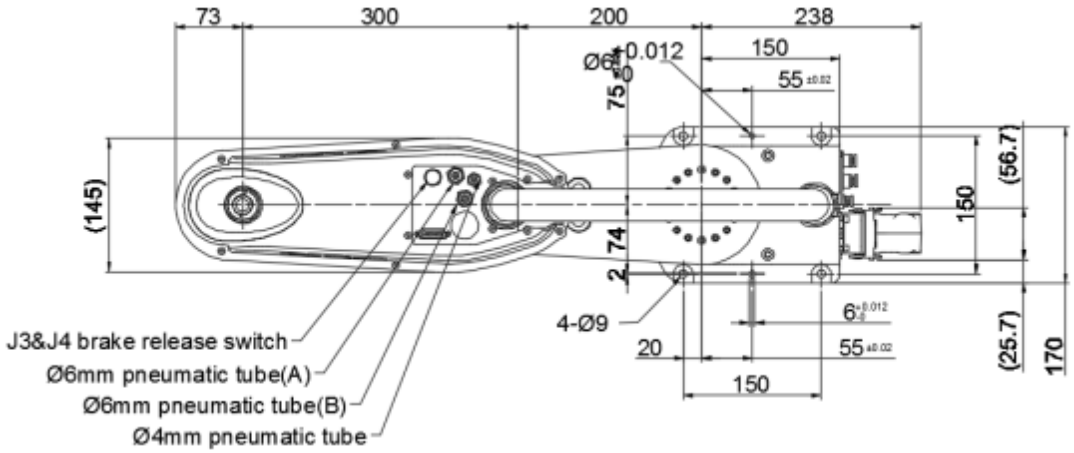


Figure4. 1 DRS40L series dimensions figure

4.8.2 DRS50L series robot arm dimensions

Figure 4.2 below is the dimensions figure of DRS50L series; the unit is mm.



Z axis range		
Type	SS	SO
*1	323 mm	423 mm
*2	200 mm	300 mm
*3	61 mm	161 mm

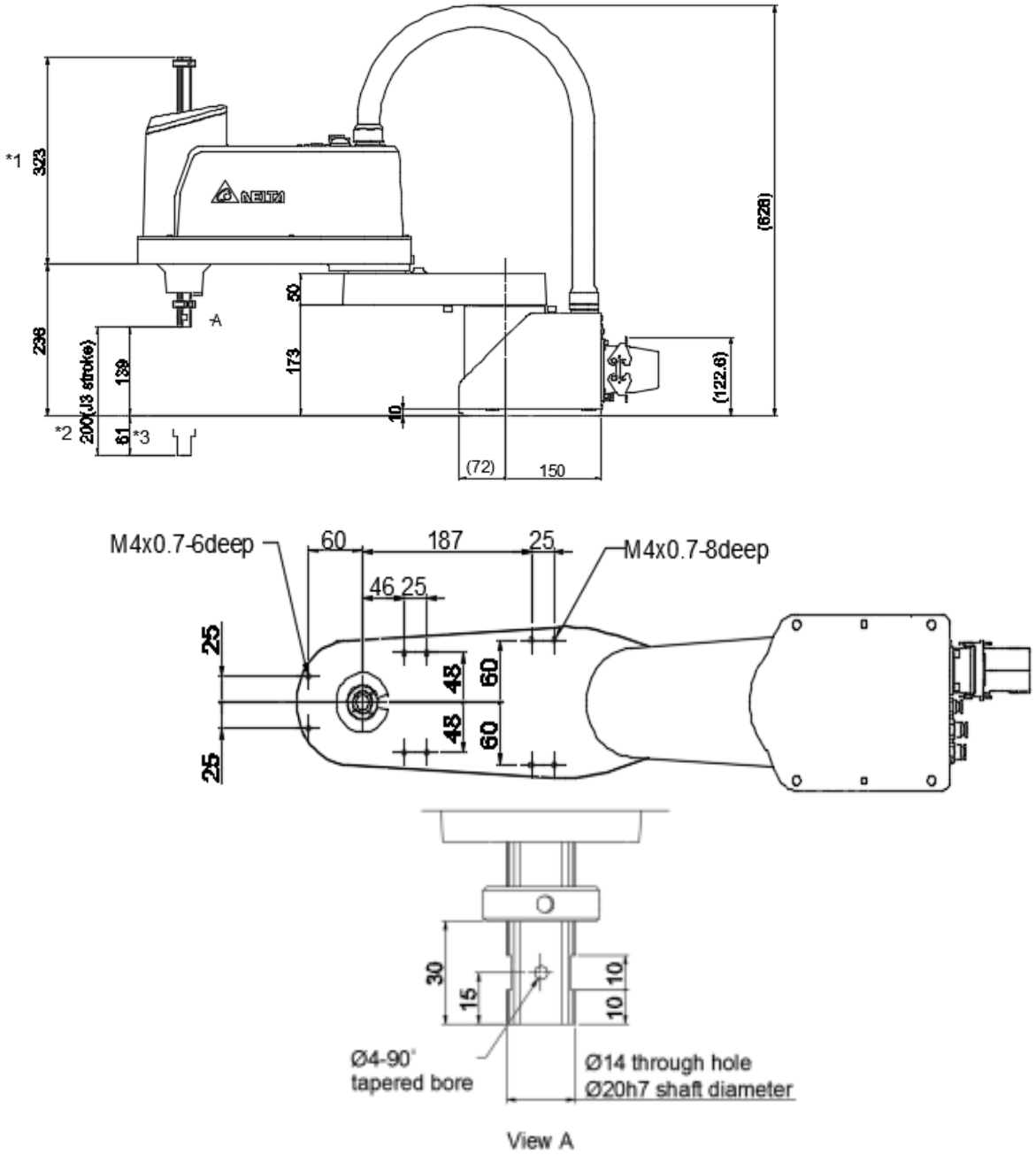
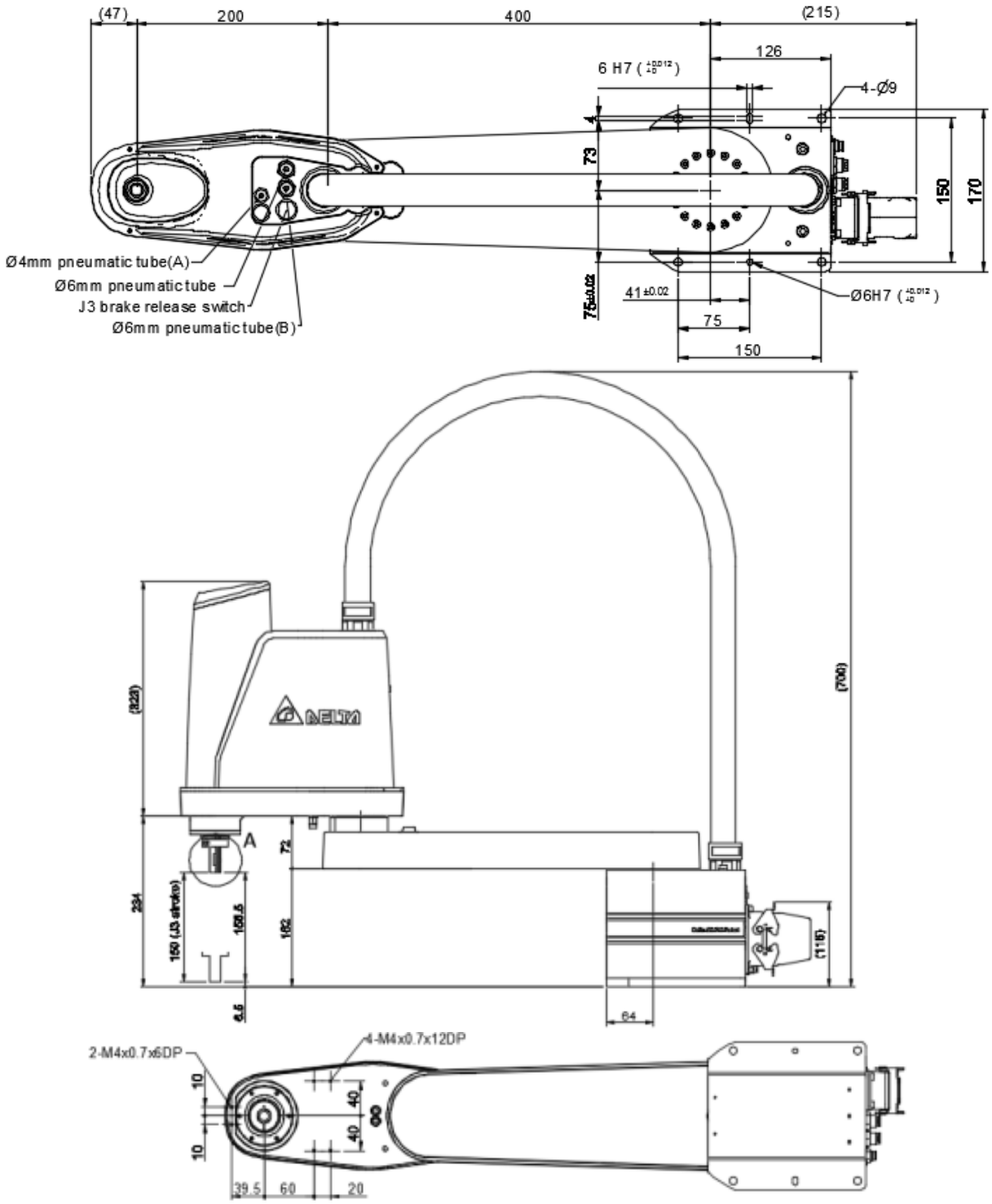


Figure4. 2 DRS50L series dimensions figure

4.8.3 DRS60L3 series robot arm dimensions

Figure 4.3 below is the dimensions figure of DRS60L3 series; the unit is mm.



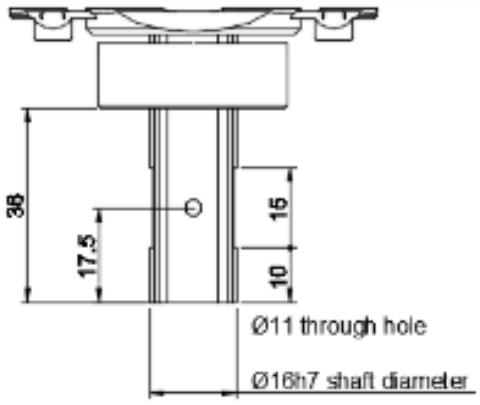
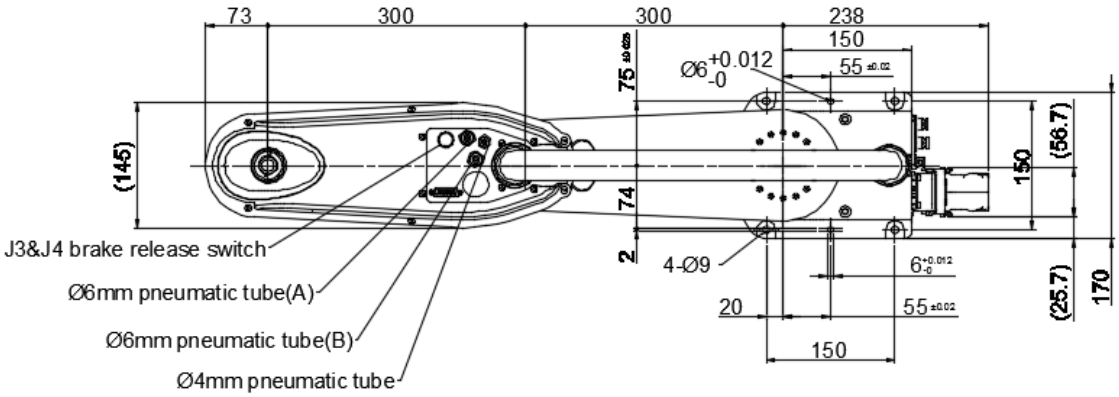


Figure4. 3 DRS60L3 series dimensions figure

4.8.4 DRS60L6 series robot arm dimensions

Figure 4.4 below is the dimensions figure of DRS60L6 series; the unit is mm.



Z axis range		
Type	SS	SO
*1	323 mm	423 mm
*2	200 mm	300 mm
*3	61 mm	161 mm

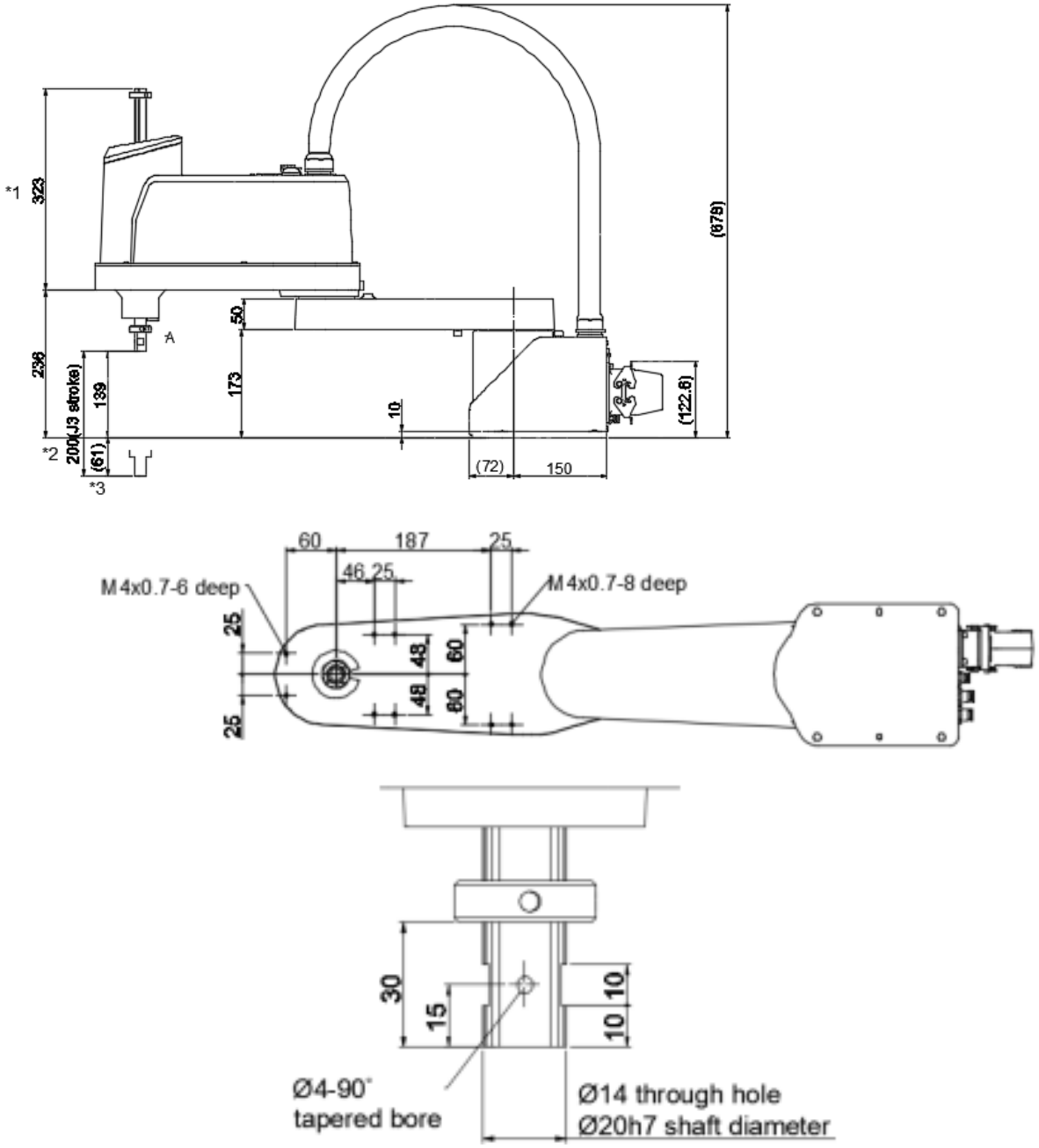
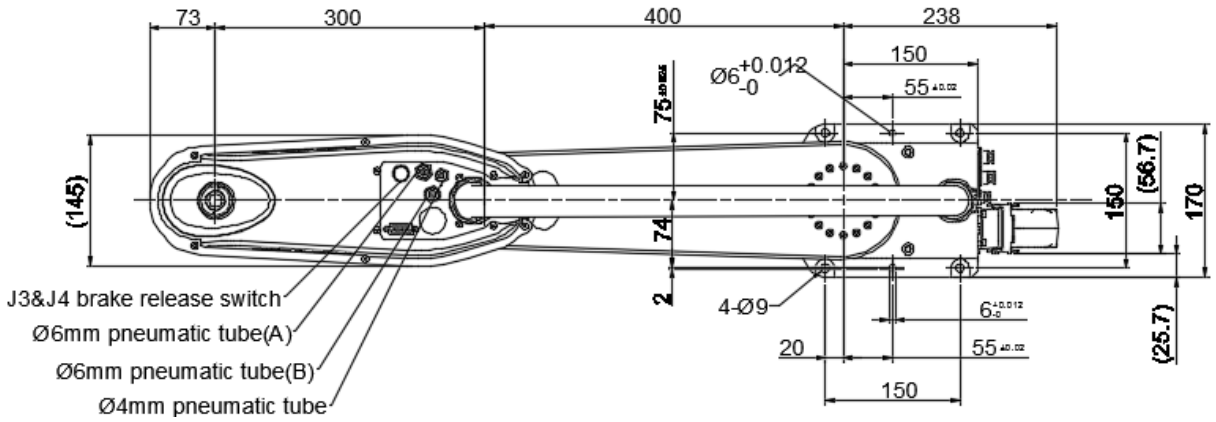


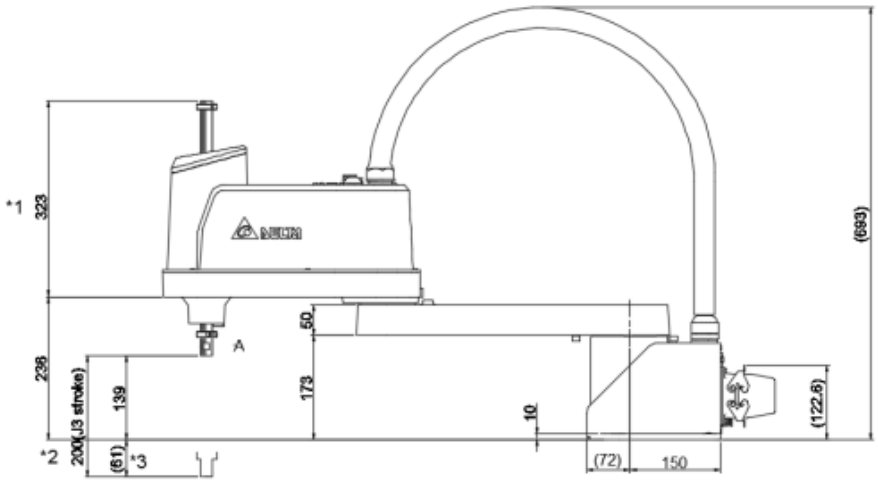
Figure4. 4 DRS60L6 series dimensions figure

4.8.5 DRS70L series robot arm dimension

Figure 4.5 below is the dimensions figure of DRS70L series; the unit is mm.



Z axis range		
Type	SS	SO
*1	323 mm	423 mm
*2	200 mm	300 mm
*3	61 mm	161 mm



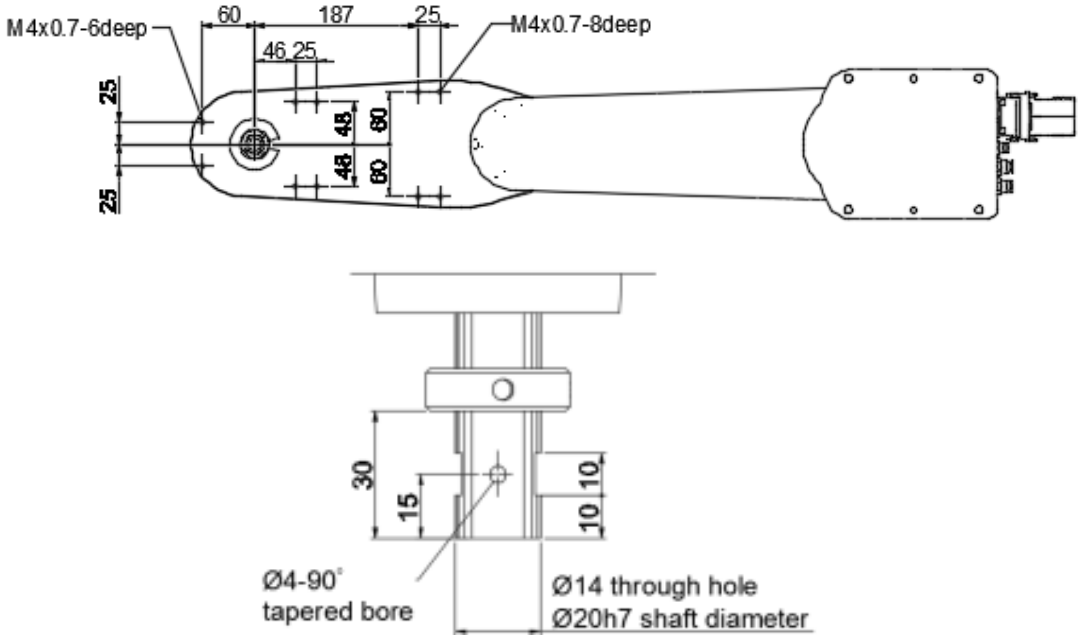


Figure4. 5 DRS70L series dimensions figure

4.8.6 DRS60H series robot arm dimension

Figure 4.6 below is the dimensions figure of DRS60H series; the unit is mm.

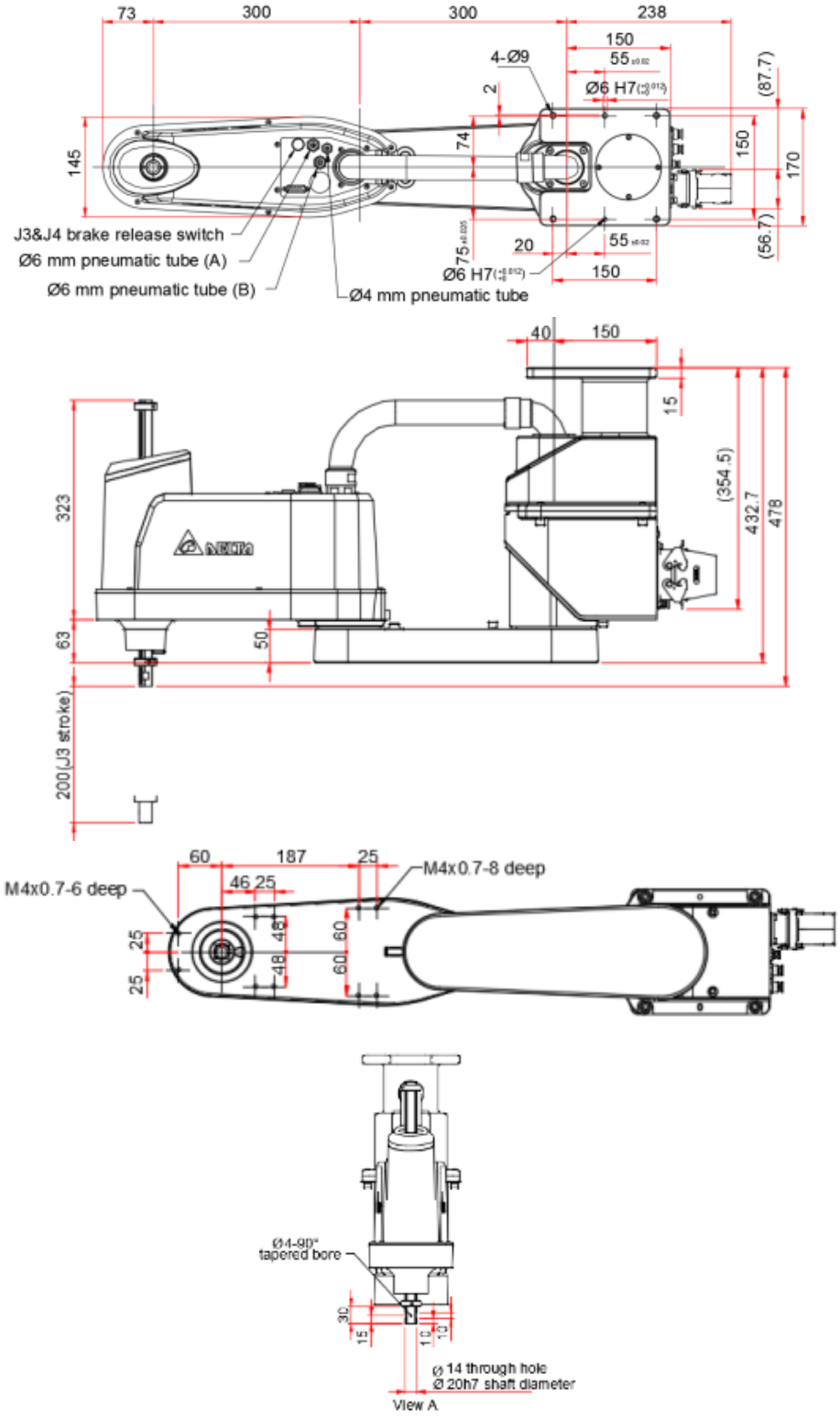


Figure4. 6 DRS60H series dimensions figure

4.8.7 DCS controller dimensions

DCS controller dimensions are as shown in Figure 4.7 below.

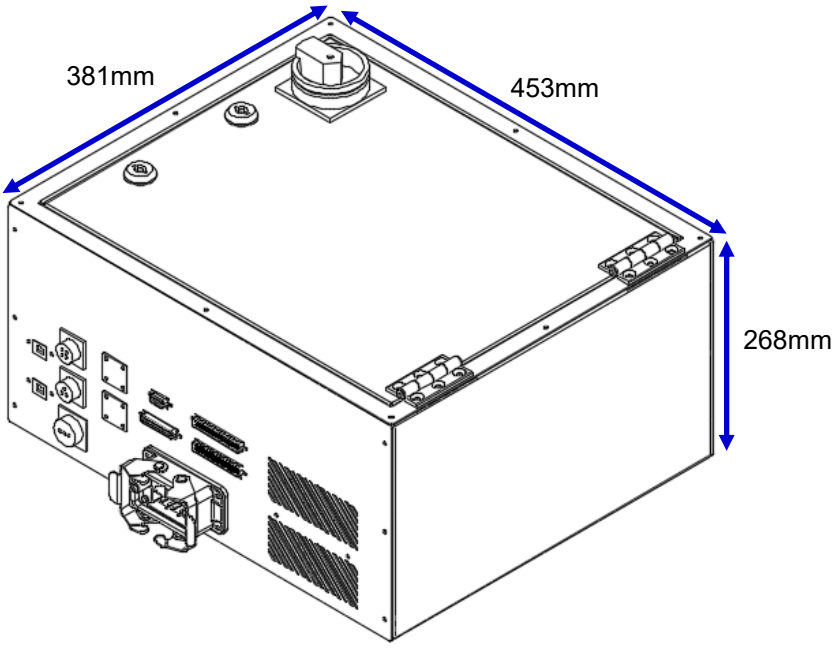


Figure4. 7 Controller dimensions figure

Controller installation notes:

- Do not put your finger or foreign matter into the heat-radiating fan of controller, or it may cause injury hazards.
- This controller does not have explosion-proof or splash-proof structures, so do not place it at locations that are too humid or else it can be easily splashed by liquids.
- Before moving, installing, wiring and using, please read this Manual carefully.
- Do not randomly stack objects on top of the controller, and do not bump into the controller.
- Do not install the controller in a location subjecting to excessive vibration.
- Do not plug or unplug the power while the power is on the ON status or while operating as doing so may cause damages to the internal components of the robot orcontroller.
- The input power of the controller is 220V~, 50/60Hz; do not input non-specified voltages as doing so may cause the controller to burn or inaccurate robot movements.

5. Hardware point

This chapter will introduce the point position and working range of the robot.
Since the robot is a semi-finished product system, please install and adjust the active point positions according to the actual system in order to prevent operational errors causing damages to the robot and surrounding devices due to impact.

	■ Please confirm the working area of the robot before installation, and plan the composition of the surrounding system properly. ■ Please install safety protection devices around the working area of the robot, such as railings, safety gratings, pressure pads or laser scanners etc. in order to guarantee the safety of the workers. ■ Please adjust the active point positions of the robot properly according to the actual plan in order to prevent operational errors and causing damages to the robot and surrounding devices due to impact. ■ After adjusting the active points, please lock in the screws properly or else the points might lose their functions.
	■ Adding any new point positions on your own is strictly prohibited; this will damage the rigidity of the mechanism. Our company will not be held responsible for any damages resulted from doing so. ■ Changing the screen size of any point is prohibited.

5.1 DRS 3kg series limit hardware point

The installation location of the DRS 3kg series limit point is as shown in Figure 5.2 below; Table 5.1 is the limit point screw and locking torque.

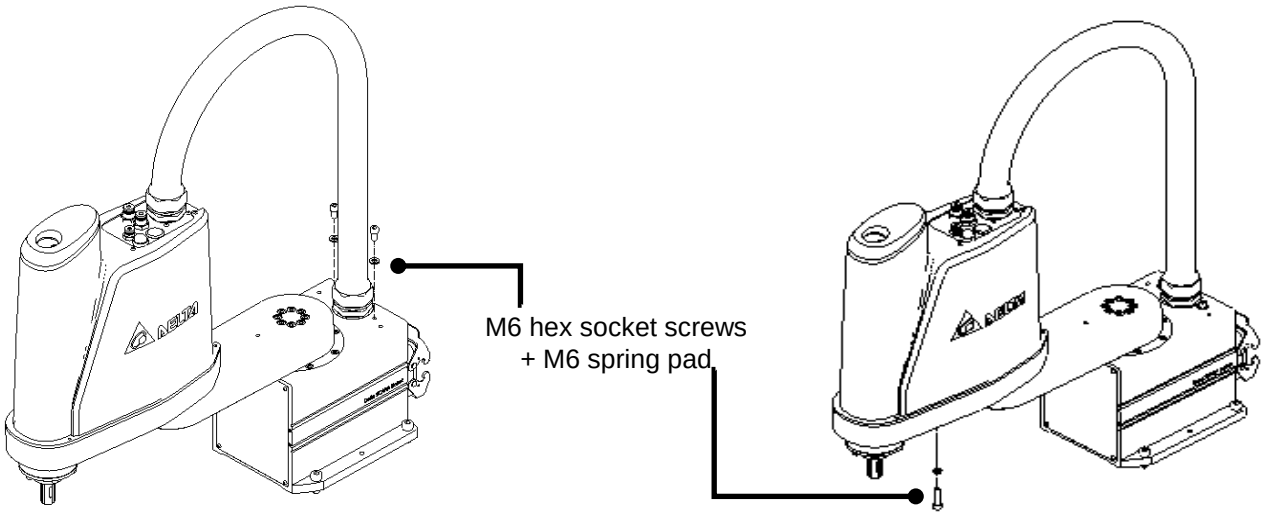


Figure5. 1 DRS 3kg series limit hardware point installation illustration

Table5. 1 DRS 3kg series limit hardware point locking torque

	Name	Screw torque value	Remark
Tools	#5 hex wrench	9.7 to 10.5 N-m	M6x12 hex socket screws + M6 spring pad

5.2 DRS 6kg series limit hardware point

The installation location of the DRS 6kg series limit point is as shown in Figure 5.2、5.3 below.

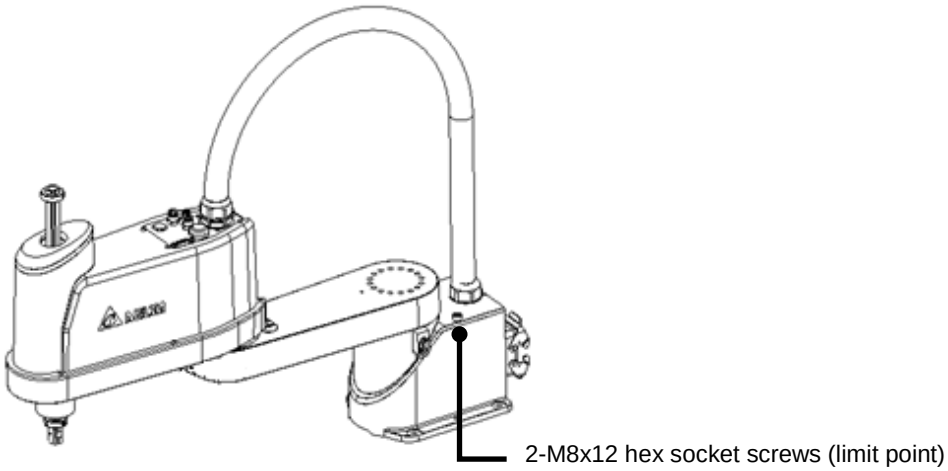


Figure5. 2 DRS 6kg series first arm limit hardware point installation illustration

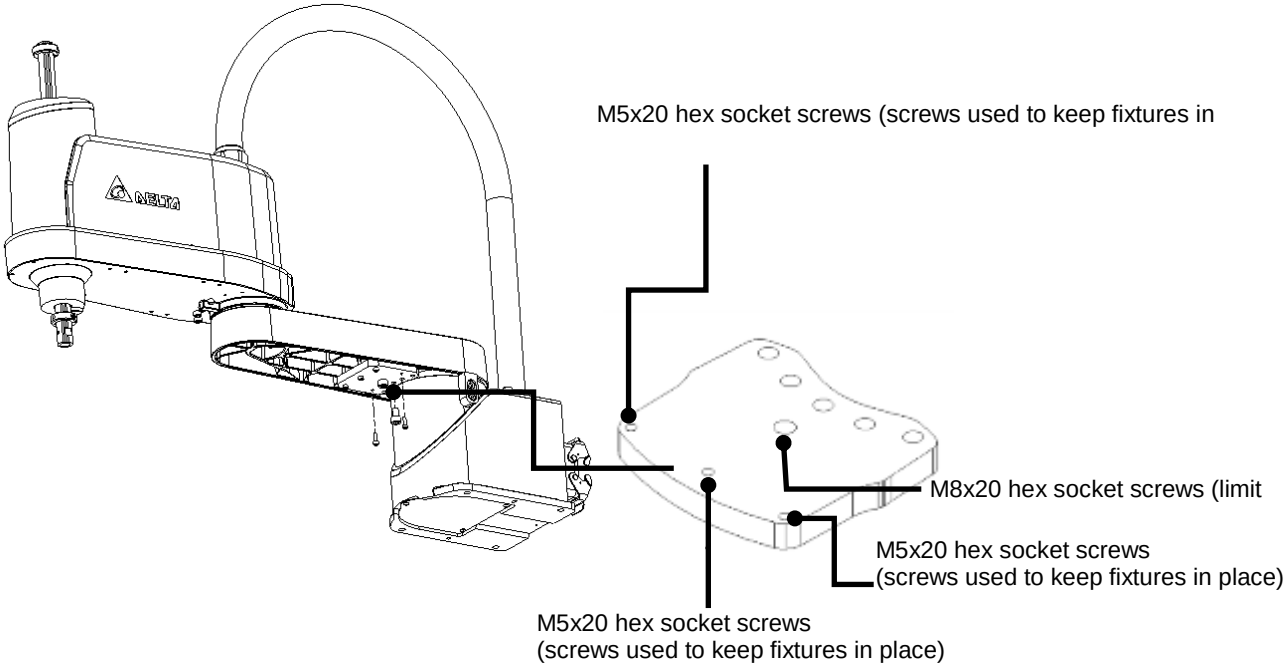


Figure5. 3 The installation position of the first arm limit point of DRS 6kg series

The screws used to locking torque for the installation of the first arm and base limit point of DRS 6kg series are as shown in Table 5.2.

Table5. 2 DRS 6kg series hardware point locking torque

	Name	Screw torque value	Remark
Tools	#6 hex wrench	20 to 20.3 N-m	M8x20 hex socket screws M8x12 hex socket screws
	#4 hex wrench	5.7 to 6 N-m	M5x20 hex socket screws

The position of the second arm limit hardware point of DRS 6kg series is as shown in Figure 5.4 below.

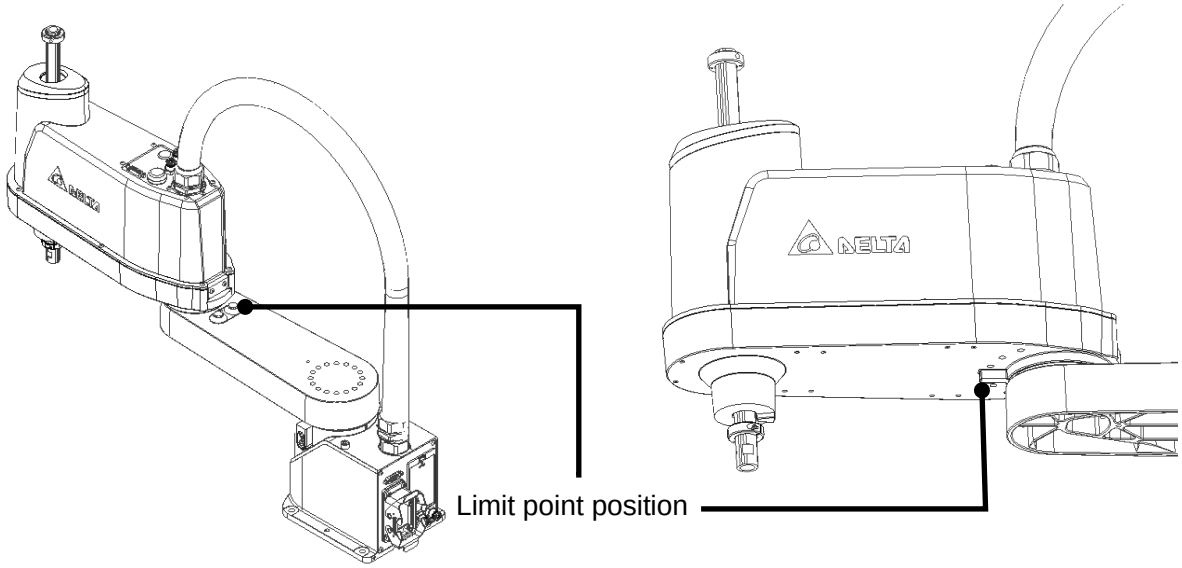


Figure5. 4 DRS 6 kg series second arm limit hardware point installation illustration

Table 5.3 below is the first arm point screw and locking torque for DRS 6kg series installation.

Table5. 3 DRS 6kg series hardware point locking torque

	Name	Screw torque value	Remark
Tools	#6 hex wrench	20 to 20.3 N-m	M8x12 hex socket screws +M8 spring washer

5.3 DRS60H series limit hardware point

The installation location of the DRS60H6 series limit point is as shown in Figure 5.5 below.

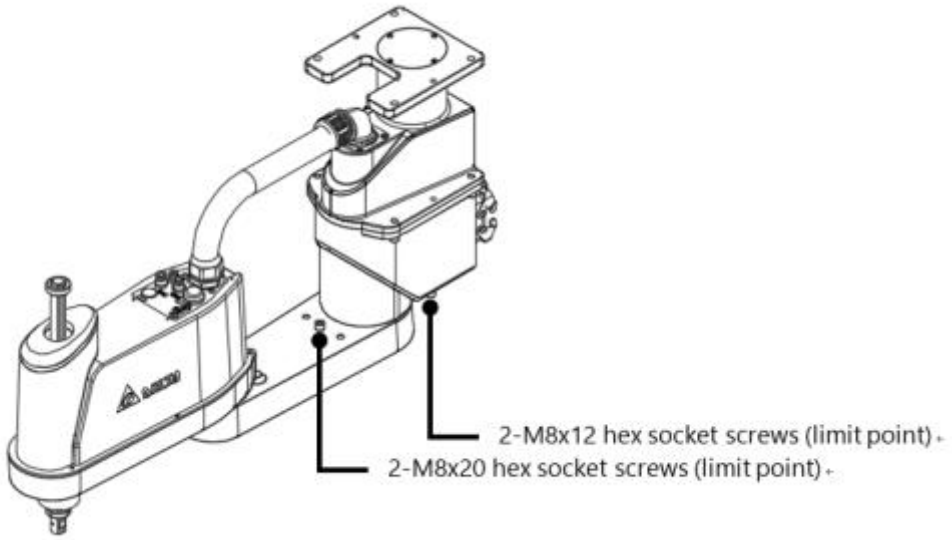


Figure5. 5 DRS60H first arm limit hardware point installation illustration

Table5. 4 DRS60H series first arm active hardware point locking torque

	Name	Screw torque value	Remark
Tools	#6 hex wrench	20 to 20.3 N-m	M8x20 hex socket screws M8x12 hex socket screws

The position of the second arm limit hardware point of DRS60H series is as shown in Figure 5.6 below.

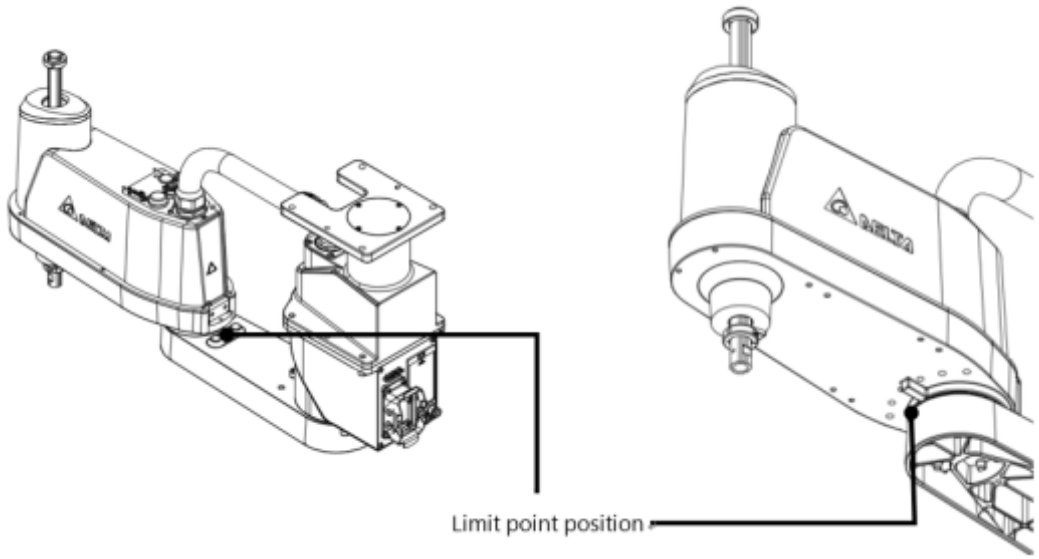


Figure5. 6 DRS60H6 second arm limit hardware point installation illustration

5.4 DRS40L3 series active hardware point

When the working range of the SCARA arm needs to restricted, active hardware limit points can be added

The installation position of the first arm active point of DRS40L3 series and the working angle are as shown in Figure 5.7 below.

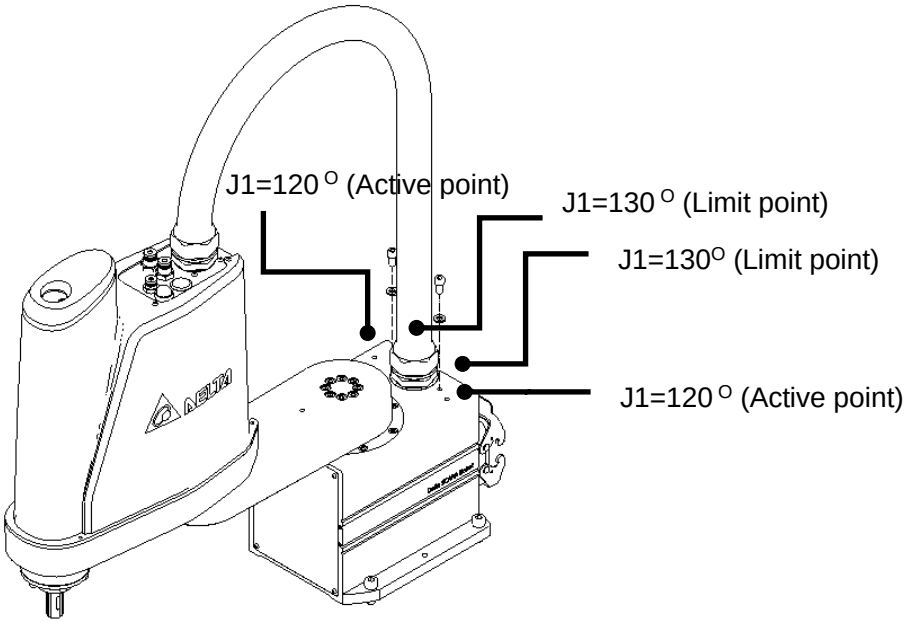


Figure5. 7 DRS40L3 series first arm active point position and the various operation ranges

Table 5.5 below is the first arm point screw and locking torque for DRS40L3 series installation.

Table5. 5 DRS40L3 series point screw locking torque

	Name	Screw torque value	Remark
Tools	#5 hex wrench	9.7 to 10.5 N-m	M6x12 hex socket screws + M6 spring washer

The installation position of the second arm active point (119°, 132°) of DRS40L3 series and the working angle are as shown in Figure 5.8 below.

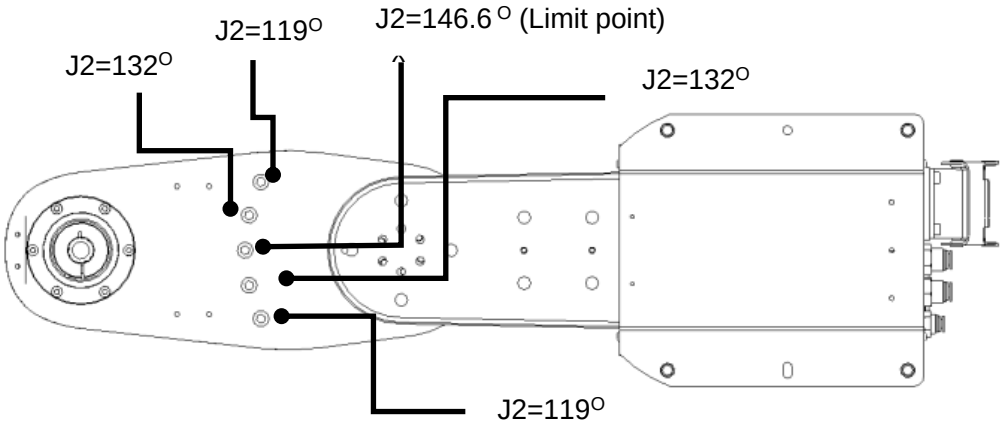


Figure5. 8 DRS40L3 second arm active point position and working ranges

Table 5.6 below is the second arm point screw and locking torque for DRS40L3 series installation.

Table5. 6 DRS40L3 series second arm active point locking torque

	Name	Screw torque value	Remark
Tools	#5 hex wrench	9.7 to 10.5 N-m	M6x12 hex socket screws + M6 spring washer

5.4 DRS60L3 series active hardware point

The installation position of the first arm active point of DRS60L3 series and the working angle are as shown in Figure 5.9 below.

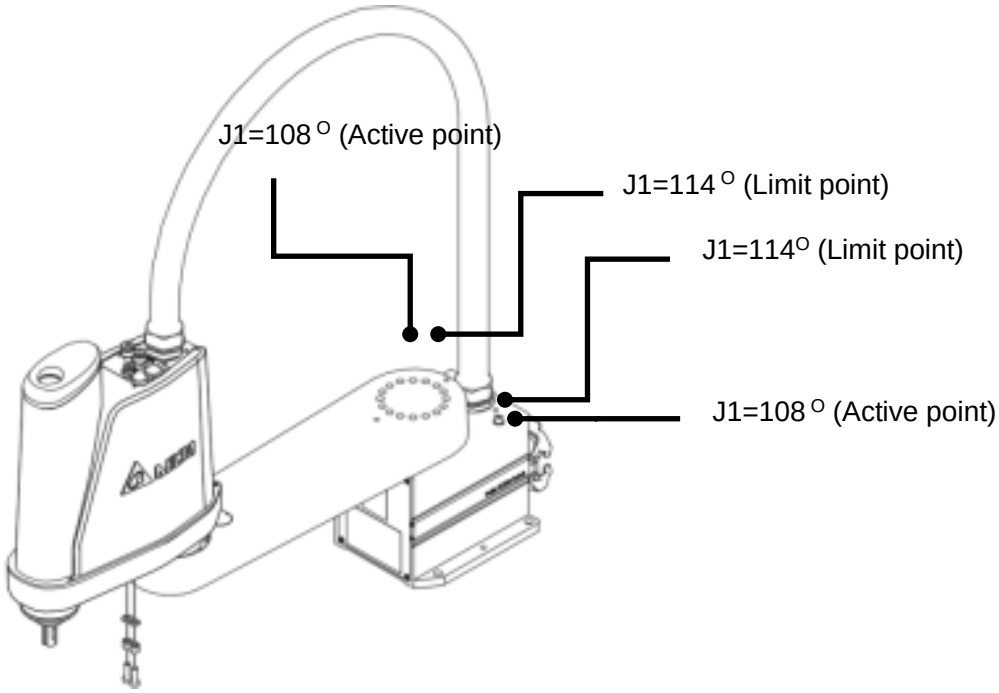


Figure5. 9 DRS60L3 series first arm active point position and the various operation ranges

Table 5.7 below is the first arm point screw and locking torque for DRS60L3 series installation.

Table5. 7 DRS60L3 series point screw locking torque

	Name	Screw torque value	Remark
Tools	#5 hex wrench	9.7 to 10.5 N-m	M6x12 hex socket screws + M6 spring washer

The installation position of the second arm active point (121°, 145°) of DRS60L3 series and the working angle are as shown in Figure 5.10 below.

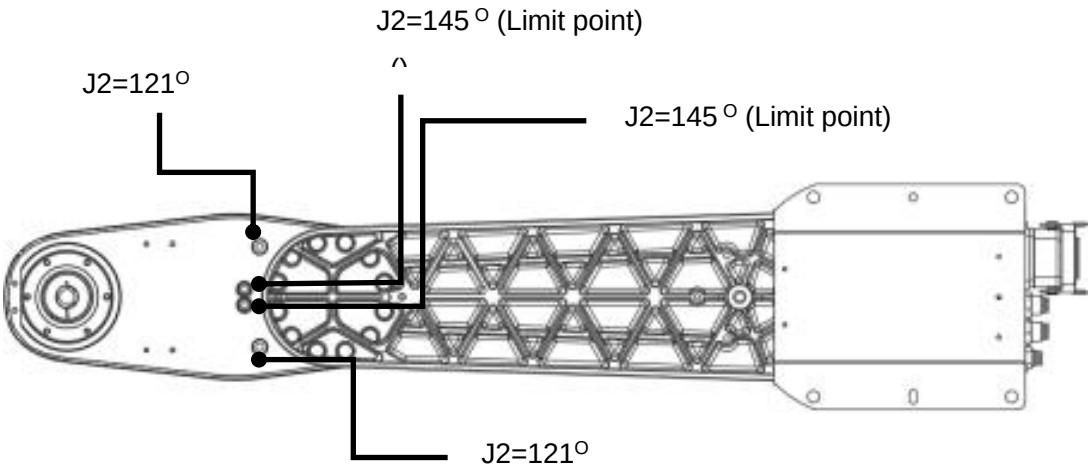


Figure5. 10 DRS60L3 second arm active point position and working ranges

Table 5.8 below is the second arm point screw and locking torque for DRS60L3 series installation.

Table5. 8 DRS60L3 series second arm active point locking torque

	Name	Screw torque value	Remark
Tools	#5 hex wrench	9.7 to 10.5 N-m	M6x12 hex socket screws + M6 spring washer

5.5 DRS 50L6/60L6/70L 6 kg series active hardware point

The installation position of the first arm limit point of DRS50L6 series is as shown in Figure 5.11 below.

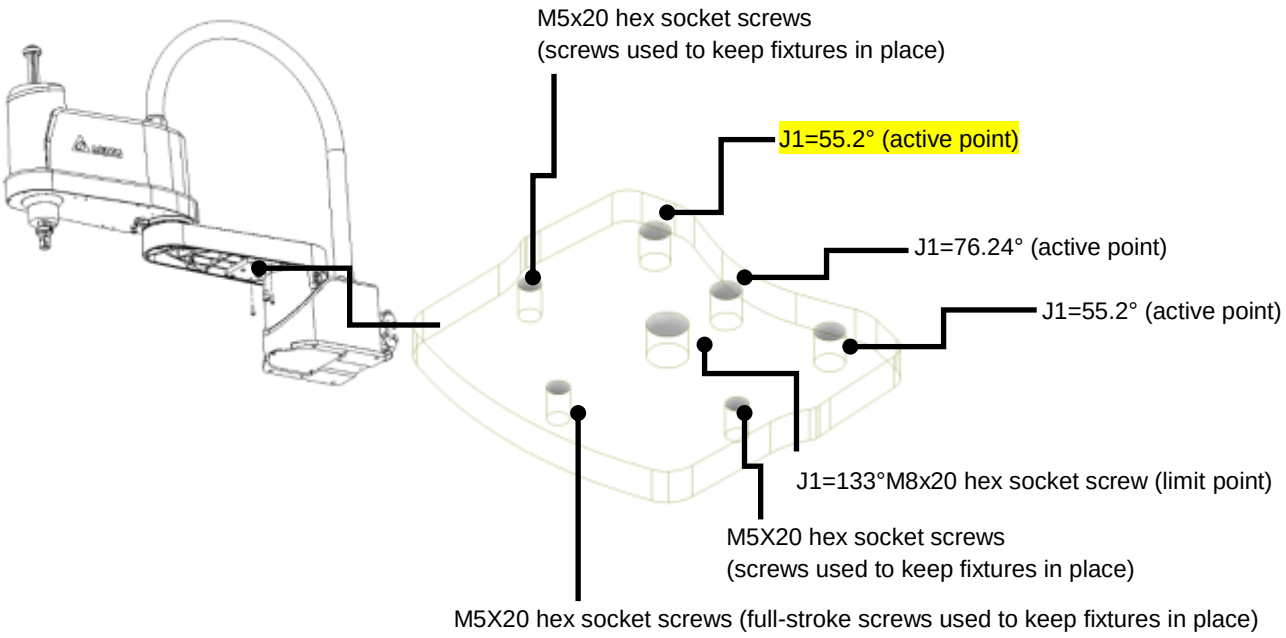


Figure5. 11 The installation position of the first arm limit point of DRS50L6 series

Table 5.9 below is the first arm point screw and locking torque for DRS50L6 series installation.

Table5. 9 DRS50L6 series first arm active hardware point locking torque

	Name	Screw torque value	Remark
Tool	#4 hex wrench	5.7 to 6 N-m	M5x20 hex socket screws

The installation position of the first arm limit point of DRS60L6 series is as shown in Figure 5.12 below.

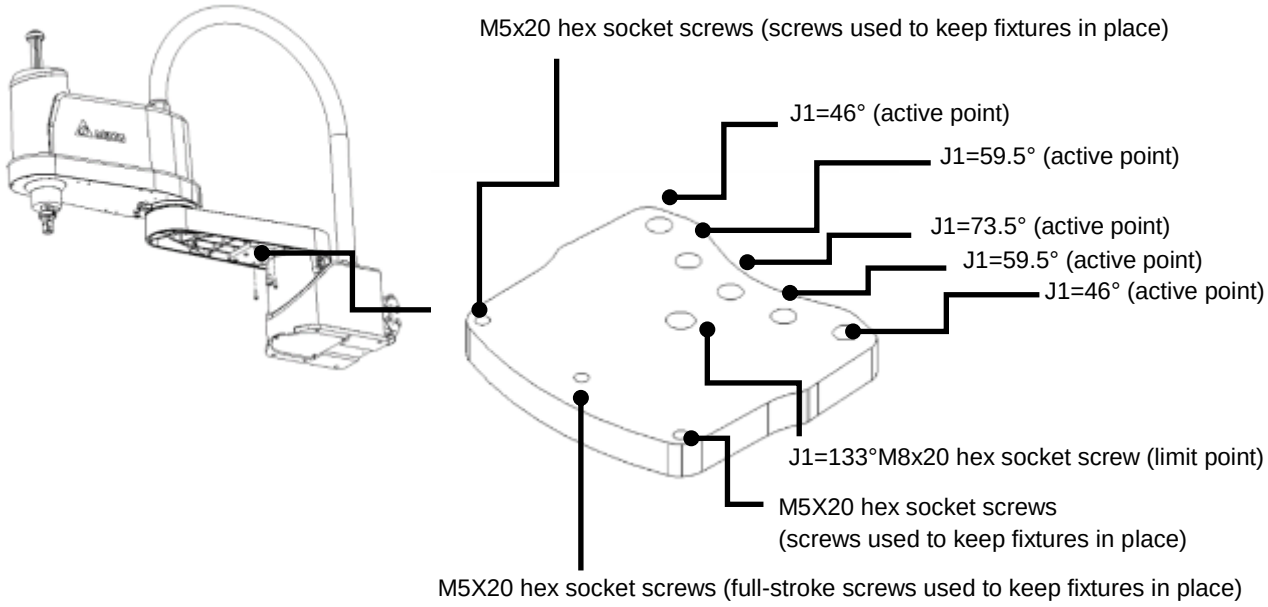


Figure5. 12 The installation position of the first arm limit point of DRS60L6 series

Table 5.10 below is the first arm point screw and locking torque for DRS60L6 series installation.

Table5. 10 DRS60L6 series first arm active hardware point locking torque

	Name	Screw torque value	Remark
Tool	#4 hex wrench	5.7 to 6 N-m	M5x20 hex socket screws

The installation position of the first arm limit point of DRS70L6 series is as shown in Figure 5.13 below.

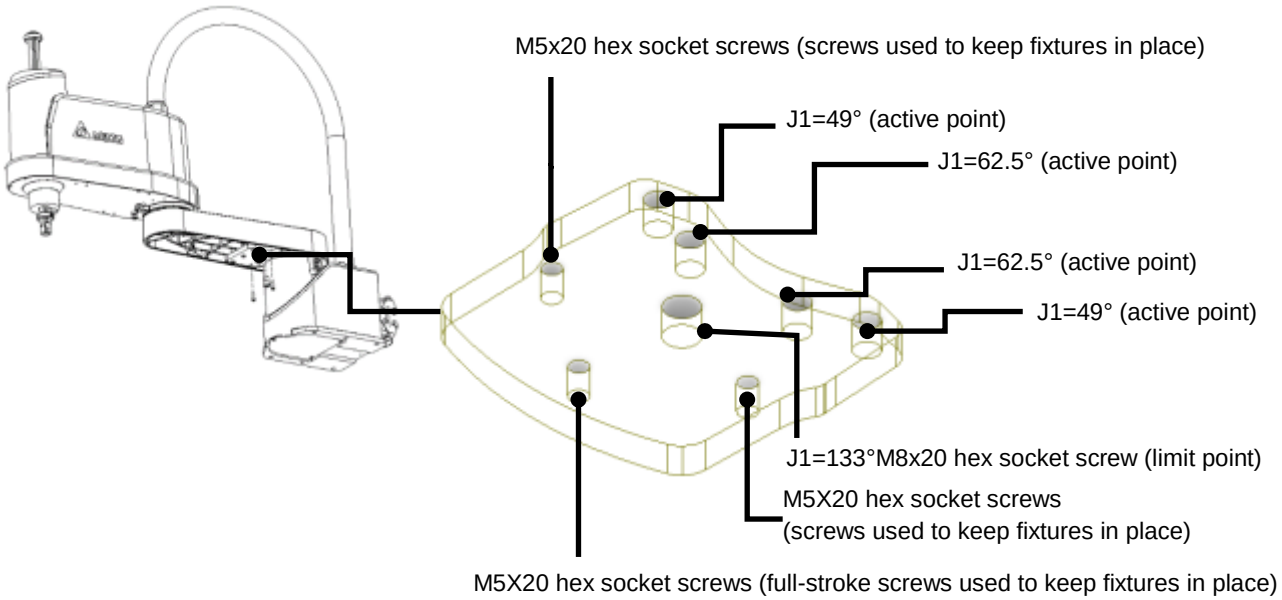


Figure5. 13 The installation position of the first arm limit point of DRS70L6 series

Table 5.11 below is the first arm point screw and locking torque for DRS70L6 series installation.

Table5. 11 DRS70L6 series first arm active hardware point locking torque

	Name	Screw torque value	Remark
Tool	#4 hex wrench	5.7 to 6 N-m	M5x20 hex socket screws

The installation position of the second arm active point and angle (101°, 121°, 141°) of DRS 6kg series are as shown in Figure 5.14 below.

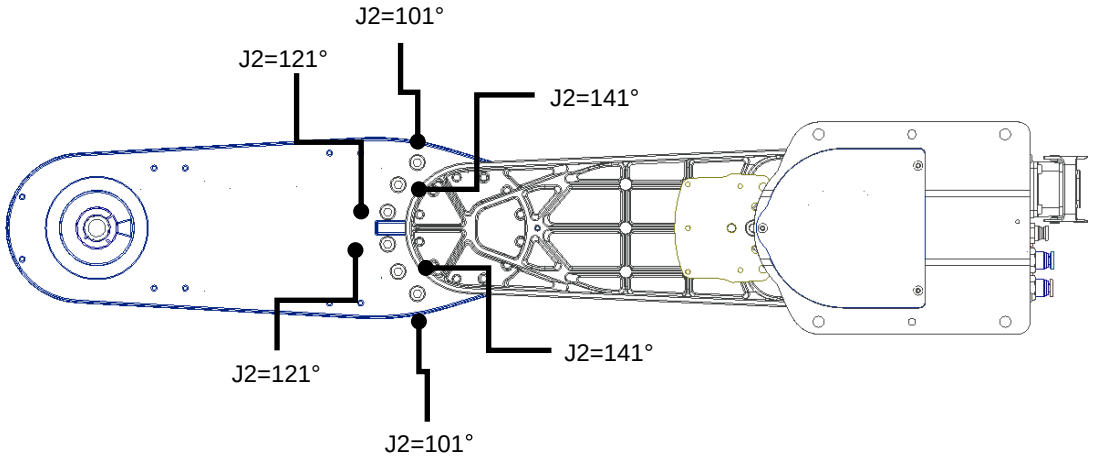


Figure5. 14 DRS 6kg series installation position of the second arm active point and angle

5.6 DRS 60H series active hardware point

The installation position of the first arm limit point of DRS 60H series is as shown in Figure 5.15 below.

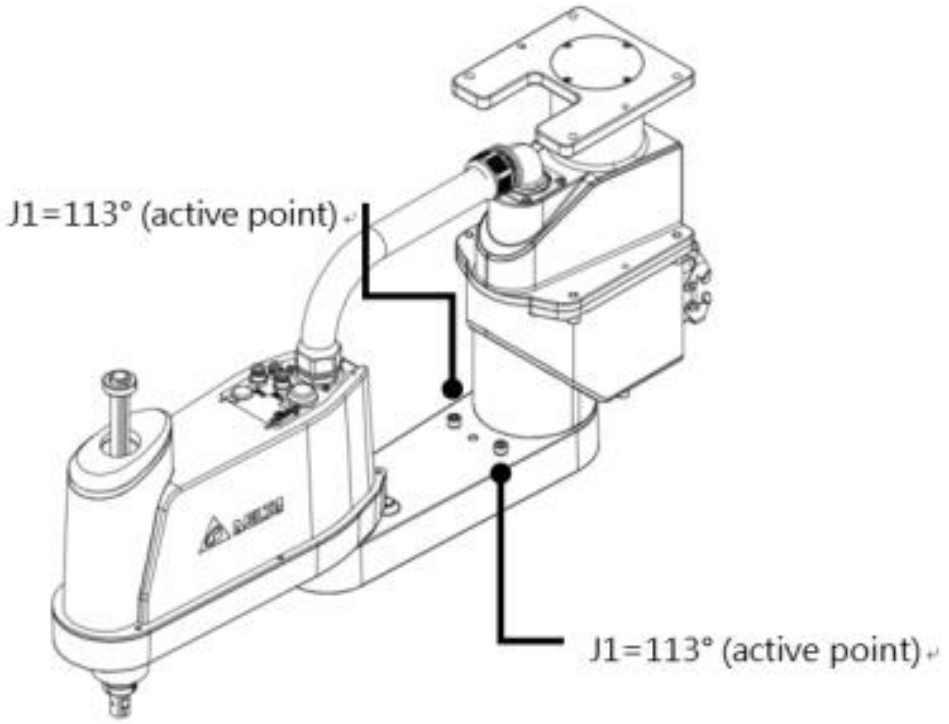


Figure5. 15 The installation active hardware position of the first arm limit point of DRS60H series

Table 5.12 below is the first arm point screw and locking torque for DRS60H series installation.

Table5. 12 DRS60H series first arm active hardware point locking torque

	Name	Screw torque value	Remark
Tools	#6 hex wrench	20 to 20.3 N-m	M8x20 hex socket screws M8x12 hex socket screws

The installation position of the second arm active point and angle (101°, 121°, 141°) of DRS60H series are as shown in Figure 5.16 below.

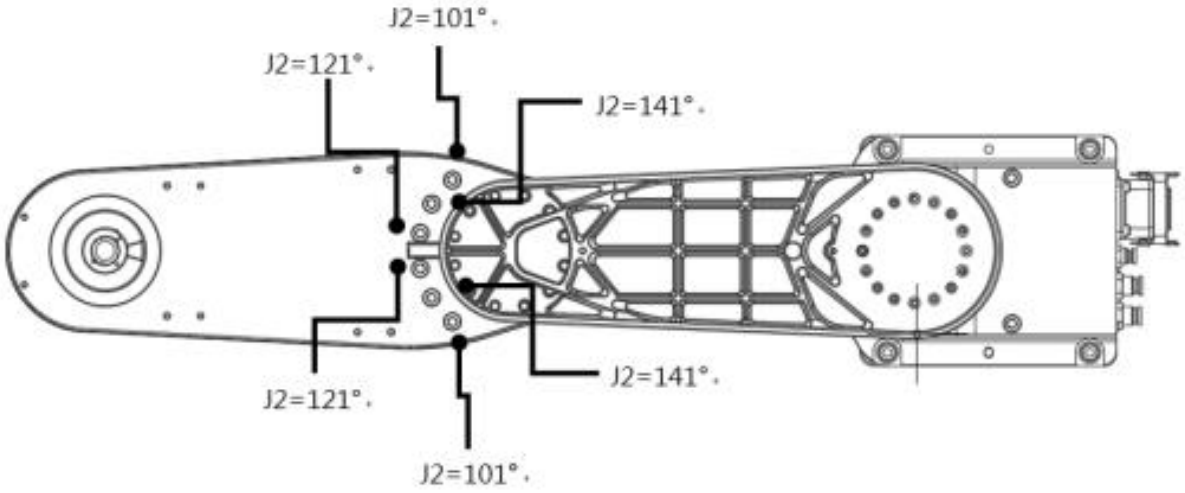


Figure5. 16 DRS60H series installation position of the second arm active point and angle

Table 5.13 below is the second arm point screw and locking torque for DRS60H series installation.

Table5. 13 DRS60H series second arm active point locking torque

	Name	Screw torque value	Remark
Tools	#6 hex wrench	20 to 20.3 N-m	M8x12 hex socket screw + spring pad

5.7 DRS CE series active hardware point

The installation adjustment position of the Z axis active hardware point of DRS CE 3kg series is as shown in Figure 5.17 below. Screw torque value 9.7 to 10.5 N-m.。

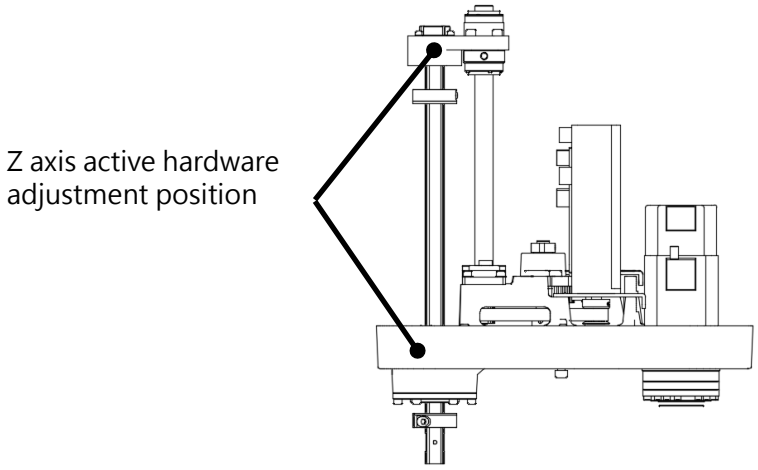


Figure5. 17 DRS 3kg series Z axis active hardware adjustment position

The installation adjustment position of the Z axis active hardware point of DRS 6kg series is as shown in Figure 5.18. DRS 60H series is as show in Figure 5.19.Screw torque value 1.8 to 2.0 N-m.

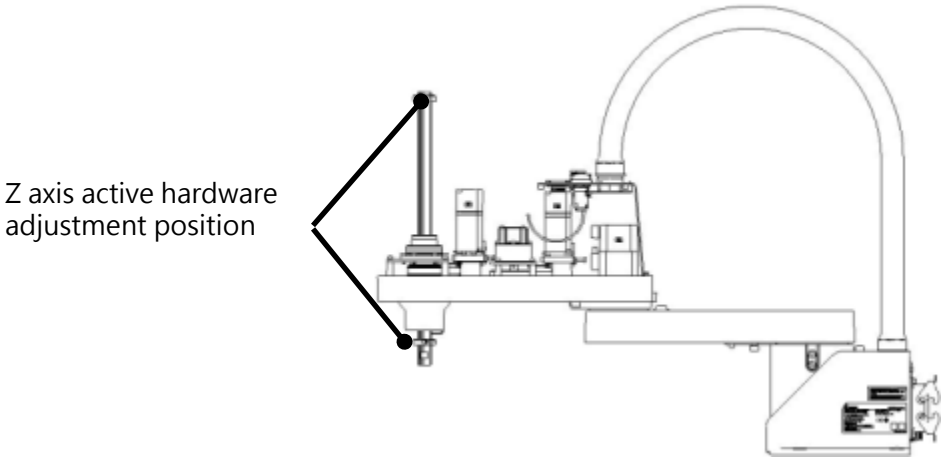


Figure5. 18 DRS 6kg series Z axis active hardware adjustment position

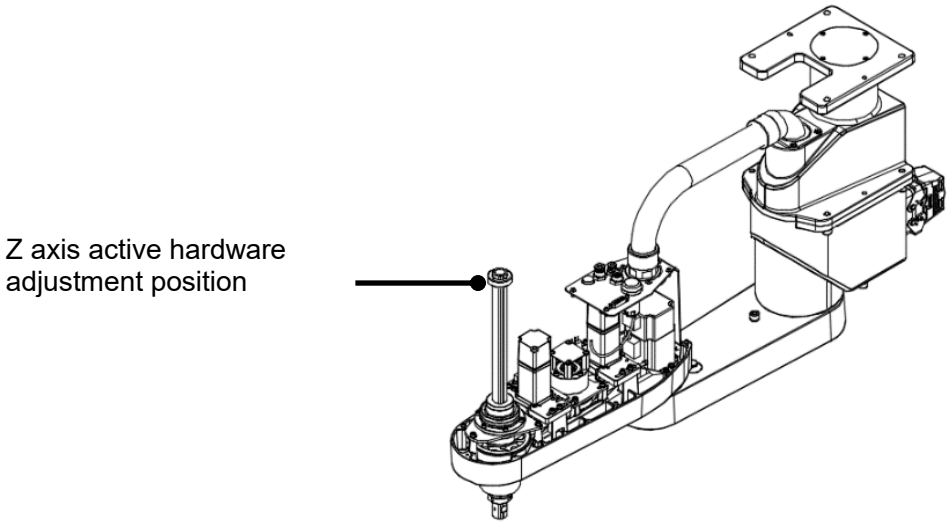


Figure5. 19 DRS60H series Z axis active hardware adjustment position

6. Robotparts descriptions

This chapter will introduce the names, functions and operating directions of the various parts of the robot.

	■ Please install safety protection devices around the working area of the robot, such as railings, safety gratings, pressure pads or laser scanners etc. in order to guarantee the safety of the workers. ■ Please read this manual carefully before operation in order to use the robot properly, help prevent impact and ensure the safety of workers. ■ Please operate the robot outside the safety protection area in order to ensure worker safety.
	■ Adding any new point positions on your own is strictly prohibited; this will damage the rigidity of the mechanism. Our company will not be held responsible for any damages resulted from doing so. ■ Changing the screw size of any point is prohibited. ■ Randomchanges or modification of the robot is strictly prohibited; our company is not responsible for any problems resulted from doing so.

6.1 DRS 3kg series robot parts descriptions

The appearance and parts of DRS 3kg series are as shown in Figure 6.1 below.

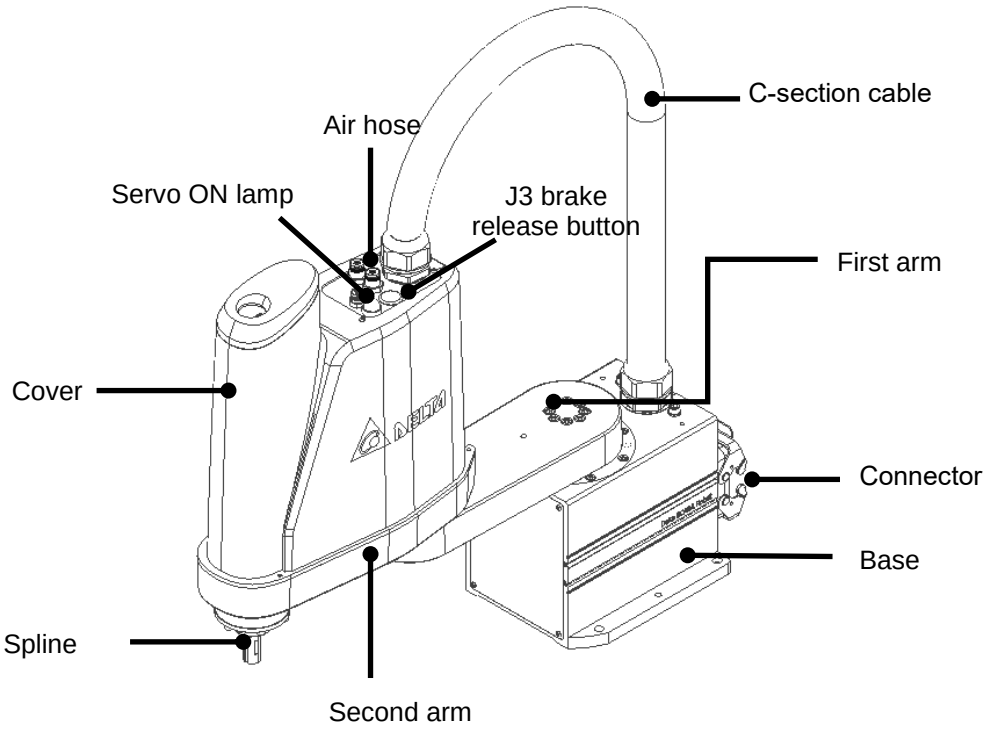


Figure6. 1 DRS 3kg series appearance figure

The internal components of the DRS 3kg series base are as shown in Figure 6.2 below.

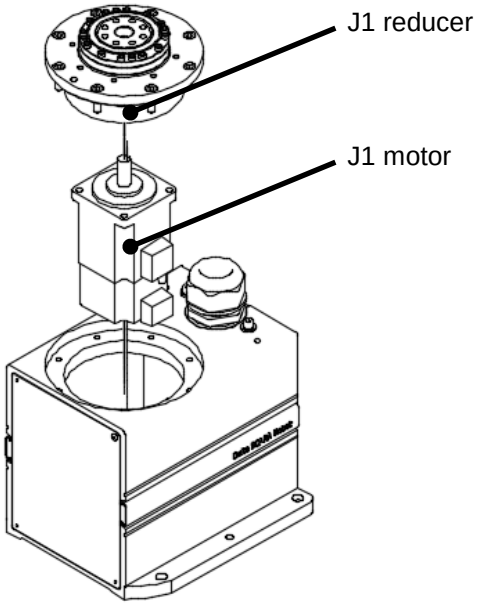


Figure6. 2 Internal components of the DRS 3kg series robot base

The internal components of the DRS 3kg series second arm are as shown in Figure 6.3 below.

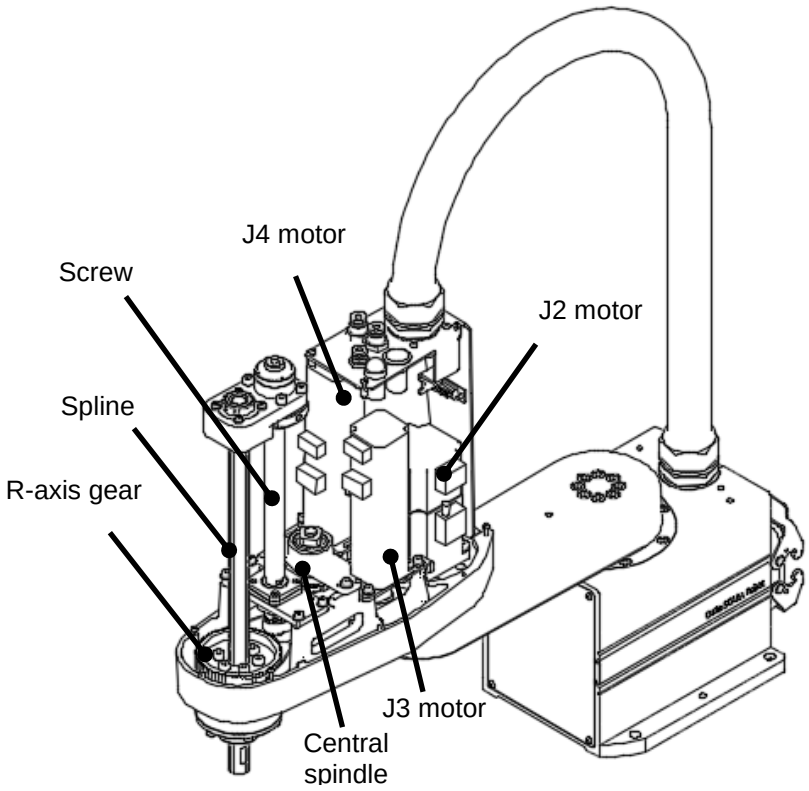


Figure6. 3 Internal components of the DRS 3kg series second arm

6.2 DRS 6kg series robot parts descriptions

The appearance and parts of DRS 6kg series are as shown in Figure 6.4 below.

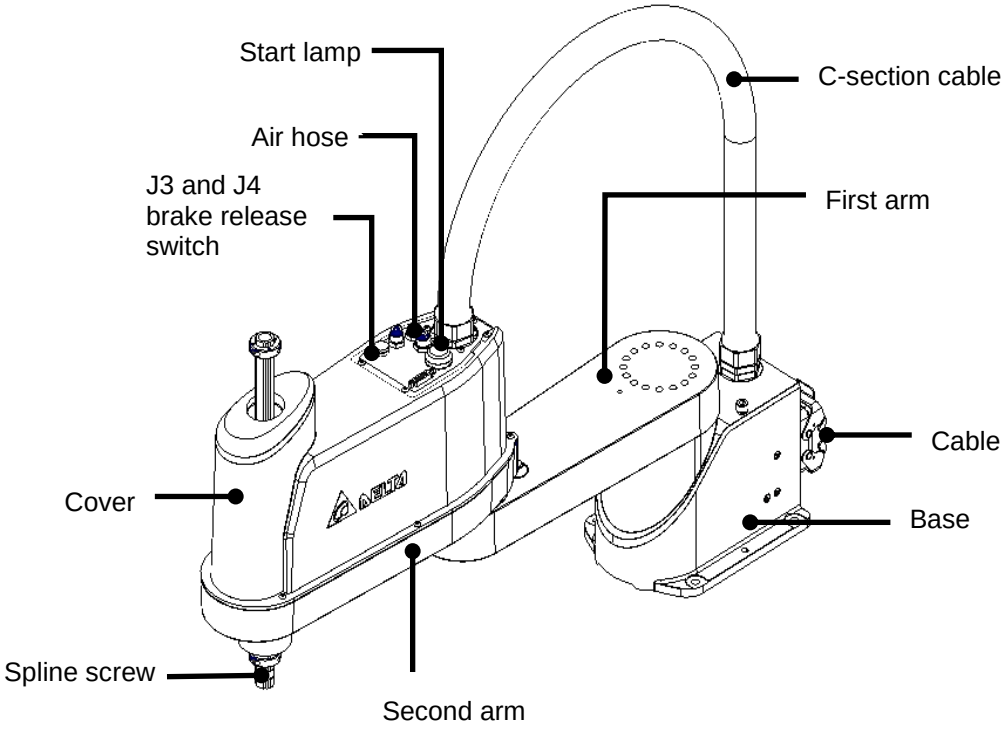


Figure6. 4 DRS 6kg series appearance figure

The internal components of the DRS 6kg series base are as shown in Figure 6.5 below.

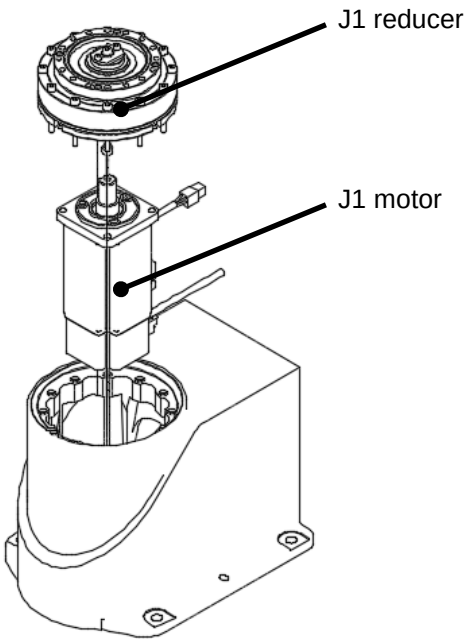


Figure6. 5 Internal components of the DRS 6kg series robot base

The internal components of the DRS 6kg series second arm are as shown in Figure 6.6 below.

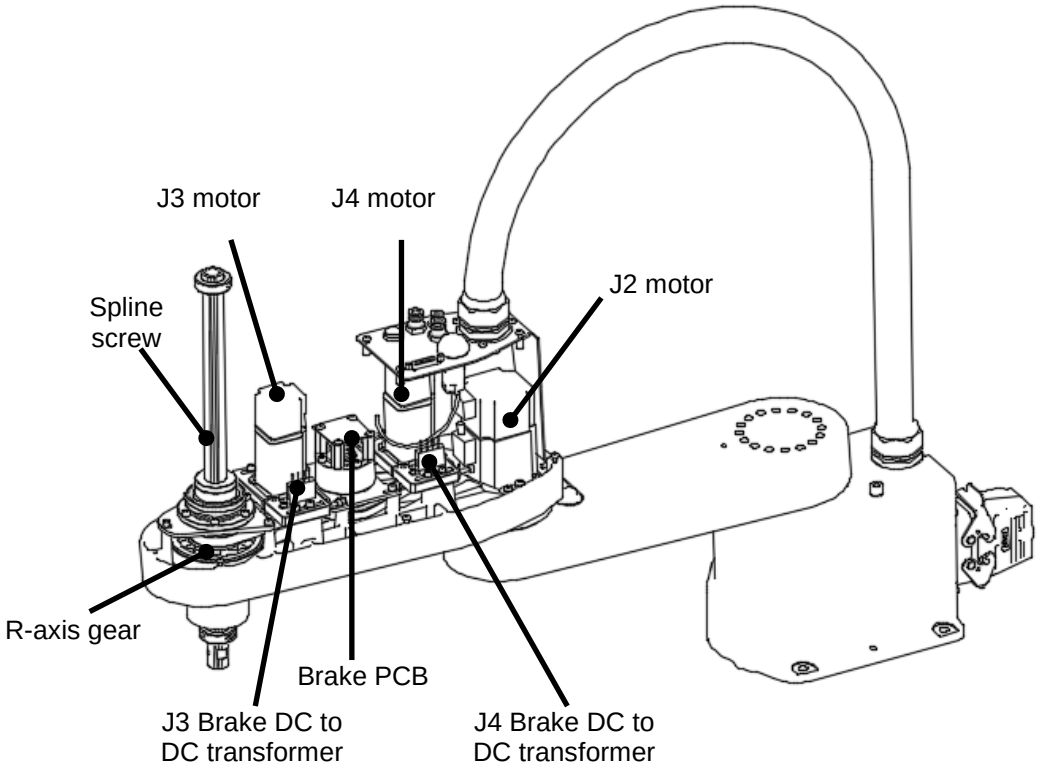


Figure6. 6 Internal mechanisms and components of the DRS 6kg series second arm

6.3 DRS 60H series robot parts descriptions

The appearance and parts of DRS60H series are as shown in Figure 6.7 below.

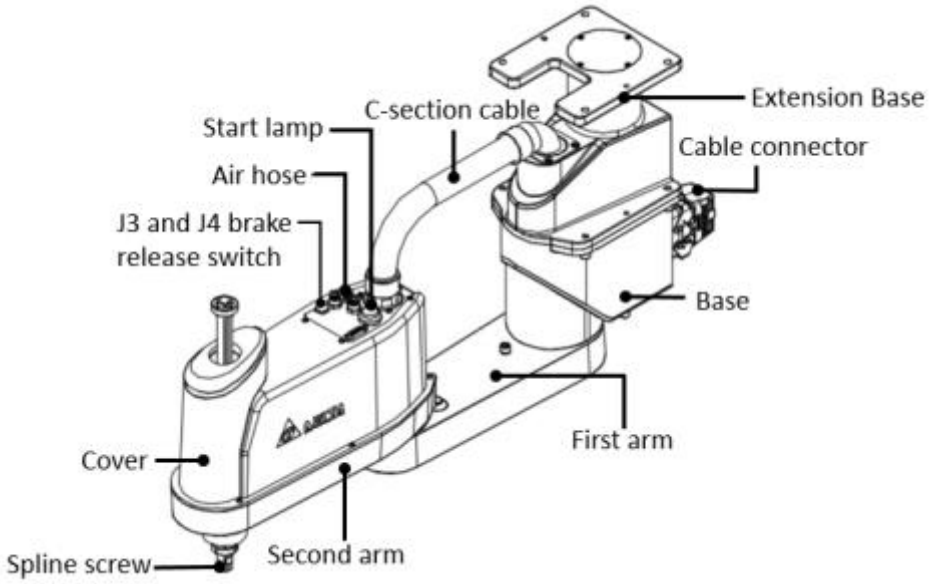


Figure6. 7 DRS60H series appearance figure

The internal components of the DRS60H series base are as shown in Figure 6.8 below.

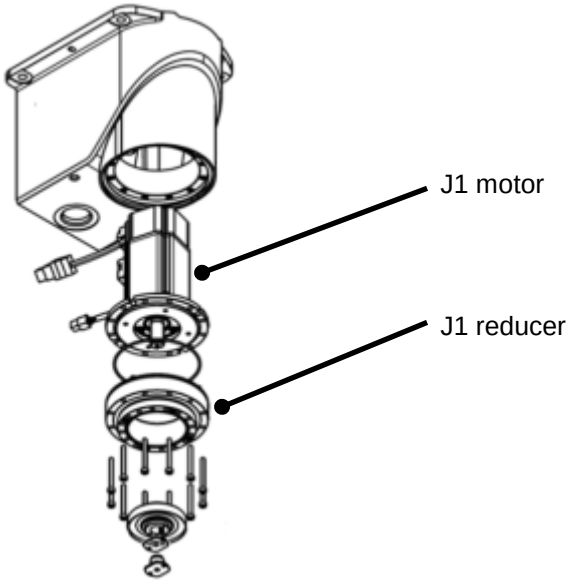


Figure6. 8 Internal components of the DRS60H series robot base

The internal components of the DRS60H series second arm are as shown in Figure 6.9 below.

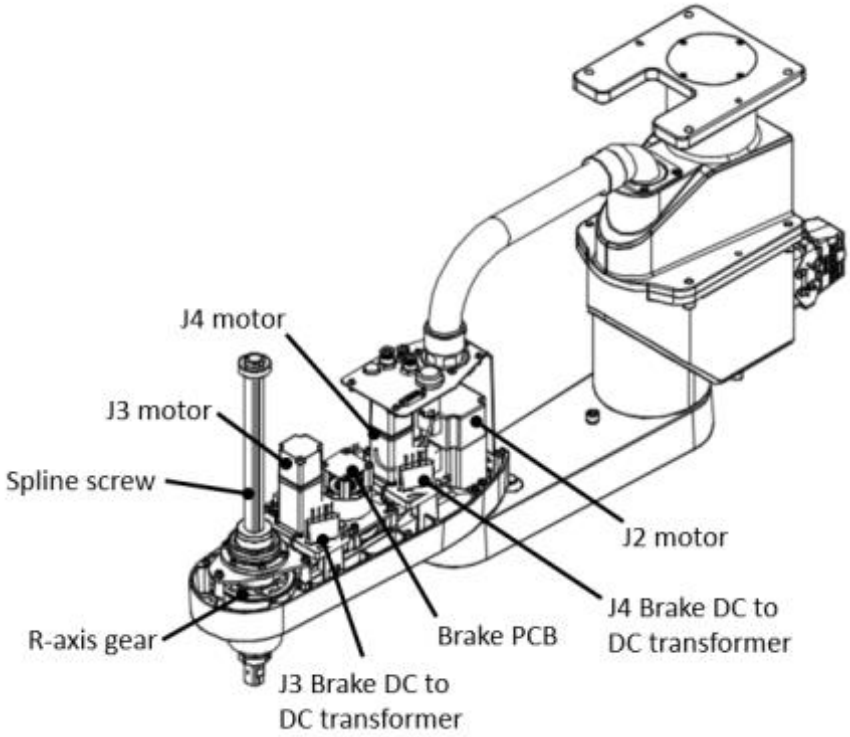
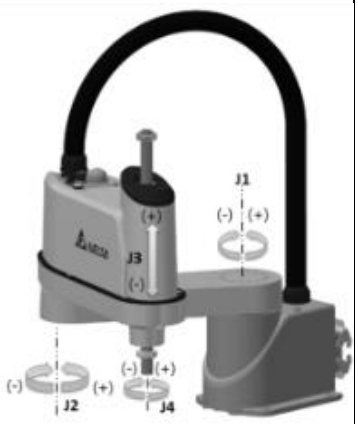
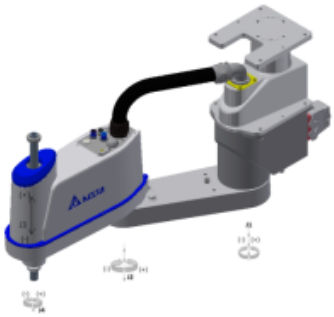
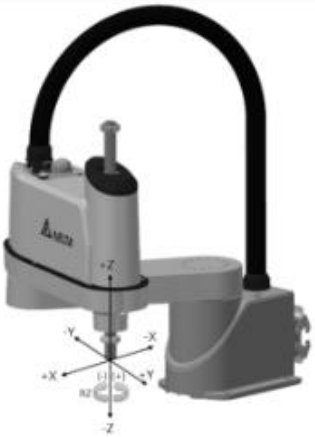


Figure6. 9 Internal mechanisms and components of the DRS60H series second arm

6.4 DRS robot operation directions

DRS series are four-axis robots composed of the first arm (J1), second arm (J2), Z-axis (J3) and RZ-axis (J4); its operation directions are divided into Joint coordinate and Cartesian coordinate according to the type. The operation directions of the robot are as shown in Table 6.1 below and the (+) and (-) shown in the figure are the actual operation directions of each axis.

Table6. 1 DRS series robot coordinates description

	DRS 3kg series	DRS 6kg series	DRS60H series
Joint coordinate			
Cartesian coordinate			

6.5 DRS 3kg series buttons and lamps

DRS 3kg series brake release button function description:

This button is located on the head of the robot and its location is as shown in Figure 6.10 below; pressing this button will release the J3-axis brakes so that users can manually move the J3-axis, making it easier for users to perform operations such as installing processing fixtures etc.

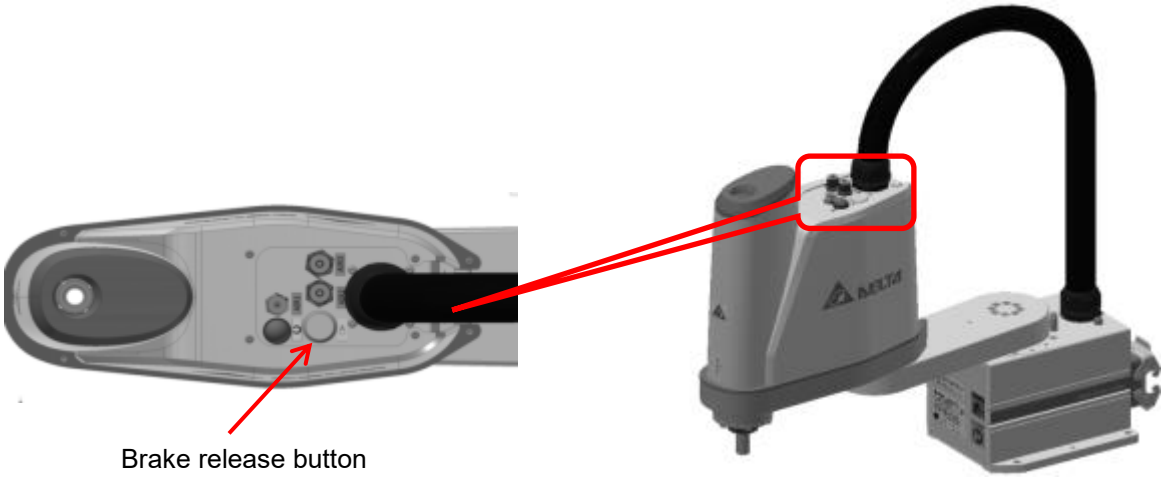


Figure6. 10 DRS 3kg series break release button position

Note:

1. When load is added to the J3-axis, the J3-axis might slide down when this button is pressed.
2. Do not place hands on the holes of the head cover or below the J3-axis in order to prevent the hands from getting caught.
3. Relative safety attention locations are as shown in Figure 6.11 below.

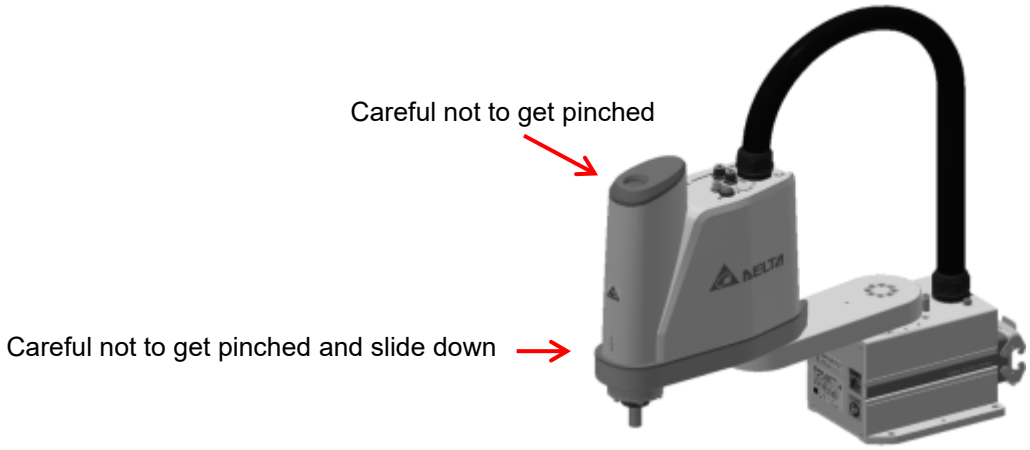


Figure6. 11 DRS 3kg series break release attention

6.6 DRS 3kg series lamp descriptions

The lamp is located on the head of the robot as shown in Figure 6.12 below. The lamp will turn on when the robot status is Servo ready and the lamp will go off when the robot is abnormal or when Servo is off.

Note: When the lamp is on, it means that the robot is in standby mode; do not get close to the robot at this time as the robot might start moving at any second.

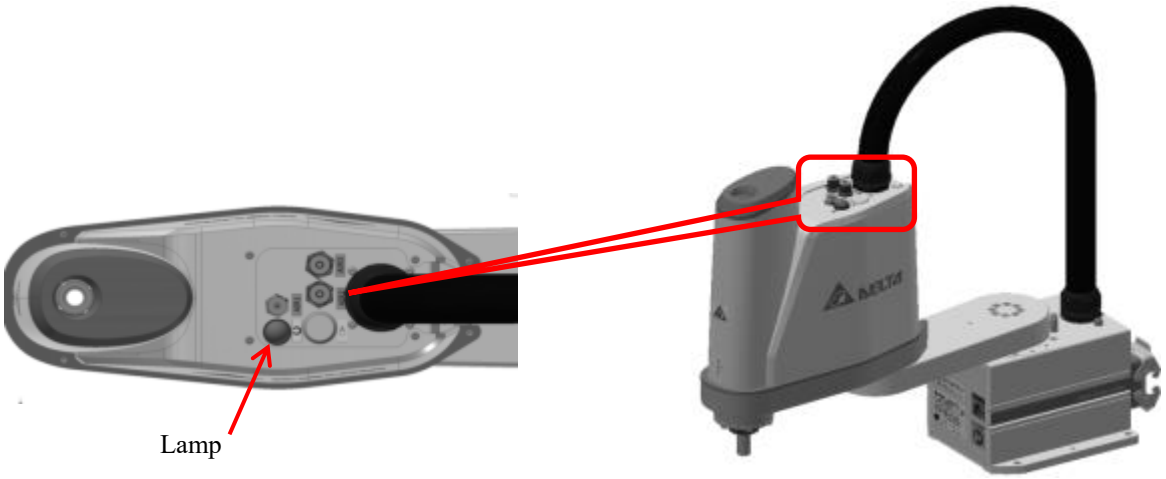


Figure6. 12 DRS 3kg series lamp location

6.7 DRS 6kg series buttons and lamps

DRS 6kg series brake release button function description:

This button is located on the head of the robot and its location is as shown in Figure 6.13 below; pressing this button will release the J3 and J4 axes brakes so that users can manually move the J3 and J4 axes, making it easier for users to perform operations such as installing processing fixtures etc.

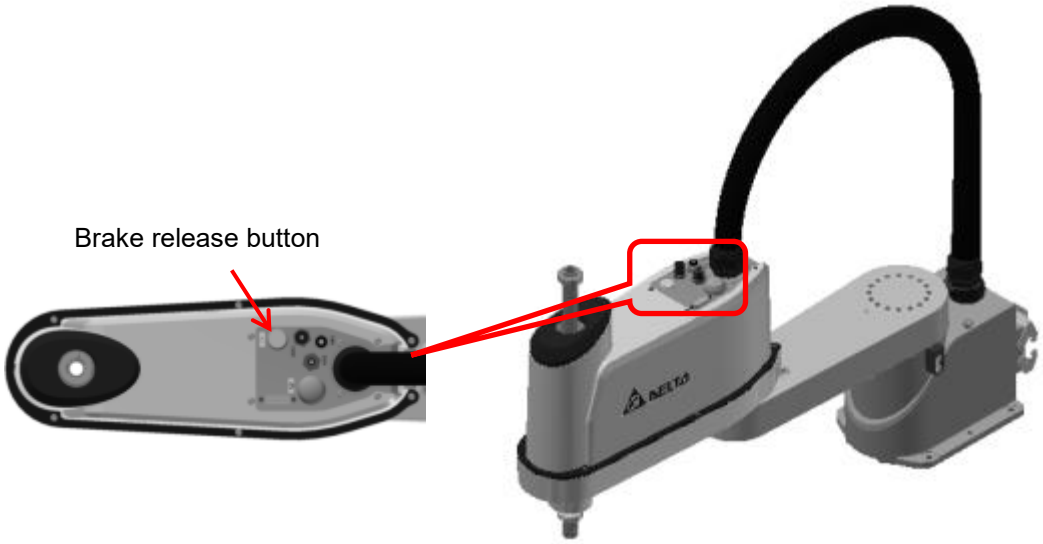


Figure6. 13 DRS 6kg series break release button position

Note:

1. When load is added to the flange, the J3-axis might slide down when this button is pressed.
2. Do not place hands on the holes of the head cover or below the J3-axis in order to prevent the hands from getting caught.
3. When the brake release button is pressed to rotate the J3 and J4 axes, please beware of whether the load will have impact on the robot itself.
4. Relative safety attention locations are as shown in Figure 6.14 below.

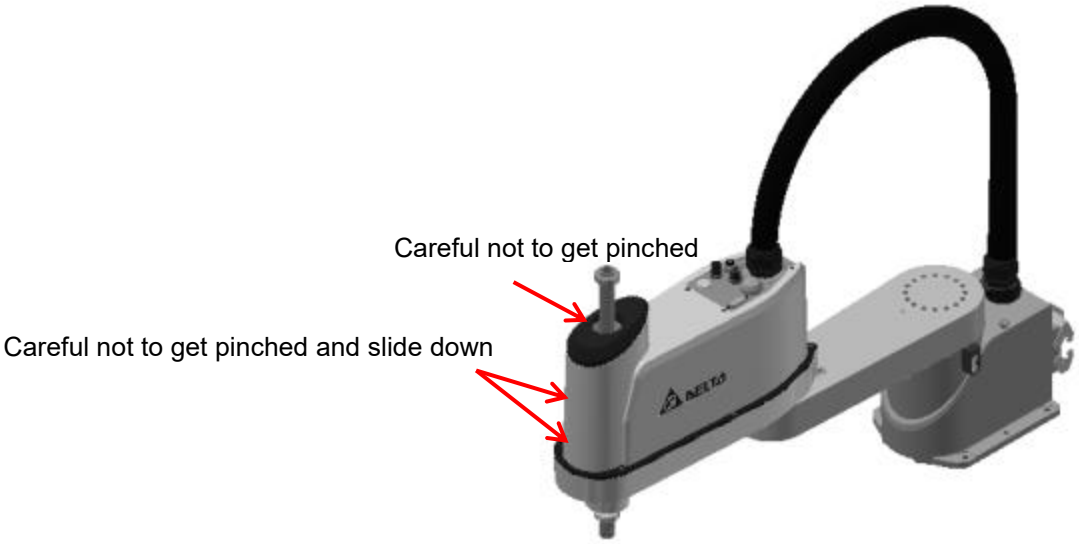


Figure6. 14 DRS 6kg series break release attention

DRS 6kg series lamp descriptions:

The lamp is located on the head of the robot as shown in Figure 6.15 below. The lamp will turn on when the robot status is Servo ready and the lamp will go off when the robot is abnormal or when Servo is off.

Note: When the lamp is on, it means that the robot is in standby mode; do not get close to the robot at this time as the robot might start moving at any second.

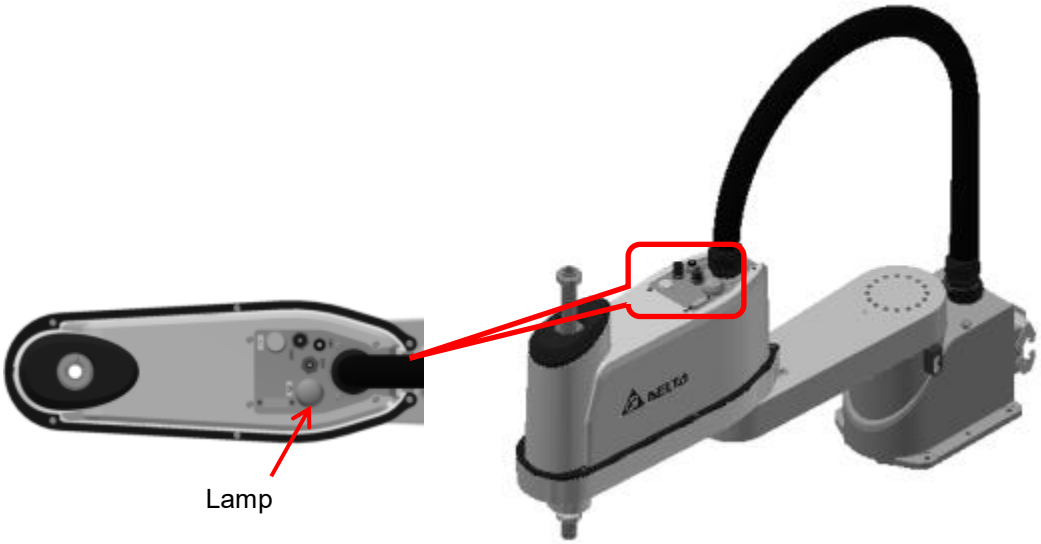


Figure6. 15 DRS 6kg series lamp location

6.8 DRS60H series air hose and signal connector configuration

DRS60H series brake release button function description:

This button is located on the head of the robot and its location is as shown in Figure 6.16 below; pressing this button will release the J3 and J4 axes brakes so that users can manually move the J3 and J4 axes, making it easier for users to perform operations such as installing processing fixtures etc.

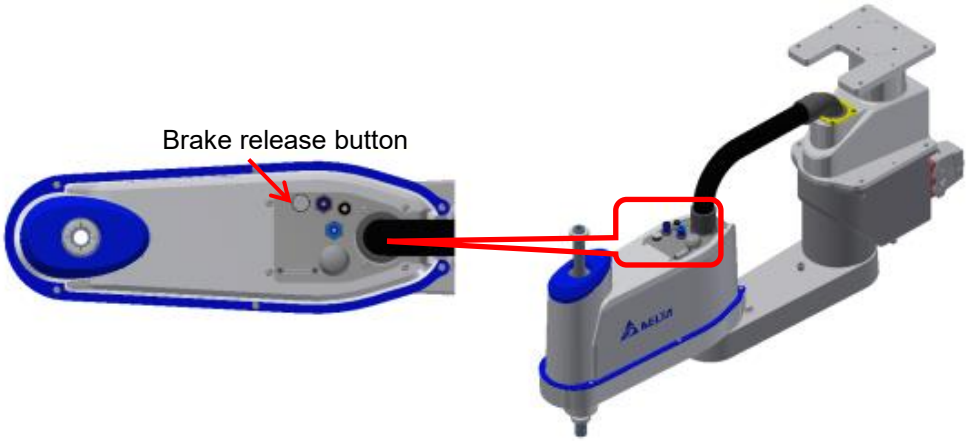


Figure6. 16 DRS60H series break release attention

Note:

1. When load is added to the flange, the J3-axis might slide down when this button is pressed.
2. Do not place hands on the holes of the head cover or below the J3-axis in order to prevent the hands from getting caught.
3. When the brake release button is pressed to rotate the J3 and J4 axes, please beware of whether the load will have impact on the robot itself.
4. Relative safety attention locations are as shown in Figure 6.17 below.

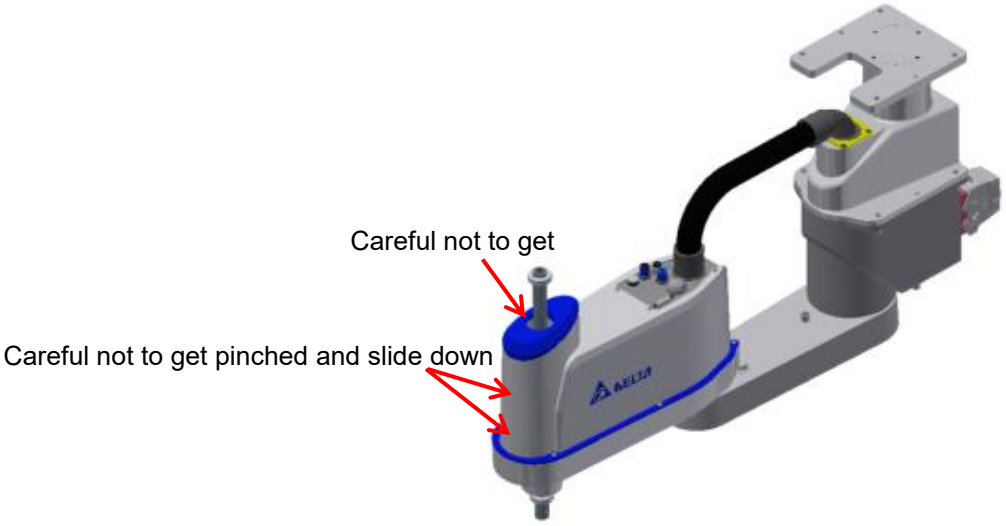


Figure6. 17 DRS60H series break release attention

DRS60H series lamp descriptions:

The lamp is located on the head of the robot as shown in Figure 6.18 below. The lamp will turn on when the robot status is Servo ready and the lamp will go off when the robot is abnormal or when Servo is off.

Note: When the lamp is on, it means that the robot is in standby mode; do not get close to the robot at this time as the robot might start moving at any second

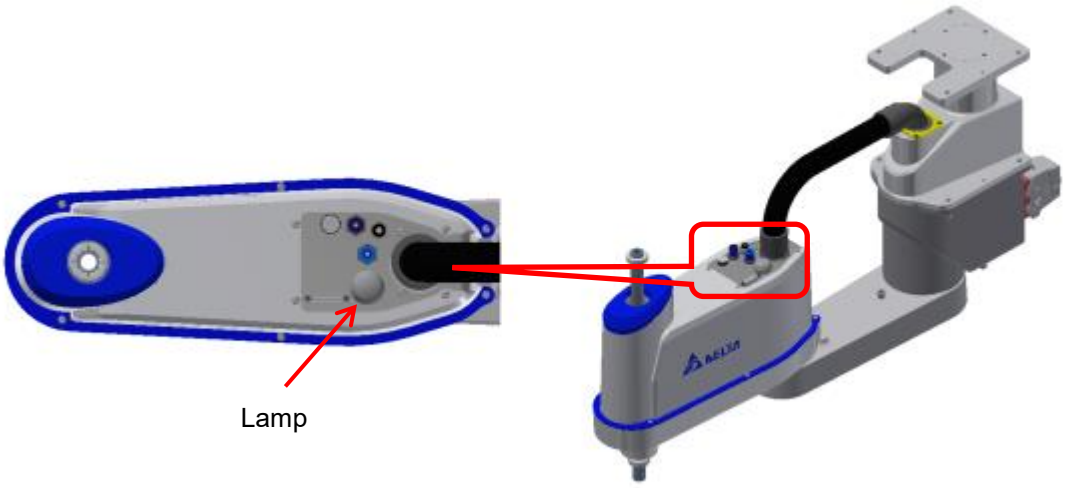


Figure6. 18 DRS60H series lamp location

6.9 DRS CE series air hose and signal connector configuration

DRS CE series air hose configuration:

Since customers need to install different clips and fixtures during actual applications, the robot provides a signal connector and three sets of air hoses for customers to install. The installation location of the DRS 3kg series air hose is as shown in Figure 6.19 below, and the installation location of the DRS 6kg series and DRS60H series air hose are as shown in Figure 6.21 below.

Item	Specifications	Remark
Signal connector	15Pin(Female)	-
Air hose connector	Φ6	Black

Item	Specifications	Remark
Signal connector	15Pin(Female)	-
Air hose connector	Φ6	Black

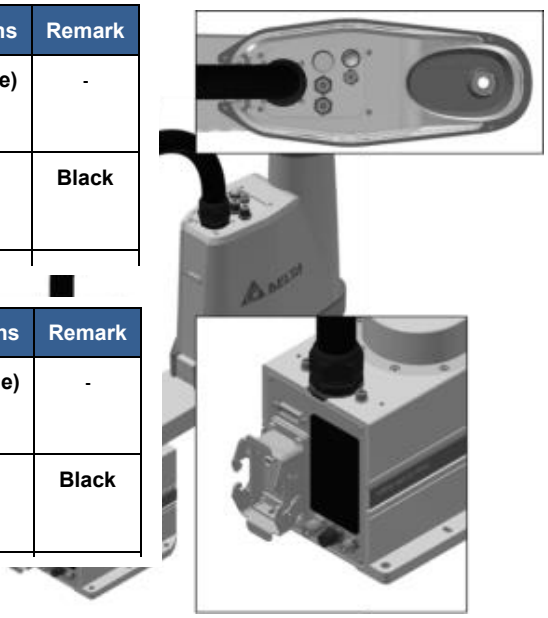


Figure6. 19 Installation location of DRS 3kg series air hose connector

Item	Specifications	Remark
Signal connector	15Pin(Female)	-
Air hose connector	Φ6	Black

Item	Specifications	Remark
Signal connector	15Pin(Female)	-
Air hose connector	Φ6	Black

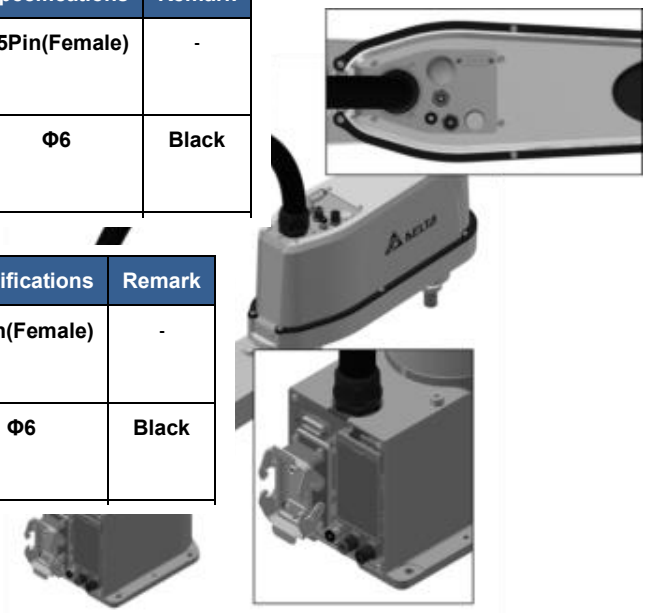
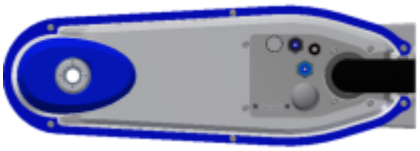
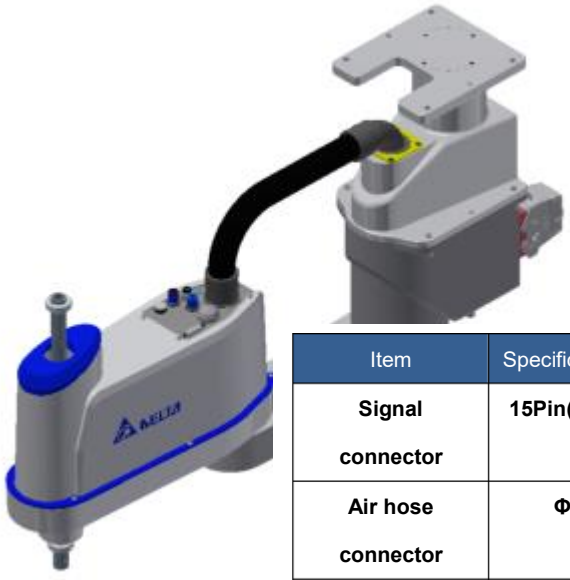


Figure6. 20 Installation location of DRS 6kg series air hose connector



Item	Specifications	Remark
Signal connector	15Pin(Female)	-
Air hose connector	Φ6	Black
Air hose connector	Φ6	Blue
Air hose connector	Φ4	Black



Item	Specifications	Remark
Signal connector	15Pin(Male)	-
Air hose connector	Φ6	Black
Air hose connector	Φ6	Blue
Air hose connector	Φ4	Black

Figure6. 21 Installation location of DRS60H series air hose connector

Please refer to Figure 6.22 below for the relationship curve between the burst pressure and temperature of the 3 air hoses provided inside the robot. Please consider the effects that the environmental temperature has to the air hose while in use.

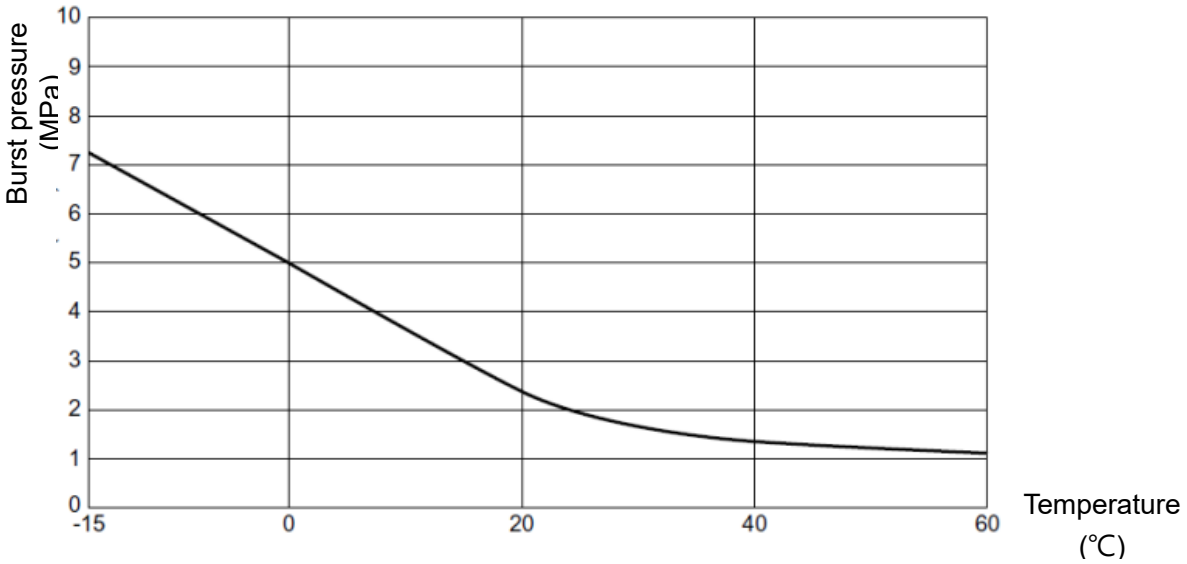


Figure6. 22 Air hose burst pressure table

Note:

1. Only pneumatic system connection pipelines are provided for the robot arm; system integrators shall install the final actuator and pneumatic system according to EN ISO 4414.
2. DRS CE series signal connector configuration:

Standard D-Sub 15 pin is used for the connector; a female connector is used for the head and a male connector is used for the base. Please use with the D-Sub connector provided in the accessory pack; the pins are as shown in Figure 6.23 below.

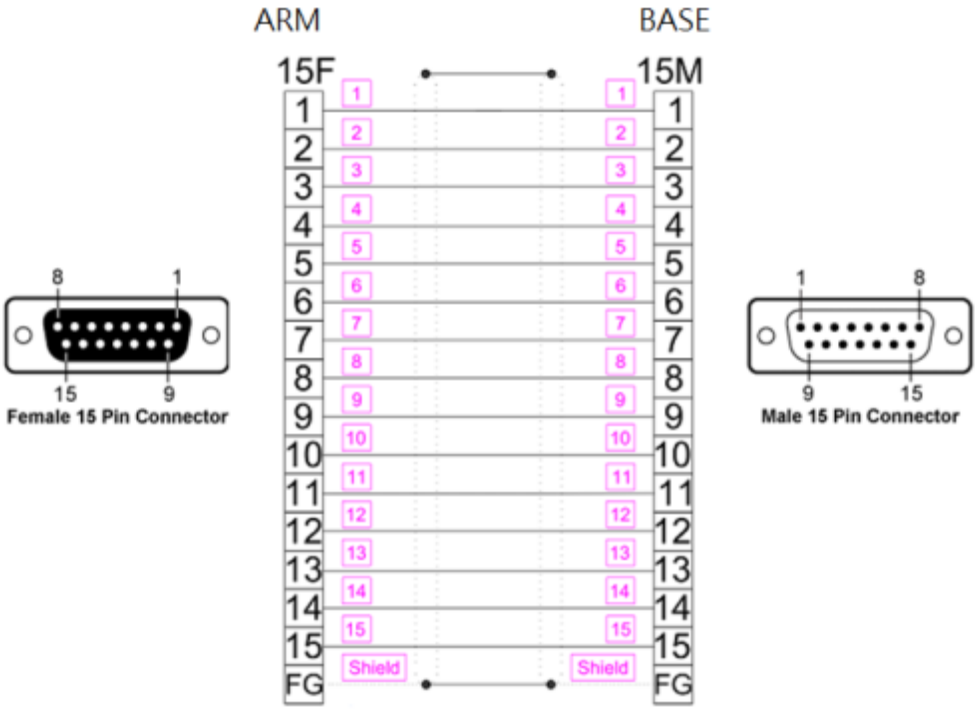


Figure6. 23 Signal connector wiring table

Note:

1. This connector is only provided for customers to install devices with small signals such as sensors etc.; please do not connect large current signals.
2. Do not use this connector as a motor connector or high frequency signal connector.
3. The maximum current of each point of this connector is 1A; do not overload it.

6.10 DRS CE series battery location

Figure 6.24 below is the location of the DRS CE series battery. and Figure 6.25 below is the location of the DRS60H series battery. There are 2 batteries in the battery holder and the battery is responsible for memorizing the position of each axis of the robot.

Please execute battery-change operations properly according to the maintenance table (please refer to the maintenance chapter) in order to ensure that the encoder position of the robot can be memorized properly.

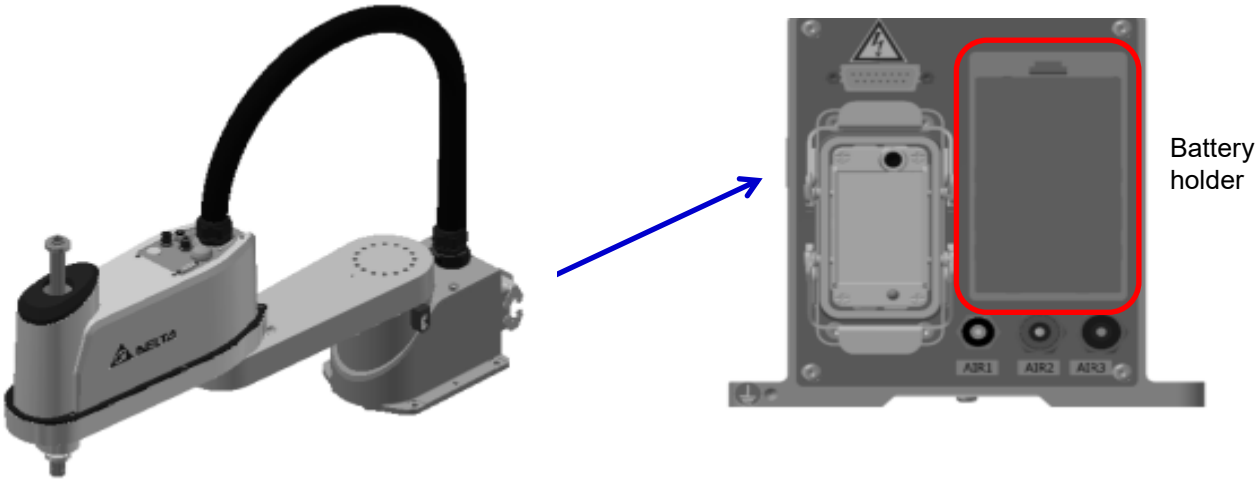


Figure6. 24 DRS CE series battery location

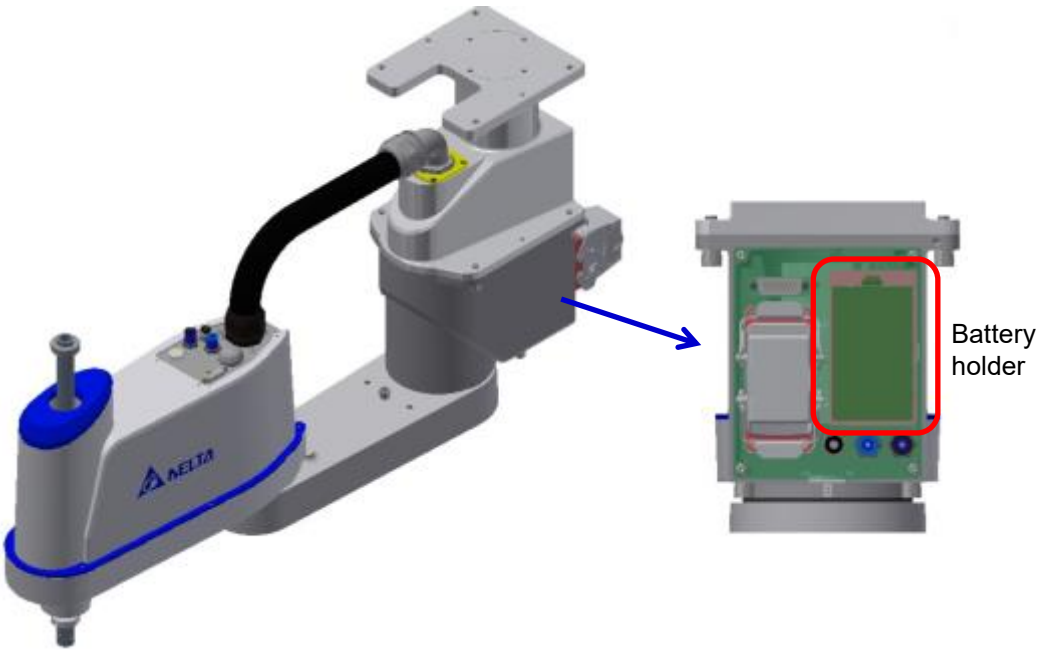


Figure6. 25 DRS60H series battery location

7. Wiring

This chapter introduces the compositions of the peripheral systems of the controller and the wiring. Since the robot is a semi-finished product system, please construct safety protection systems, operation buttons and lamps etc., around the robot according to the instructions in the manual properly in order to ensure the integrity and safety of the entire system.

	■ Please perform wiring according to the explanations in the manual properly. ■ Please install safety protection devices around the robot, such as railings, safety gratings, pressure pads or laser scanners etc., in order to guarantee the safety of the workers. ■ Please turn off the power during wiring otherwise there is the danger of electrical shocks. ■ Do not perform any wiring within 10 minutes of turning of the power because there is residue voltage in the driver that has not yet been fully discharged. ■ Wiring operations shall be performed with personnel with related licenses; personnel without related licenses shall not perform wiring operations.
	■ Personnel without related licenses shall not perform wiring operations. ■ Do not use any method to bypass the safety protection system; the safety protection system includes the emergency stop signal and railing signal. ■ The emergencystop signal and railing signal are no-voltage contact signals; do not connect any AC or DC power otherwise it will cause damages to the power control box. ■ Modifications of any wiring inside the power control box is prohibited; our company is not responsible for any controller malfunctions or damages resulted from doing so.

7.1 Controller peripheral interface

The robot controller is integrated with the driver control; this controller can be used with visual systems and teach pendants, and be expanded with drivers or remote input/output modules to easily complete the integration with peripheral systems. Figure 7.1 is a schematic of the combination of power control box interface peripherals.

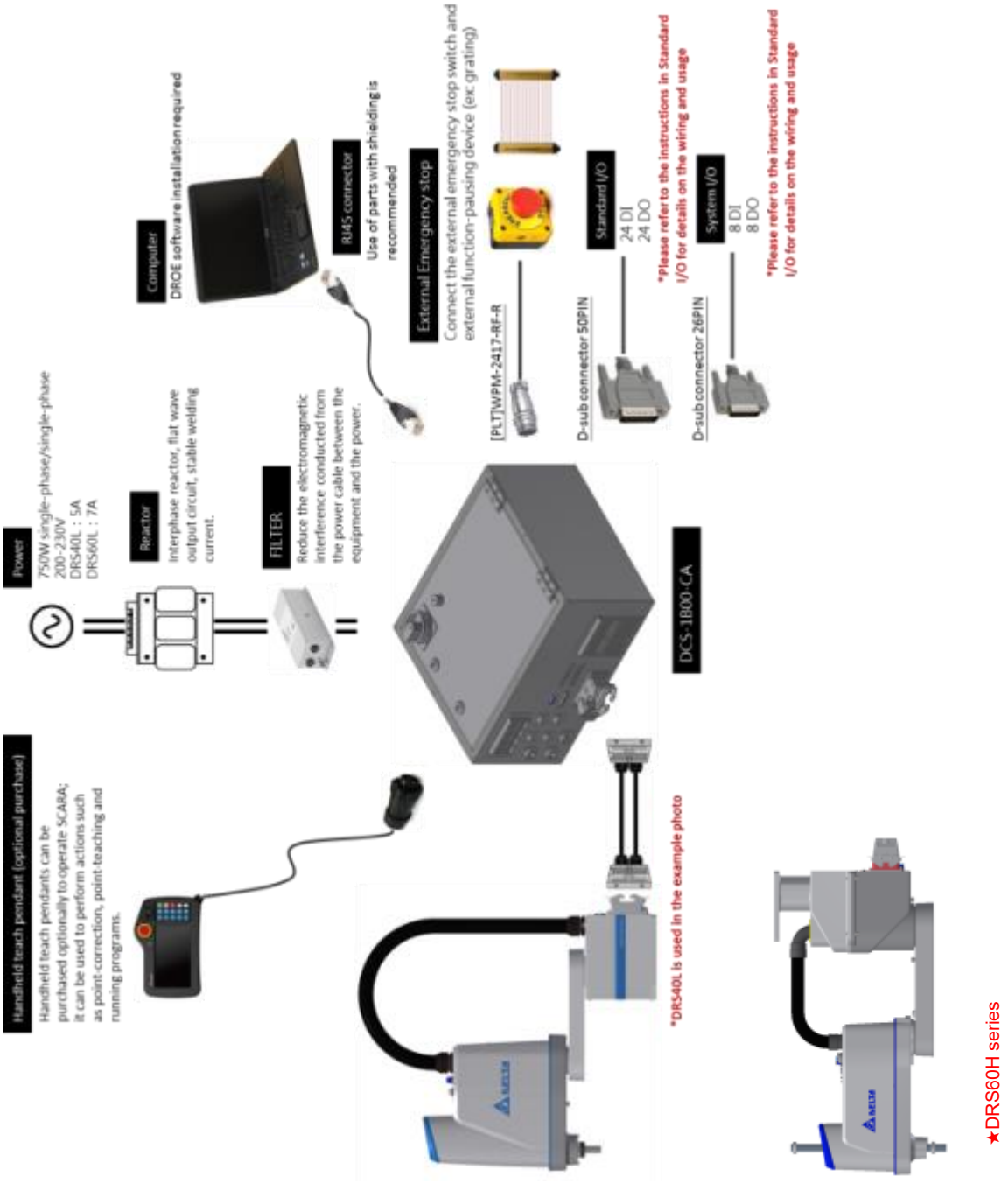


Figure7. 1 Power control box interface peripheral combination

7.2 Introduction to the controller interface

Figure 7.2 below is the DCS power control box interface; the following are individual explanations of the controller interface, explaining the function of the interface and the wiring.

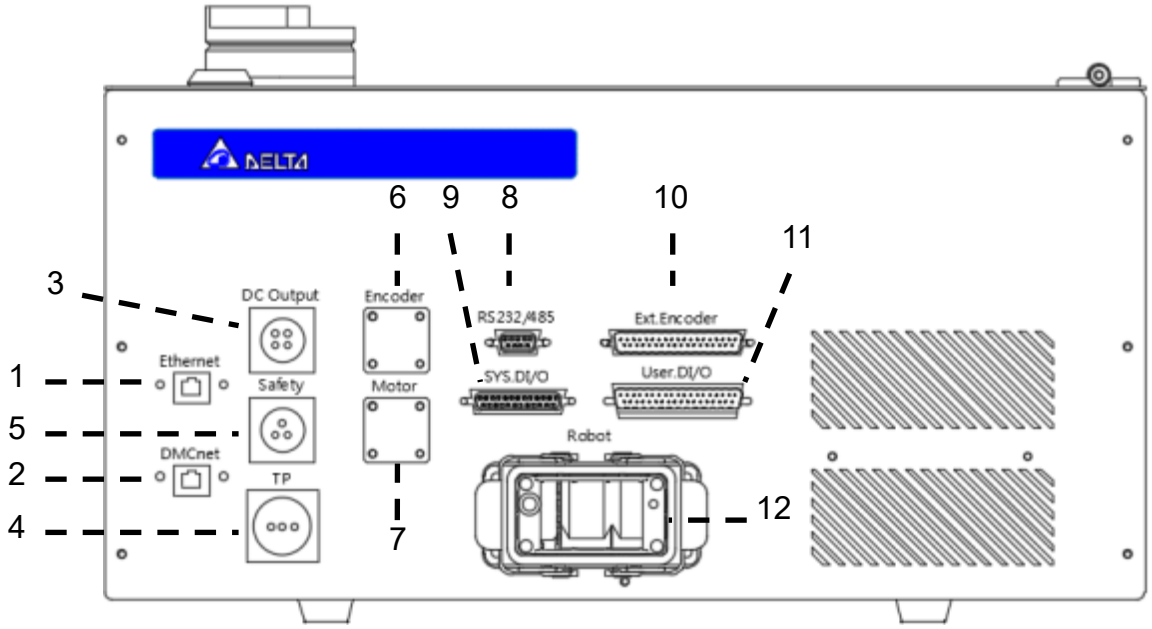


Figure7. 2 DCS robot control box connection definitions

1. EtherNet communication port.
2. DMCnet communication port.
3. Direct current output connector: Provides customers with DC24V (2A) for external connection.
4. Teach pendant connector: Location to connect handheld teach pendants (DTS).
5. Safety connector: Signal connector provided for customers to connect external safety protections.
6. External shaft motor connection (optional): Power connector for the fifth axle motor.
7. External shaft encoder connection (optional): Encoder connector for the fifth axle motor.
8. Serial communication connector: RS-232/RS485 communication connector.
9. System output input connector: System I/O; provides customers with defined system input points and output points for external connections.
10. External encoder connector: Allows customers to connect and use 1 external encoder.
11. User output input connector: User I/O; a total of 24 sets of DI and 12 sets of DO.
12. Robot connector: Connects the motor and between the robot and the power control box, and the encoder cable signal.

7.2.1 Main circuit power connection

The input power specification of the Delta robot controller is AC 200V to 230V single-phase 50/60 Hz. Customers need to connect the main power manually and please use cables that comply with VW-1 flame resistance and UL758 wire diameter specifications, as well as cables with the specifications in Table 7.1 below:

Table7. 1 Main circuit power specification table

Power control box main circuit power cable specifications	
Power cable diameter	2.0mm²
Ground cable diameter	10mm²

Installation:

1. There is a forced interface behind the power control box for customers to install the cables for the main power circuit; the forced connector specifications are as shown in Table 7.2 below.

Table7. 2 Forced connector specification table

Forced connector specifications	
Forced connector allowable cable diameter	14.5mm~19mm

2. Please insert the power cable of the main circuit to this forced connector, as shown in Figure 7.3 below.

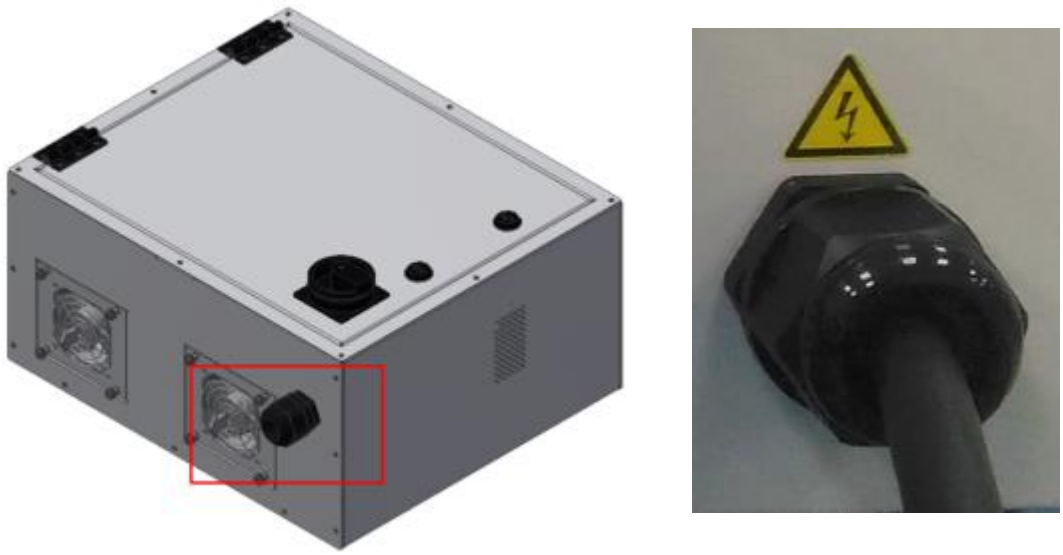


Figure7. 3 Power cable penetrating the forced connector

3. Open the controller box hatch and the power circuit breaker is located at the top-left corner of the power control box, as shown in Figure 7.4.

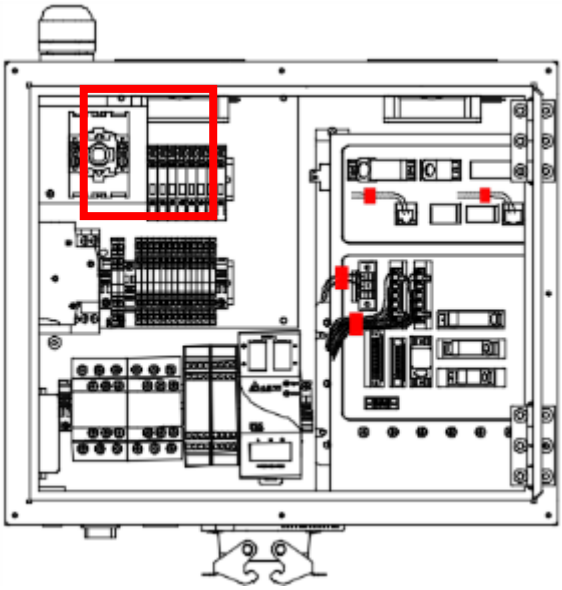


Figure7. 4 Power breaker location

4. The primary and secondary power breakers both have shock-proof protection covers; please use a flat-head screwdriver (1.8mm) to open the primary protection cover, as shown in Figure 7.5.

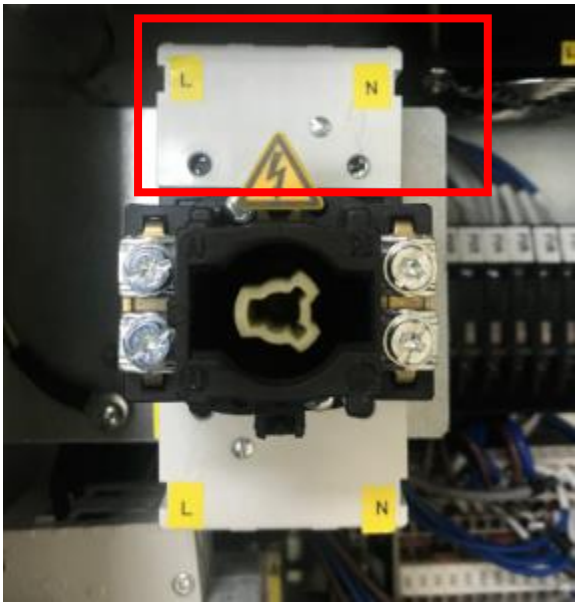


Figure7. 5 Primary power breaker protection cover location

5. Connect L and N of the power cable to where L and N is marked on the primary power breaker, and connect the ground cable to the point marked PE on the grounding copper. Place the protection cover back on once installation is complete, as shown in Figure 7.6.

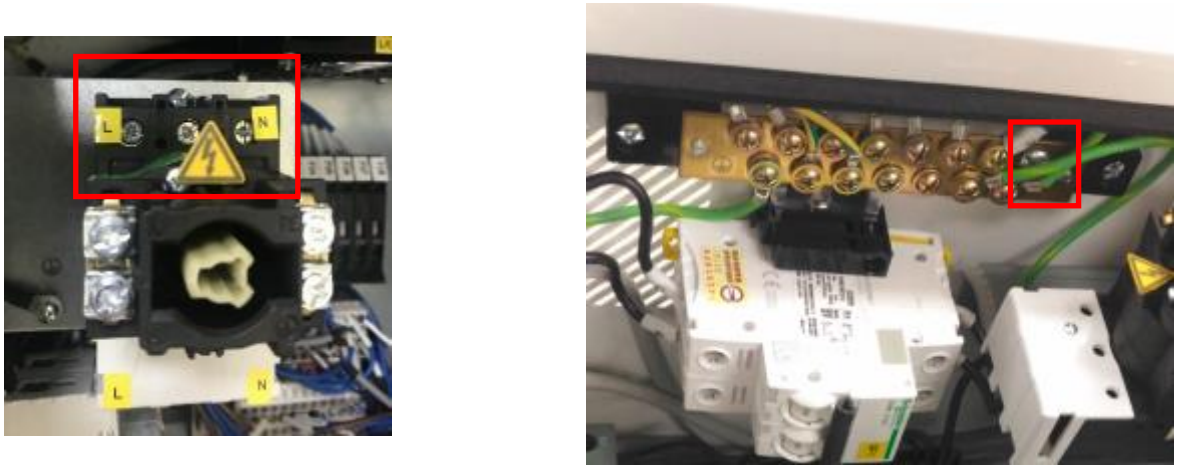


Figure7. 6 Power cable and ground cable installation location

Note:

Since the robot is a semi-finished product system, please add a filter . reactor and Ferrite Core to the power line sent to the controller in order to ensure the power has no noise and hormonic, as shown in Figure 7.7

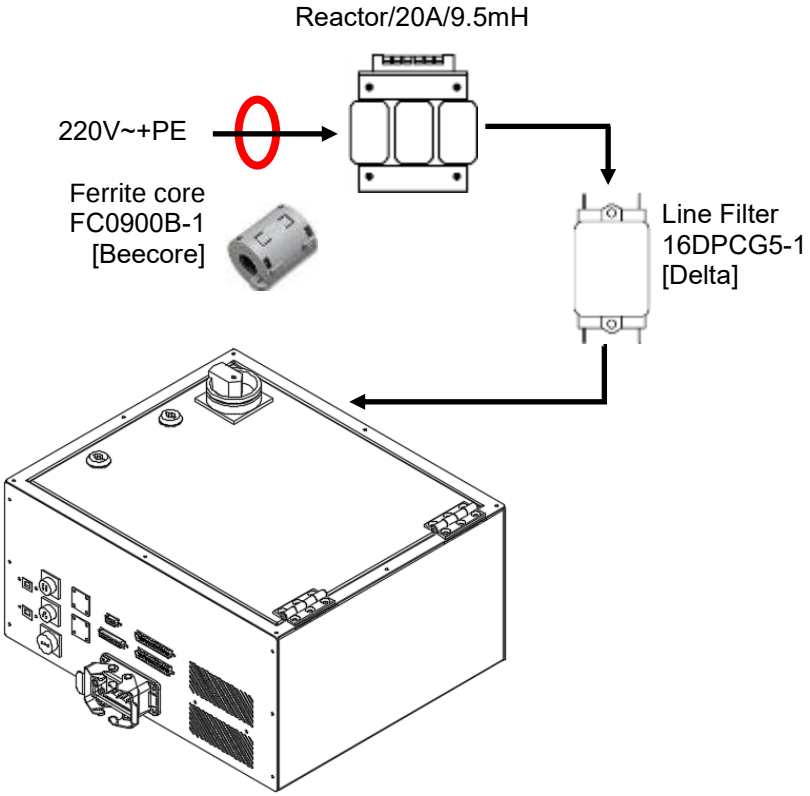


Figure7. 7 Add filter & reactor to the controller power

7.2.2 Robot connectors

Detachable cables are used for the connection between the robot and the DCS robot control box; the two ends are connected with heavy load connectors. Please make sure the buckles are locked in properly before turning on the power. The installation of the power control box connector is as shown in Figure 7.8 and the standard connection cables are as shown in Figure 7.9.

Please note the connector directions; both ends of the connector have foolproof designs so forced connection will cause damages to the connector and the equipment.

The standard length of the cables between the robot and control box is 3m; customers shall not extend the cables on their own as doing so will cause problems such as weakening the signals and causing the equipment to malfunction.

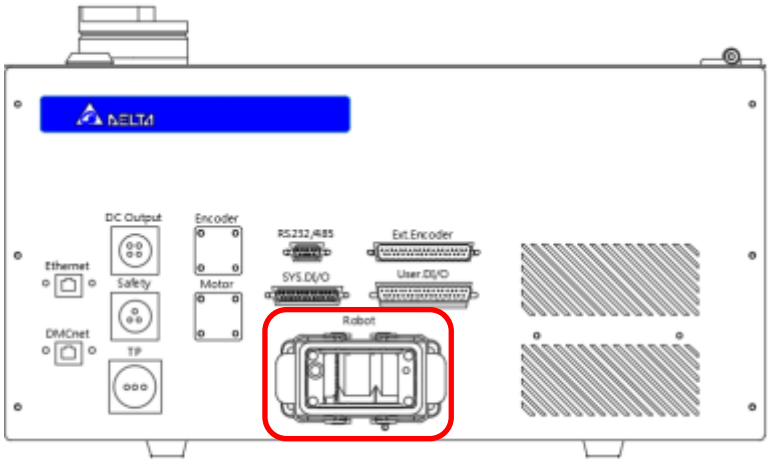


Figure7. 8 Robot connecting seat

Figure7. 9 Robot standard connection cable

7.2.3 External encoder connector

A set of external optical ruler or encoder is provided for external optical rulers or encoders (A, B, Z); the connection of the controller into a fully closed loop can be applied for CVT functions. The location of the external encoder connector and definitions of the pins are as shown in Figure 7.10 and Table 7.3 below.

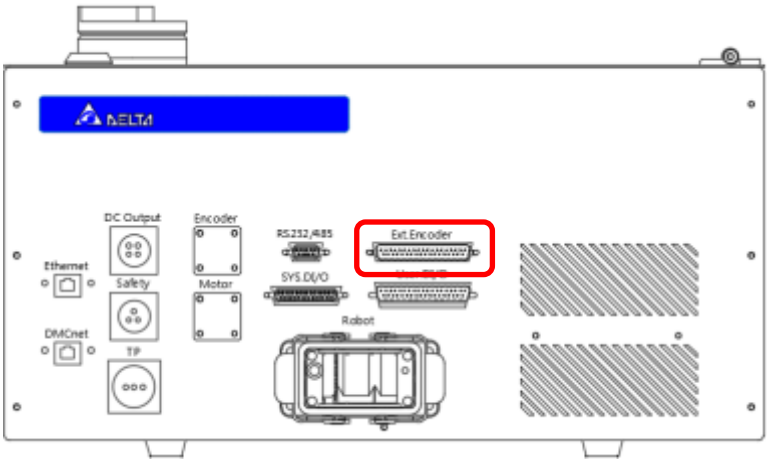


Figure7. 10 External encoder connection seat

Table7. 3 External encoder connector pin definition table

Pin	Name	Pin	Name	Pin	Name	Pin	Name
1	1-Z	2	1-/Z	19		20	
3	1-B	4	1-/B	21		22	
5	1-A	6	1-/A	23		24	
7	1-5V	8	1-0V	25		26	
9	2-Z	10	2-/Z	27		28	
11	2-B	12	2-/B	29		30	
13	2-A	14	2-/A	31		32	
15	2-5V	16	2-0V	33		34	
17		18		35		36	

7.2.4 User.DI/O

Standard D-SUB50P/Female/3 row connector; this connector defines the user output input pins and provides 12 sets of output and 24 sets of input that can be planned freely. The location of the connector is as shown in Figure 7.11 and the definitions of the pins are as shown in Table 7.4 below.

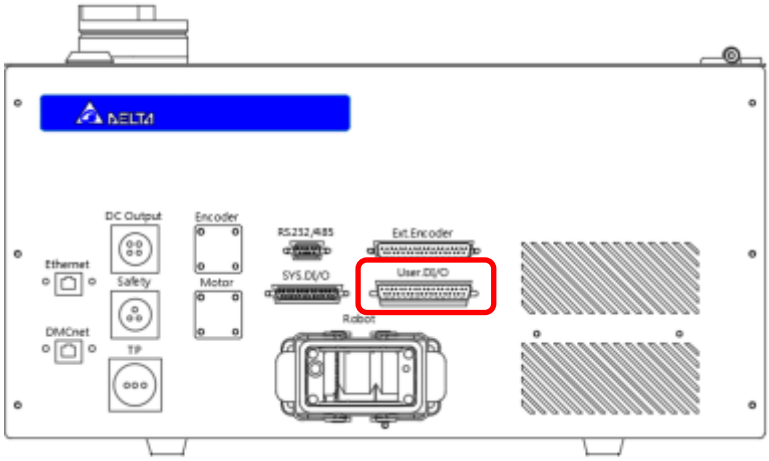


Figure7. 11 User output input connector seat

Table7. 4 User digital output input connector pin definition table

Pin	Name	Pin	Name	Pin	Name	Pin	Name
1	DI1	2	DI2	27	DO2+	28	DO2-
3	DI3	4	DI4	29	DO3+	30	DO3-
5	DI5	6	DI6	31	DO4+	32	DO4-
7	DI7	8	DI8	33	DO5+	34	DO5-
9	DI9	10	DI10	35	DO6+	36	DO6-
11	DI11	12	DI12	37	DO7+	38	DO7-
13	DI13	14	DI14	39	DO8+	40	DO8-
15	DI15	16	DI16	41	DO9+	42	DO9-
17	DI17	18	DI18	43	DO10+	44	DO10-
19	DI19	20	DI20	45	DO11+	46	DO11-
21	DI21	22	DI22	47	DO12+	48	DO12-
23	DI23	24	DI24	49	-	50	DI_COM
25	DO1+	26	DO1-	-	-	-	-

User digital input (User.DI) wiring example

User input signal D1 includes a total of 24 points from Pin1~Pin24; users can freely select between NPN or PNP wiring.

When the power of the controller itself is going to be used for the input signal DI:

- The NPN wiring method is as shown in Figure 7.12 below; please connect DI COM (Pin50) of User.DI/O (D Sub-50P) to P24V (Pin1) of the DC output, and connect the output signals including buttons, switches and sensors etc. to DI.

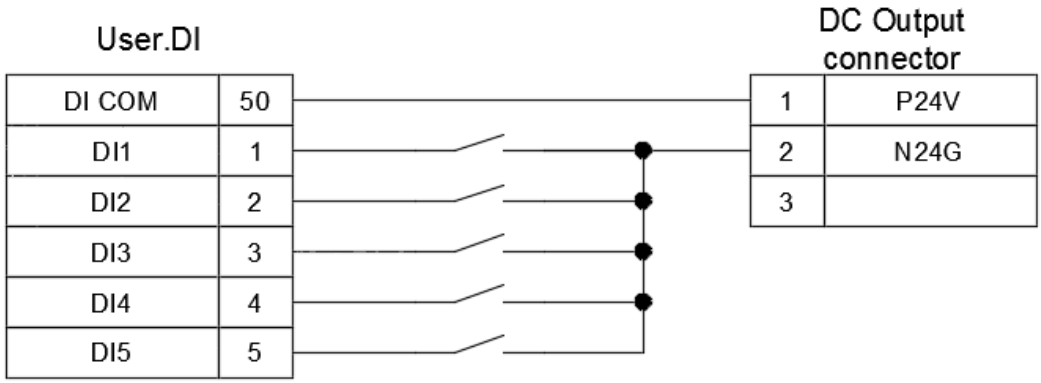


Figure7. 12 NPN wiring for when the input signal DI uses power of the controller itself

- The PNP wiring method is as shown in Figure 7.13 below; please connect DI COM (Pin50) of User.DI/O (D Sub-50P) to N24G (Pin2) of the DC output, and connect the output signals including buttons, switches and sensors etc. to DI.

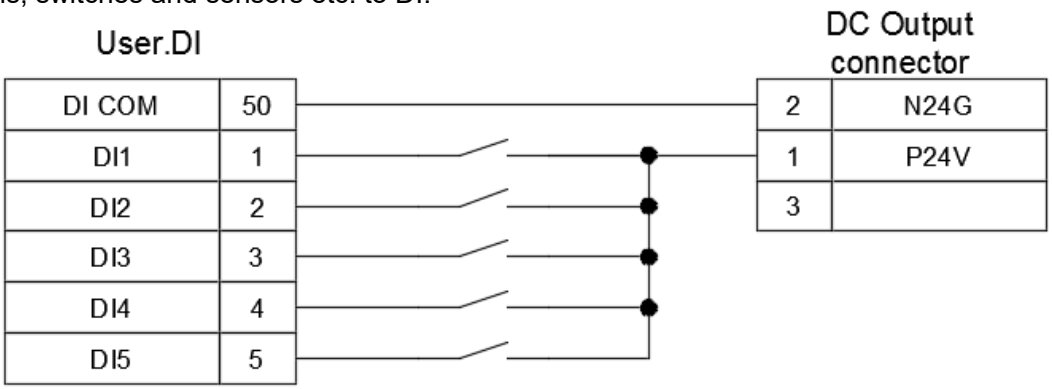


Figure7. 13 PNP wiring for when the input signal DI uses power of the controller itself

Note:

The power control box DC output connector already provides the N24G power; please do not connect the User.DI signal to other powers in order to prevent the signal from not being able to be sent or causing the DI contact to burn.

When the input signal DI is going to be connected directly with the upper controller and NPN wiring is used, the wiring method is as shown in Figure 7.14.

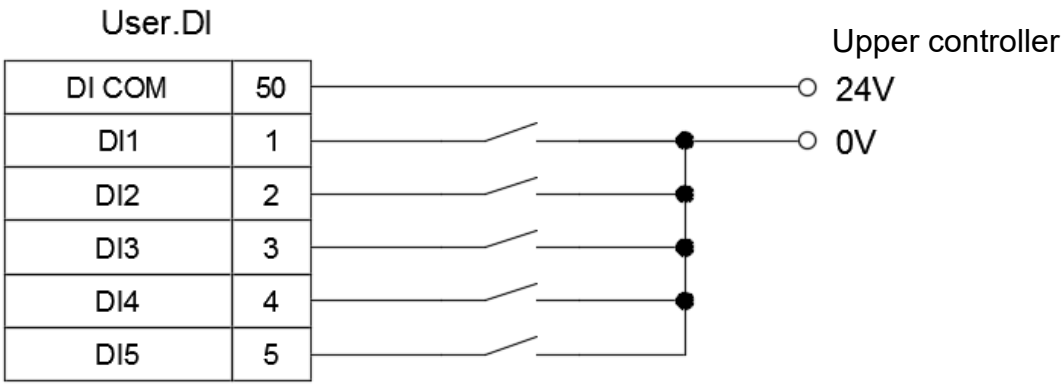


Figure7. 14 Input signal DI connected to upper controller using NPN connection

When the input signal DI is going to be connected directly with the upper controller and PNP wiring is used, the wiring method is as shown in Figure 7.15.

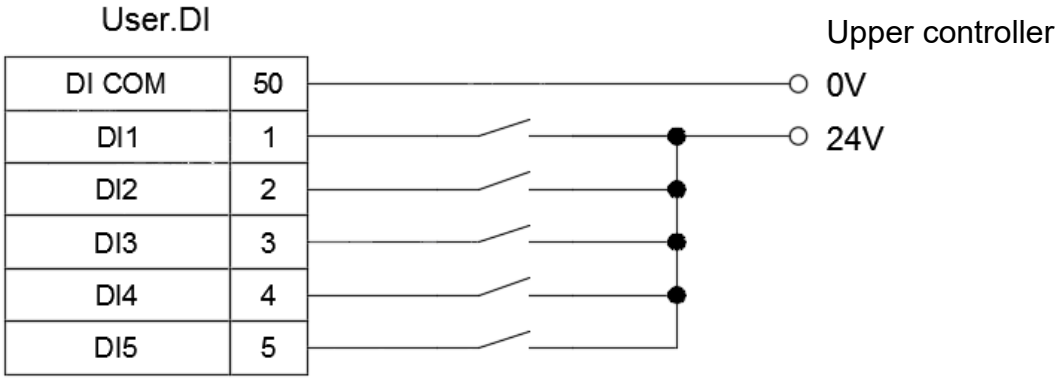


Figure7. 15 Input signal DI connected to upper controller using PNP connection

The output signal DO includes a total of 24 points of output from Pin25~Pin48; the output method can be NPN or PNP.

Customers can freely choose whether the output voltage signal will be controller voltage output or upper controller voltage output.

- When the selected output voltage signal is the controller voltage output

  The NPN wiring method is as shown in Figure 7.16 below:

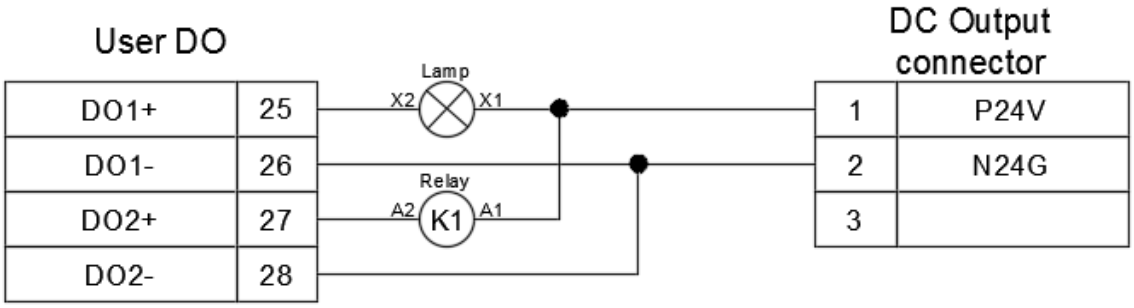


Figure7. 16 User DO controller voltage output NPN wiring

The PNP wiring method is as shown in Figure 7.17 below:

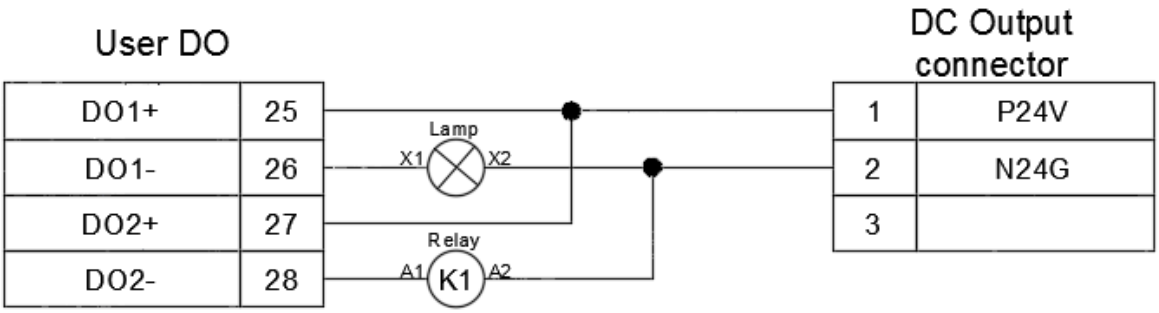


Figure7. 17 User DO controller voltage output NPN wiring

Mixed NPN and PNP wiring method is as shown in the figure below:

In Figure 7.18 below, PNP output wiring is used for the lamp and NPN output wiring is used for the relay.

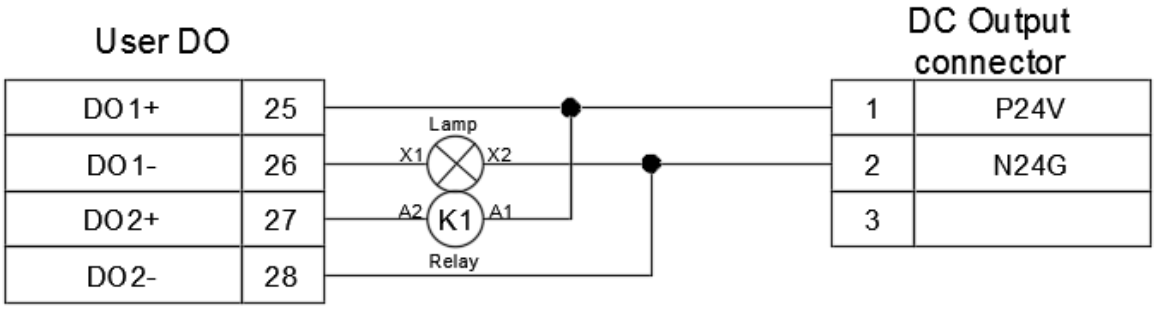


Figure7. 18 User DO controller voltage mixed output wiring

- When the selected output voltage signal is the upper controller voltage output
  The NPN wiring method is as shown in Figure 7.19 below:

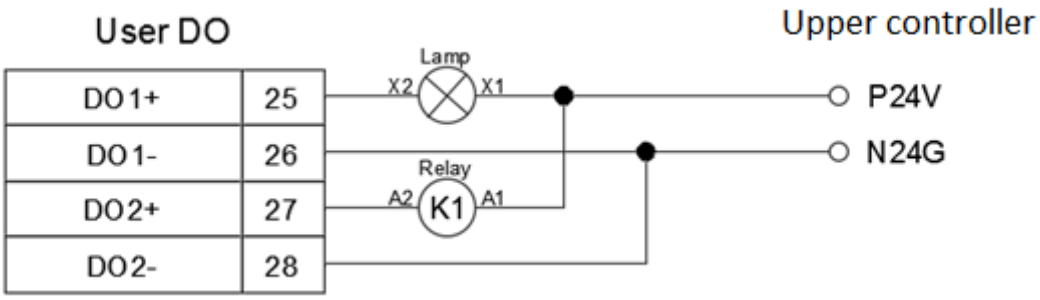


Figure7. 19 User DO upper controller voltage output NPN wiring

The PNP wiring method is as shown in Figure 7.20 below:

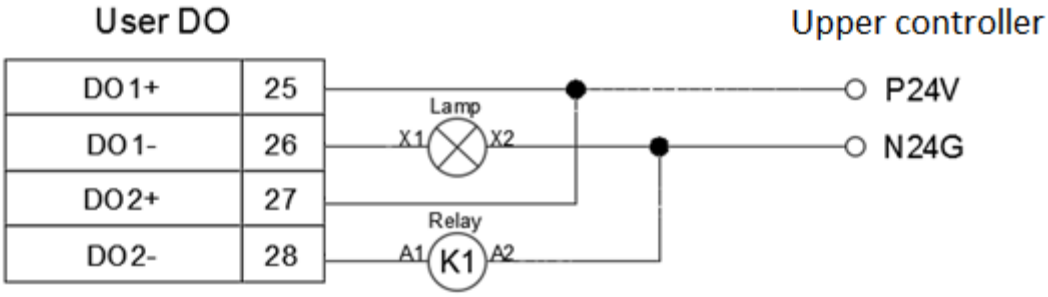
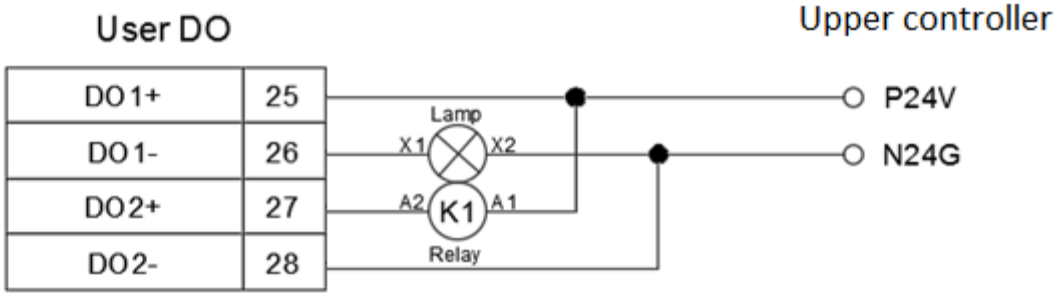


Figure7. 20 User DO upper controller voltage output PNP wiring

Upper controller mixed NPN and PNP wiring method is as shown in the figure below:
In Figure 7.21 below, PNP output wiring is used for the lamp and NPN output wiring is used for the



relay.

Figure7. 21 User DO upper controller voltage mixed output wiring

Note:

1. Each DO output point can supply 40mA at most. To activate heavy current load, please execute through the relay.
2. Do not connect AC power to the DO output point; such wiring methods will damage the controller.

7.2.5 System digital output input connectors

Standard D-Sub25P/Female connector; System DI/O provides 5 point input and 7 point output to communicate with the upper controller. Pin definitions are as shown in Table 7.5, and the connector interface locations are as shown in Figure 7.22.

Table7. 5 System pin definition table

Pin	Name	Function	Pin	Name	Function
1	DI3	Reserved	11	DO3+	In-place status
2	DI4	Mode selection 1	12	DO3-	
3	DI5	Mode selection 2	13	DO4+	Function Pause Status
4	DI6	Project run 1	14	DO4-	
5	DI7	Project run 2	15	DO5+	Project run status
6	DI8	Abnormality alarm reset	16	DO5-	
7	DO1+	Abnormality alarm status	17	DO6+	
8	DO1-		18	DO6-	
9	DO2+	Servo status	19	DO7+	Controller ready
10	DO2-		20	DO7-	

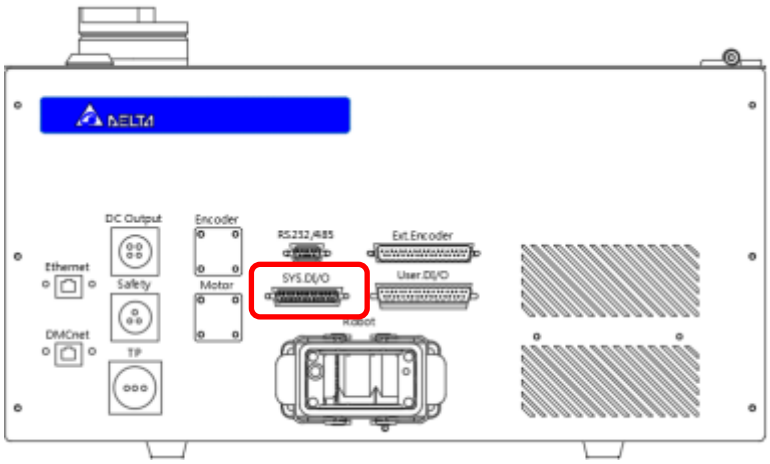


Figure7. 22 System output input connector seat

Please connect Pin2 (N24G) of the DC output connector in the power control box interface with the input signal DI by using a button or selection switch during wiring. The DC Output location is as shown in Figure 7.23.

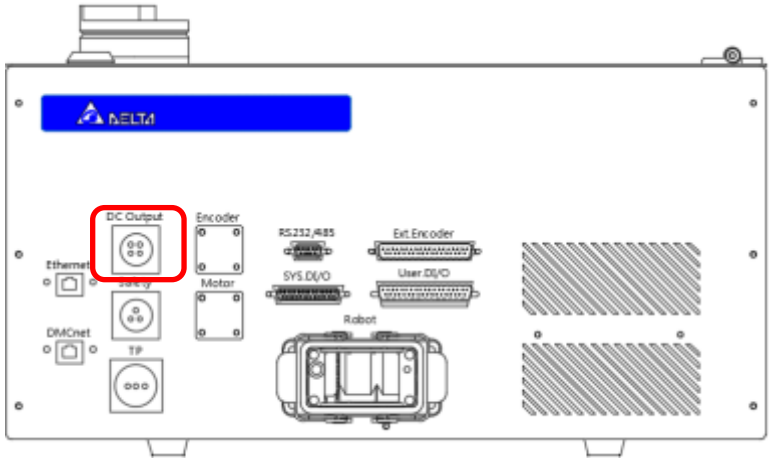


Figure7. 23 DC Output connector location

Note:

1. The DC output provides a maximum output of 1A, and can only be connected with small DI/O signals.
2. Do not connect too many DC signals otherwise it might cause the fuse to burn.

The wiring method for the input signal DI is as shown in Figure 7.24.

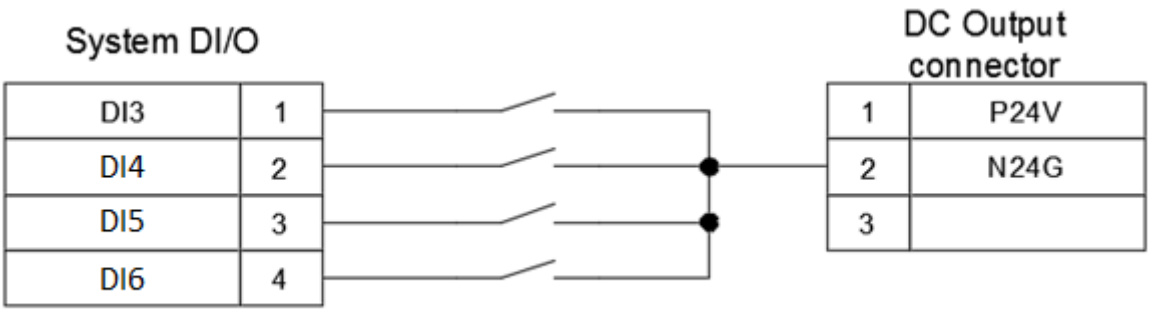


Figure7. 24 Input signal DI wiring

Note:

1. All system. NPN (sink) connection is used for all DI signals.
2. The power control box DC output connector already provides the N24G power; please do not connect the System.DI signal to other powers in order to prevent the signal from not being able to be sent or causing the DI contact to burn.
3. When the transmitted DI signal is live or when transmitting the signal from upper controller to DI, please execute through the relay or optocoupler.

The output signal DO includes a total of 8 points of output from Pin7~Pin22; the output method can be NPN or PNP.

Customers can freely choose whether the output voltage signal will be controller voltage output or upper controller voltage output.

- When the selected output voltage signal is the controller voltage output

  The NPN wiring method is as shown in Figure 7.25 below:

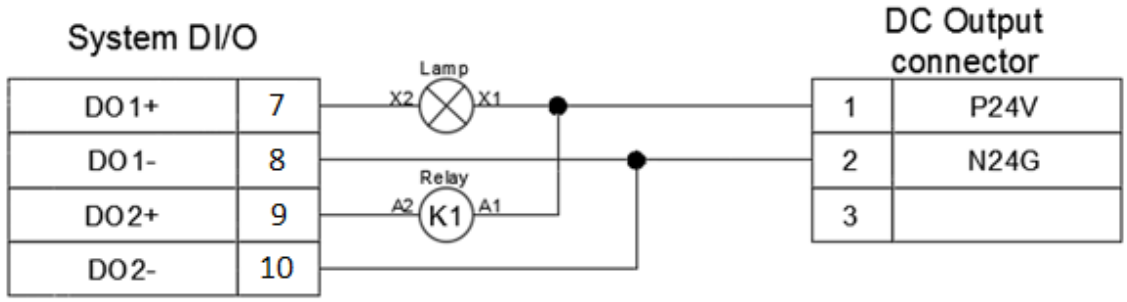


Figure7. 25 System DO controller voltage output NPN wiring

The PNP wiring method is as shown in Figure 7.26 below:

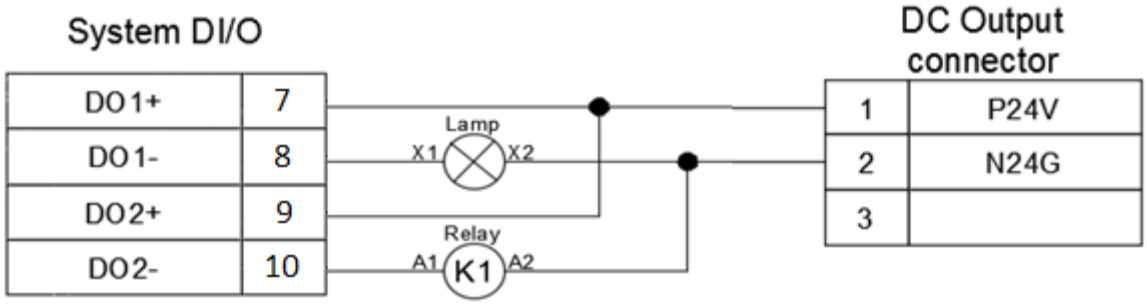


Figure7. 26 System DO controller voltage output PNP wiring

Mixed NPN and PNP wiring method is as shown in Figure 7.27 below:

In the figure below, PNP output wiring is used for the lamp and NPN output wiring is used for the relay.

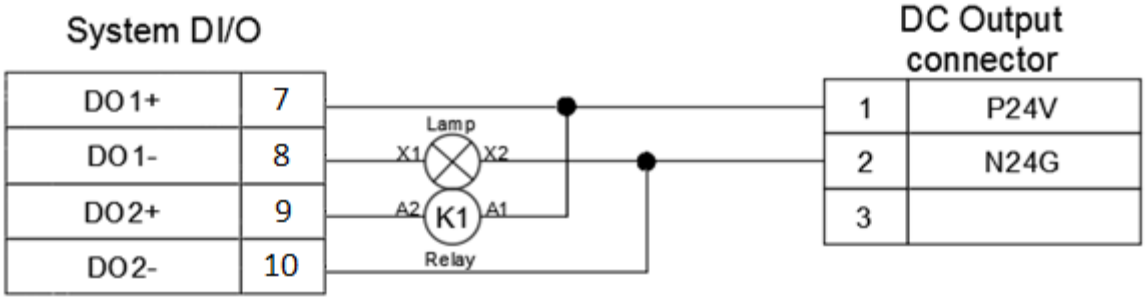


Figure7. 27 System DO controller voltage mixed output wiring

- When the selected output voltage signal is the upper controller voltage output.
  The NPN wiring method is as shown in Figure 7.28 below:

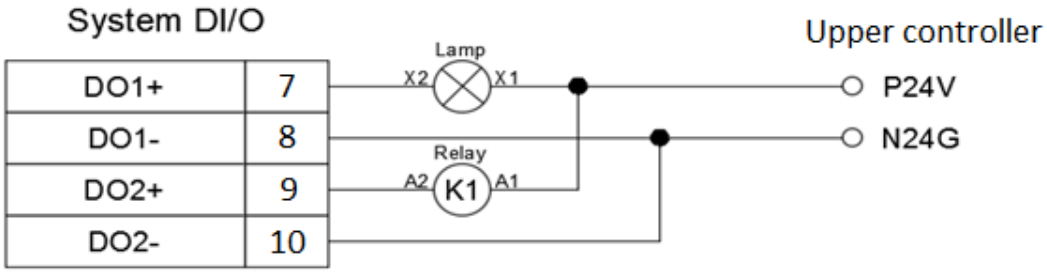


Figure7. 28 System DO upper controller voltage output NPN wiring

The PNP wiring method is as shown in Figure 7.29 below:

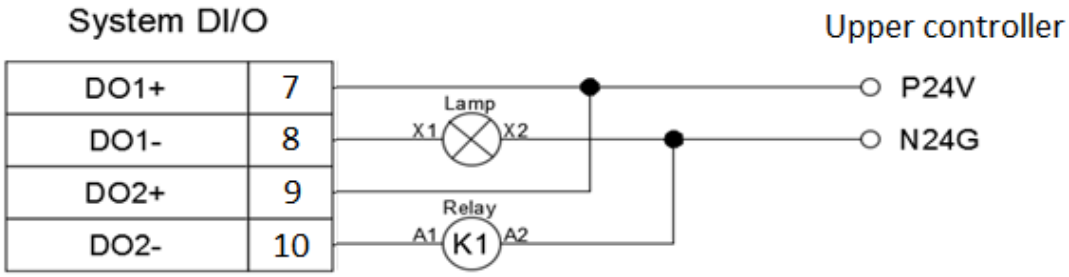


Figure7. 29 System DO upper controller voltage output PNP wiring

Upper controller mixed NPN and PNP wiring method is as shown in Figure 7.30 below:
In the figure below, PNP output wiring is used for the lamp and NPN output wiring is used for the relay.

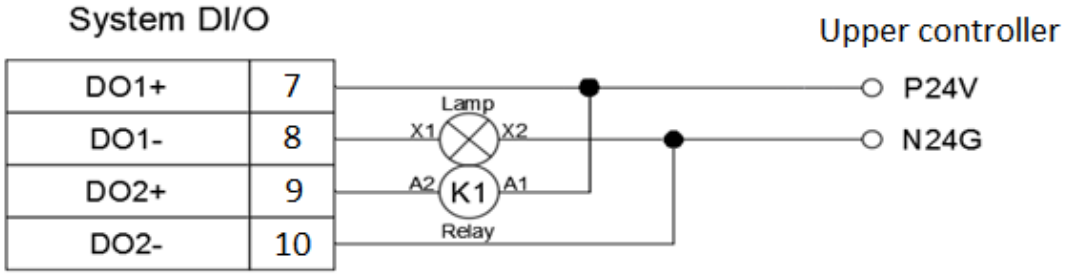


Figure7. 30 System DO upper controller voltage mixed output wiring

Note:

1. Each DO output point can supply 40mA at most. To activate heavy current load, please execute through the relay.
2. Do not connect AC power to the DO output point; such wiring methods will damage the controller.

7.2.5.1 System digital input (SYS.DI) usage

DI3 reserved

This function is temporarily reserved and does not have any meaning.

DI4, DI5 mode selection switch

Provides 2 point DI4 and DI5 signals. User then selects whether to perform manual teach or automatic operation mode.

Mode selection truth table is as shown in Table 7.6 below.

Table7. 6 DI4, DI5 mode selection truth table

Status command	DI4	DI5	Description
No function	**0**	**0**	No function
T1 mode	**1**	**0**	Under T1(Manual teach) mode, need to press the Enable switch of TP to JOG,the combined JOG speed of the robot will be lower than 250mm/s.
Auto mode	**0**	**1**	Under Auto Mode, the operating speed of the Robot is the speed being set in the program.

T1 25% Mode:

- Under T1(Manual teach) mode, need to press the Enable switch of TP to JOG
- When shifting to T1 25% Mode, the combined JOG speed of the Robot will be lower than 250mm/s.
- If the combined speed is over 250 mm/s, the Controller will force the Robot to run at 250 mm/s automatically.
- Under this mode, TP/DROE can execute the robot operation; but DI6 and DI 7 cannot be used to execute the program Run/Pause/Stop.

Auto Mode:

- To execute the program automatic running, please select Auto Mode. Under this mode, it is impossible to use TP for executing T1 mode operations.
- Before executing the automatic operation under Auto Mode, confirm that people are cleared of the Robot operation scope.
- When executing the automatic operation under Auto Mode for the first time, please run the Robot at lower speed and then proceed with high-speed operation after confirming that the Robot is acting smoothly without any error.
- Under Auto Mode, the operating speed of the Robot is the speed being set in the program.
- Under Auto Mode, the user can only run the program currently selected by DROE.

Note:

1. Please use the two-stage key switch (one for contact A and one for contact B) in order to ensure that the operation mode cannot be changed randomly and prevent danger from happening. The key switch is as shown in Figure 7.31 below.

Figure7. 31 Two-stage key switch figure

2. DI4 for contact A, DI5 for contact B.
3. The key must be able to be pulled out from any direction or else workers might activate the robot by accident and causing danger.
4. Please do not hang or place the keys randomly. It should be kept safely with authorized users in order to ensure safe usage.
5. Please differentiate the key switches using the symbols in Figure 7.32 below:

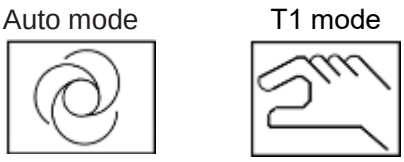


Figure7. 32 Mode selection symbol

6. The mode selection switch can be installed outside the railing together with the operation panel constructed by the user, as shown in Figure 7.33.
   Operation panel should be from the ground 0.6m to 1.7m between to make it easier for users to operate.

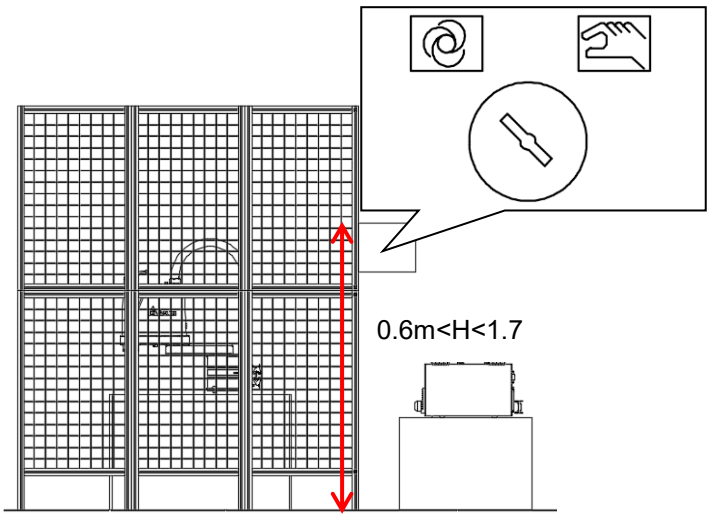


Figure7. 33 Mode selection switch installation location

DI6, DI7 program execution

Provides the function for customers to perform program run; the program can be paused, stopped and run by executing the functions from the external switch; its description is as shown in Table 7.7 below.

Table7. 7 Program execution signal truth table

Status command	DI6	DI7	Description
No function	**0**	**0**	No function
PAUSE	**0**	**1**	The program pause function can be executed through external input signals, and will pause the current block; resuming it will start execution from the next action.
STOP	**1**	**0**	The program stop function can be executed through external input signals; resuming it will start execution from the first line of this process.
RUN	**1**	**1**	The program execute function can be executed through external input signals, but this is only valid for Auto mode.

DI8 abnormality warning reset

- If error occurs to the Robot or the Controller, the abnormal signal contact will be released.
- When eliminating the error, the signal must be maintained at ON status for 200 ms.
- For the error list and troubleshooting method, please refer to software manual.
- Reset button installation location：

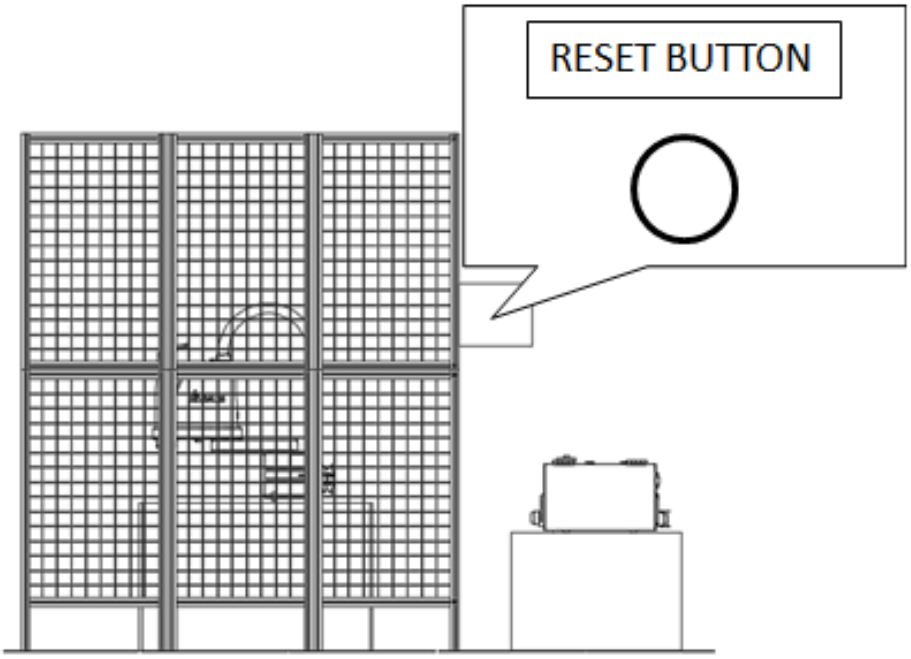


Figure7. 34 Reset button installation location

7.2.5.2 Digital output (DO) usage

DO1 robot abnormality alarm status display

The status descriptions of the system digital output SYS.DO1 is as shown in Table 7.8 below.

Table7. 8 SYS.DO1 status descriptions

SYSDO status / system item	ON	OFF
DO1	Currently there is abnormality alarm status	Currently there is no abnormality alarm status

DO2 robot servo status display

The status descriptions of the system digital output SYS.DO2 is as shown in Table 7.9 below.

Table7. 9 SYS.DO2 status descriptions

SYSDO status / system item	ON	OFF
DO2	Means that the current robot motor servo is ON	Means that the current robot motor servo is OFF

DO3 robot in-place status display

The status descriptions of the system digital output SYS.DO3 is as shown in Table 7.10 below.

Table7. 10 SYS.DO3 status descriptions

SYSDO status / system item	ON	OFF
DO3	Means that the robot is currently moving	Means that the robot is currently in-place and stopped

DO4 function pause function status display

The status descriptions of the system digital output SYS.DO4 is as shown in Table 7.11 below.

Table7. 11 SYS.DO4 status descriptions

SYSDO status / system item	ON	OFF
DO4	Means that this function was not triggered	Means that this function was triggered

DO5, DO6 program run status display

The status descriptions of the system digital output SYS .DO5 and SYS.DO6 are as shown in Table 7.12 below.

Table7. 12 SYS.DO5 status descriptions

SYS.DO6 status / SYS.DO5 status	ON	OFF
ON	Program running	Program run stop
OFF	Program run pause	System Reserved

DO7 controller preparation complete status display

The status descriptions of the system digital output SYS.DO7 is as shown in Table 7.13 below.

Table7. 13 SYS.DO7 status descriptions

SYS.DO status / system item	ON	OFF
SYS.DO7	Means that the controller function preparation is complete	Means that the controller function preparation is not yet complete

7.2.6 Safety connector

The controller provides 8 point safety signals for users to connect; these 8 point safety signals can be used by the user to construct comprehensive robot safety protection. The location of the safety connector is as shown in Figure 7.35.

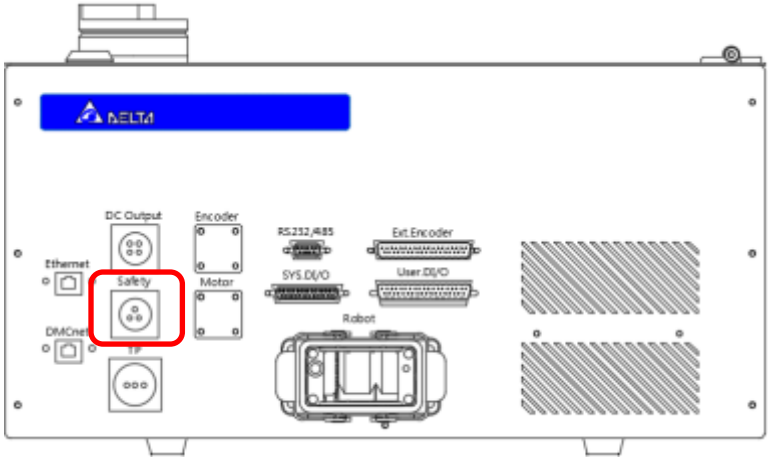


Figure7. 35 Safety connector seat

Connector pin definitions are as shown in Table 7.14 below.

Table7. 14 Safety connector pin definition table

Pin	Name	Description
1	NC1	Connects to external emergency switch
2	NC1	
3	NC2	
4	NC2	
5	NO1	Connects to external grating of protective stop signal
6	NO1	
7	NO2	
8	NO2	

Connects to external emergency stop notes:

- The emergency stop is a dry contact (voltage-free contact) signal. Do not connect AC or DC voltage signal, or it may cause the damage to the internal components of the controller.
- Short-circuiting the emergency stop signal is strictly prohibited; this ensures the safety of the overall robot system and workers.
- Emergency stop is a safety signal; please install the emergency stop button at a location that can be easily pressed.
- Please distribute the power properly according to the methods described in the wiring diagram. The emergency stop button must have 2NC contact. If only 1 NC contact is connected, the power control box will have emergency stop abnormalities continuously.
- Please do not connect one 1NC contact to Pin1~Pin4 of the safety connector simultaneously; this will cause the safety level of the system to decrease.
- Please construct according to the entire actual equipment and install one or more emergency stop buttons. When multiple emergency stops need to be connected, please use serial connection for the emergency stop NC signal; parallel connections cannot be used.
- When the emergency stop signal is triggered, the robot will stop immediately and the AC power will be cut in order to reach type 0 safety stop.

A correct wiring example of a single emergency stop button is as shown in Figure 7.36.

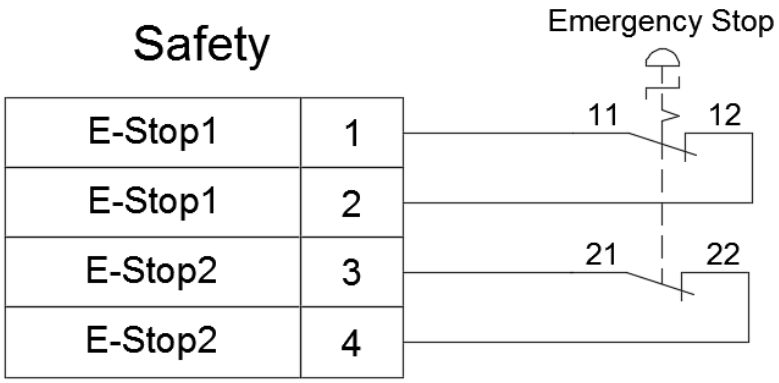


Figure7. 36 Wiring example of a single emergency stop button

Figure 7.37 below shows the wiring method when only a single emergency stop button NC contact is used; this wiring method is wrong and such wiring will cause the system to become abnormal continuously.

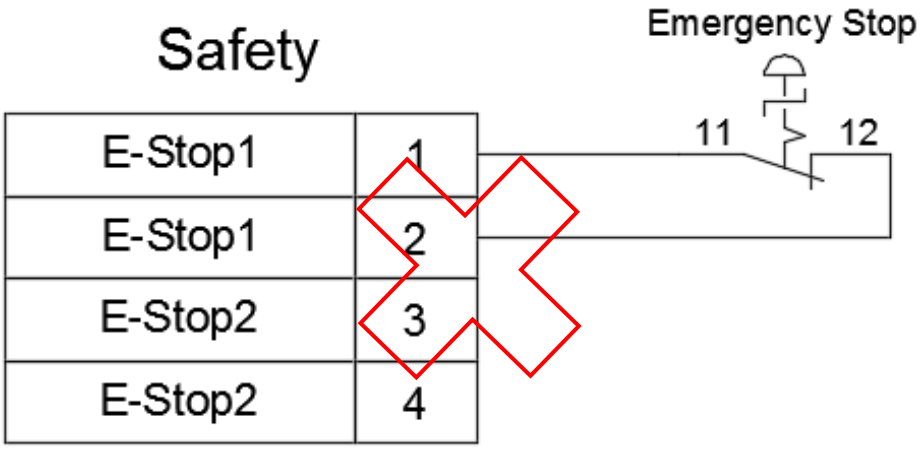


Figure7. 37 Wrong wiring of a single NC emergency stop

Figure 7.38 below shows when only a single emergency stop button NC is used and the safety signal is connected. This wiring method is wrong; do not use such a wiring method. Such connection will result in a decreased safety level of the entire system.

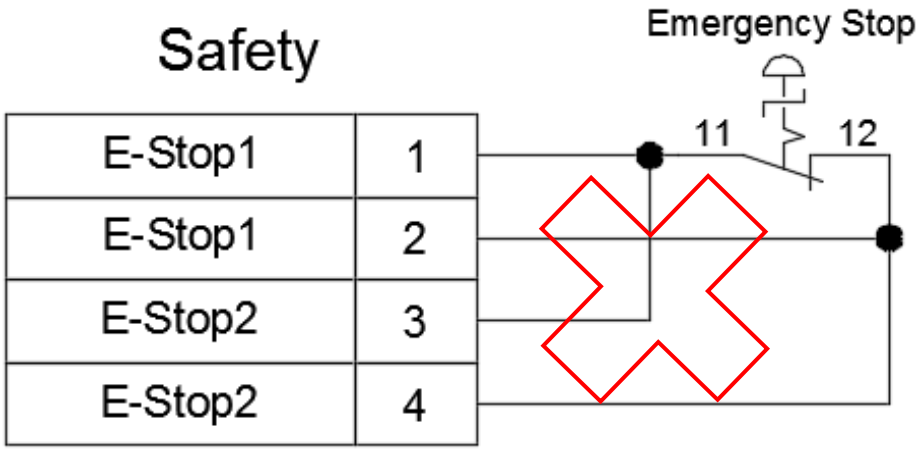


Figure7. 38 Wrong wiring of a single NC emergency stop with safety signal connected

When multiple emergency stop buttons need to be connected, please perform wiring according to Figure 7.39 and distribute the locations of each emergency stop buttons appropriately so that when a dangerous situation occurs, the emergency stop button can be quickly pressed to stop the robot actions.

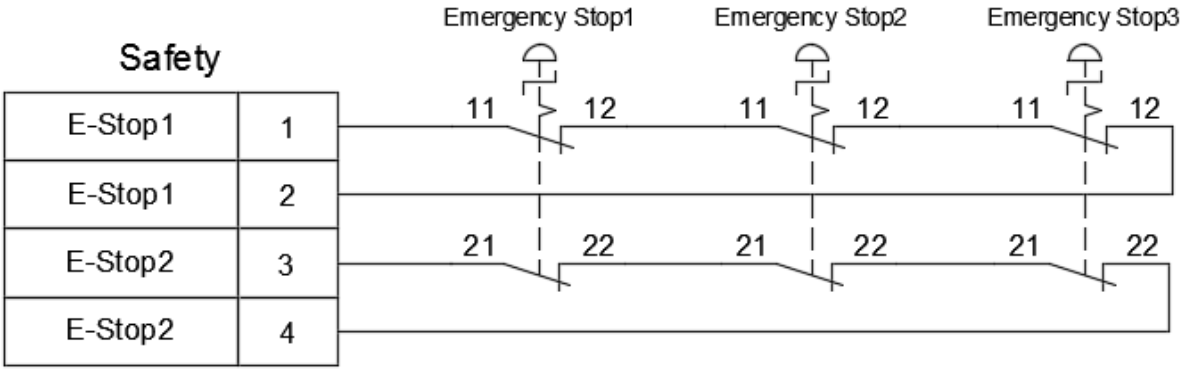


Figure7. 39 Wiring example of multiple emergency stop buttons

Pin5~Pin8 of the safety connector are the safety protection contacts; users can install railings, safety grating, pressure pad or laser scanner etc. according to their needs. The wiring of multiple safety protection is as shown in Figure 7.40 below. Please refer to the safety protection construction and installation descriptions for the installation requirements of the safety protection.

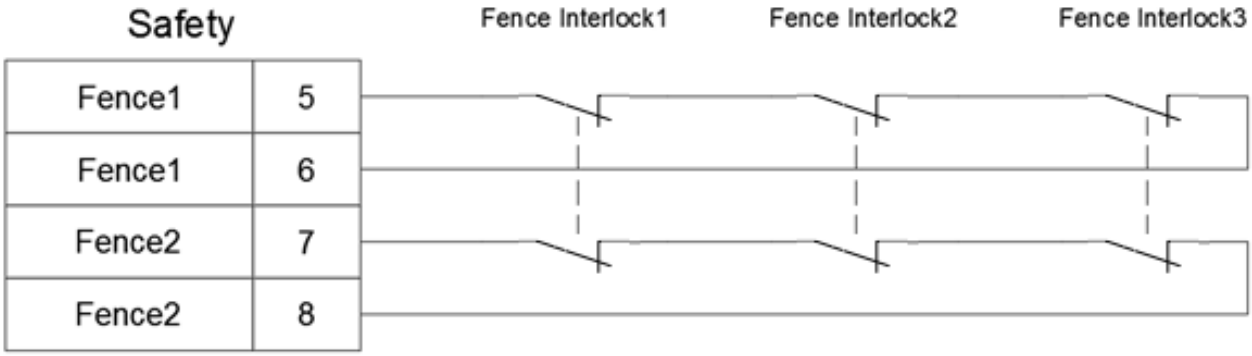


Figure7. 40 Wiring figure of multiple safety protection devices (for fance)

*According to the definition of different components (EX: Pressure-sensitive safety mat) there contacts will be differences (NO contacts and NC contacts)

For safety protection needs, users can install safety lock switches on the railings in order to ensure that the safety door can close properly, as shown in Figure 7.41 below.

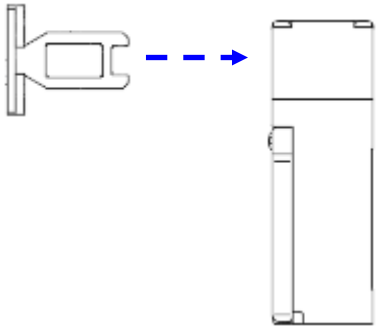


Figure7. 41 Safety door switch figure

A safer practice is to select electromagnetic safety door switches so that when the safety door is closed, the safety switch will generate magnetic force to keep the door lock bolt securely in place and prevent users from accidentally opening the door and entering the railing, causing danger.
The power switch of the electromagnetic safety door lock can be installed inside the railing so that when workers are accidentally trapped inside the railing, they only need to turn off the power switch to release and electromagnetic safety door and save themselves. The installation method is as shown in Figure 7.42 below.

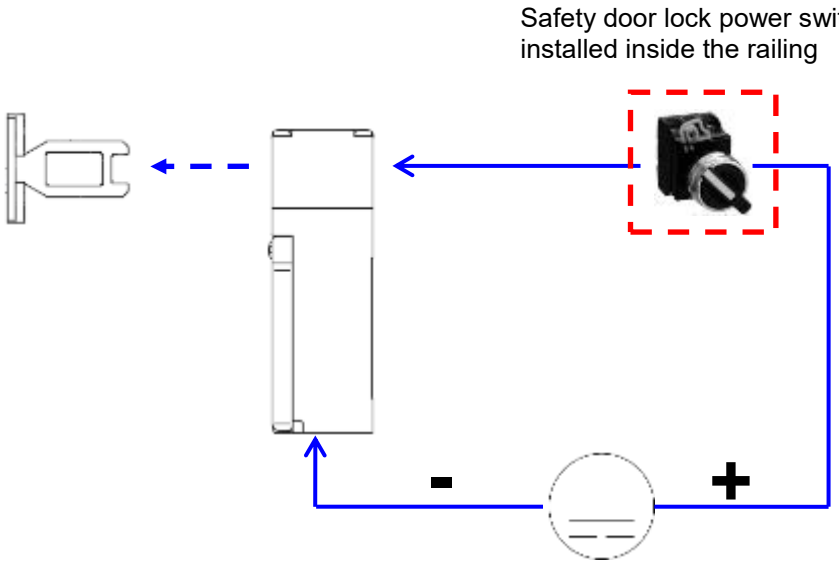


Figure7. 42 Electromagnetic safety switch wiring

7.2.7 Direct current output connector

There is a DC output connector on the power control box interface for customers to connect DI/O signals.

The connector location is as shown in Figure 7.43 and the pin definitions are as shown in Table 7.15.

Note:

1. The power provided by the DC output connector is DC24V/1A. Do not use this connector with other DC power or else it will cause the fuse to burn.
2. Do not randomly change the fuse of this DC output connector or else it might result in burning of the cable.

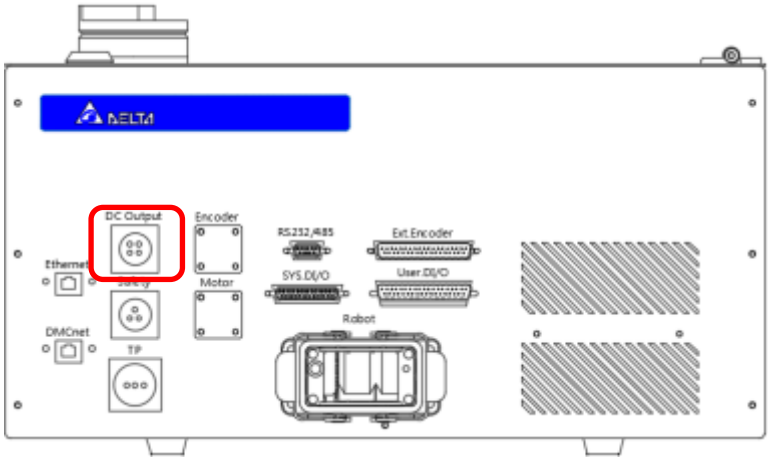


Figure7. 43 DC output connector location

Table7. 15 DC output pin definition

Pin	Name	Description
1	DC24V	Connect to the positive potential
2	DC24G	Connect to the negative potential
3	-	-

7.2.8 Handheld teach pendant connector

Users can use the handheld teach pendant to operate the robot, teach points, edit robot program and perform I/O surveillance easily. The connection method is as shown in Figure 7.44.

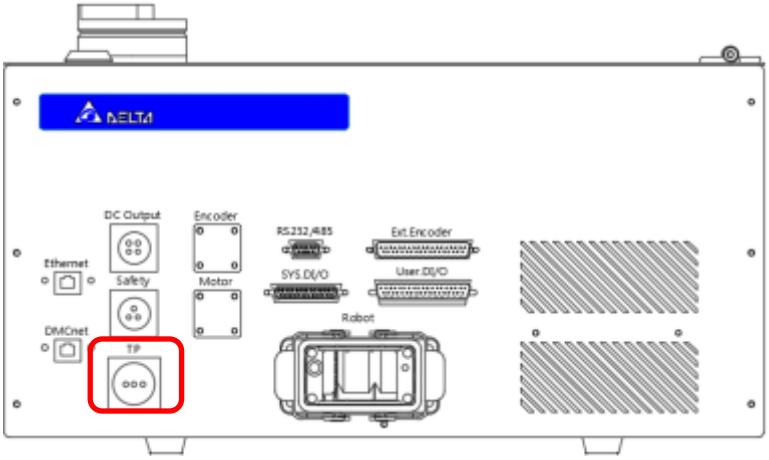


Figure7. 44 Communication connector seat

Cautions for operating TP:

- For DRS40L3/DRS60L6, Please check the TP version V0.40.00.00.
- TP can execute T1 mode (JOG teaching) and Auto mode (automatic execute program operations).
- If safety door is open(fence is triggered), in the T1 mode and Auto mode, must press the Enable switch in the middle position to perform JOG teaching and automatic program execution.
- The JOG speed will be limited to 250mm/sec when TP is in T1 mode.
- When using TP to operate the Robot, do not stand within the working scope of the Robot to prevent from getting hit by the Robot.
- When using TP to JOG the robot, the left hand must press down on the middle of the enable switch located behind the TP in order to jog the robot. Pressing other positions will cut all driver AC power. The enable switch behind the TP is as shown in Figure 7.45.

Figure7. 45 TP Enable switch icon

- During emergency, press the Emergency Stop on TP or release the enable switch and the Robot will stop operating immediately.
- Do not press the screen on the TP with a sharp object or a pen, or it may cause the damage to the screen.
- Please refer to the TP manual for detailed operations, or download it from the official Delta website.
- Cautions for assembling/dismantling TP:
- Install the TP to the Electrical Control Box when the power is disconnected.
- If it is required to dismantle the TP from the Electrical Control box, set the Electrical Control Box to OFF position and then perform the dismantling. After TP is removed, please install the TP
- Bypass connector included in the accessory pack onto the power control box, or else abnormalities will occur and it cannot be operated is as shown in Figure 7.46
- Auto mode should be used bypass connector included in the accessory pack.

Figure7. 46 TP Enable switch icon

When teaching the robot using TP, please press the enable switch located at the left-back side of TP with your left hand, making the enable switch stay in the middle position, and your right hand can operate the physical buttons on TP or the touch screen. Figure 7.47 shows the correct way to hold the TP.

Figure7. 47 Correct way to hold the TP

TP interface structure: it is mainly divided into touch screen, physical buttons, emergency stop button and select/adjust knob, as shown in Figure 7.48 below.

Figure7. 48 TP handheld teach pendant

Since the cable length of TP is 5m, please hang TP next to the safety railing when not in use, and select a suitable height so that it is easily accessible. As shown in Figure 7.49 below.

Please put away the TP cable properly; placing it on the floor might result in damages to the cable from being stepped on by workers.

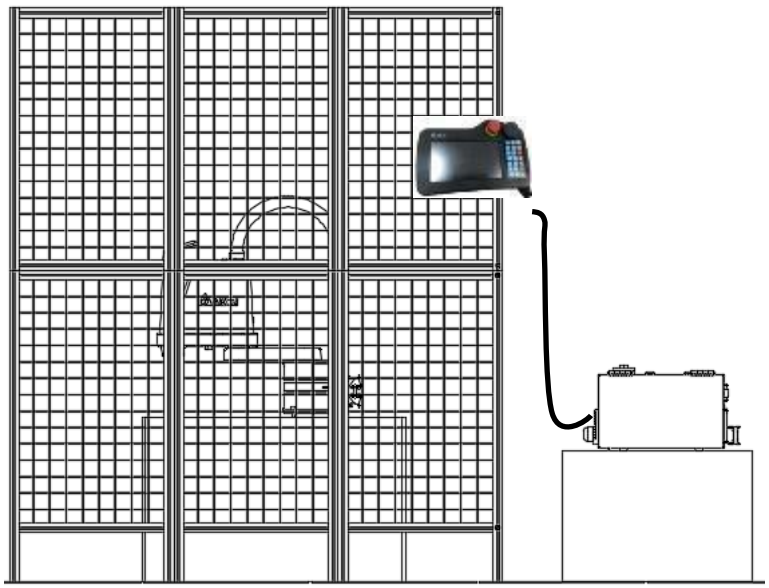


Figure7. 49 TP installation location

7.2.9 Serial transmission (RS-232, RS-485)

Standard D-Sub 9P/Female Connector. With controllers such as PC, PLC and HMI, etc. that are designed with RS-232/485 function, users may carry out the communication with the power control box controller through such connector to read the Robot data or control the Robot. In addition, controllers equipped with RS-232/485 functions can also be connected to perform data reading or writing to the controller.

The location of the RS-232/485 connector is as shown in Figure 7.50.

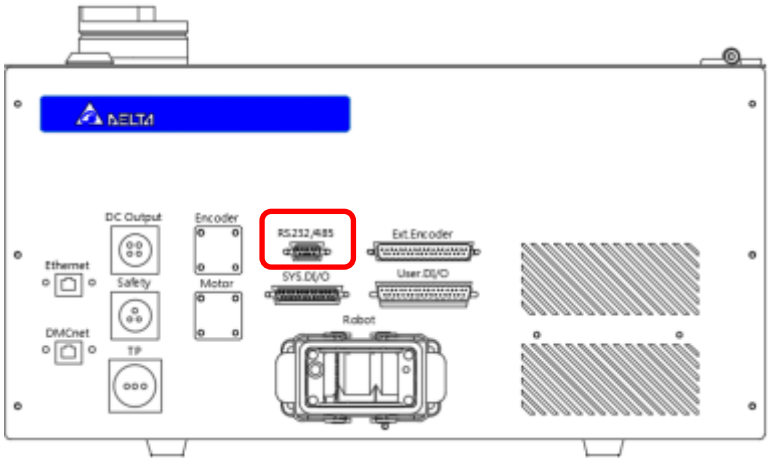


Figure7. 50 RS-232/485 connector location

In order to ensure that there is no interference for data transmission, please use twisted pair cables with isolation nets for the connections. The RS-232/485 pin definitions are as shown in Table 7.16.

Table7. 16 Serial transmission (RS-232, RS-485) connector function definition table

Pin	Name	Description
1	RS485+	Driver end data transmission differential + end
2	RS232_RX	Driver end data receiver connected to the RS-232 transmitter end of the PC.
3	RS232_TX	- Driver end data transmitter connected to the RS-232 receiver end of the PC. - Connected to the RS-232 receiver end of the PC
4	-	Reserved
5	GND	+5V and signal end grounding
6	RS485-	Driver end data transmission differential - end
7	-	Reserved
8	-	Reserved

9	-	Reserved

7.2.10 Communication port (ETHERNET)

By connecting the network cable to Ethernet connector, the PC can perform communication connection with the controller. In addition, the following can be performed through the Delta DROE software:

- Edit robot language and save the program into the controller to perform project management.
- Jog the robot, set the origin and reset the origin etc.
- Servo and robot related parameter settings.
- Execute I/O monitoring.
- Alarm, troubleshooting.

For detailed operation of DROE software, please refer to the description contained in Delta DROE Operation Manual.

The connection method of the connector is as shown in Figure 7.51.

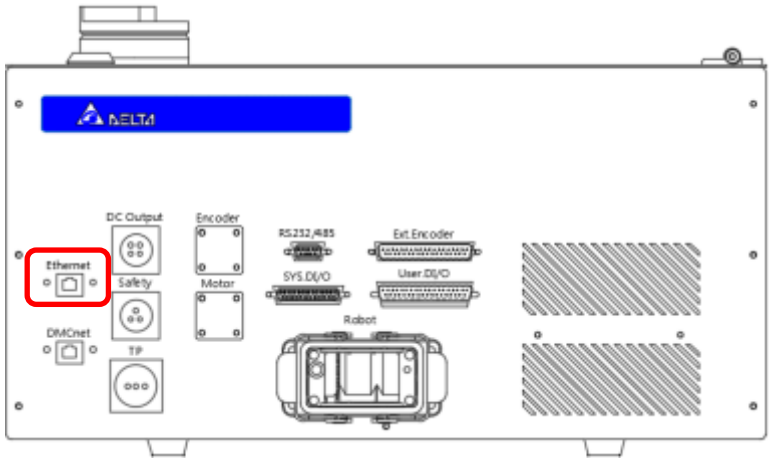


Figure7. 51 Communication port

7.2.11 Communication port (DMCNET)

Diverse Delta products can be connected through the Delta high speed communication network DMCNET; for example, drivers or remote DI/O modules. Connect one side of a standard RJ45 to the power control box interface and connect the other end to the Delta DMCNET product as shown in Figure 7.52.

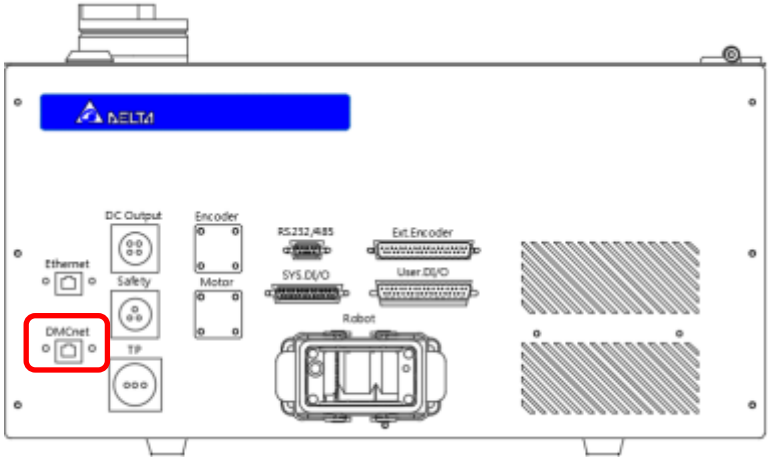


Figure7. 52 DMCNET communication port

A maximum of 12 Delta product workstations equipped with the DMCNET function can be connected through DMCNET connection, as shown in Figure 7.53.

Note:

1. When an external driver is connected to the DMCNET connection, if the power control box is a 6-axes power control box, a maximum of 4-axes external driver can be connected; if the power control box is a 7-axes power control box, a maximum of 3-axes external driver can be connected.
2. If the connected DMCNET has no driver, a maximum of 12 DI-O module units can be connected.

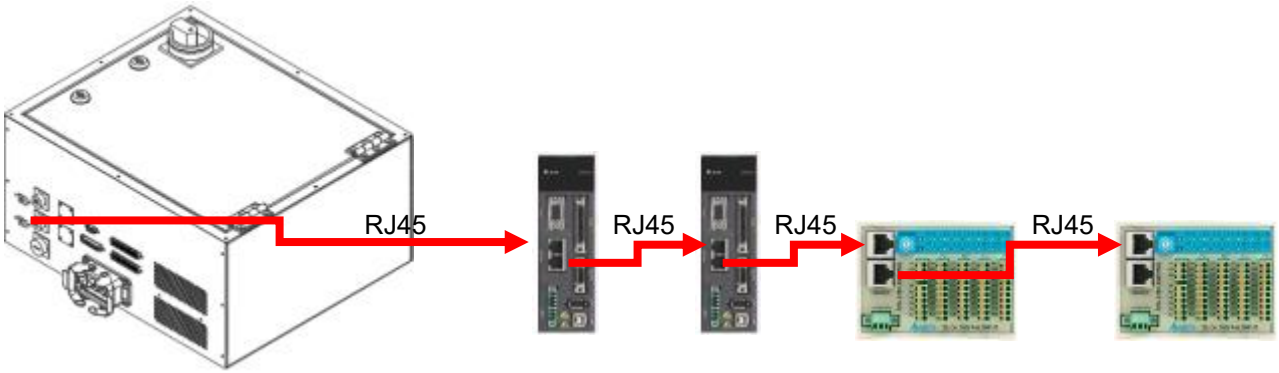
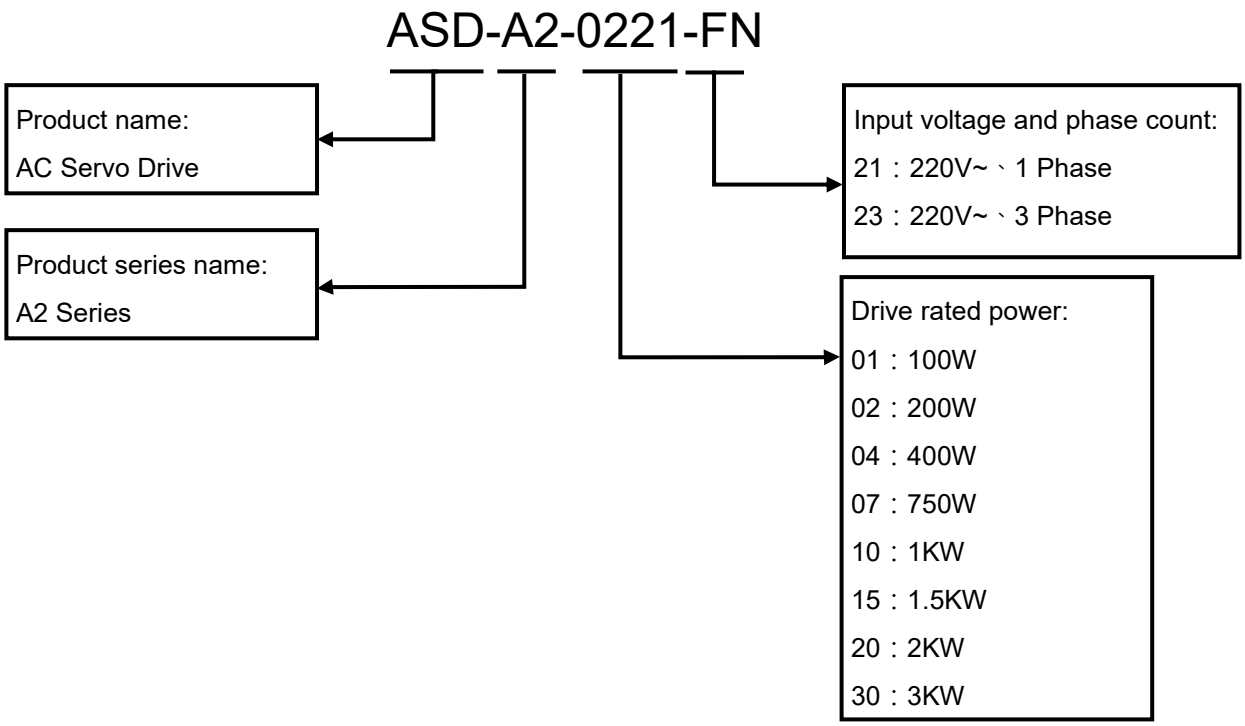


Figure7. 53 DMCNET connection icon

Driver models that can be connected through DMCNET are as follows:



When connecting an external expansion axis driver, please add an electromagnetic contactor in front of the driver; the control of the electromagnetic contactor is done by using the upper controller or emergency stop to cut off the AC power supplied to the driver, as shown in Figure 7.54 below.

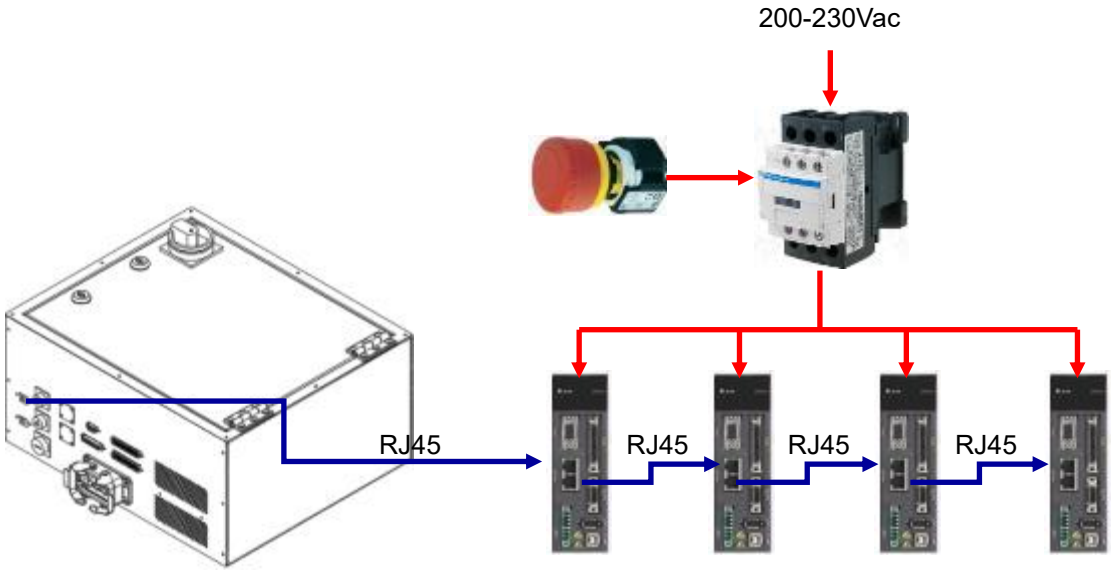


Figure7. 54 Power control box with external driver system architecture

Listed below is the model number of DI/O module that can be connected:

Input Module:

- ASD-DMC-RM32MN

  32-point Input Module.

  Input signal: By connecting with COM point, the user may select input signal as PNP or NPN.

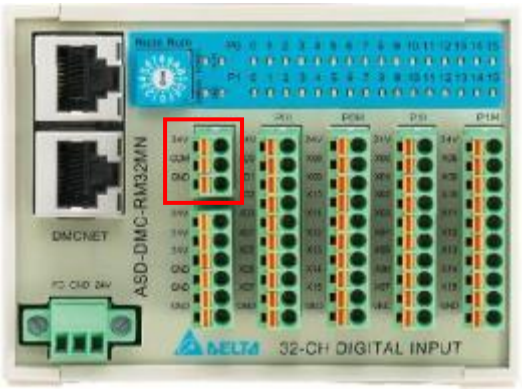


Figure7. 55 ASD-DMC-RM32MN

Shorting between COM and 24V: Common point of input signal is GND.

Shorting between COM and GND: Common point of input signal is 24V.

Output Module:

- ASD-DMC-RM32NT

  32-point Output Module

  Type of output signal: NPN

  Rating of output current: 100mA/1 point

  Type of output circuit: Transistor

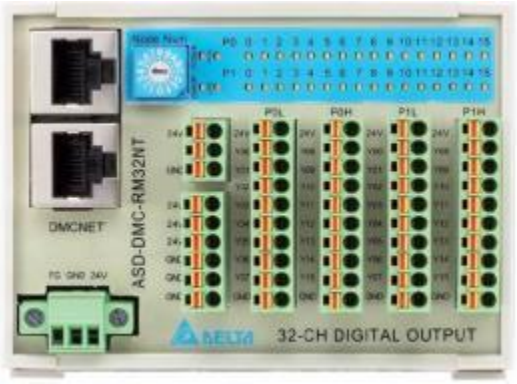


Figure7. 56 ASD-DMC-RM32NT

8. Installation and operation

This chapter will introduce how to install, wire, connect the robot and the execution method for initial operation.

	■ Please read this manual carefully before usage in order to ensure proper usage and the safety of the maintenance staff. ■ Due to operational environment and operator safety considerations, our company will provide dedicated training for the operators of different robot applications in order to ensure usage safety. Please contact our company or your local dealers if training is needed. ■ Please workers with related professional knowledge or qualified engineers to perform the installation and wiring of the robot. ■ This robot DRS CE series can only be used with our company's controller DCS-1B00-CA. Please do not modify the machine or wiring by yourself or use with other controllers. Our company will not be held responsible for any injuries or fatalities caused by accidents that resulted from doing so. ■ Please use our company's handheld teaching pendant and installed it on the controller DCS-1B00-CA to perform manual operations and edit programs. ■ Do not on flammable or toxic processing lines. ■ Carefully select the model according to the loading quality; do not try to expand to the specified capacity. ■ The robot is a partially completed machine; the assembly and construction of the protection and safety circuit should be responsibility of the final system integrator. ■ All children and visitors should keep a safe distance from the processing area. ■ Do not wear loose clothes, ties, rings or bracelets, and wear protection cases to protect long hairs. These things can be easily caught in the machine by accident and causing injuries to the staff or other dangers during operation. ■ Please turn off the power, isolate the power properly and wait for the robot

	to stop completely when the robot is no longer used before you leave. ■ Please follow the manual to install the safety protection devices such as railings, gratings, regional laser or pressure pads in order to prevent workers for getting inside the working range of the robot and result in injuries or other dangers due to impact by the robot. ■ Please confirm there is no one in the railing before operating the robot and performing operations. ■ Do not laugh or talk to other workers while operating the robot; such wrong behaviors may result in collision of the robot or injuries to other workers. ■ Please install the final system integration of user operation buttons and warning lights etc. outside the railing in order to ensure usage safety. And the height of the operating interface should be a suitable (0.6m to 1.7m) range for operators to touch. ■ Please use the two-stage key selection switch to change between T1 and Auto mode; the keys must be able to be unplugged in both directions. ■ Please have the senior supervisor keep the T1/Auto mode selection switch key. Do not place it randomly or leave it inserted on the selection switch as doing so may result in the personnel activating the robot accidentally, causing injuries to the workers. ■ Please do not stand within the moving range of the robot when teaching the robot manually for the first time in order to prevent danger from occurring due to being unfamiliar with the operations. ■ Please use slow speed operations when operating the robot manually for the first time, otherwise being unfamiliar with the operations may result in damages to the robot due to impact or causing injuries to other workers. ■ Please do not turn the power on and off frequently as doing so may result in damages to the controller. ■ Improper operations might damage the robot. ■ When collisions occurred to the robot, please first turn off the power of the robot and then check the components and cables of the robot to make sure they are not damaged before turning the power back on to perform operations again. ■ Please use a safety lock on the railing switch when entered the railing to operate the robot in order to prevent the railing from closing suddenly causing the robot to activate accidentally. ■ If the teaching pendant cable on the controller needs to be removed, please do so when power is completely cut, otherwise the teaching

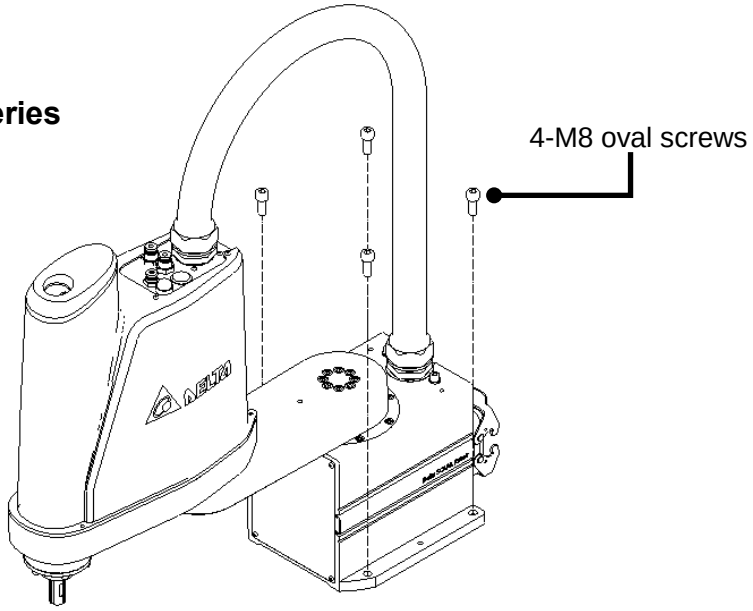
	pendant might get damaged. ■ The location of the interlock switch between the structure of the safety protection device and the protection device should comply with EN ISO 14120 and EN ISO 14119 standards, and the safety distance should be designed according to EN ISO 13857 standards.
	■ Do not randomly make any changes to any components on our company's handheld teach pendant, including the emergency stop and Enable switch. Doing so will lower the safety performance and level, even lose the safety protection. ■ Short-circuiting of any safety protection signals on the controller is strictly prohibited, otherwise our company will not be held responsible for any work accidents that occurred. ■ When operating the robot all personnel are prohibited to stand close or within the robot working range; doing so will cause injuries to the workers. ■ Do not unplug any cables on the controller while the robot is operating; doing so will cause damages to the controller. ■ Do not open the protective cover or protection device while the machine and robot are operating.

8.1 Robot and power control box installation

8.1.1 Robot installation

The installation of the robot should be as shown in Figure 8.1 below; lock the base on a flat surface using M8 screws + flat gaskets, and lock it tight by using the locking torque (20N-m) instructed.

DRS40/50/60/70L series



DRS60H series

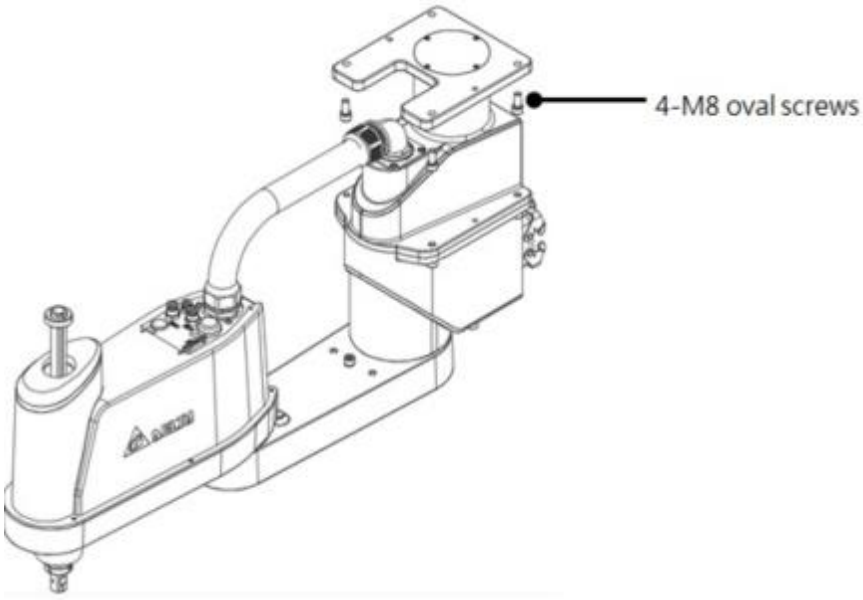


Figure8. 1 Robot installation screw lock position

8.1.2 Controller installation

Controller installation notes:

1. The controller uses forced fan cooling, so sufficient space must be left in the front, back and left side of the controller or else it will cause malfunctions. Figure 8.2 shows the cooling illustration of the controller.

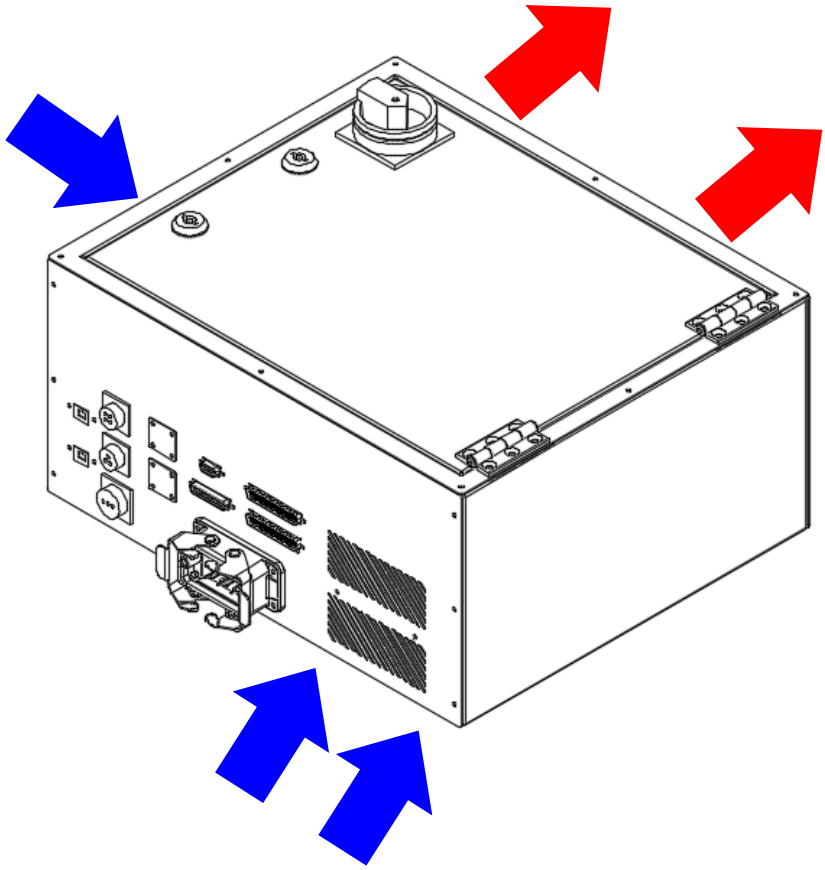


Figure8. 2 Controller cooling

2. When installing the controller, in order to make the cooling cycle work well, please keep a distance of at least 150mm in front and back of the controller, and reserve at least 100mm space on the left side of the controller. Figure 8.3 shows the cooling distance and space requirements for the installation of the power control box.

3. Do not topple over the power control box as doing so will cause it to malfunction.

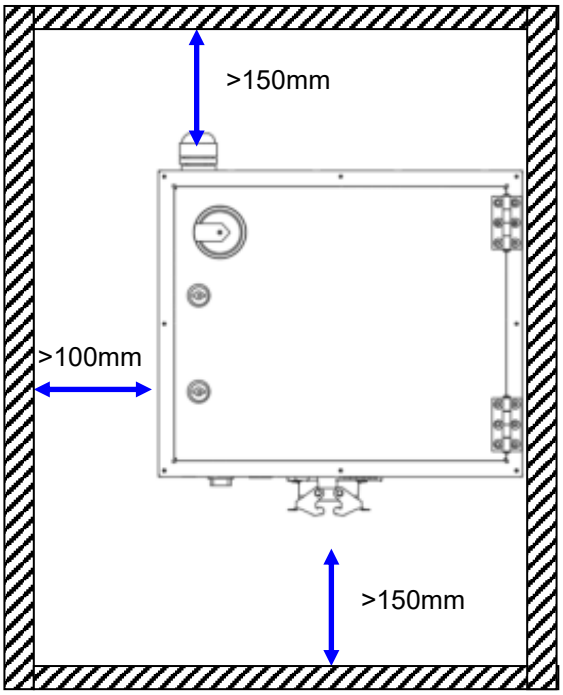


Figure8. 3 Controller installation cooling distance

4. When the controller is installed outside the equipment of the final system integrator, please make sure that the height of the power control box is at 0.6m to 1.7m between. Such a height makes it easier for users to operate the controller and to turn the controller power on and off. Figure 8.4 below shows the height requirement for the installation of the controller.

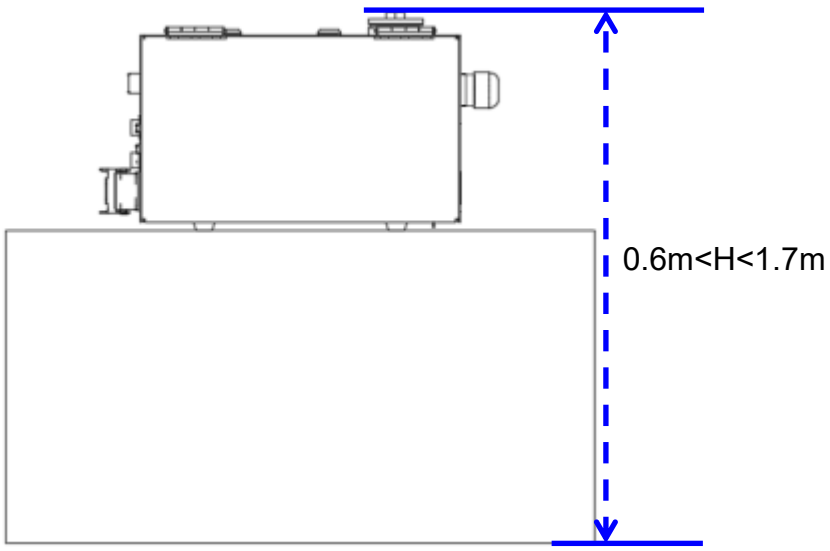


Figure8. 4 Controller installation height

5. When installing the controller, please check to leave space for opening the controller door, or else it will be difficult to perform repairs. Figure 8.5 showsthe space used when the power control box door is opened.

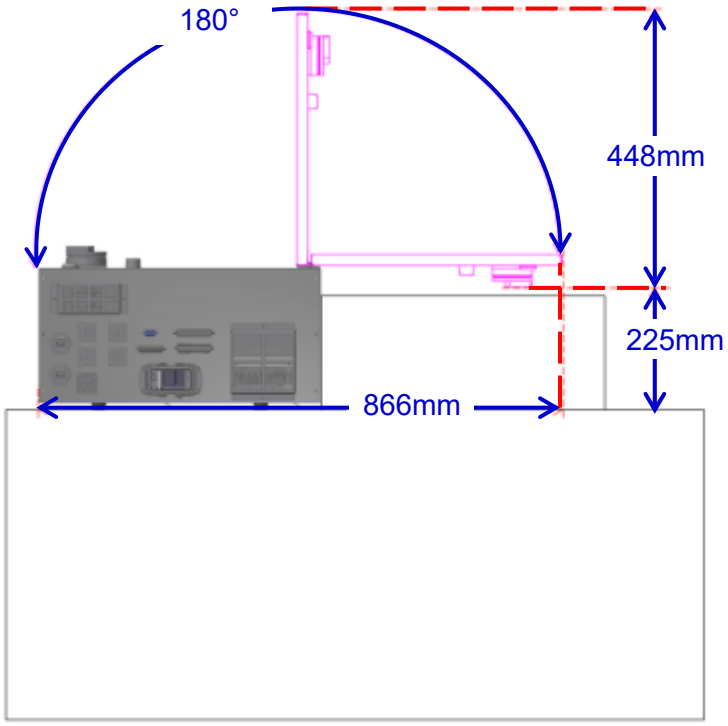


Figure8. 5 Controller box door open space

6. When fixing the power control box in place, please do as shown in Figure 8.6 below and use 2 L-shaped plates to keep the two sides of the controller tightly together and fixed in place.

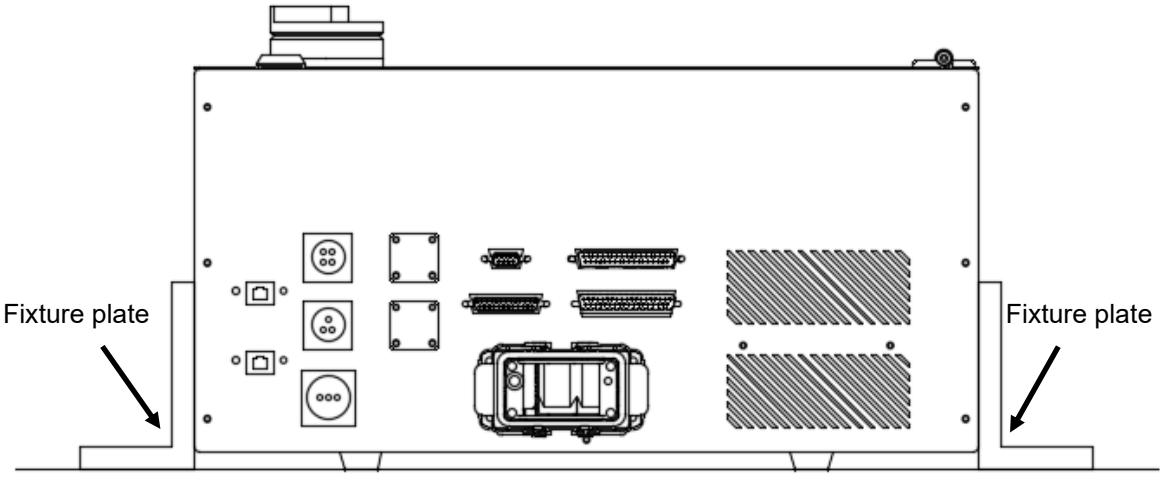


Figure8. 6 Controller installation fixture method

8.2 Safety protection device construction

8.2.1 Railing construction notes

The final system integrator must construct safety protection devices around the robot properly, such as railings, pressure pads and gratings etc.
Please refer to Chapter 3 for the construction of safety protection devices.

The use of the safety switch with key attached as shown in Figure 8.7 below is recommended for the installation of the safety lock for the railing.

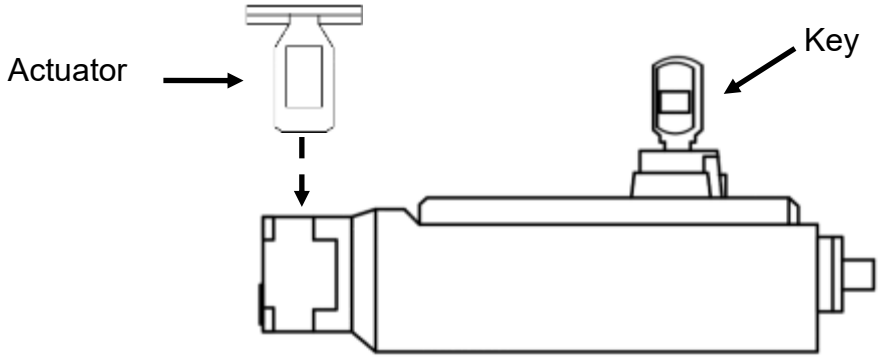


Figure8. 7 Key safety switch

Workers entering the railing should have the keys with them; this can effectively prevent the door from being close and accidentally starting the robot.
Even if the railing is closed, the safety switch will not be activated without the key to switch the safety switch to Lock mode.
When the safety switch with the attached key is selected, please select so that the key can be removed at any position; otherwise, there will be the risk of anyone can switch the safety mode randomly.

Please also install one or more safety switches or key switches inside the railing, and use serial connection to connect it with the safety switch signal of the railing so that if the railing was accidentally closed, the workers trapped inside the railing can turn off the safety switch signal and make the controller cut the power supplied to the robot. This ensures the safety of the workers trapped inside.
Please refer to Figure 8.8 below for the installation example figure.

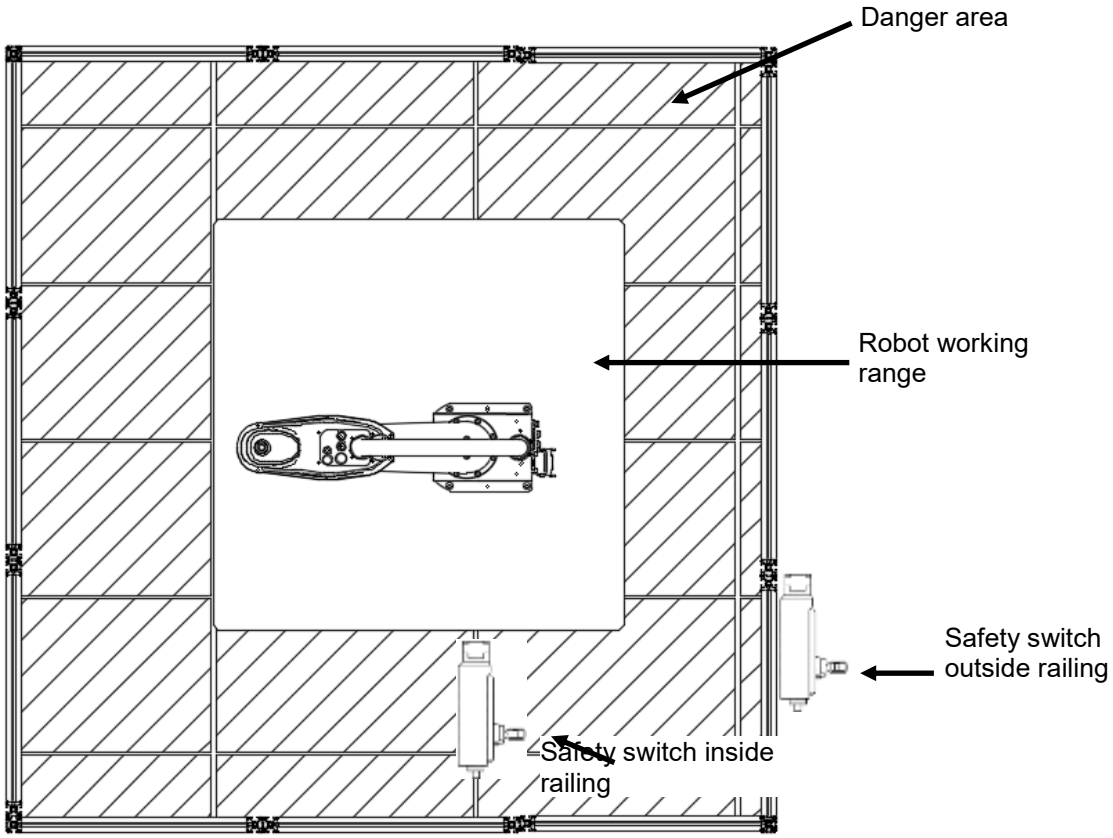


Figure8. 8 Safety railing signal installation example

The wiring method of the safety railing signal is as shown in Figure 8.9 below. The safety signal contact on the controller must be a voltage-free contact; the use of live signal will cause damages to the components inside the controller.

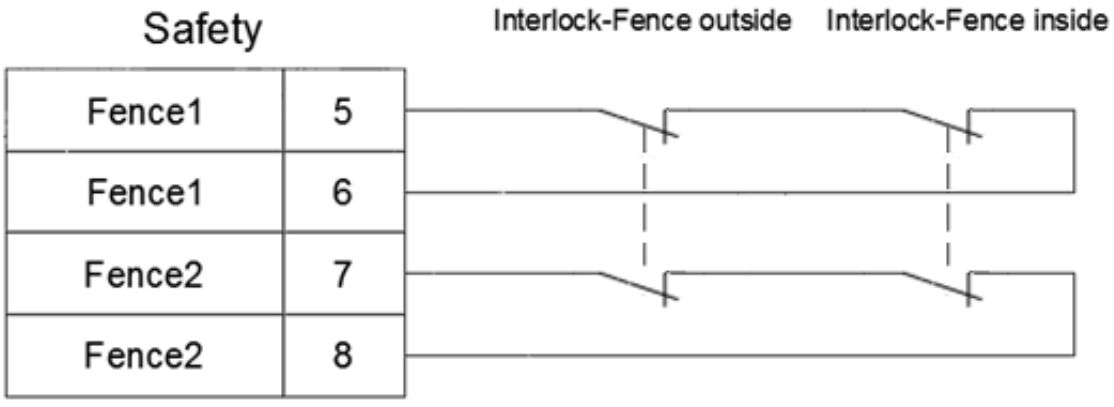


Figure8. 9 Wiring example of multiple safety railing signals

8.2.2 Emergency stop installation notes

Please refer to Chapter 3.2.1 for details on items related to the installation of the emergency stop button.

The installation of the emergency stop button must be at an obvious place and cannot be blocked by other equipment or objects.

Please install the emergency stop button at an appropriate height; it cannot be too high or too low or else it will be difficult to operate during emergencies.

Please install more than one emergency stop buttons according to the actual length of the equipment; the distance between the emergency stop buttons must not exceed the length of the two arms of a person in order to ensure that the emergency stop button can quickly be pressed during an emergency situation. Please refer to the installation example in Figure 8.10 below for the installation of emergency stop buttons.

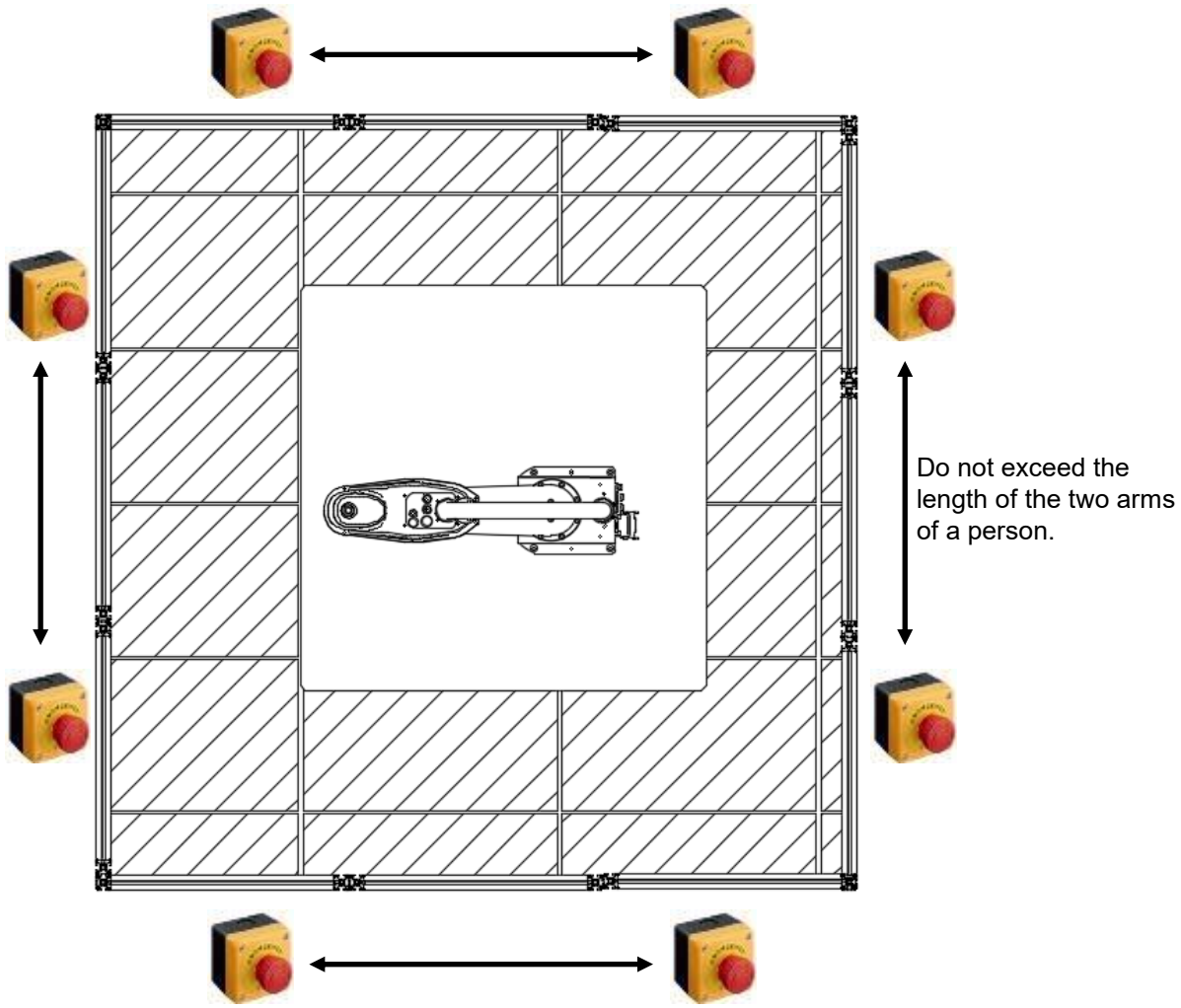


Figure8. 10 Example of installing multiple emergency stop switches outside the railing

Please also install one or more emergency stop buttons inside the railing so that if workers are trapped inside the railing, they can press the emergency stop button inside the railing and the controller will remove the power from the robot in order to ensure the safety of the workers trapped inside the railing. Figure 8.11 below is an example of installing emergency stop buttons inside the railing.

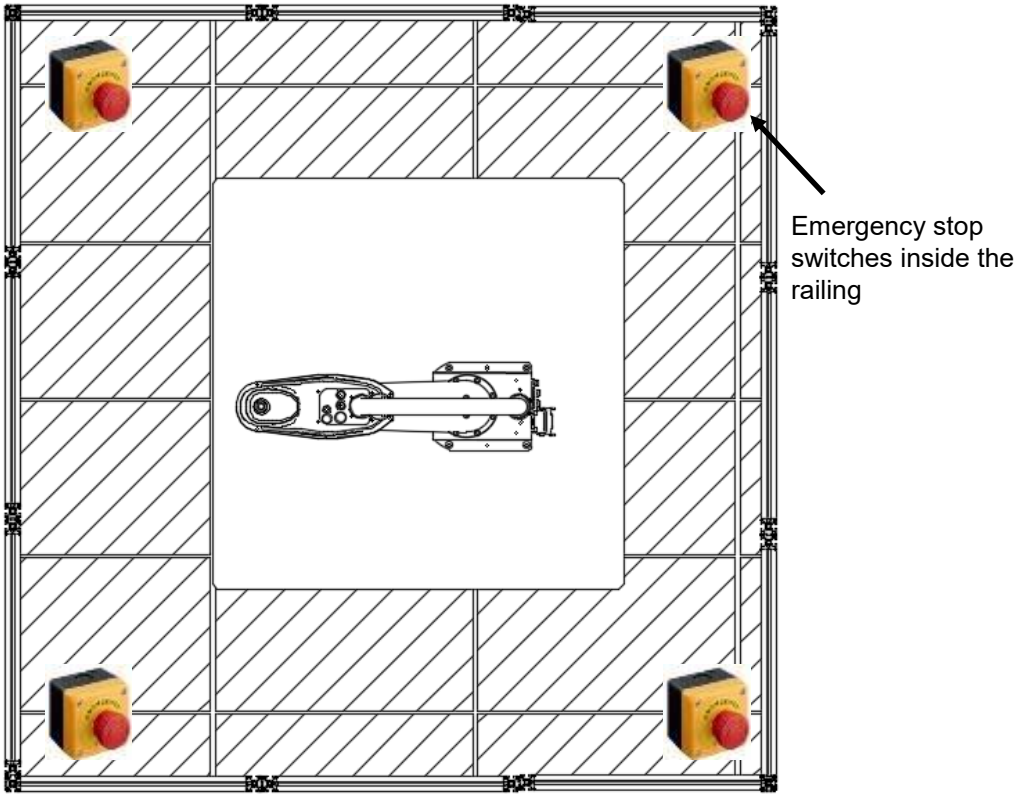


Figure8. 11 Example of installing multiple emergency stop buttons inside the railing

If the final system integrator installed additional emergency stop signals, they must be connected to the emergency stop signal of the robot using serial connection in order to ensure the safety of the entire system.

The wiring method of multiple emergency stop buttons is as shown in Figure 8.12. The emergency stop signal contacts on the entire system must be voltage-free contacts; the use of live signals will cause damages to the components inside the controller.

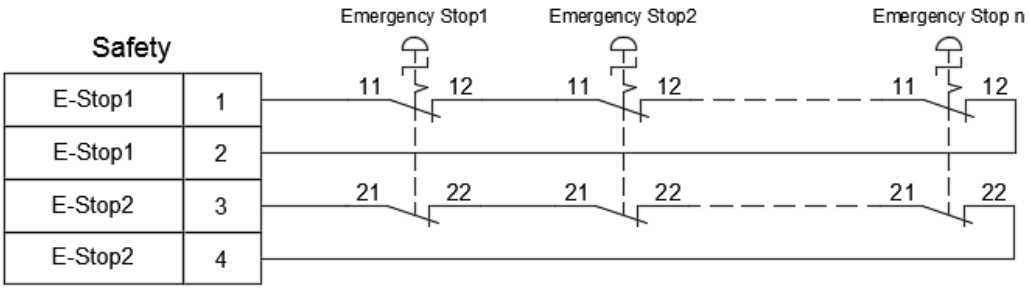


Figure8. 12 Wiring example of multiple emergency stop buttons

8.3 Wiring

Please have workers with related wiring knowledge responsible for the wiring, otherwise, it can easily cause danger.

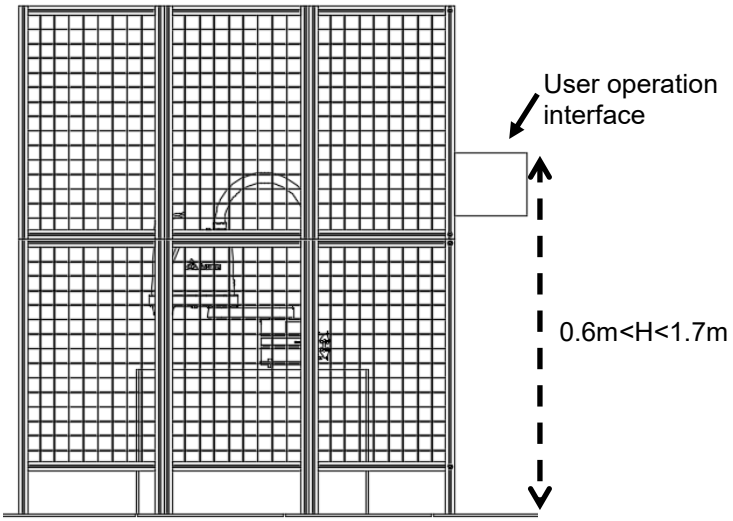
Please implement the grounding properly in order to ensure the safety.

Please refer to Chapter 7 for details on related wiring for the controller; please have the final system integrator to perform wiring according to your actual needs.

Please install the user interface at an appropriate height (at higher 0.6m to 1.7m between) so that it is easier for users to operate. Improper operation interface height can easily cause risks to exist in terms of usage.

Please install the user interface outside the railing in order to ensure the safety. Please refer to Figure 8.13 below for an example on operation interface installation.

DR40/50/60/70L series



DR60H series

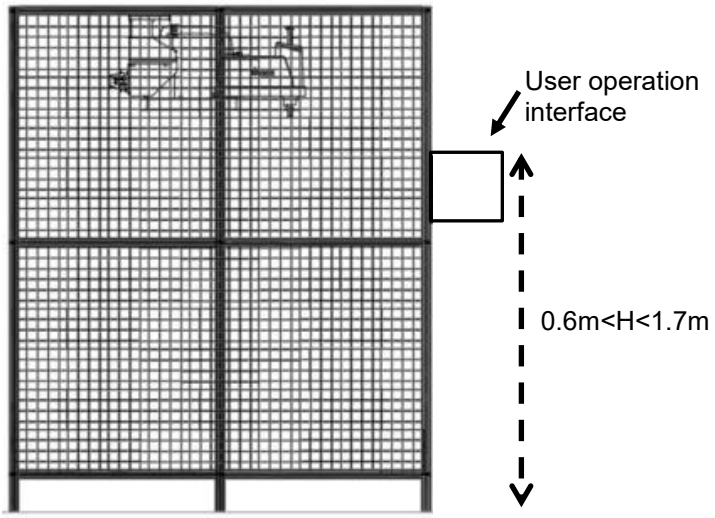


Figure8. 13 User interface installation height

Please use the robot cables from our company to connect the robot and controller, as shown in Figure 8.14 below.

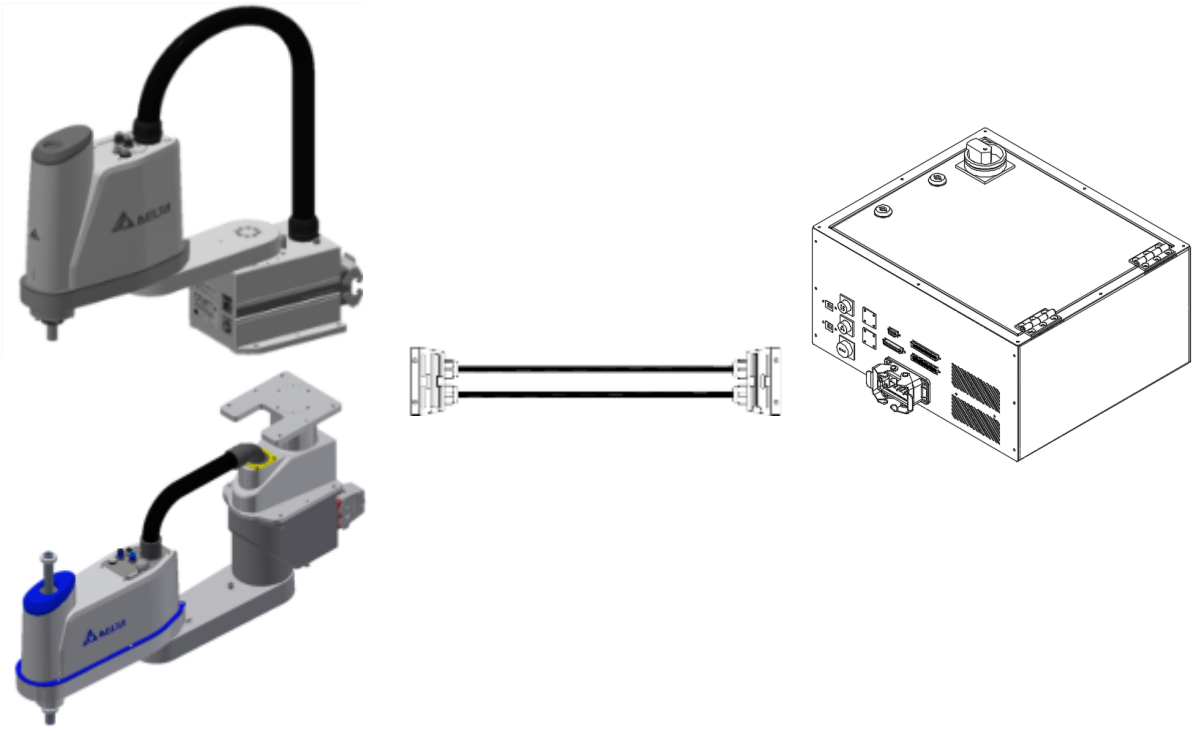


Figure8. 14 Robot cable connection figure

When installing the robot cable on the robot and controller, please lock the connector and fixture seat properly in place, otherwise it can easily cause poor signal contact and other dangers. As shown in Figure 8.15 below.

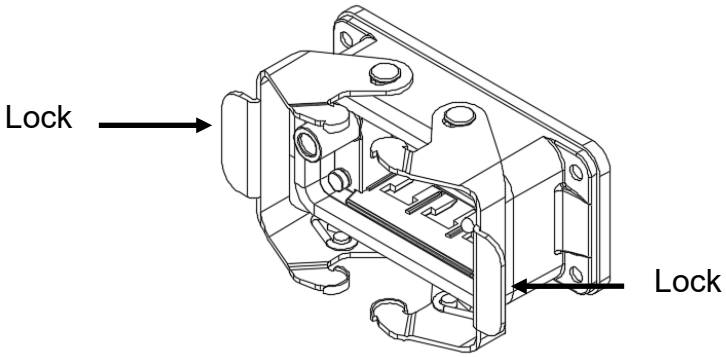


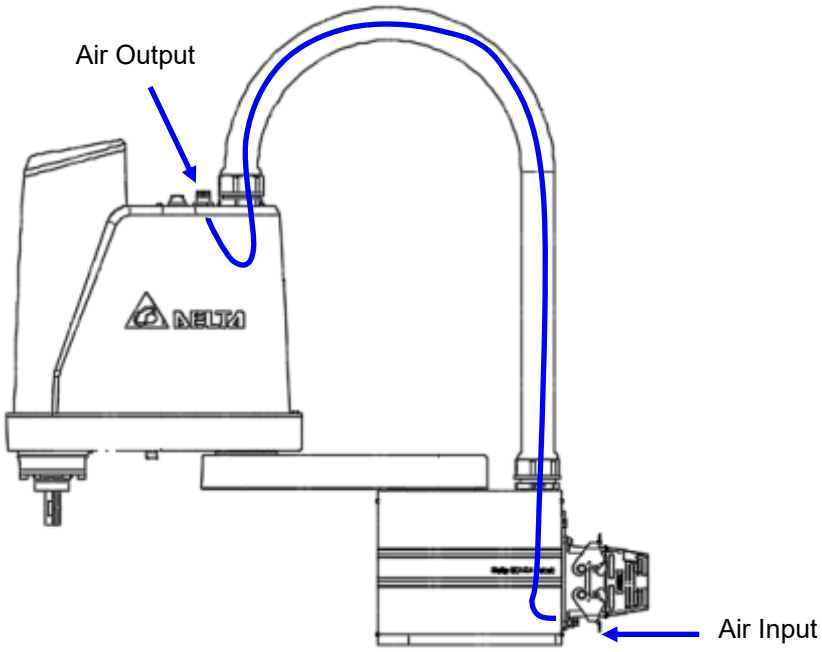
Figure8. 15 Locking the connector fixture seat

The robot provides 2 Φ6 air hoses and 1 Φ4 air hose for users to use.

Please use clean, oil-less, steam air source; otherwise, it can cause damages to the pneumatic piping or components inside the robot. Only pneumatic system connection pipelines are provided for the robot arm; system integrators should install the final actuator and pneumatic system according to EN ISO 4414.

The pneumatic piping enters from the base at the bottom of the robot and connects to the head, as shown in Figure 8.16 below.

DRS40/50/60/70L series



DRS60H series

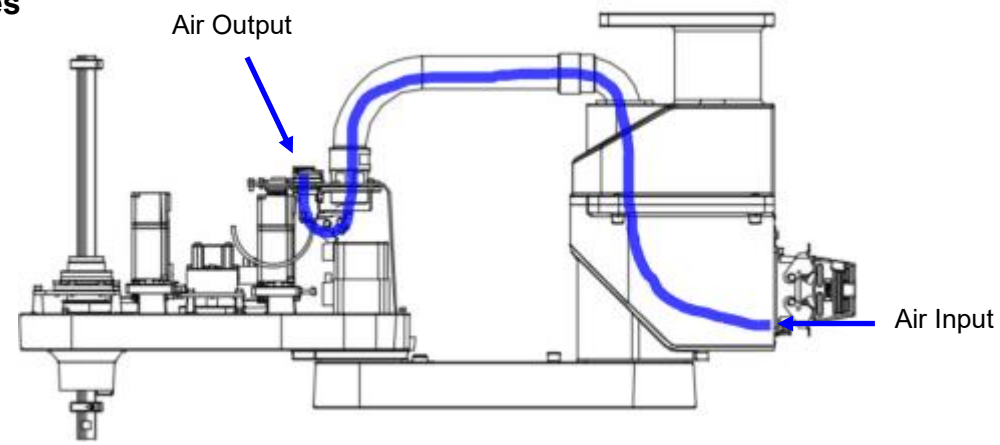
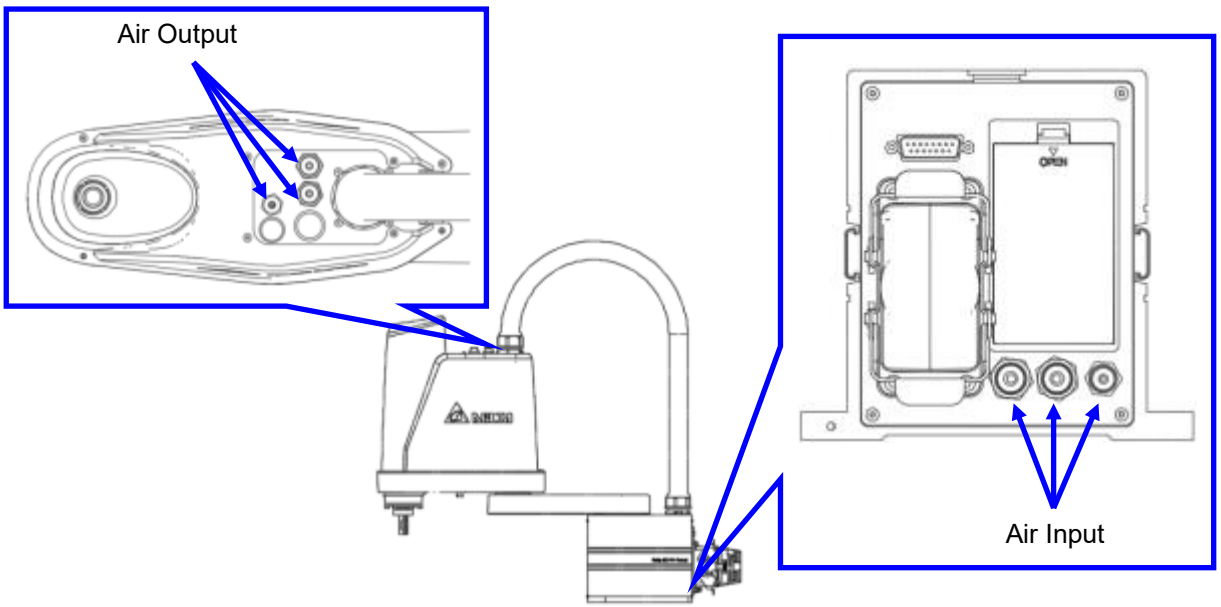


Figure8. 16 Air pipe path inside the robot

Detailed locations of the robot air pipe are as shown in Figure 8.17 below.

DRS40/50/60/70L series



DRS60H series

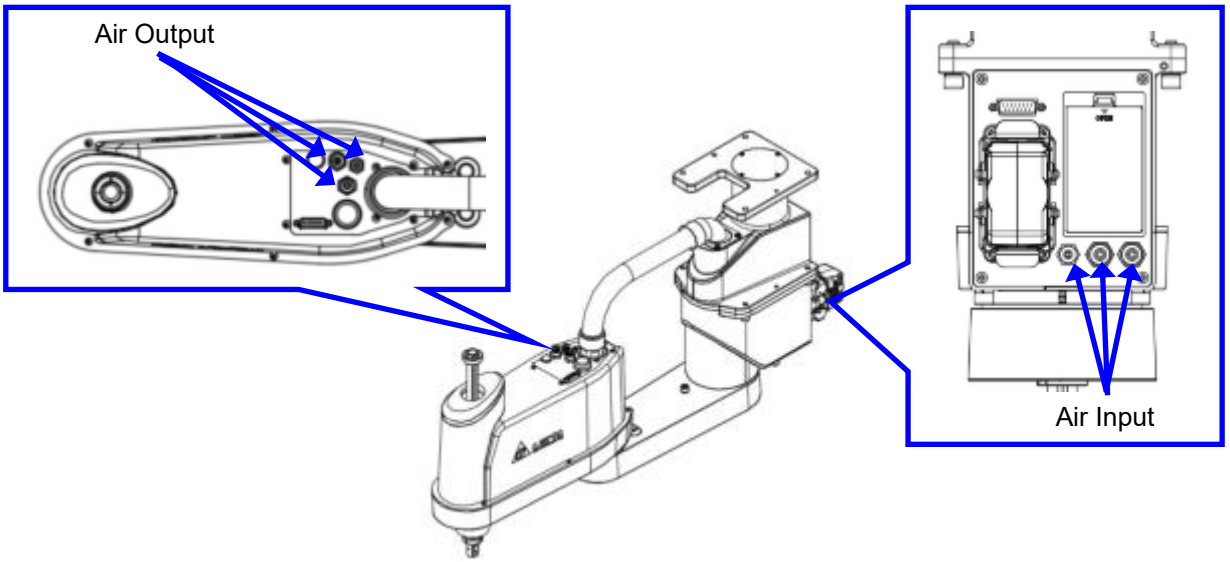


Figure8. 17 Detailed locations of the robot air pipes

2 D Sub-15Pin connectors are provided inside the robot, easy for customers to use when installing fixture sensors at the TCP terminal.

The signal circuit enters from the base at the bottom of the robot and connects to the back of the head, as shown in Figure 8.18 below.

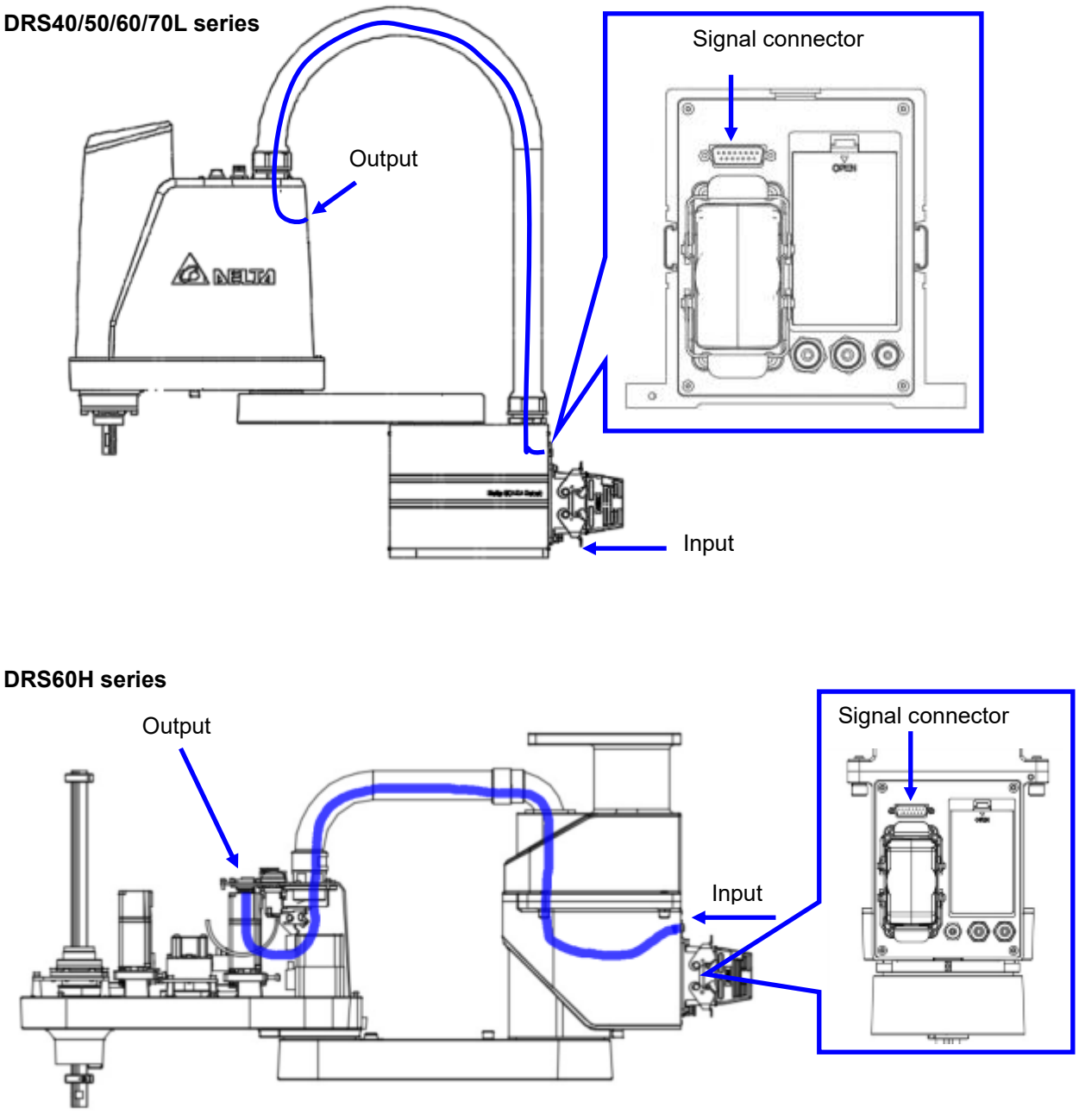


Figure8. 18 Signal path inside the robot

Figure 8.19 below is a wiring example using the D Sub-15Pin connector provided inside the robot when the customer is installing sensors at the TCP terminal.

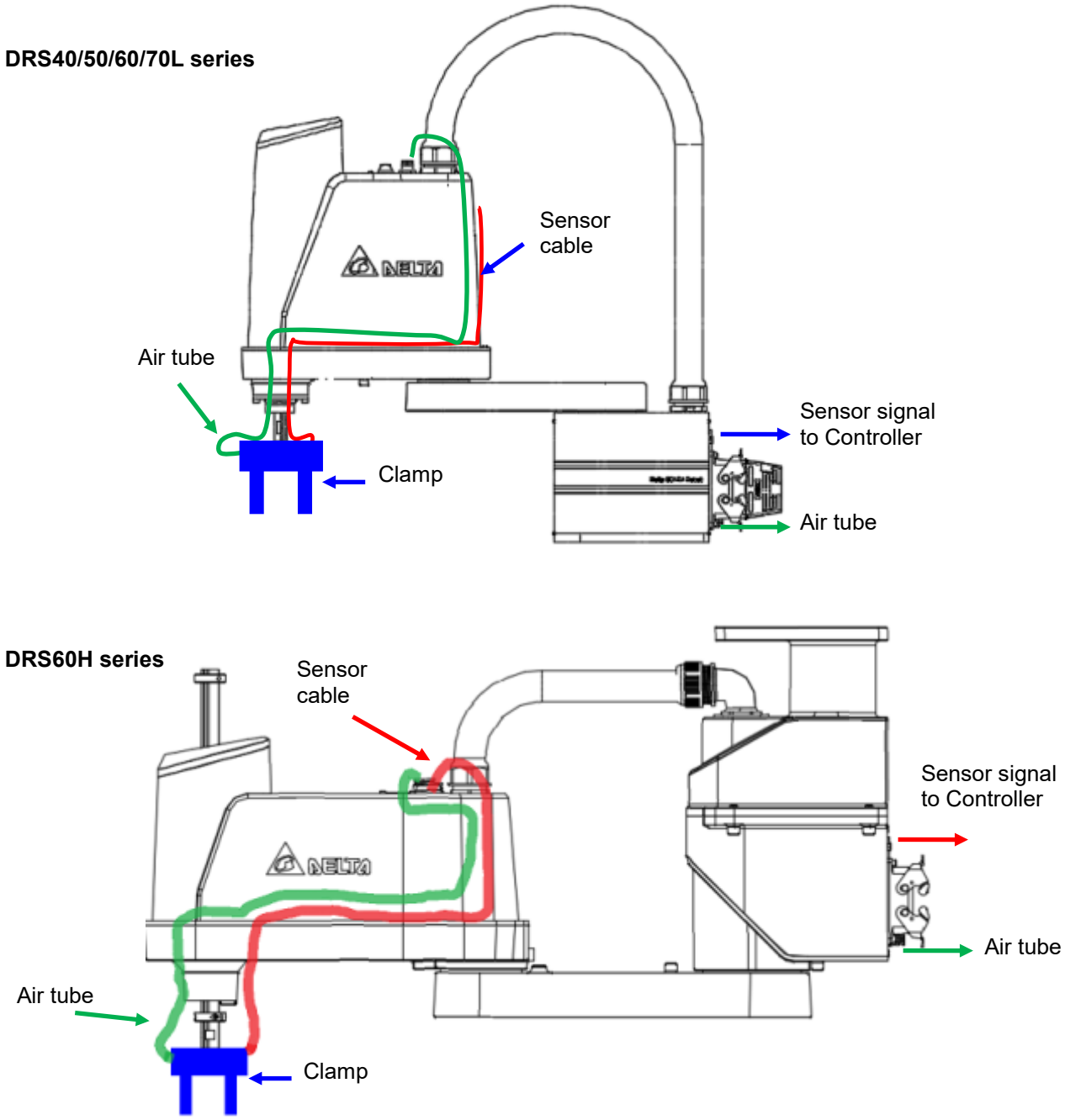


Figure8. 19 Wiring example connecting the sensor using the robot connector

8.4 Inspection before power transmission

Please check whether the wiring of the entire system is properbefore connecting the power; the following sections are items to check for the robot and controller systems.
The final system integrator not only should check the items in the following sections one by one, they should also perform detailed inspection of the entire system one last time.

8.4.1 Emergency stop signal check

1. Unplug the safety connector, take a multimeter and set the Ω gear to the lowest gear.
2. Reset all emergency stop buttons.
3. Measure Pin1 and 2 of the safety connector; the reading on the multimeter must be <0.5Ω, as shown in Figure 8.20 below.

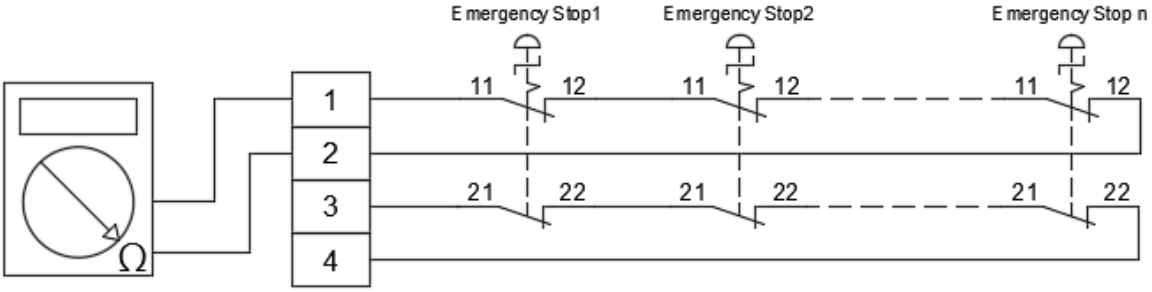


Figure8. 20 Reset emergency stop signal and measure Pin1 and 2

4. Measure Pin3 and 4 of the safety connector; the reading on the multimeter must be <0.5Ω, as shown in Figure 8.21 below.

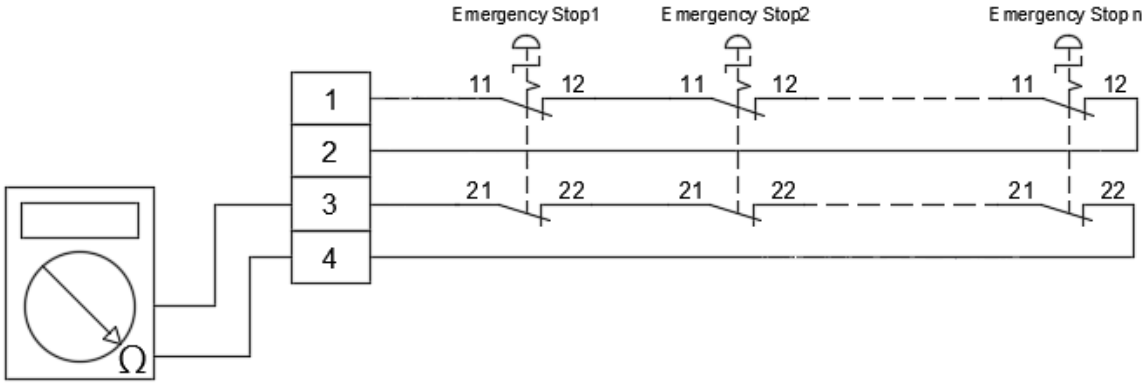


Figure8. 21 Reset emergency stop signal and measure Pin3 and 4

5. Press one of the emergency stop buttons.

6. Measure Pin1 and 2 of the safety connector; the reading on the multimeter must be ∞, as shown in Figure 8.22 below.

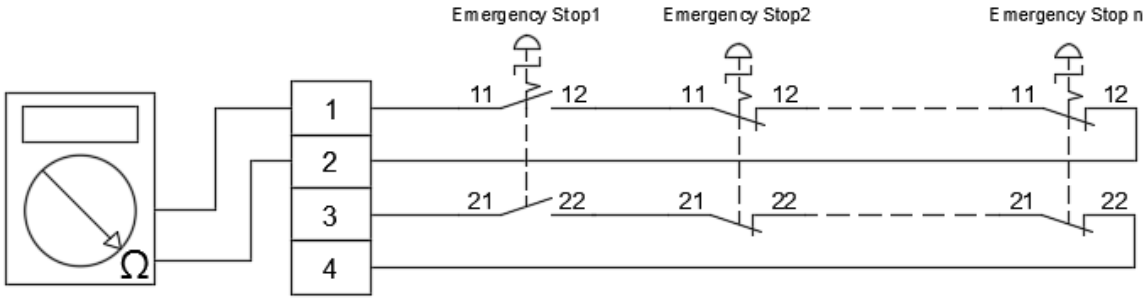


Figure8. 22 Press the emergency stop signal and measure Pin1 and 2

7. Measure Pin3 and 4 of the safety connector; the reading on the multimeter must be ∞, as shown in Figure 8.23 below.

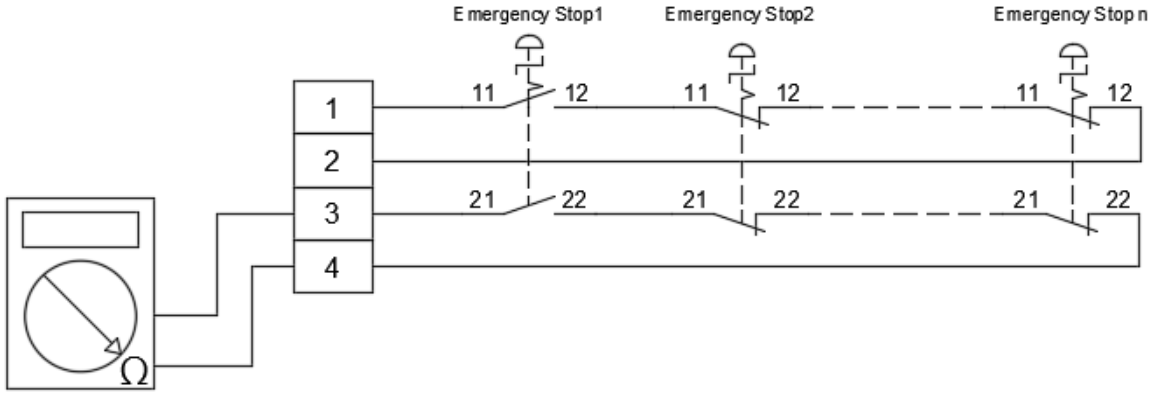


Figure8. 23 Press the emergency stop signal and measure Pin3 and 4

8. Reset the emergency stop button pressed.
9. Press a second emergency stop button, and repeat steps 5, 6 and 7 until all emergency stop button signals have been checked.

8.4.2 Railing safety signal check

1. Unplug the safety connector, take a multimeter and set the Ω gear to the lowest gear.
2. Turn off all railing safety signals.
3. Measure Pin5 and 6 of the safety connector; the reading on the multimeter must be <0.5Ω, as shown in Figure 8.24 below.

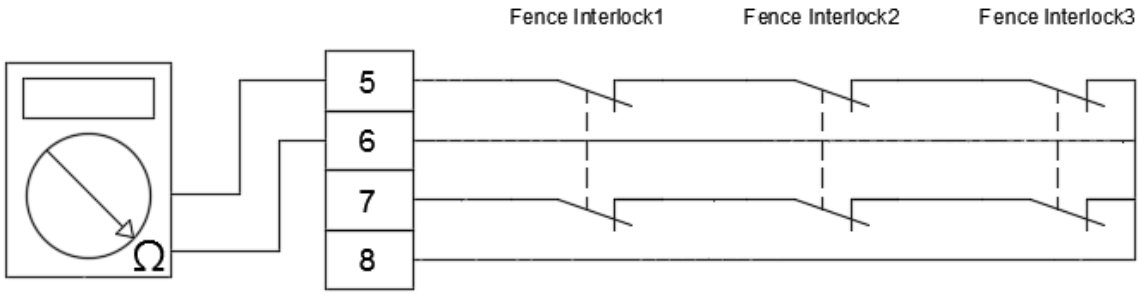


Figure8. 24 Turn off railing safety signal and measure Pin5 and 6

4. Measure Pin7 and 8 of the safety connector; the reading on the multimeter must be <0.5Ω, as shown in Figure 8.25 below.

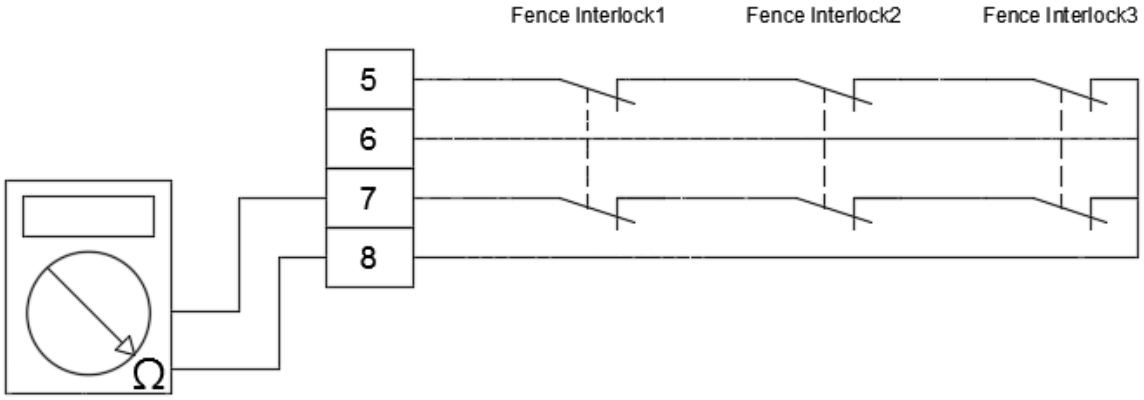


Figure8. 25 Turn off railing safety signal and measure Pin7 and 8

5. Turn on one of the railings.

6. Measure Pin5 and 6 of the safety connector; the reading on the multimeter must be ∞, as shown in Figure 8.26 below.

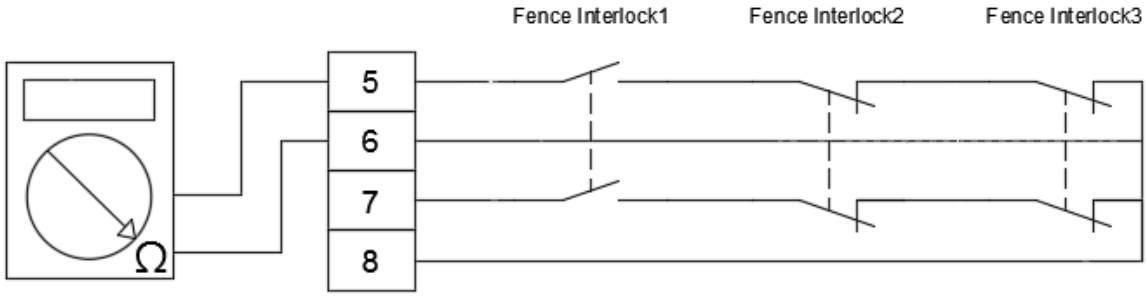


Figure8. 26 Turn on railing safety signal and measure Pin5 and 6

7. Measure Pin7 and 8 of the safety connector; the reading on the multimeter must be ∞, as shown in Figure 8.27 below.

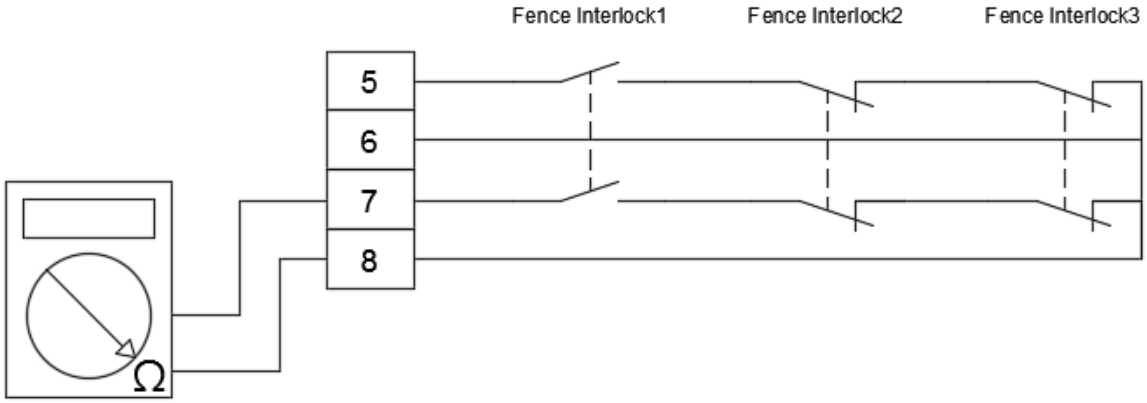


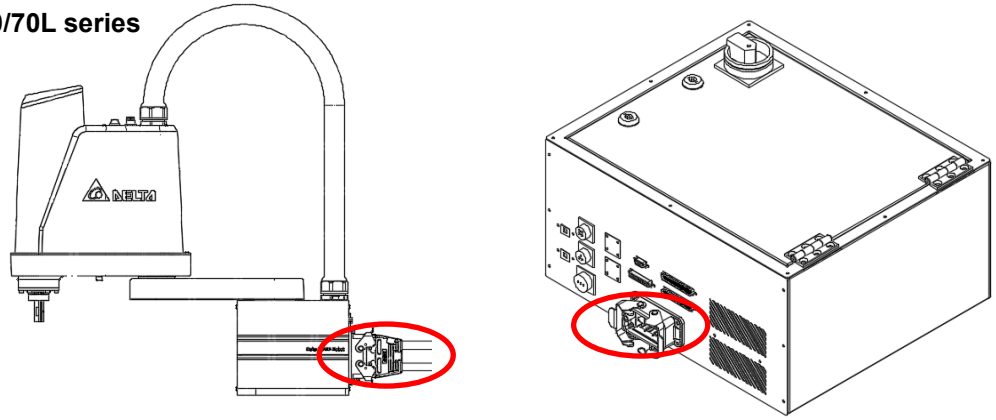
Figure8. 27 Turn on railing safety signal and measure Pin7 and 8

8. Reset the emergency stop button pressed.
9. Press a second emergency stop button, and repeat steps 5, 6 and 7 until all emergency stop button signals have been checked.

8.4.3 Robot cable check

Connect the robot cable on the robot and controller; the connector must be locked tightly and the connector should not be loose. The location to check is as shown in Figure 8.28 below.

DRS40/50/60/70L series



DRS60H series

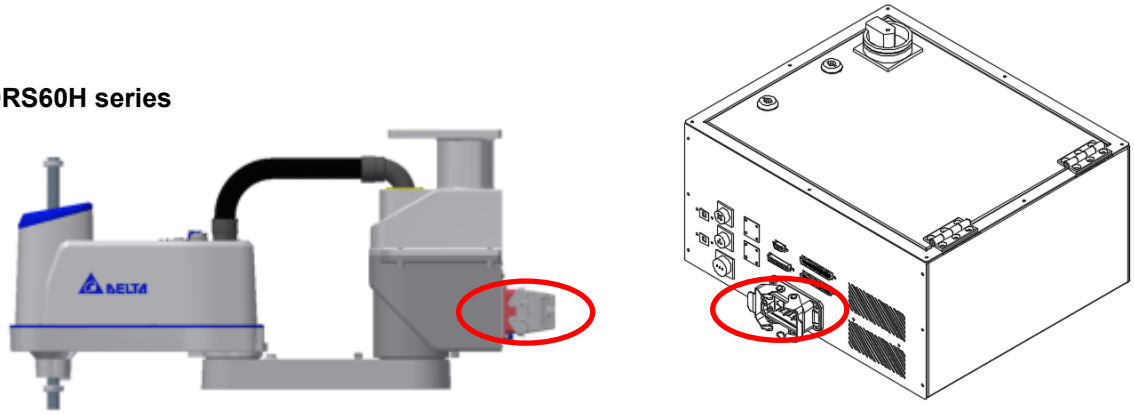


Figure8. 28 Location of robot cable to check

8.4.4 Controller DI/O signal check

Check whether the controller DI/O signal connections are correct.

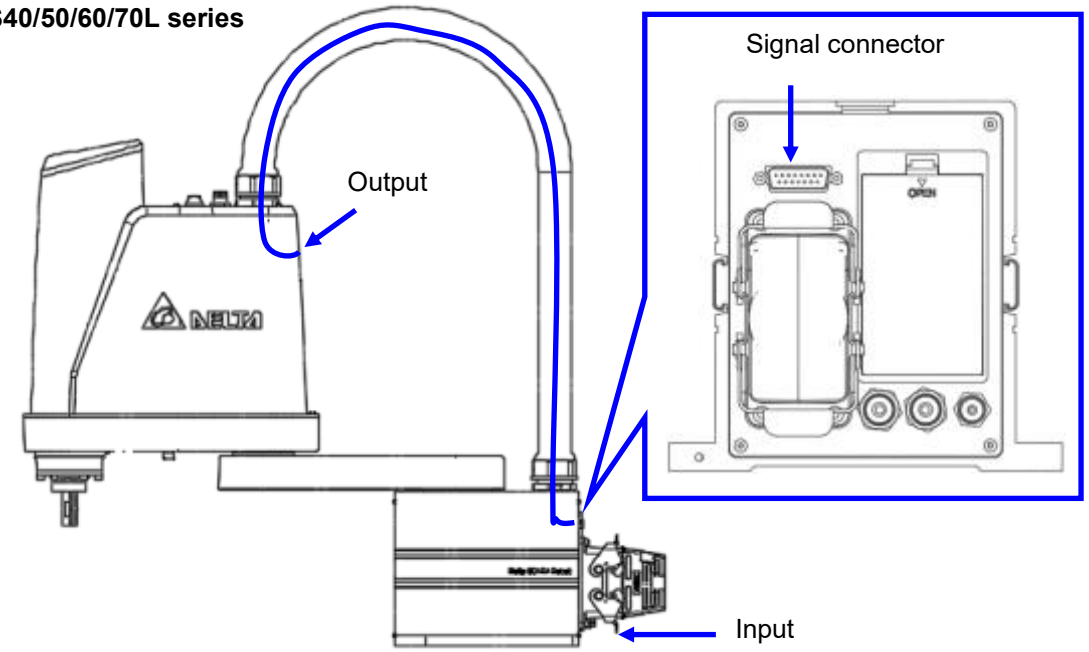
The controller DI/O signal is DC 24V signals using NPN or PNP connections; it cannot be connected to the AC power.

Check whether all connectors on the controller and robot are tightly locked.

8.4.5 Air hose installation check

Check whether the air hose of the robot is loose; the air hose should not come off from the air hose connector, as shown in Figure 8.29.

DRS40/50/60/70L series



DRS60H series

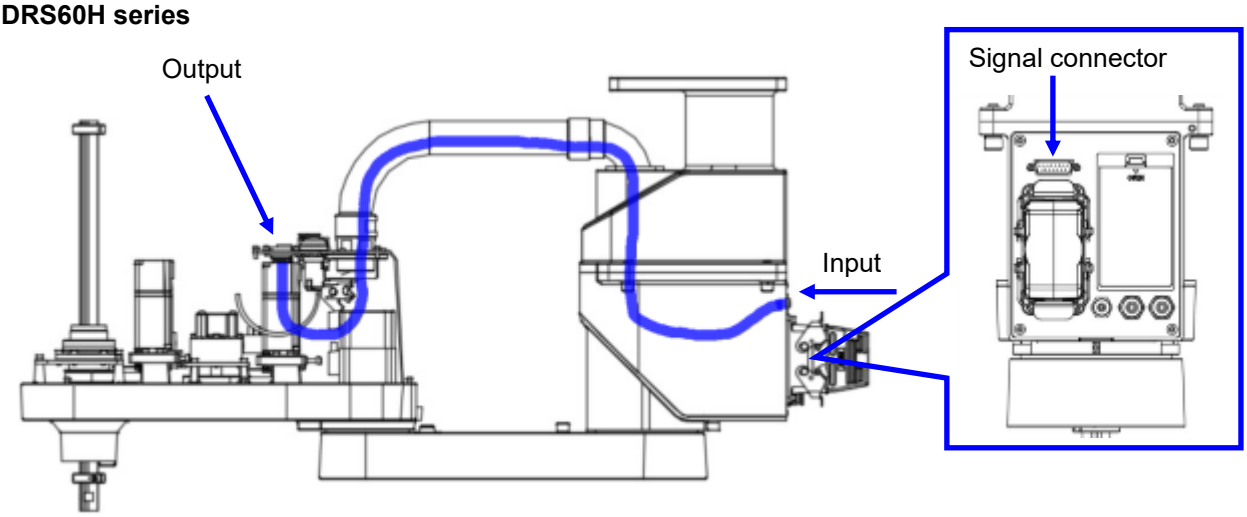


Figure8. 29 Location of robot air hose to check

8.4.6 Input power check

1. Check the primary L and N wiring of the power switch inside the controller; the L and N power cables cannot be loose. The location to check is as shown in Figure 8.30 below.

Figure8. 30 Controller power switch primary power check

2. Check the ground cable of the power grounding system; please use a grounding cable of 10mm² or above; the location of the grounding cable is as shown in Figure 8.31. Serrated washes must be used when connecting the grounding cable in order to effectively prevent the grounding cable from coming loose.

Figure8. 31 Controller grounding cable check

3. Please check whether the input power range is 200-230Vac; if the input power voltage is not within this range, do not turn on the power of the controller.

8.4.7 Safety protection device check

After power is connected to the controller, please check all safety protection devices properly before operating the robot in order to ensure that the system integration and wiring are correct.
We recommend users use the following steps to check the safety protection devices:

1. Please first turn off the controller power.
2. Connect the TP to the controller.
3. Reset the emergency stop button on the TP and all other external emergency stop buttons.
4. Turn off all railings.
5. Turn on the controller power.
6. Press the emergency stop button on TP; Alarm 003 “Controller input power abnormal” must appear on TP.
7. Reset the emergency stop button on TP.
8. Reset the abnormal signal.
9. Press the external emergency stop button; Alarm 003 “Controller input power abnormal” must appear on TP.
10. Reset the external emergency stop button.
11. Reset the abnormal signal.
12. Repeat steps 7-9 to check all external emergency stop signals one by one.
13. Turn on the railing; Alarm 003 “Controller input power abnormal” must appear on TP.
14. Turn off the railing.
15. Reset the abnormal signal.
16. Repeat steps 13-15 to check all external railing signals one by one.

8.5 Initial operation

8.5.1 Initial operation risk notification

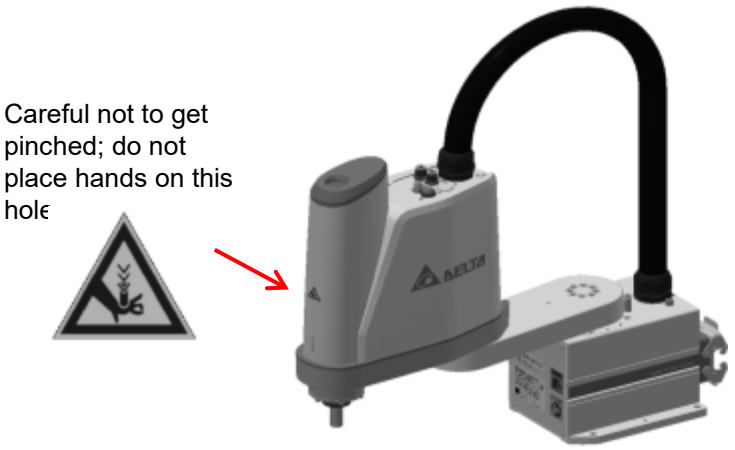
Since users are unfamiliar with the operations when executing operations for the first time, it is possible that workers might get hit by the robot.

If any abnormal noises, vibrations or leakages were detected, please turn off the controller power immediately and recheck the robot and surrounding integrated systems.

Please read Chapter 6.3 Robot operation direction carefully before performing operations.

When executing operations manually, please be careful not to place hands on the hole on the head of the robot because the worker's hand might get caught when the operation to lower the Z-axis is performed and may result in injuries, as shown in Figure 8.32 below.

DRS40/50/60/70L series



DRS60H series

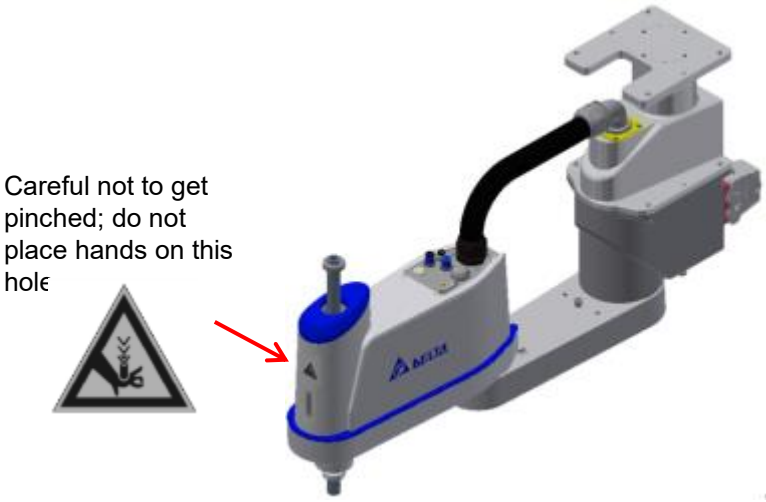


Figure8. 32 Location of robot to be careful not to get pinched

When the brake release push button on the robot head is pressed, the Z-axis will slide down if heavy

objects were hung on the Z-axis. Please be careful not to place hands under the Z-axis in order to prevent hands from getting squeezed, as shown in Figure 8.33 below.

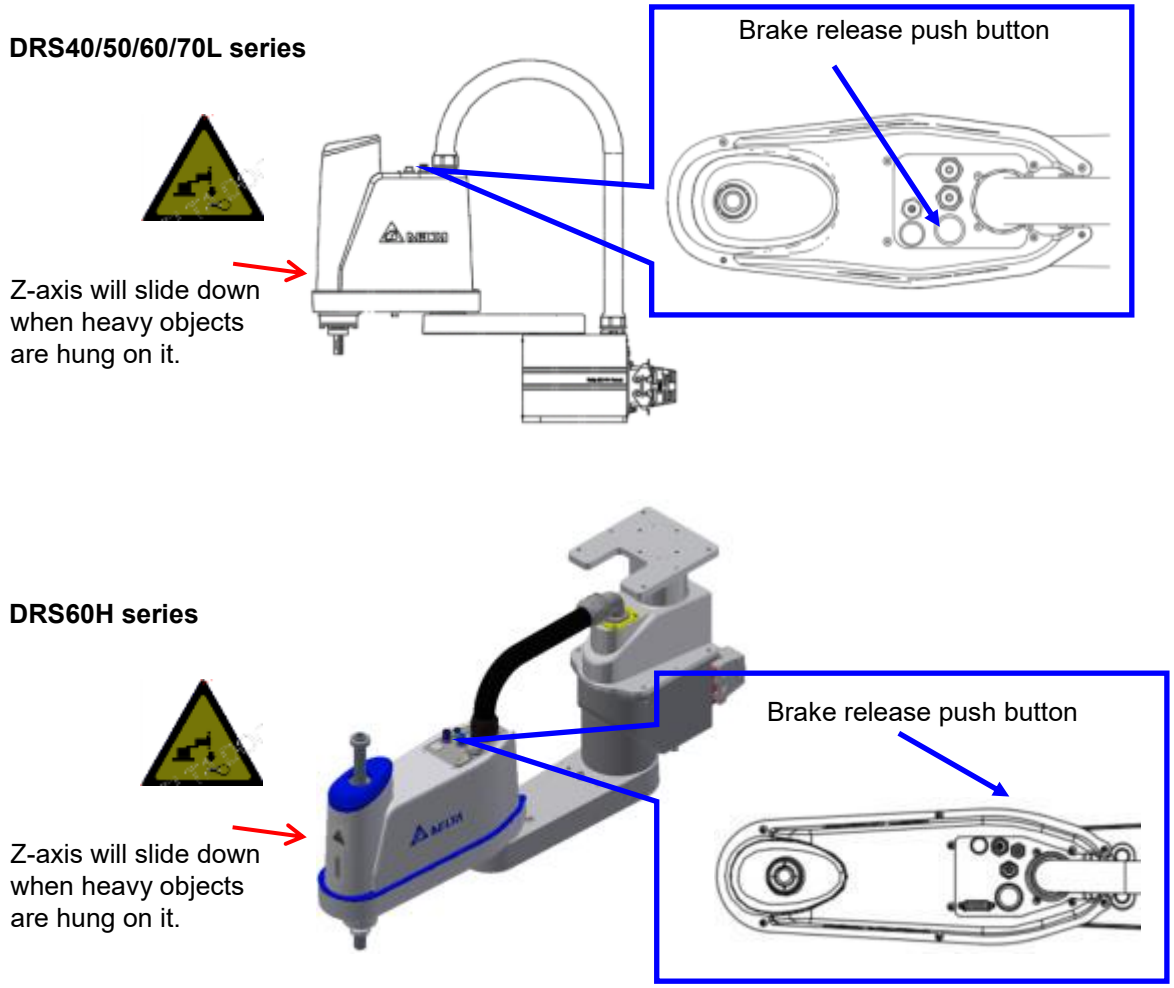


Figure8. 33 Location to be careful of when the Z-axis slides down

Please teach the points from outside of the railing when operating for the first time. If it has to be taught inside the railing, please stand at the safe area inside the railing in order to avoid getting hit by the robot during operation, as shown in Figure 8.34 below. The part with the slashes is the safe location inside the railing; please perform operations from here.

Please be careful not to extend arms and legs into the operation range of the robot during operation.

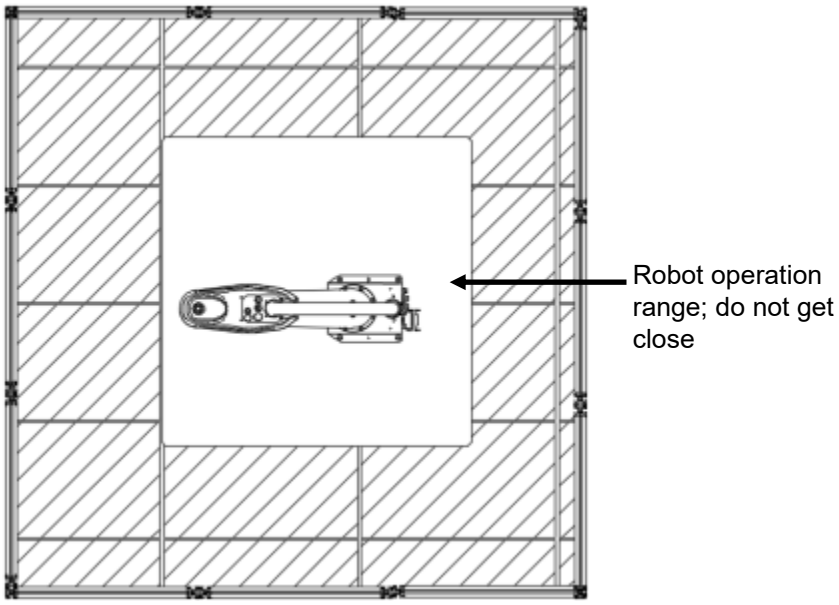


Figure8. 34 Working area and safe area of the robot inside the railing

8.5.2 When operating TP for the first time

1. When teach pendant is used to operate the robot, please connect the teach pendant connector onto the controller. Please disconnect the power before connecting; the location for connection is as shown in Figure 8.35.

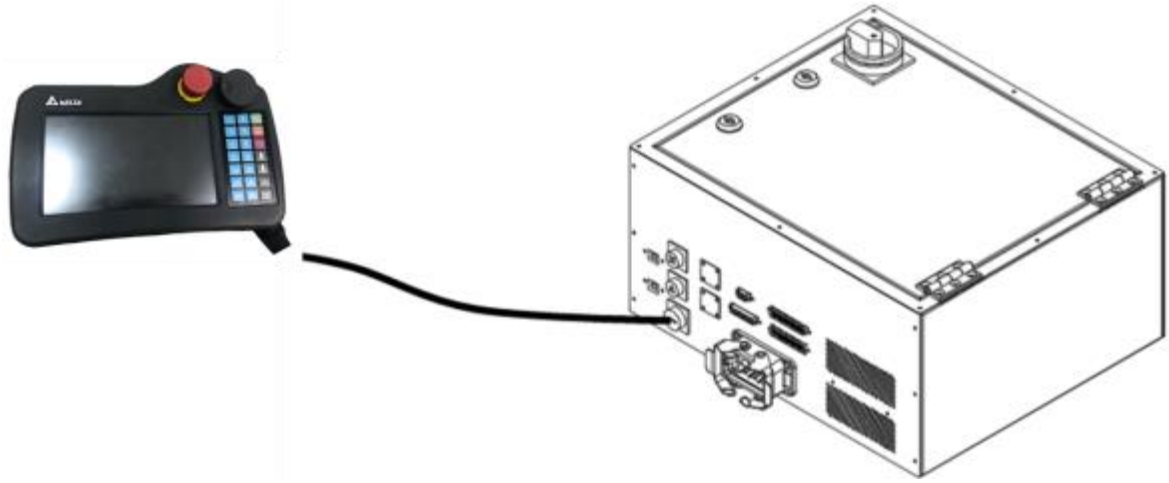


Figure8. 35 Teach pendant connection location

2. During an emergency situation, pressing the emergency stop button on the teach pendant can cut the power outputted to the robot from the controller; Figure 8.36 below is the emergency stop button on the teach pendant.

Figure8. 36 Location of the emergency stop button on the teach pendant

3. The enable switch at the back of the teach pendant is a 3-position button; the robot can only be operated when pressed at the middle position.
   When the enable switch is released or pressed all the way down, it will cut the power outputted to the robot from the controller. Figure 8.37 below is the location of the enable switch behind the teach pendant.

Figure8. 37 Location of the enable switch behind the teach pendant

4. Please switch the operation mode to manual (T1 mode) mode. At this time the status display on the teach pendant screen will change to 

**; press the enable switch behind the TP at the middle position and then press the 

button on the teach pendant screen to Servo ON the robot. Figure 8.38 below is the position on the teach pendant screen.

Figure8. 38 Servo button position on teach pendant screen

5. To Servo off the robot, just press 

the button again to Servo off the robot. At this time the icon will change to 

** .

6. When Servo on the robot, pressing the physical + and - buttons to the right of the teach pendant can operate the robot. The location of the physical buttons to the right of the teach pendant is as shown in Figure 8.39 below.

Figure8. 39 Location of teach pendant physical buttons.

7. When T1 mode is used to operate the robot, the controller will automatically limit the moving speed of the robot to 250mm/sec; users cannot change this speed.

8. Please refer to the software manual for details on teach pendant operations.

9. When TP is no longer used, please install the TP short-circuiting connector included in the accessory pack onto the controller, as shown in Figure 8.40.

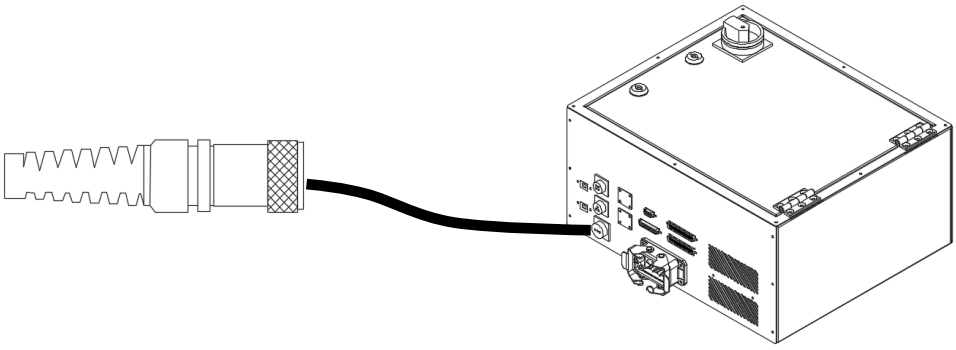


Figure8. 40 TP short-circuit connector figure

8.6 Abnormal condition disposal

When faced with abnormal conditions, we recommend users to dispose of them using the following methods:

1. Press the emergency stop button outside the railing.
2. Switch the mode selection to manual (T1 mode) status. This action ensures that workers will not accidentally press start operation again and restart the robot before the abnormal condition was eliminated.
3. Make sure the robot motion has come to a complete stop before opening the railing. Place the safety switch lock on after opening the railing in order to prevent the railing from accidentally being closed, causing the repair personnel to get trapped.
   Please remember to always carry the key when key switch is used; do not leave the key on the safety switch of the railing.
4. Press the emergency stop button inside the railing again to ensure the safety of the repair personnel inside the railing.
5. Check the robot and eliminate the problem. (Please refer to the abnormality message and troubleshooting chapters for related abnormality troubleshooting methods)
6. Reset the emergency stop button inside the railing.
7. Remove the lock on the railing safety switch.
8. Reset the emergency stop button outside the railing.
9. After resetting the abnormal signal, switch the model selection switch back to Auto mode, and execute program operation again.
10. If the abnormal condition cannot be eliminated or if you don’t know how to troubleshoot the abnormal condition, please contact your local dealer.

8.7 How to save injured workers

If workers were accidentally hit and injured, or got caught by the robot, please save them using the following steps.

1. Press the emergency stop button to cut off the power sent to the robot from the controller, as shown in Figure 8.41.
   You can also turn off the controller or the master power switch installed by the final system integrator.

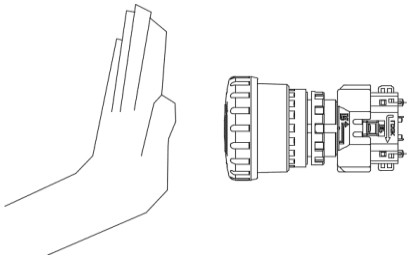
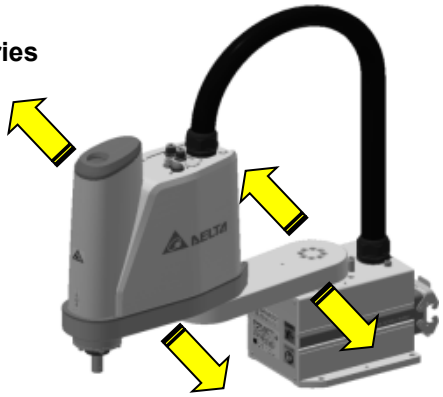


Figure8. 41 Press the emergency stop button

2. Since the J1 and J2 axes of the DRS series robots do not have brakes, the robot can be pushed to the left or right as shown in Figure 8.42.

DRS40/50/60/70L series



DRS60H series

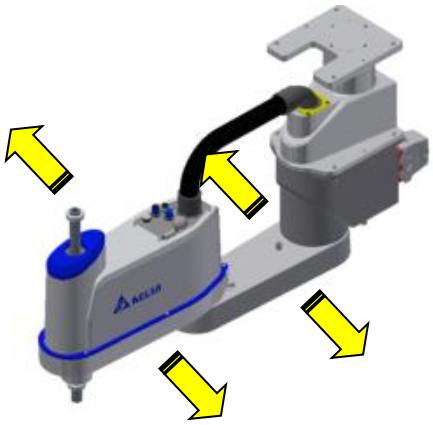


Figure8. 42 Push robot figure

3. If the worker was caught by the Z-axis, please use an auxiliary tool or elevation device to lift the Z-axis so that the worker can break away from the robot, as shown in Figure 8.43.

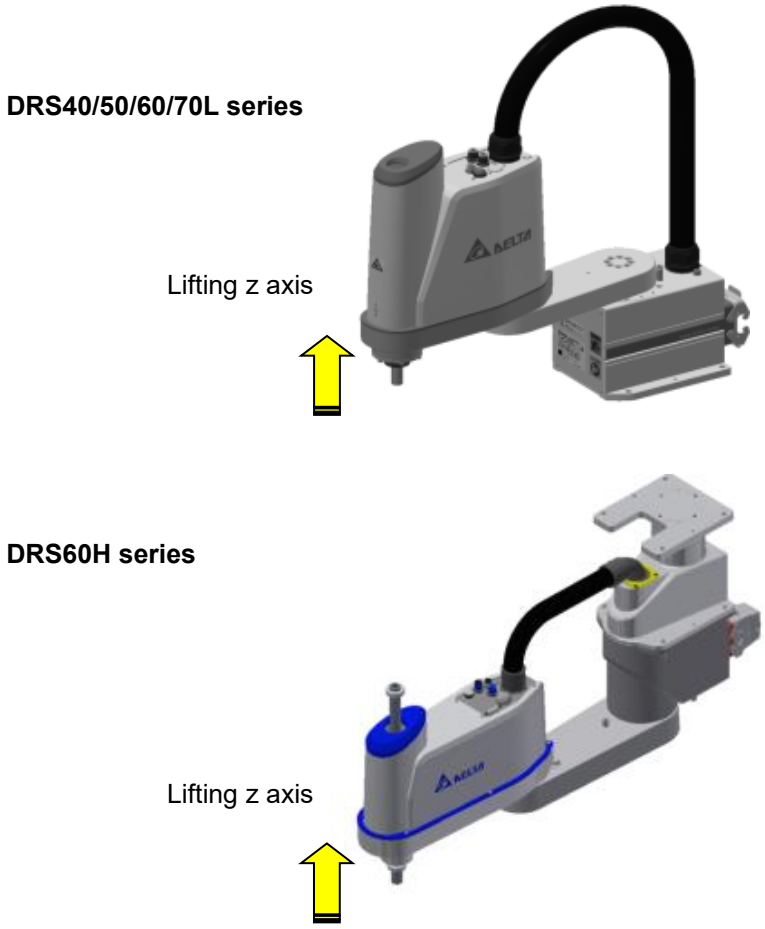


Figure8. 43 Save worker by lifting Z-axis

4. Carry, pull or drag the injured worker away from the equipment and send them to the hospital as soon as possible.

5. Carrying the injured worker is not suitable for all injuries; choose the most appropriate way to help the injured worker break away.

8.8 How to turn off the power

When the robot is not in use, please turn off the power of the controller properly and confirm that the robot has come to a complete stop before leaving.

The following steps are the correct way to turn off the power:

1. Press the emergency stop button
   Please press the emergency stop button around the railing; this action can ensure that the controller will not send power to the robot the next time the power is turned on, and it also ensures that the robot is in the power off status and the safety of the worker.

2. Turn off the controller power
   Please turn the controller power switch to the left to turn off the power of the controller properly, as shown in Figure 8.44.

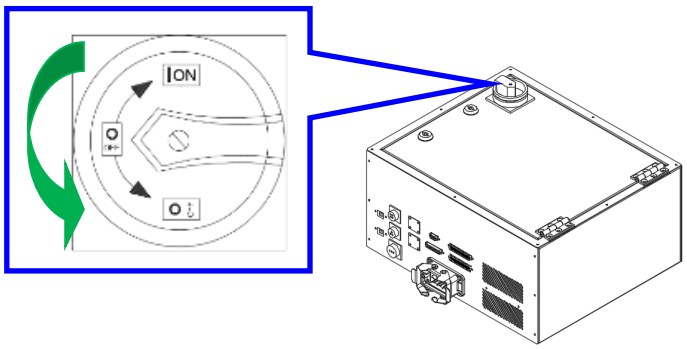


Figure8. 44 Turn off the controller power

3. Confirm that the robot has come to a complete stop before leaving.

4. User can also place a lock on the power switch of the controller in order to prevent operators to randomly turning on the power, as shown in Figure 8.45.

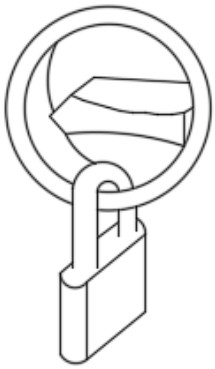


Figure8. 45 Place a lock on the power switch

9. Maintenance

In order to prolong the usage life of the robot and to ensure accuracy for usage and reduce malfunctions, maintenance and inspections must be performed properly according to the maintenance table.

	■ Please perform maintenance and inspection properly according to the manual in order to prolong the usage life of the robot. ■ Please add a safety lock on the power switch of the power box when performing maintenance or repair operations to the robot, and place a “Do not power on” safety warning. ■ When internal components of the controller is damaged, replacing with other brand components is prohibited; doing so may cause safety dangers or result in decrease of safety performance levels. ■ Make sure foreign objects do not attach or enter the robot when performing maintenance or inspection. ■ Making random oil changes during maintenance may result in damaging the performance of the robot or to the mechanical components. ■ Protection devices and repair doors in the danger areas that need to be opened or removed regularly for the purpose of operations, maintenance, cleaning and configuration should be interlocking. ■ Personnel performing maintenance or repairs to the robot or robot system should receive the necessary process training in order to execute the tasks required. And also use genuine parts, or else it might cause grave danger to users. ■ The processing of wasted material should comply with local laws and regulations, and should be treated carefully.
	■ Random changes to the maintenance schedule of the robot and maintenance oil are strictly prohibited. ■ Maintenance and inspection to the controller and robot is prohibited while power is being supplied, or else it may cause electrical shocks or injuries to the workers. ■ When a controller component is damaged, replacing with other brand components is prohibited; doing so many result in damaging the performance of the controller or the components. ■ The power control box must not be opened within 10 minutes of powering off because the residual voltage in the driver may cause electrical shocks.

9.1 DRS CE series inspection table

Table 9.1 below is the inspection table of the DRS CE series robots.

Please turn off the power switch properly during inspection and press the emergency stop button to ensure worker safety, otherwise dangers might occur.

When power is needed to check the motion range and reproducibility of the robot, please be careful not to stand in the motion range of the robot in order to avoid dangers from happening.

Table9. 1 DRS CE series inspection table

DRS 40L3/DRS60L6 inspection table							
Check item	Check location	Power	Daily	Monthly	Seasonally	Every six months	Yearly
Screw	End tool fixture screw	OFF	◆	◆	◆	◆	◆
	Robot base fixture screw		◆	◆	◆	◆	◆
	Each axis reducer fixture screw						◆
	Motor fixture screw						◆
Ensure the connector is completely in place	Terminal mounting cable connector		◆	◆	◆	◆	◆
	Robot cable connector			◆	◆	◆	◆
Check appearance defects	Robot appearance		◆	◆	◆	◆	◆
	External cable		◆	◆	◆	◆	◆
Make sure there is sufficient lubricant	Spline shaft		◆	◆	◆	◆	◆
	Screw shaft					◆	◆
Confirm each timing belt tension and abrasion	Second arm internals					◆	◆
Confirm that the cables and air hoses are not improperly bent	Each cable and air hose					◆	◆
Battery	Robot base						◆
Slightly move cable back and forth to see if detached	External cable (including the cable device on the robot)				◆		
Check the motion range of every axis	Every axis	ON					◆
Confirm there are no abnormal vibrations or noises	Entire robot		◆	◆	◆	◆	◆
Check reproducibility	Entire robot					◆	

Table 9.2 below is the oil table for each DRS axis part that requires oil change during maintenance. Please use the oils described in the table or similar quality oils to perform maintenance in order to ensure normal use of each component.

Table9. 2 Oil table of the maintenance oil for each axis parts

Part	Lubrication component	Lubrication interval	Lubricant
J1	J1 reducer	Change motor	MP No.2 (Sumico Lubricant)
J2	J2 reducer	Change motor	MP No.2 (Sumico Lubricant)
J3	Screw	Run 50km	AFB
J4	Spline	Run 50km	AFB

9.2 Robot battery maintenance and replacement

Please change the battery once every year, otherwise it will cause the robot to lose positions.

1. When the battery voltage is less than 3.1V, the controller will display the abnormality warning Ed061; please change a new battery within 15 days.
2. Please confirm that the voltage of the replaced battery is higher than 3.1V.
3. When the battery voltage is less than 2.7V, it will result in absolute position data loss.
4. Please perform battery replacement while the controller is powered on in order to prevent absolute position data loss.
5. When the battery is removed, do not turn off the power in order to prevent absolute position data loss.
6. When the absolute position data is lost, the origin reset process must be performed again.
7. Please use batteries with specifications that comply with Delta specifications; otherwise, it might cause damages to the machine. Please refer to the battery specifications shown in Table 9.3.

Table9. 3 Battery specification table

Name	Li/SOCI2 Cylindrical Battery
Type	ER14505
Delta model number	ASD-CLBT0100
International standard size	AA
Standard voltage	3.6V
Standard capacity	2700mAh
Maximum continuous discharge current	100mA
Maximum pulse current	200mA
Dimensions (D x H)	14.5mm x 50.5mm
Operating temperature	-40~+85°C

Figure 9.1 shows the location of the DRS CE series battery

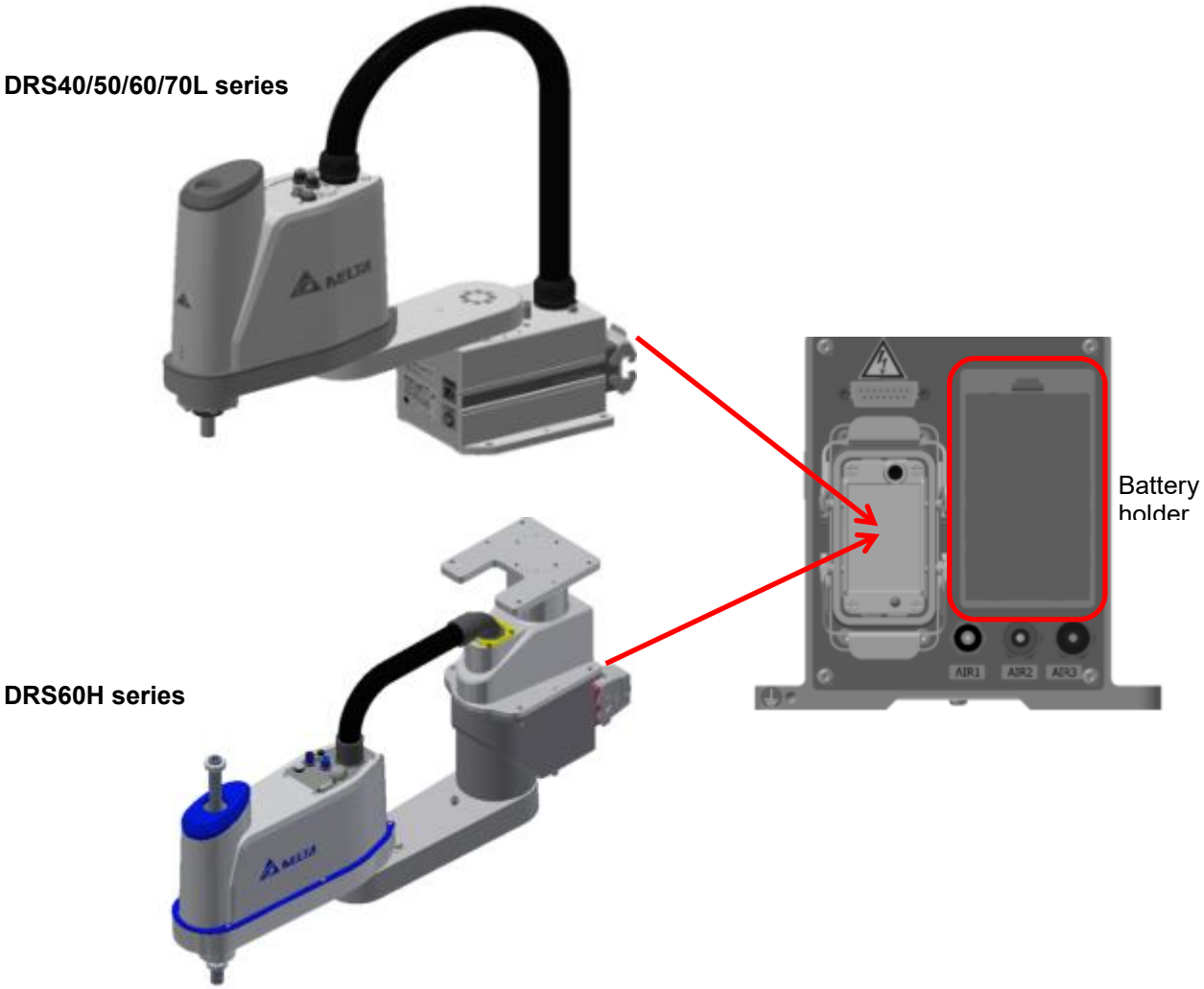


Figure9. 1 DRS CE series battery location

10. Bill of materials

This chapter lists some important components; please purchase components with same specifications if the component is damaged and needs to be replaced.

	■ Randomly replacing components with different specification is prohibited; our company is not responsible if problems occurred. ■ Randomly replacing components with different specification is prohibited; doing so may result in reduced performance of the controller.

10.1 DCS controller bill of materials

Figure 10.1 below are the locations of the components inside the DCS-1B00-CA controller.

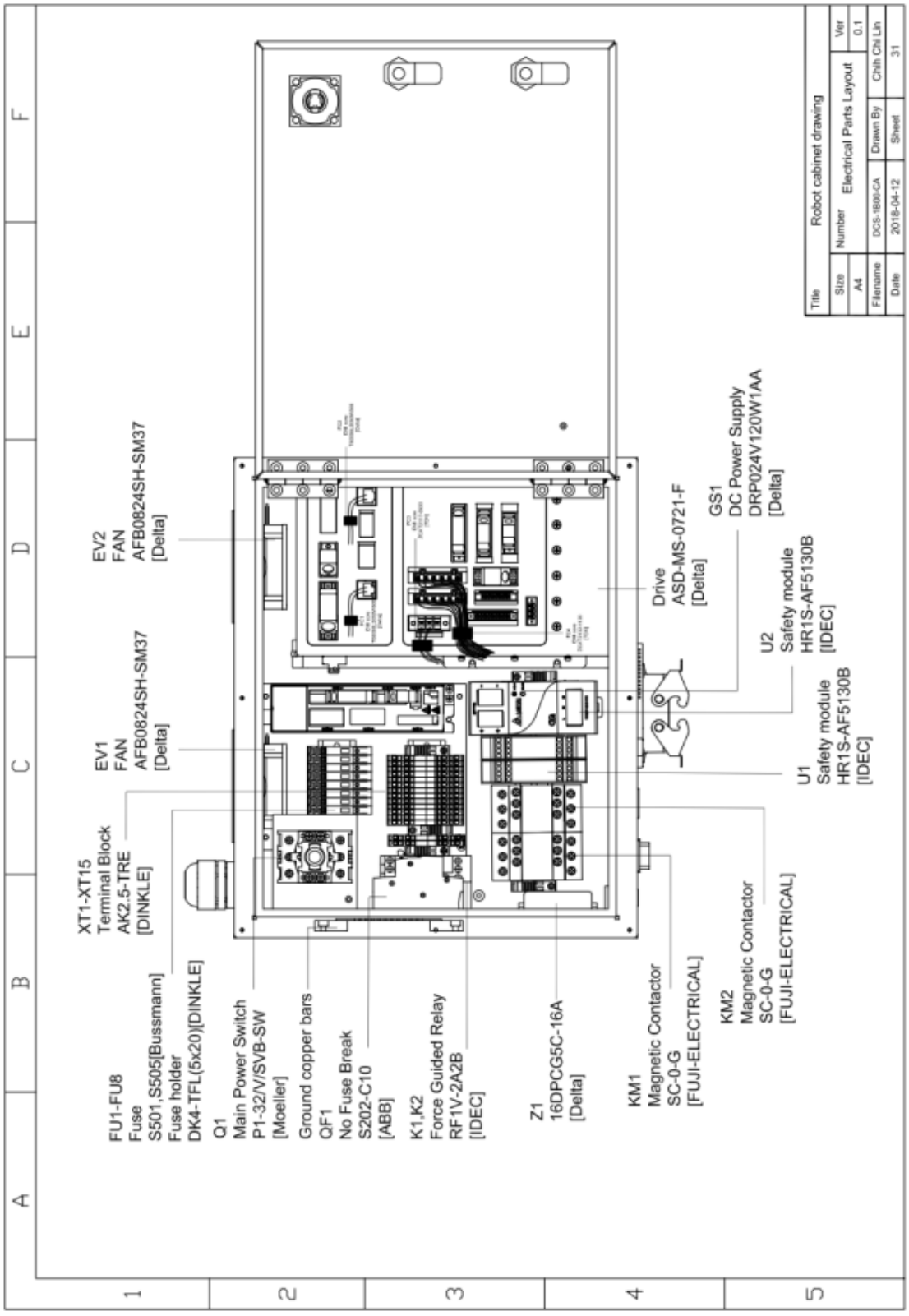


Figure10. 1 Controller internal parts layout

Table 10.1 below is the bill of materials for the DCS controller; please replace materials according to the specification table below when damaged.

Please replace components with the same model number, otherwise it might cause more damages or danger, or reduce the performance of the controller and robot.

Our company will not be responsible for any damages to the controller or problems resulted from replacing with different components.

Table10. 1 DCS controller bill of materials

Item	Description	Manufacture	Model number	Specification information
Q1	Main power switch	EATON	P1-32/V/SVB-SW	Ue=AC690V Iu=32A AC-3=7.5kV
Z1	Line Filter	DELTA	16DPCG5C	Ith=16A, AC115V/250V
MS	Drive	DELTA	ASD-MS-0721-F	750W*4, 1PH/3PH, AC200-230V
QF1	No fuse break	ABB	S202-C10 2P10A	Ui=AC400V Ith=10A Uimp 6kV
FU1	Fuse for MS drive	COOPER Bussmann	S501-5-R	5A×1P, 250V~
FU2	Fuse for DC power supply	COOPER Bussmann	S505-2-R	2A×1P, 250V~
FU3-FU4	Fuse for MS drive control	COOPER Bussmann	S501-3.15-R	3.15A×1P, 250V~
FU5-FU8	Fuse for FAN&Safety control	COOPER Bussmann	S505-2-R	2A×1P, 250V~
FU-Holder	Fuse holder	DINKLE	DK4-TFL(5x20)	300V/16A
KM1, KM2	Magnetic contactor	FUJI	SC-0_G	24Vdc Ith=60A
GS1	Switch Power Supply	DELTA	DRP024V120W1AA	Input AC220V Output DC24V 120W
K1,K2	Force Guided Relay	IDEC	RF1V-2A2B	250V/6A
K1,K2 Socket	Relay Socket	IDEC	SF1V-4-07L	250V/6A
U1, U2	Safety module	IDEC	HR1S-AF5130B	DC24V
M1	Servo motor	DELTA	ECMR-CV0604RS	400W
M2	Servo motor	DELTA	ECMR-CV0602RX	200W

M3, M4	Servo motor	DELTA	ECMR-CV0401PX	100W
XT1-XT9	Terminal block	DINKLE	AK2.5-TR	800V/24A
BT1-BT2	Battery	EVE	ER14505	DC 3.6V
Modul1, 2	Connector	TYCO	HMN-012-F HMN-012-M	250VAC/10A
Modul3	Connector	TYCO	HMN-025-F HMN-025-M	250VAC/10A
TP	Enable switch	IDEC	HE2B-M211PB	AC-12: 250VAC, 0.5A DC12: 30VDC, 1A AC-15: 250VDC, 0.5A DC-13: 125VDC, 0.22A
TP	EMS	IDEC	XA1E-BV313R	250V, 1.5A(AC15) 30V, 1A(DC13)
EV1, EV2	Cooling fan	DELTA	AFB0824SH-SM37	16-26VDC
TS1	Temperature Switch	Sensata	YS11A55B	7A/250Vac
PCB1	Battery PCB	Delta	5503100200	DC3.6V
PCB2	Brake release PCB	Delta	5503100300	DC24V
PB1	Brake release push Button	IDEC	LB6ML-M1T14W	600V/10A
HL1	Servo ON Lamp (DRS40L3)	IDEC	AL6M-P4WC	DC24V
HL1	Servo ON Lamp (DRS60L6)	IDEC	YW1P-2UQ4PW	DC24V

11. Simple troubleshooting

This chapter introduces some simple troubleshooting methods and abnormality messages and contents of the controller.

	■ Please perform troubleshooting properly according to the descriptions in the manual. ■ Do not perform any troubleshooting within 10 minutes of turning off the power because there is residue voltage in the driver that has not yet been fully discharged. ■ Troubleshooting tasks must be performed by personnel with related licenses in order to guarantee the safety properly.
	■ Personnel without related licenses must not perform troubleshooting tasks. ■ Randomly replacing components inside the controller is prohibited because components that do not comply with the specifications might result in damages to the controller or danger occurring. Our company will not be held responsible if this occurs. ■ Modification of any wiring inside the power control box to eliminate the malfunction is prohibited because doing so might result in damages to the controller or danger occurring. Our company will not be held responsible if this occurs.

11.1 Fuse replacement

In order to protect the various components inside the power control box, fuses are used for each power circuit to protect its electrical circuit. If the corresponding fuse is burnt, the corresponding circuit will not be able to operate normally. The corresponding fuses of each circuit are as shown in Table 11.1 below:

Table11. 1 Fuse specifications and corresponding fault status list

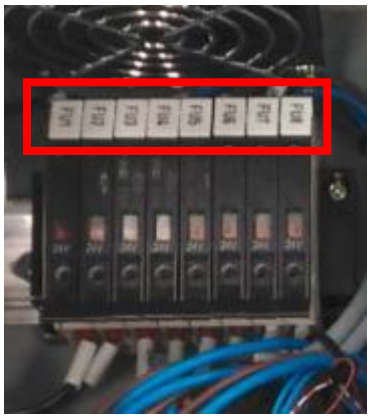
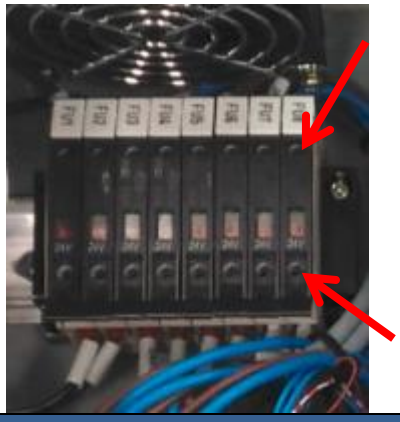
Component name	Corresponding circuit	Fault status	Fuse specifications
FU1	Controller AC power circuit	• Operator interface displays E?003 low voltage • Robot system unable to Servo on	[Bussmann] S501-5-R/5A
FU2	DC power supply inlet circuit	• Controller unable to turn on • Power control box fan unable to operate • Power control box safety module unable to turn on • Handheld teach pendant unable to turn on	[Bussmann] S505-2-R/2A
FU3	DCS controller DC control power circuit (high potential)	• Controller unable to turn on	[Bussmann] S501-3-R/3A
FU4	DCS controller DC control power circuit (low potential)	• Controller unable to turn on	[Bussmann] S501-3-R/3A
FU5	Robot power control box other parts related circuits	• Operator interface displays E?013 safety stop • Safety module unable to turn on • Fan unable to operate	[Bussmann] S505-2-R/1A
FU6	Robot power control box other parts related circuits	• Operator interface displays E?013 safety stop • Safety module unable to turn on • Fan unable to operate	[Bussmann] S505-2-R/2A
FU7	Robot power control box interface DC output circuit (high potential)	• Robot interface DC output unable to output power normally	[Bussmann] S505-2-R/2A
FU8	Robot power control box interface DC output circuit (low potential)	• Robot interface DC output unable to output power normally	[Bussmann] S505-2-R/2A

Note: When replacing the fuse please replace the products with specifications listed in the table above, or use products with same specifications and complies with the safety regulations

Solution:

If the malfunction status above occurred, it might be due to the corresponding fuse being burnt. Please open the power control box door to check the fuse circuit and perform replacement if necessary. Please make sure to wait for 10 minutes after the power has been turned off before opening the power control box door to perform replacement operations in order to avoid residue voltages and getting electrical shocks. Please refer to the processes in Table 11.2 below to perform the replacement.

Table11. 2 Fuse replacement steps

1. Open the power control box door and find the corresponding fuse to perform checking; there are labels on top of the fuses that corresponds to the fuses.	2. Please use the ohm gear of a multimeter to perform measurement of the fuse; if it has an open circuit it means that the fuse has been burnt and needs to be replaced.
	
3. Open the fuse seat cover when replacing the fuse, and remove the fuse by moving it from left to right, then install a fuse that corresponds to the specifications listed in Table 4-1.	4. Replace the fuse cover to complete the replacement.
	

11.2 Troubleshooting temperature of power control box being too high

If the cooling fan of the box body malfunctioned or the installation space was not installed according to the distance specified in the manual, the temperature inside the power control box will become too high, causing components inside the power control box to get damaged due to the temperature being too high. In response to such situations, there is a temperature sensing component installed inside the power control box. This component will monitor the temperature inside the power control box and if the temperature exceeds the component specification of 55°C, then blocking actions will be performed to the safety circuit and the E?013 safety stop abnormality alarm will occur.

Solution:

1. Check if the cooling fan malfunctioned and replace it with a fan with specifications listed in the specification table.
2. Check if the installation environment complies with the distance specified in the manual.
3. To eliminate points 1 and 2, please open the box door for cooling. Once confirmed that the temperature inside the power control box is less than 35°, power can be connected again.
4. Table 11.3 below shows how the temperature sensing component blocks and automatically resets the temperature.

Table11. 3 Temperature sensor component specifications

Temperature sensor component specifications	
Blocking circuit temperature	>55 ° C
Reset circuit temperature	<35 ° C

11.3 Abnormality warning list

When an abnormality occurs, the abnormality code number can be received through the handheld teach pendant. Table 11.4 below shows the abnormality alarms according to their group categories.

Table11. 4 Group abnormality warning codes

Abnormality warning display	Abnormality warning name	Abnormality type		Servo status	
		ALM	WARN	ON	OFF
E?801	Origin not set for all axes	○			○
E?803	Motion instruction not compatible	○			○
E?80A	Motion instruction not ready	○			○
E?80B	Unknown motion instruction	○			○
E?80C	Motion instruction buffer error	○			○
E?813	Error occurred during axis command explanation process	○			○
E?814	Error occurred during axis motion instruction execution process	○			○
E?815	Single axis exceeded software limit	○			○
E?821	Robot stance does not match	○			○
E?822	Point-to-point motion instruction target position exceeded working range of robot	○			○
E?823	Line continuous path instruction target position exceeded working range of robot	○			○
E?824	Space motion exceeded working range	○			○
E?825	Forward kinematics conversion error	○			○
E?827	Group does not exist	○			○
E?829	Coordinates switch error	○			○
E?82A	User coordinates switch error	○			○
E?82B	Tool coordinates switch error	○			○
E?832	Internal communication packet lost	○			○
E?833	Internal communication checksum error	○			○
E?841	Arc instruction out of bounds	○			○
E?842	Cannot form arc	○			○
E?843	Arc mode error	○			○
E?851	Conveyor belt tacking visual parameter transmission timeout	○			○
E?852	Conveyor belt tracking speed exceeded limit	○			○
E?853	Conveyor belt tacking visual parameter transmission timeout	○			○

Note:

1. When an abnormality message different from the ones in the list above appears, please contact your local dealer or technical personnel.
2. “?” represents the group category abnormality warning numbers “1.~2.”.

Table 11.5 below is the axis abnormality warning table according to each axis category

Table11. 5 Axis category abnormality warning code number

Abnormality warning display	Abnormality warning name	Abnormality type		Servo status	
		ALM	WARN	ON	OFF
E?001	Over-current	○			○
E?002	Over-voltage	○			○
E?003	Under-voltage		○		○
E?004	Motor match error	○			○
E?005	Regeneration error	○			○
E?006	Overload	○			○
E?007	Over-speed	○			○
E?009	Position control error too large	○			○
E?011	Encoder abnormal	○			○
E?012	Correction abnormal	○			○
E?013	Safety stop		○		○
E?014	Reverse limit abnormal		○		○
E?015	Positive limit abnormal		○	○	
E?016	IGBT overheated	○			○
E?017	Memory abnormal	○			○
E?018	Detector output abnormal	○			○
E?019	Serial communication between controller and driver abnormal	○			○
E?020	Serial communication between controller and driver timeout		○	○	
E?022	Main circuit power abnormal		○		○
E?023	Advanced overload warning		○	○	
E?024	Internal encoder initialization magnetic field error	○			○
E?025	Encoder internal error	○			○
E?026	Encoder internal data reliability error	○			○
E?027	Encoder internal reset error	○			○
E?028	Encoder high voltage error or encoder internal error	○			○
E?029	Gray code error	○			○
E?030	Motor collision error	○			○
E?031	Motor power cable break detection	○			○
E?034	Encoder internal communication abnormal	○			○
E?044	Driver function usage rate warning		○		
E?060	Absolute position lost		○		○
E?061	Encoder voltage too low		○	○	
E?062	Absolute position loop overflow		○	○	
E?067	Encoder temperature warning		○	○	
E?069	Motor type error	○			○
E?06A	Absolute position lost				

Abnormality warning display	Abnormality warning name	Abnormality type		Servo status	
		ALM	WARN	ON	OFF
E?070	Encoder processing not complete warning		○		○
E?072	Encoder over-speed		○		○
E?099	EEPROM needs upgrading	○			○
E?111	DMCNET packet receive overflow	○			○
E?185	DMCNET Bus hardware abnormal	○			○
E?201	MDCNET data initialization error	○			○
E?235	Position command overflow	○			○
E?245	Positioning timeout	○			○
E?283	Driver positive limit		○	○	
E?285	Driver reverse limit		○	○	
E?289	Position counter overflow	○			○
E?301	DMCNET synchronization failed	○			○
E?302	DMCNET synchronization signal too fast	○			○
E?303	DMCNET synchronization signal timeout	○			○
E?304	DMCNET IP command failed	○			○
E?500	STO function activated	○			○
E?501	STO_A lost (signal lost or error)	○			○
E?502	STO_B lost (signal lost or error)	○			○
E?503	STO_error	○			○
E?555	Driver malfunction	○			○

Note:

1. “?” represents axis category abnormality warning number “1 to 6” and letters “D to I”.

11.4 Abnormality warning cause and disposal method

The following are the causes of each abnormality warning and their troubleshooting methods.

Group category:

E?801 origin not set for all axes	
Cause	Origin not set for all axes
Inspection and disposal method	If all axes return to origin was not performed before moving coordinates, please perform set origins for all axes.
Solution	Abnormality warning reset.

E?803 motion instruction incompatible	
Cause	Motion command does not support overlapping mode
Inspection and disposal method	Check whether the three types of instructions single-axis point-to-point (MovJ), multi-axes point-to-point (MovP, MovPR, MArchP) and space instructions (MovL, MovLR, MArc, MCircle, MArchL) were used simultaneously. These three types of motion instruction cannot overlap each other. Please replace using other motion instructions or avoid instruction overlap.
Solution	Abnormality warning reset.

E?80A motion instruction not ready	
Cause	Motion command interpretation not ready; unable to perform interpretation
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?841 arc instruction out of bounds	
Cause	The target position of the instruction given exceeded the working range.
Inspection and disposal method	Please check whether the target position of each axis' motion instruction is within the software limit range set.
Solution	Abnormality warning reset.

E?842 cannot form arc	
Cause	Entered condition unable to form arc.
Inspection and disposal method	Check whether the conditions entered to form the arc are correct; if 3 points are collinear, radius is 0, or round center is on the circumference etc., arc cannot be formed. Please resend command position according to the arc-forming conditions.
Solution	Abnormality warning reset.

E?843 arc mode error	
Cause	Arc mode error.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?851 conveyor belt tacking visual parameter transmission timeout	
Cause	1. Data transmission error. 2. Visual system not yet triggered.
Inspection and disposal method	1. Make sure that the visual system was triggered before activating the robot. 2. Check whether the configurations and settings of the visual system are correct.
Solution	Abnormality warning reset.

E?852 conveyor belt tracking speed exceeded limit	
Cause	Conveyor belt speed too fast.
Inspection and disposal method	Lower the speed of the conveyor belt.
Solution	Abnormality warning reset.

E?853 conveyor belt tacking visual parameter transmission timeout	
Cause	Setting error in the user coordinates code number used for the conveyor belt tracking application.
Inspection and disposal method	Check whether the user coordinate code number used in the conveyor belt tracking application meets the user coordinate usage specifications (cannot be 0 and greater than 5).
Solution	Abnormality warning reset.

Axis category:

E?001 over-current	
Cause	1. Driver output short-circuited. 2. Motor connection error. 3. IGBT abnormal.
Inspection and disposal method	1. Check whether the wiring between the motor and driver has short-circuited; if short-circuited, please eliminate the short-circuit status and prevent the wiring from being exposed. 2. Please refer to the wiring order in the manual and check the wiring order for connecting the motor to the driver, then re-wire it again. Please send this product back to the dealer or original manufacturer for repairs if problems still exist.
Solution	Abnormality warning reset.

E?002 over-voltage	
Cause	1. Main circuit input voltage too high. 2. Driver hardware malfunction.
Inspection and disposal method	1. Check whether the input voltage of the main circuit is within the rated voltage value; if not, please use the correct voltage component or connect a stabilizer to convert the voltage to within the rated range. 2. Check whether the input voltage of the main circuit is within the rated voltage range; if this error still occurs, please send the driver back to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?003 under-voltage	
Cause	1. Main circuit input voltage too low. 2. Main circuit has no input voltage source. 3. Power input error.
Inspection and disposal method	1. Use an ammeter to measure the voltage to see whether the voltage of the main circuit is normal. 2. Please refer to the wiring order in the manual to check whether the wiring of the main circuit input voltage is normal; if there is wiring error, please re-wire. 3. Check whether the power system complies with the specification definition; please use the correct voltage component or connect a stabilizer to convert the voltage to within the rated range.
Solution	Voltage recovery and clear.

E?004 motor match error	
Cause	1. Encoder loose. 2. Motor match error.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?005 regeneration error	
Cause	1. Use of regenerative resistance error or no external regenerative resistance connected. 2. Parameter setting error.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?006 overload	
Cause	1. Continual use while exceeding the rated load of the driver. 2. Wiring error between the motor and encoder. 3. Defective motor encoder.
Inspection and disposal method	1. Check the wiring between U, V, W and the encoder; if error is discovered, please re-wire it correctly. 2. Please return the motor to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?007 over-speed	
Cause	Improper settings for parameters P2-34 (over-speed warning conditions).
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?009 position control error too large	
Cause	External load too great.
Inspection and disposal method	Please use a value within the maximum PayLoad range or adjust the PayLoad value.
Solution	Abnormality warning reset.

E?011 encoder abnormal	
Cause	1. Encoder wiring error. 2. Encoder loose or poor contact. 3. Encoder damaged.
Inspection and disposal method	1. Confirm whether the wiring was done properly according to the instructions in the manual. 2. Check the MotorENC. on the driver and whether the wiring on the both ends of the servo motor is loose. If the connector is loose, reconnect the driver MotorENC. and the wiring of the position detector.
Solution	Reconnect the power and clear.

E?012 correction abnormal	
Cause	Current calibration abnormal
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?013 safety stop	
Cause	1. Emergency stop switch is trsggered. 2. Protective stop signal is triggered, Safety dooe is open (Fence is triggered). 3. In T1 mode, no press TP enable switch.
Inspection and disposal method	1. Confirm whether the emergency stop switch was activated. The safety stop switch is usually a NC button; if accidentally activated, please close the safety stop button. 2. Confirm whether the Protective stop signal was activated. 3. Check mode switch and TP.
Solution	Abnormality warning reset.

E?014 reverse limit abnormal	
Cause	1. Reverse limit switch activated 2. Insufficient servo server stability
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?015 positive limit abnormal	
Cause	1. Positive limit switch activated 2. Insufficient servo server stability
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?016 IGBT overheated	
Cause	1. Continual use of driver while overloaded 2. Driver output short-circuited.
Inspection and disposal method	1. Check whether the load is too great and please use a value within the maximum PayLoad range or adjust the PayLoad value. 2. Check the output wiring of the driver and make sure the wiring is correct.
Solution	Abnormality warning reset.

E?017 memory abnormal	
Cause	1. Parameter data write abnormal or parameter abnormal; this happens during factory parameter reset or when there is driver model setting error. 2. Driver memory abnormal. 3. Data in ROM damaged; this happens when power is connected. Usually data in the ROM is damaged or that there is no data in the ROM; please send it back to the dealer.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?018 detector output abnormal	
Cause	1. Encoder error. 2. Output pulse wave exceeded the allowable range by the hardware.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?019 serial communication between controller and driver abnormal	
Cause	1. Improper communication parameter settings. 2. Incorrect communication address. 3. Incorrect communication values.
Inspection and disposal method	1. Reset to the default factory values. 2. Please return it to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?020 serial communication between controller and driver timeout	
Cause	Driver did not receive communication commands for an extended period of time.
Inspection and disposal method	Check whether the communication cable is loose or disconnected and make sure the wiring is correct.
Solution	Abnormality warning reset.

E?022 main circuit power abnormal	
Cause	Main circuit power abnormal.
Inspection and disposal method	1. Check whether the RS power cable is loose or that there is no input power. 2. Please connect the power properly; if the power is normal and this abnormality warning still cannot be eliminated, please send the driver back to the dealer or original manufacturer for repairs.
Solution	Abnormality warning reset.

E?023 advanced overload warning	
Cause	Advanced overload warning
Inspection and disposal method	Confirm whether it is used while overload and please refer to the disposal method of abnormal warning E?006.
Solution	Abnormality warning reset.

E?024 internal encoder initialization magnetic field error	
Cause	Encoder initialization magnetic field error. (Magnetic field position U, V, W error).
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?025 encoder internal error	
Cause	1. Encoder internal error (internal memory abnormal and internal counter abnormal). 2. When power is connected, the motor started due to mechanical inertia or other elements.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?026 encoder internal data reliability error	
Cause	Encoder error (internal data abnormal three times continuously).
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?027 encoder internal reset error	
Cause	Encoder chip reset.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?028 encoder high voltage error or encoder internal error	
Cause	1. Battery voltage too high. 2. Encoder internal error.
Inspection and disposal method	Check the driver to see whether the charging circuit and battery installation are abnormal (voltage >3.8 V), please use an ammeter to measure whether the battery voltage is more than 3.8 V.
Solution	Reconnect the power and clear.

E?029 Gray code error	
Cause	A circle of absolute position error.
Inspection and disposal method	Reconnect the power for the motor to operate and confirm whether the abnormality warning recurs; if it does, please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?030 motor collision error	
Cause	1. Confirm whether the anti-collision function of the motor is activated. 2. Please return it to the dealer or original manufacturer for repairs.
Inspection and disposal method	Reconnect the power for the motor to operate and confirm whether the abnormality warning recurs; if it does, the encoder needs to be replaced.
Solution	Reconnect the power and clear.

E?031 motor power cable break detection	
Cause	Motor power cable broke.
Inspection and disposal method	Check whether the power cable (U, V, W, GND) of the motor had broken and wire and ground it properly according to the manual.
Solution	Reconnect the power and clear.

E?034 encoder internal communication abnormal	
Cause	Encoder internal communication abnormal.
Inspection and disposal method	Check whether the battery wiring is loose; if it is, please rewire the battery and reconnect the power once confirmed wired properly.
Solution	Reconnect the power and clear.

E?044 driver function usage rate warning	
Cause	Driver function usage rate warning.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?060 absolute position lost	
Cause	1. Battery voltage too low. 2. Replaced battery while the driver control power is off. 3. Absolute position coordinate initialization was not completed after the absolute function was enabled. 4. Battery power supply circuit has poor contact or disconnected. 5. Electronic gear ratio changed.
Inspection and disposal method	1. Check whether the battery voltage is under 2.8 V. 2. Do not replaced or remove the battery power while the driver control power is Off. 3. Complete absolute coordinate initialization and the origin reset function, and perform absolute position coordinate reconstruction. 4. (1) Check whether the battery was installed properly and whether its wiring is correct. (2) Check the encoder wiring. (3) Check the wiring between the external battery box and the driver. Disposal method: Perform the origin reset process again.
Solution	Reconnect the power and clear.

E?061 encoder voltage too low	
Cause	Battery voltage too low.
Inspection and disposal method	1. Check whether the panel battery voltage is under 3.1 V (tentative specification). 2. Measure whether the battery voltage is under 3.1 V (tentative specification); if the voltage is too low, please replace the battery while the driver control power is ON.
Solution	Automatically clears.

E?062 absolute position loop overflow	
Cause	Stroke exceeded range.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?067 encoder temperature warning	
Cause	Encoder temperature too high warning (85 ~ 100℃).
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?069 motor type error	
Cause	Absolute functions not allowed to be activated for incremental motors.
Inspection and disposal method	1. Check whether the motor is an incremental type or has an absolute type encoder.
Solution	Reconnect the power and clear.

E?06A absolute position lost	
Cause	Absolute position coordinate initialization was not completed after the absolute function was enabled.
Inspection and disposal method	1. Complete absolute coordinate initialization and the origin reset function, and perform absolute position coordinate reconstruction. 2. Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?070 encoder processing not complete warning	
Cause	Related instructions were not completed when performing encoder barcode writing or related actions.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?072 encoder over-speed	
Cause	While power is supplied by the driver: rotation speed exceeded 8800rpm; while power is supplied by the battery: rotation speed exceeded 10000rpm.
Inspection and disposal method	1. Is the motor ground terminal properly grounded. 2. Is the encoder signal cable separated from the power or large current circuits in order to prevent interference. 3. Whether isolation net is used for the cable of the position detector. 4. Check whether exceeded the specifications.
Solution	1. Please connect the ground terminal of the UVW connector with the cooling part of the driver. 2. Please check whether the encoder signal cable is separated from the power or large current circuits properly. 3. Please use cables that include isolation nets. 4. Please use within specifications. 5. If there are no improvements after the disposal methods above, please return it to the dealer or manufacturer for repairs.

E?099 EEPROM needs upgrading	
Cause	EEPROM needs upgrading.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?111 DMCNET packet receive overflow	
Cause	Two or more packets were received within 1 ms.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?185 DMCNET Bus hardware abnormal	
Cause	DMCNET Bus hardware abnormal or communication packet lost.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?201 MDCNET data initialization error	
Cause	MDCNET data initialization error.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	Reconnect the power and clear.

E?235 position command overflow	
Cause	1. When the feedback position register overflows. 2. When return to origin was triggered but the return to origin process was not yet completed. 3. When E?060 and E?062 occurs.
Inspection and disposal method	Perform the origin reset process.
Solution	Reconnect the power and clear.

E?245 positioning timeout	
Cause	Position mode positioning timeout.
Inspection and disposal method	Please return it to the dealer or original manufacturer for repairs.
Solution	None.

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