



SYNTEC
TECHNOLOGY CO.,LTD.

R-series Product Manual - Installation and Maintenance

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R 系列产品手册
安装与维护

Series Product Manual
Installation and Maintenance



About this user manual

Manual content

Thank you for buying our robot products.

This manual contains instructions for proper installation and use of robots.

Please read this manual and other relevant manuals carefully before installing and using the robot system. After reading, please keep it safe for easy access.

Unauthorised copying or reprinting of part or all of this manual is prohibited.

The contents of this manual may change from time to time without prior notice.

If you find the contents of this manual wrong or need to improve or supplement, please feel free to correct.

Except as expressly stated in this manual, nothing in this manual shall be construed as any warranty or warranty by the Company with respect to personal loss, property damage or specific fitness for purpose.

The Company is not responsible for any accident or indirect injury caused by the use of this manual and the products described in it.

Manual Content

This manual contains the following instructions.:

- Installation of robots
- The use of robots
- Maintenance of robots

Reading object

This manual is oriented towards:

- Installers
- Maintenance personnel

Warranty

The robot and its optional components are delivered after the company's strict quality control, testing and inspection, and the performance is confirmed to meet the company's standards.

Within the warranty period of the delivered products, the company will only repair the faults occurred during normal use for free. Please consult a salesperson in your area for warranty period.

However, the customer will be charged for repairs (even within the warranty period) if:

1. Damage or failure caused by improper use and improper use of the manual.
2. Failure caused by the customer's unauthorized disassembly.
3. Damage caused by improper adjustment or unauthorized repair.
4. Damage caused by natural disasters such as earthquakes and floods.

Warning

1. If the use of robots or related equipment exceeds the conditions of use and product specifications described in this manual, the warranty will be invalid.
2. The Company shall not be liable for any fault or accident, or even personal injury or death caused by the use of the products.
3. The Company cannot foresee all possible risks and consequences. Therefore, this manual cannot warn the user of all possible risks.

Inquiry

For the repair/inspection/adjustment of the robot, please contact our after-sales department. If no after sales department is recorded, please contact your local distributor.

To save your time, please prepare the following items before contacting:

- Controller name/serial number
- Robot name/serial number
- Software name/version
- Problems with the system

A large, light gray watermark of the SYNTEC logo is centered on the page. The logo consists of the word "SYNTEC" in a bold, sans-serif font. The letters are slightly spaced out and have a subtle shadow effect, making them stand out against the white background.

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2 1 Safety

2.1 1.1 About This Chapter

Instructions:

This chapter introduces the safety principles and procedures to be considered when using robots.

The design and installation of robot external security devices are not covered by this chapter. Please contact your system integrator for such information.

2.2 1.2 Safety Terms




2.2.1 1.2.1 Safety Identity




About safety identify

When operating the robot in accordance with the contents of this manual, different degrees of danger may be encountered. Therefore, near the operation instructions that may cause danger, there will be a special safety mark prompt box to remind users to pay attention to precautions. The contents of the prompt box include:





- An icon representing the security level and corresponding name, such as warning, danger, prompt, etc.
- A simple description of what could happen if the operator did not eliminate the hazard
- Instructions on how to eliminate hazards




Safety level

Icon	Name	Description
	Danger	If the content with this logo is not operated in accordance with the regulations, it will cause serious or even fatal to the personnel Life damage, and will/may cause serious damage to the robot. Operations associated with such hazards include contact with high voltage components in the control cabinet and movement during robot operation into its work area, etc.
	Warning	It is suggested that the current operation may have the risk of accidents, causing serious or even fatal injuries.
	Electric Shock	It is suggested that the current operation may have the risk of electrocution, causing serious or even fatal injuries.

Icon	Name	Description
	Caution	Content bearing this logo, if not operated in accordance with the regulations, may result in personal injury and damage to the machine itself.
	Anti-static (ESD)	It is suggested that the parts involved in the current operation are sensitive to static electricity and may be damaged during the operation if they are not operated according to the specification.
	Reminder	Used to suggest important information or prerequisites.

Description

Icon	Name	Description
	Extrusion	When operators and maintenance personnel enter the robot's movement range during debugging, maintenance, overhaul and tool clamping, they may cause damage.
	Clamp hand	There is a risk of pinch when the maintenance personnel approach the belt drive during maintenance operation.
	Impingement	When operators and maintenance personnel enter the movement range of the robot during debugging, maintenance, overhaul and tool clamping, collision or serious injury may occur.
	Friction	When the operator and maintainer enter the movement range of the robot during debugging, maintenance, overhaul and tool clamping, there may be abrasions

Icon	Name	Description
	Parts fly out	Operators and maintenance personnel enter the movement range of the robot during debugging, maintenance, overhaul and tool clamping, and the tool or workpiece may fly out due to lax clamping, which may cause serious damage.
	Fire	A fire may occur in the event of a short circuit in the circuit, a lead or a device catching fire, which may cause serious injury
	High temperature	When maintenance personnel contact the high-temperature surface of the robot during equipment overhaul and maintenance, it may cause burns

Warning, any robot in motion can be fatal!

When a robot is running, it may perform undesirable or even unreasonable movements. In addition, the robot will carry a huge amount of energy when moving, and when collision occurs, it will cause serious injury/damage to the personnel and equipment in its working range

Elimination of danger

	Operate	Reference information
1	Make sure all emergency stop equipment is properly configured and installed before starting the robot.	Emergency stop equipment includes safety gate, safety grating, safety light blanket, etc.
2	In the process of robot programming, it is necessary to ensure that the teaching device is held by the person entering the working area of the robot.	Avoid the danger of operating the robot with the teaching device when the personnel outside the work area do not observe the personnel inside the work area.
3	Before starting to run the robot program, make sure that there are no people in the robot's work area.	

2.2.2 1.2.3 Safety characteristics

Instruction:

PLC is built into the Syntec system to process security-related signals, and external security signal interfaces such as safety gate and safety grating are provided.

Signals processed by PLC include:

- Emergency stop signal
- Safety gate signals
- Emergency stop reset signal
- Enable switching signals
- Pattern selection signals
- Motor On signal

2.2.3 1.2.4 What is Emergency Stop

Definition of safe stop

Emergency stop is the highest priority function in the robot system. Pressing the emergency stop button will trigger the emergency stop. At this time, all other robot control functions will stop, the robot will stop moving and the motor power of each joint will be cut off. The control system will switch to the emergency stop state, which will be maintained until it is manually reset.

Emergency stop means that all power to the robot will be cut off except for the manual brake release circuit. To restore the system to its normal state, a manual reset operation must be performed, that is, first release the emergency stop button and then manually press the power on the control cabinet.

After triggering the emergency stop, the system may take either of two different stopping modes according to different working conditions:

STOP 0, immediately cut off the power supply of the motor and make each joint brake, which is the safest way to STOP. However, the robot is in an uncontrolled state during the stopping process, and may deviate from the path after stopping. The emergency STOP in manual mode belongs to STOP 0.

STOP 1. After the emergency STOP is triggered, the control system will immediately decelerate along the path. Then the safety module will cut off the power supply of the motor and make all the joints lock, no matter whether the robot stops completely or not. In the vast majority of cases, due to a controlled stop, the robot will end up on the programming path, providing the best protection against peripherals. By default, the emergency STOP in automatic mode belongs to STOP 1.



Reminder

Emergency stop is only used to stop the robot immediately in a dangerous situation



Reminder

Emergency stop should not be stopped as a normal procedure, otherwise it will cause extra and unnecessary wear to the brake system and transmission system of the robot, and reduce the service life of the robot.

Emergency stop button

By default, the robot system is equipped with two emergency stop buttons that trigger an emergency stop when pressed. One is mounted on the control cabinet and the other is mounted on the instructor.

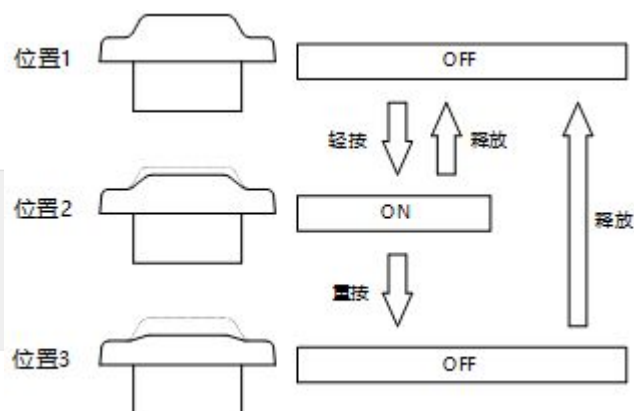


In addition, your system integrator may install additional emergency stop buttons during the robot deployment process. Please contact your system integrator or consult the robot workstation documentation for more information.

2.2.4 1.2.5 Safety switch

It is a special switch with two presses and three positions. It only works if you press the enable switch and keep it in the middle position. It will be cut off if you release it or press hard to the end.

It needs to be pressed together with other keys to prevent mistouch.



Reminder

The enable switch is mounted on the back of the instructor, and Jog or run programs can only be performed when pressed to the middle position. The operation is invalid when released or pressed to the bottom.

For safe use, the following requirements must be observed:

- Enable switches must work properly under all circumstances.
- During programming and debugging, release the safety snap switch when robot movement is not required.

Anyone entering the robot's workspace must carry a teaching device with them to prevent others from starting the robot without the knowledge of insiders.



Warning

Do not use external devices. The enabling switch will jam so that it stays in the middle!

2.3 1.3 Work safety guide

2.3.1 1.3.1 Description

About Robotic

No matter how fast they move, industrial robots are potentially dangerous. A pause or wait in a program may be followed by a very fast and dangerous motion command. Even if you are already familiar with the current robot's trajectory and mode, the robot's trajectory in automatic mode can still be changed by external signals without warning.

Therefore, safety regulations must be followed when entering the working area of the robot.

About this section

This section introduces some basic security specifications for robot end users. But space is too limited to cover every particular situation

2.3.2 1.3.2 Self Safety

Basic Principle

There are a few simple principles that must be followed in order to operate a robot safely:

- When a worker is in the safe area of the robot, the robot can only be operated in manual mode.
- When you enter the secure area of the robot, you must hold the teaching device in your hand to ensure that the robot is under your control.
- Keep an eye out for moving tools, such as drills, saws, etc. installed on the robot. Make sure the tools stop working before approaching the robot.
- Pay attention to the problem of workpiece surface or robot body. After long working hours, the temperature of robot motor and outer shell may be very high.
- Pay attention to the robot's grip and the objects it is holding. If the gripper is opened, the workpiece may fall and cause injury to personnel or damage to equipment. In addition, the grippers used by the robot can be very powerful and can cause damage if not used properly.
- Watch for electrical components in the robot and control cabinet. Even when power is lost, the energy stored in the device can be very dangerous.

Safely store the teaching pendant device

The teaching pendant device removed from the control cabinet should be stored away from the robot workstation or the control cabinet, so as not to attempt to stop the robot with an unconnected teaching device in case of danger



Warning

The teaching pendant implement taken from the control cabinet should be properly stored, so as not to mislead the operator into thinking that the teaching implement is still attached to the control cabinet

2.3.3 1.3.3 Operate the teaching pendant device

Instruction

The teaching device equipped with Syntec system is manufactured with advanced electronic components. In order to avoid failure or damage during use, please follow the following requirements.

Handheld box lecturers are developed, manufactured and tested in accordance with relevant industry standards and are intended for use only as described in this manual. If you follow the requirements in this manual, the handheld teaching device will not cause personal injury or damage in normal use.

o

Operation and cleaning

- Handle it lightly to avoid falling, throwing or strong impact on the teaching device, otherwise it may cause obstacles.
- If the instructor experiences a strong shock, verify that the enable switch and emergency stop button are still in normal working condition before using again.
- When you do not use the teaching device, please store it properly to avoid accidental dropping.
- Avoid tripping over your own cable when using the instructor.
- Do not operate the touch screen with sharp objects, such as screwdriver, pen tip, etc., otherwise the touch screen may be damaged. Operate with a finger or a stylus on top of the pointer
- Clean the touch screen often, dust and small particles of impurities may cause the touch screen to malfunction
- Do not use chemical solvents, detergents or washing surfaces to clean the instructor. Use a soft cloth and a small amount of water to scrub.
- When not using USB interface, the protective adhesive cap must be properly fastened, otherwise exposure to dust may cause interface failure.

Pendant cable

- Ensure that staff do not trip over the instructor cable and cause the instructor to fall.
- Do not squeeze the instructor cable, otherwise it may damage the inner core.

- Do not place the teaching device cable at sharp edges, as this may damage the cable sheath.

2.3.4 1.3.4 Recovery From Emergency stop

Instruction

The reset operation must be performed when the system is in an emergency stop state in order to return to the normal state. The reset process is very simple but very important to ensure that the robot system is not put into production operation in a dangerous state.

Reset emergency stop button

All button-type emergency stop devices have a safety lock mechanism that must be manually released after being pressed to reverse the emergency stop state of the device. Most emergency stop buttons are released by rotation, with the direction of rotation marked on the surface of the button. There are also some buttons that support a direct uppull release method.

Reset the external stop device

All external emergency stop devices such as safety gates, safety gratings, etc., have some type of safety lock mechanism. If you use external emergency stop devices in your robot workstation, please consult your system integrator for more device reset information.

Recovery from E-Stop

Operate	
1	Confirm that the hazardous condition causing the emergency stop has been addressed and that the hazard source is no longer present.
2	Reset a safety device that causes an emergency stop.
3	Press the RESET button on the handheld box to restore the system from the emergency stop.

2.3.5 1.3.5 Safety considerations for manual mode

About Manual Mode

In manual mode, the movement of the robot is under manual control. Jog or run the robot only if the enable switch is in the middle position.

Manual mode is used to write and debug robot programs and participate in commissioning of workstation

Enable external security signals

External security signals such as safety gate and safety grating will be enabled in automatic mode, and emergency stop will be triggered when the safety gate is opened.

Safety solve failure in processing production

Most of the time, robots are part of a production line, so robot failures do not only affect the workstation itself, but can also affect the workstation when problems occur in other parts of the production line. Therefore, it is up to those familiar with the entire production line to design fault recovery solutions to improve safety.

On a production line, for example, the robot needs to grab the workpiece from a conveyor belt. In case of robot failure, in order to ensure that the production process is not interrupted, the conveyor belt should be kept in operation while the robot is being repaired. At this time, the robot maintenance personnel should consider additional safety measures for working beside the conveyor belt in operation.

For example, when a welding robot is removed from a production line for routine maintenance, the robot feeding the robot must also be stopped to prevent human injury.

2.3.6 1.3.7 Handling when emergency

Handling of light fire

In the event of imminent fire danger or fire that has already started but not yet spread, do not panic, remain calm and extinguish the flames with the fire extinguishing equipment provided at the scene. Do not use water to extinguish the fire caused by short circuit.



Warning

The user shall provide the fire extinguishing device for the robot in the working site. The user shall select the appropriate fire extinguishing device according to the actual situation on the site

Measures to deal with severe fire

When the fire has spread and is out of control, site staff should not try to put out the fire, but should immediately notify other staff, give up personal belongings, and evacuate from the emergency exit as soon as possible. Elevators are not allowed during evacuation, and the fire brigade should be called during evacuation.

If a person or clothing is on fire, do not let him/her run away. Instead, let him/her quickly lie down on the ground and put out the fire with clothes or other suitable objects and means.

Handling of electric shock accident

When someone gets an electric shock, don't panic. First, cut off the power as soon as possible



Warning

Do not contact the electrocution person directly, otherwise the electrocution person may also be electrocuted!

Appropriate methods and measures should be taken decisively according to the specific conditions on the spot. Generally speaking, there are the following methods and measures:

- If the power switch or button is close to the shock point, pull the switch quickly and cut off the power.
- If the power switch or button is far away from the electric shock location, insulated pliers or axes, knives and shovels with dry wooden handle can be used to cut off the power side (i.e., the caller side). The cut wire should not touch the human body.

When the wire is attached to or under the body of the electrocutor, dry wooden sticks, wooden boards, bamboo poles or other tools with insulating handle (holding the insulated handle) can be used to quickly remove the wire. Do not use any metal bar or wet things to pick up the wire, so as to avoid the electrocutor.

Treatment of electrocuted wounded person after electrocution

- If the electrocuted victim is conscious, lay him/her on his/her back and watch him/her closely. Do not stand or walk for a while.
- If the contact person is unconscious, lay him/her on his/her back to make sure the airway is clear, and call or pat him/her on the shoulder at a 5-second interval to determine if he/she is unconscious. Do not swing the victim's head to call the victim. Contact the hospital as soon as possible while rescuing on the spot.
- If the electrocuted victim loses consciousness, the patient's breathing and heartbeat should be judged within 10 seconds. If there is no breathing and no pulsation of the artery, it can be determined that the respiratory heart has stopped, and it should be rescued by cardiopulmonary resuscitation immediately.

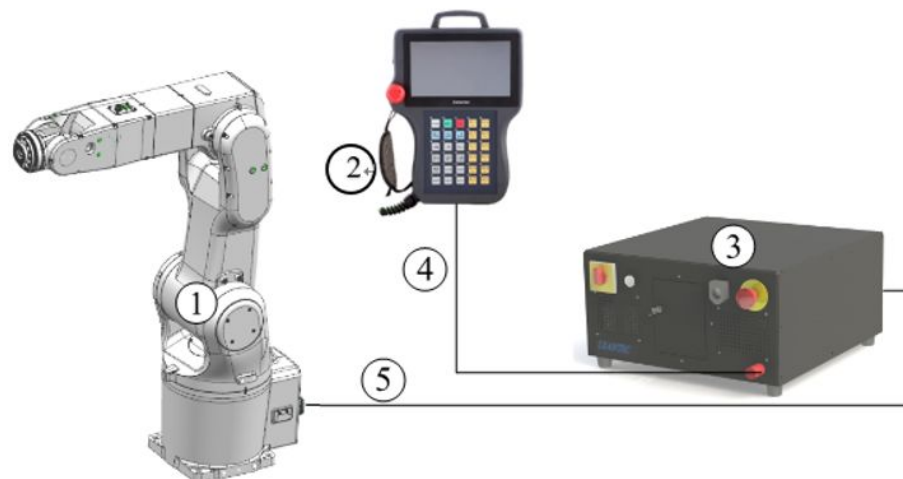
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3 2 Product overview

3.1 2.1 Overview of Robot System

System overview

A complete robot system includes the robot body, controller, instructor, connecting cables, software, terminal actuators and other accessories, as shown in the figure below.



The figures are illustrated below:

- 1 .Stands for robot
- 2 .Stands for handheld box teaching pendant device
- 3 .Represents the control cabinet
- 4 .Generation indicator cable
- 5 .Stands for cabinet cable

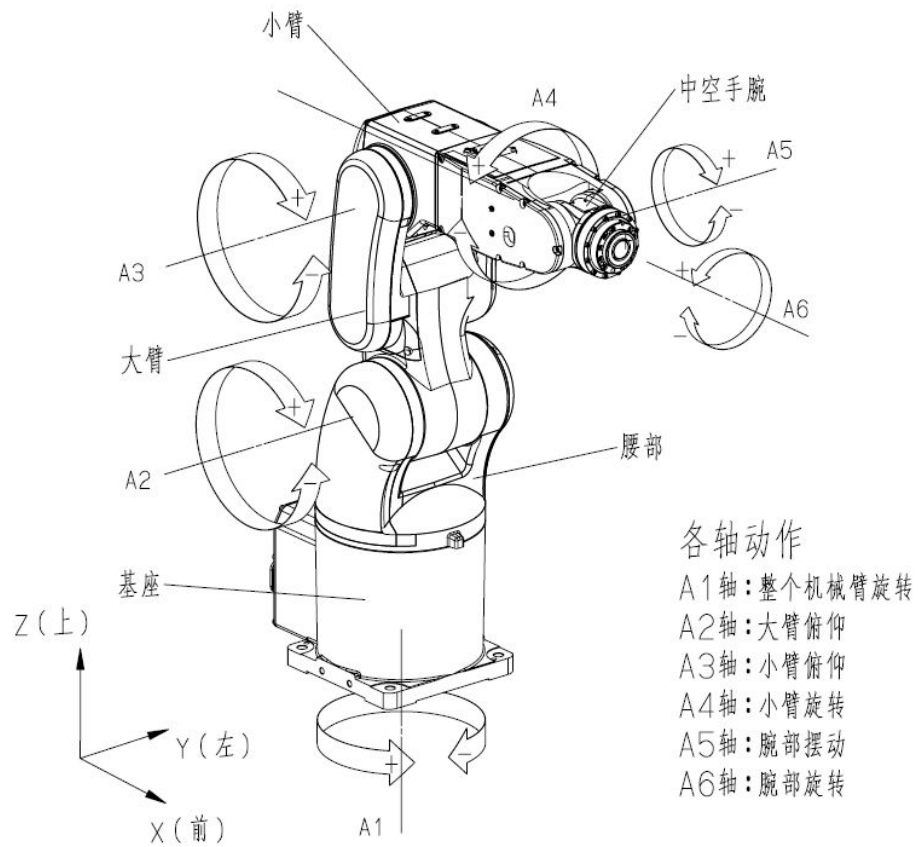
3.2 2.2 Overview of Robot Structure

Structure

The main structural parts of the robot body are made of cast aluminum alloy, with a total of 6 degrees of freedom. Each joint motor is equipped with a brake. Ontology consists of the following parts:

- Wrist -- The wrist has three degrees of freedom and is located at the output end of the robot, including axis 4th, axis 5th and axis 6th
- Forearm -- The forearm is located between the upper arm and the wrist and is driven by a shaft 3th motor.
- Upper arm -- The upper arm is located between the lower arm and the lumbar joint and is drive by shaft of 2rd motor,

- Waist -- The waist is located between the upper arm and the base and is driven by shaft of 1st motor.
- Base -- The base is the foundation of the robot, with electrical connections for the robot at its rear



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4 3 Technical parameters

4.1 3.1 Specification

Performance parameter table

LRA707-7-6A-R/LRA906-7-6A-R/LRA596-4-6A-R The performance parameters of the robot are shown in the table

Model		LRA596-4-6A-R	LRA707-7-6A-R	LRA906-7-6A-R
Axis		6		
Drive mode		AC servo drive		
Maximum arm reach		596mm	706.8mm	906.4mm
Positioning repeatability		±0.02mm	±0.02mm	±0.03mm
Maximum arm load		4kg	7kg	7kg
Range of motion	Axis 1	+170°~-170°		
	Axis 2	+144°~-80°	+135°~-96°	+130°~-96°
	Axis 3	+54°~-194°	+65°~-195°	+65°~-195°
	Axis 4	+170°~-170°		
	Axis 5	+119°~-119°	+120°~-120°	+120°~-120°
	Axis 6	+360°~-360°		
Maximum speed	Axis 1	440°/s	440°/s	355°/s
	Axis 2	355°/s	355°/s	355°/s
	Axis 3	440°/s	440°/s	355°/s
	Axis 4	490°/s	480°/s	480°/s

Model		LRA596-4-6A-R	LRA707-7-6A-R	LRA906-7-6A-R
	Axis 5	450°/s		
	Axis 6	720°/s	705°/s	705°/s
Operating temperature		+0°~+40°		
Storage temperature		-10°~+55°		
Protection Grade		Standard IP54, optional IP67		
Method of Installation		Floor,upside,tilt		
Base Dimension		190mm×190mm	210mm×210mm	210mm×210mm
Base Mounting Hole		160mm×160mm	180mm×180mm	180mm×180mm
Noise Level		≤70dB(A)		
Weight		approx 29KG	approx 50kg	approx 52kg

LRA596-4-6H-R/LRA707-7-6H-R/LRA906-4-6H-R The performance parameters of the robot are shown in the table:

Model	LRA596-4-6H-R	LRA707-7-6H-R	LRA906-7-6H-R
Axis	6		
Drive mode	AC servo drive		
Maximum arm reach	596mm	707mm	906.4mm
Positioning repeatability	±0.02mm	±0.02mm	±0.03mm
Maximum arm load	4kg	7kg	7kg

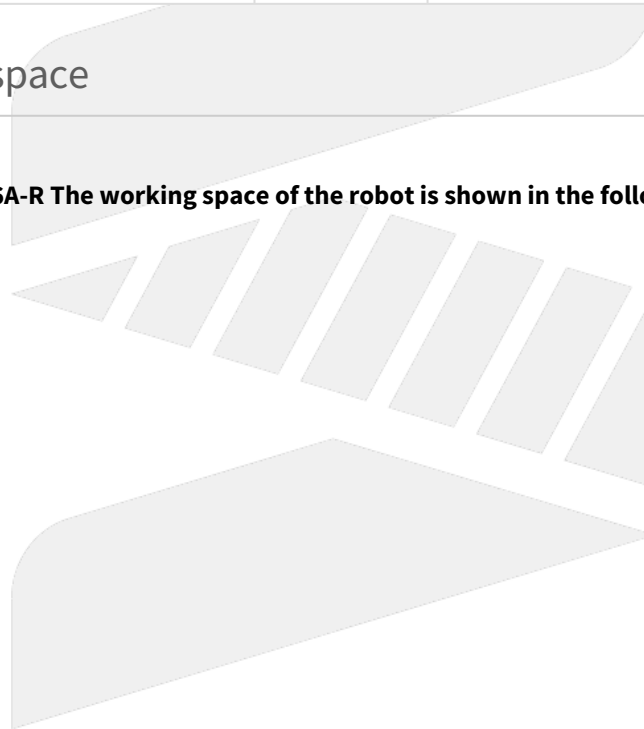
Model		LRA596-4-6H-R	LRA707-7-6H-R	LRA906-7-6H-R
Range of motion	Axis 1	+170°~-170°		
	Axis 2	+140°~-80°	+135°~-96°	+130°~-96°
	Axis 3	+54°~-194°	+65°~-195°	+65°~-195°
	Axis 4	+170°~-170°		
	Axis 5	+119°~-119°	+120°~-120°	+120°~-120°
	Axis 6	+360°~-360°		
Maximum speed	Axis 1	440°/s	440°/s	355°/s
	Axis 2	355°/s	355°/s	355°/s
	Axis 3	440°/s	440°/s	355°/s
	Axis 4	480°/s		
	Axis 5	450°/s		
	Axis 6	948°/s	900°/s	900°/s
Operating temperature		0°~+40°		
Storage temperature		-10°~+55°		
Protection Grade		Standard IP54, optional IP67		
Method of Installation		Floor,upside,tilt		
Base Dimension		190mm×190mm	210mm×210mm	210mm×210mm

Model	LRA596-4-6H-R	LRA707-7-6H-R	LRA906-7-6H-R
Base Mounting Hole	160mm×160mm	180mm×180mm	180mm×180mm
Noise Level	≤70dB(A)		
Weight	approx 29kg	approx 50kg	approx 52kg

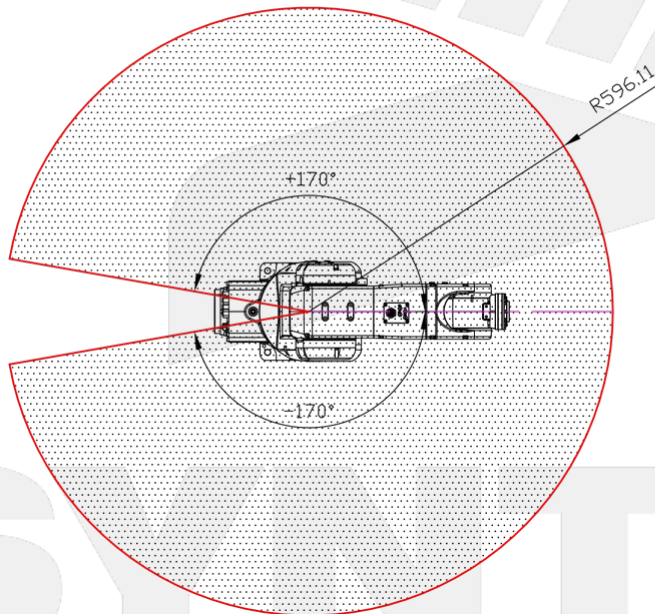
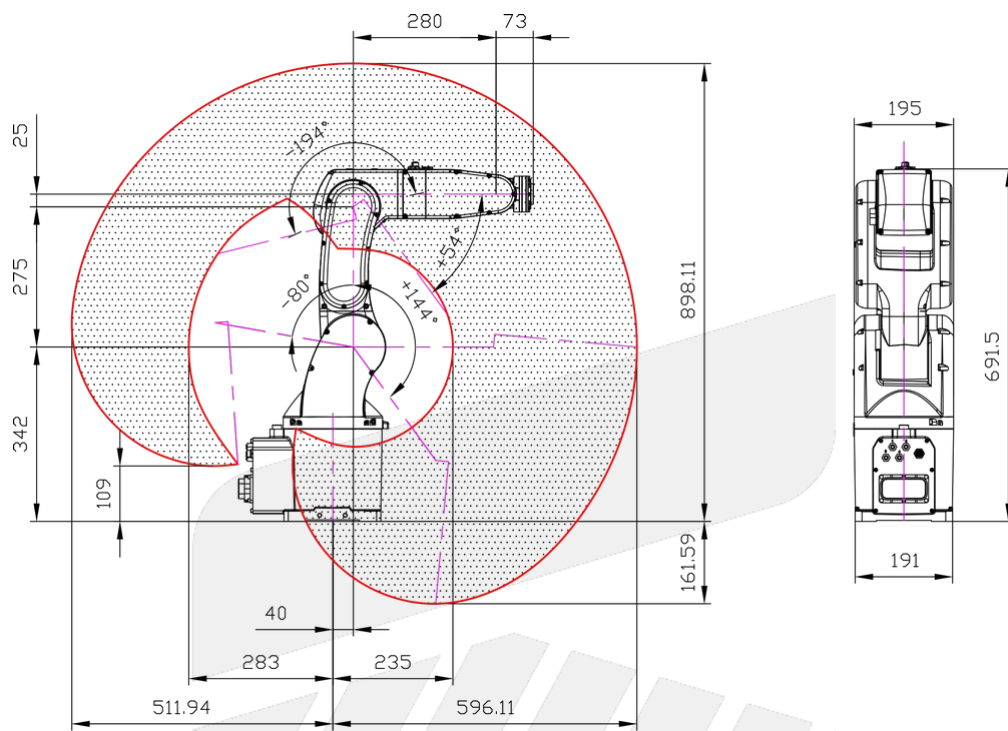
4.2 3.2 The workspace

Robot workspace

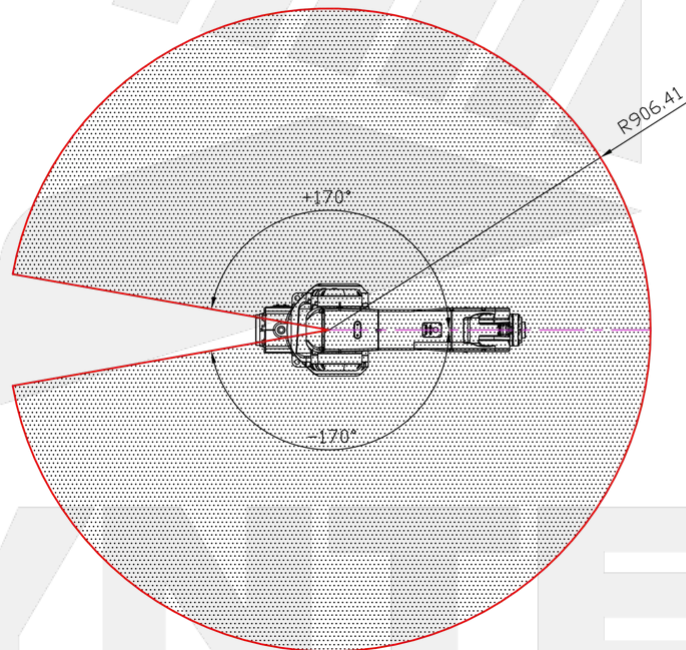
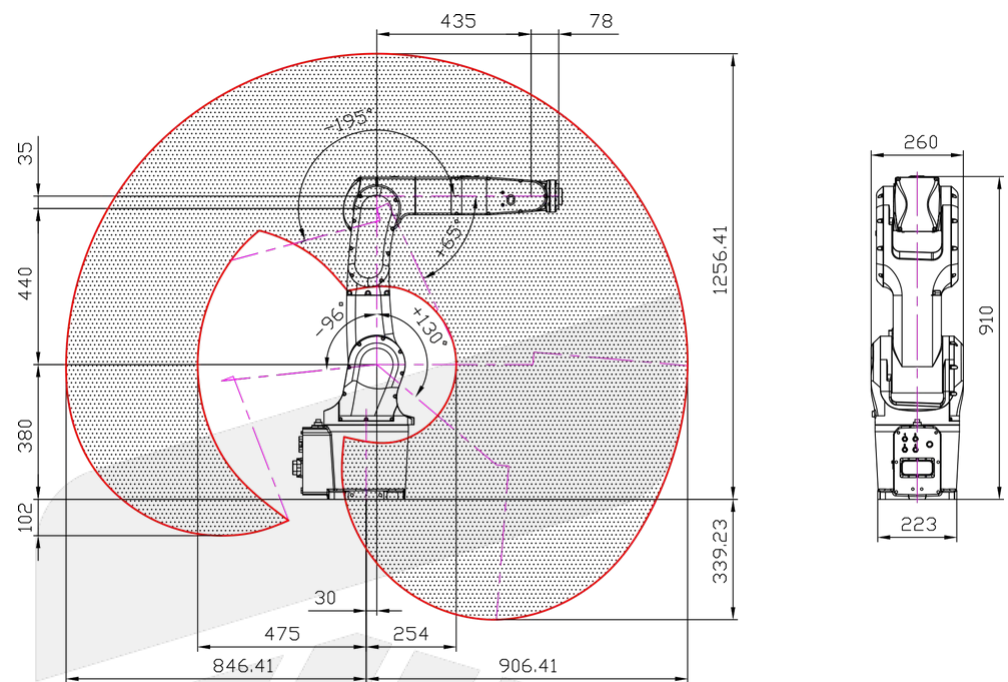
LRA596-4-6A-R The working space of the robot is shown in the following figure:



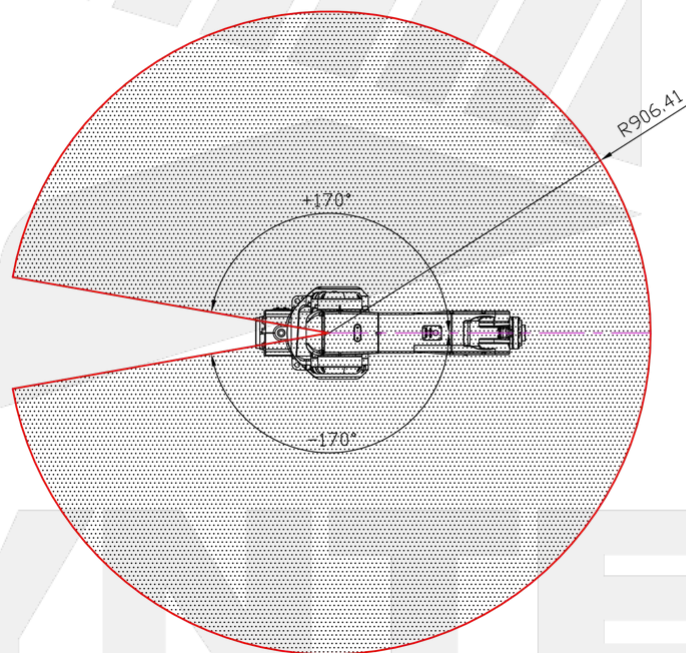
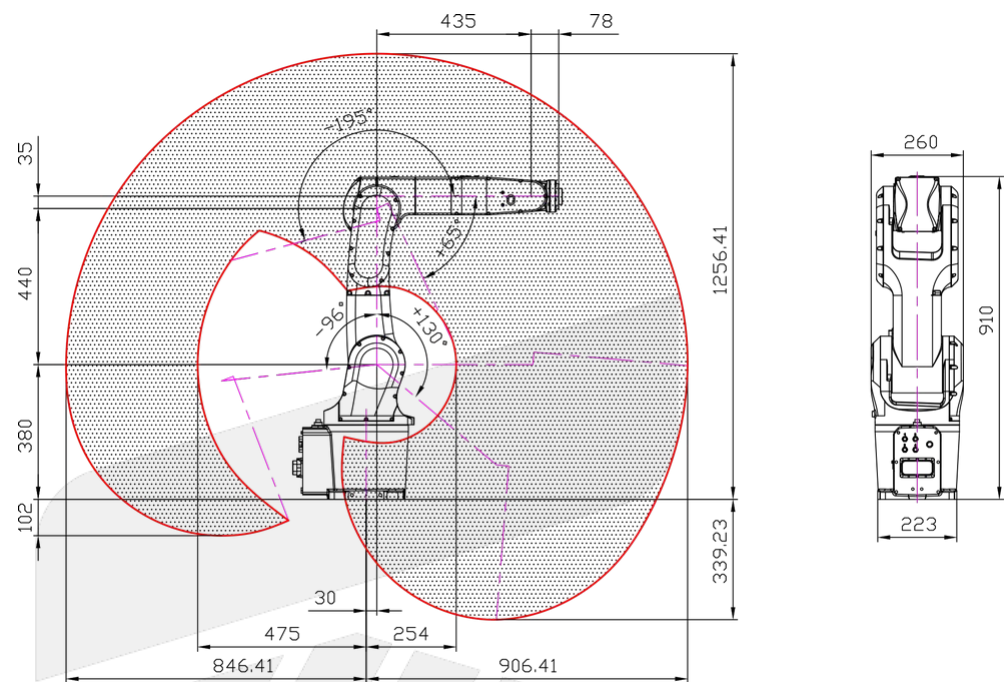
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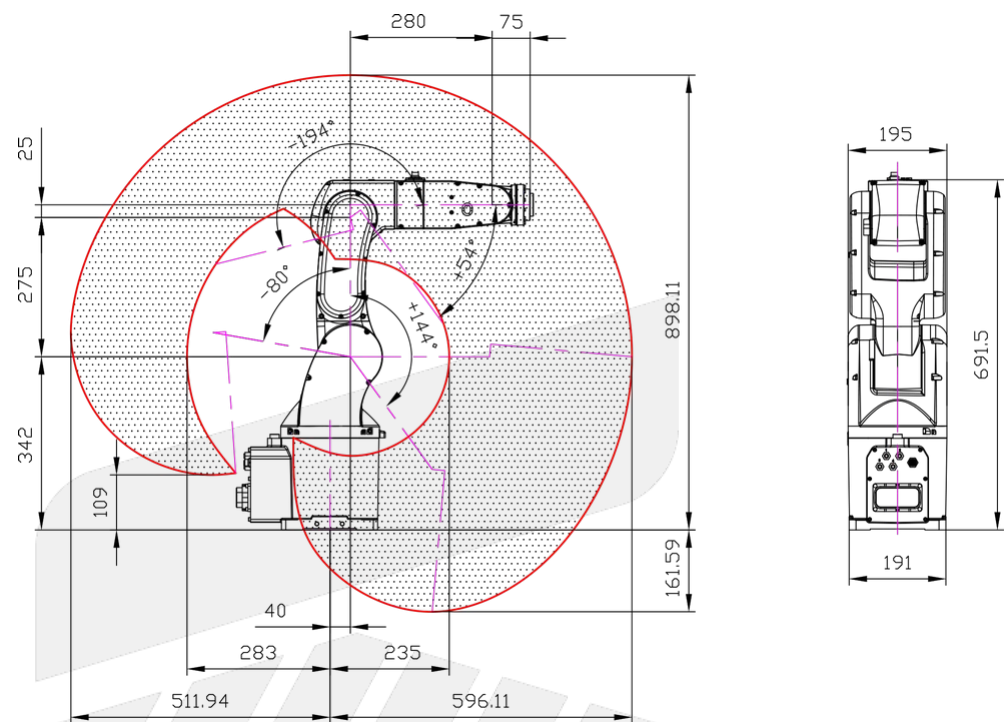
LRA707-7-6A-R The working space of the robot is shown in the following figure:



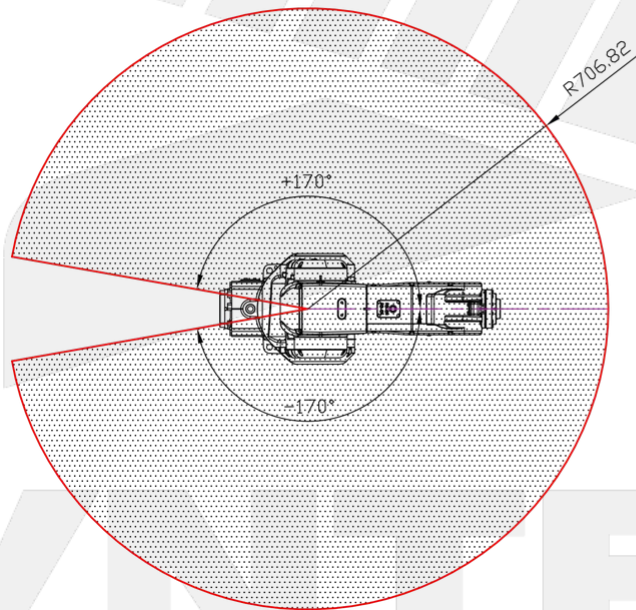
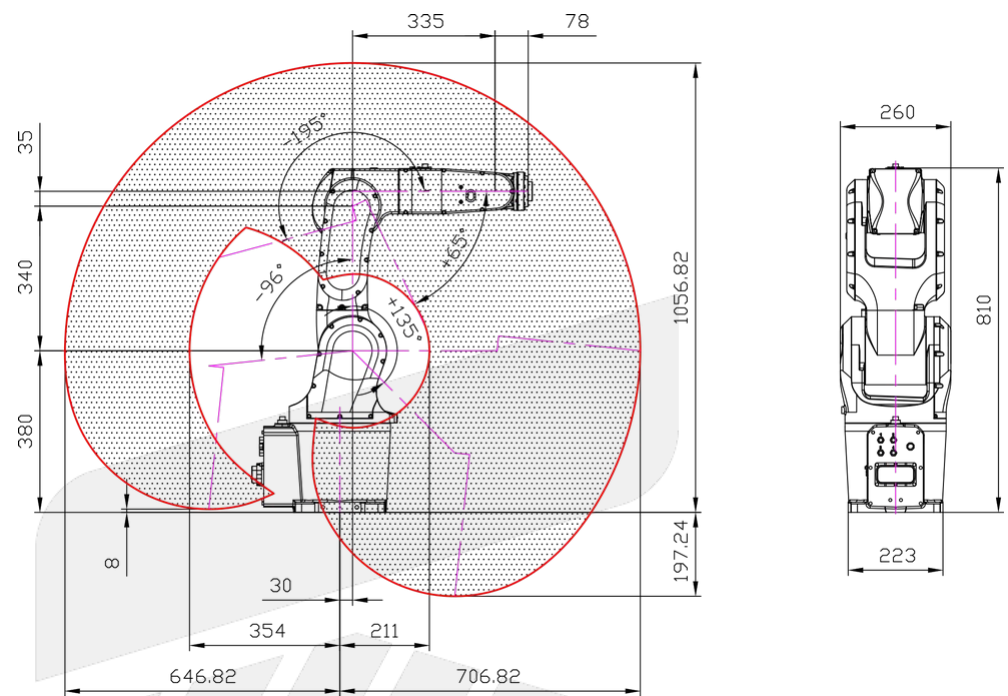
LRA906-7-6A-R The working space of the robot is shown in the following figure:



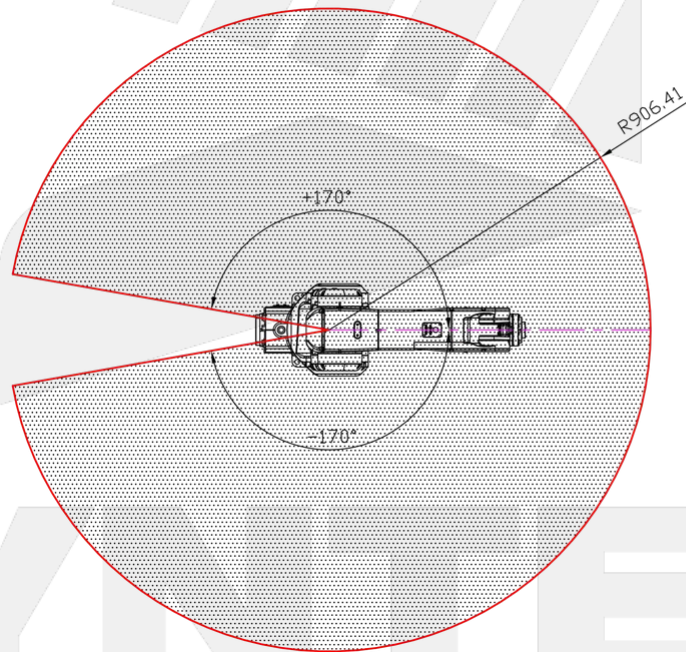
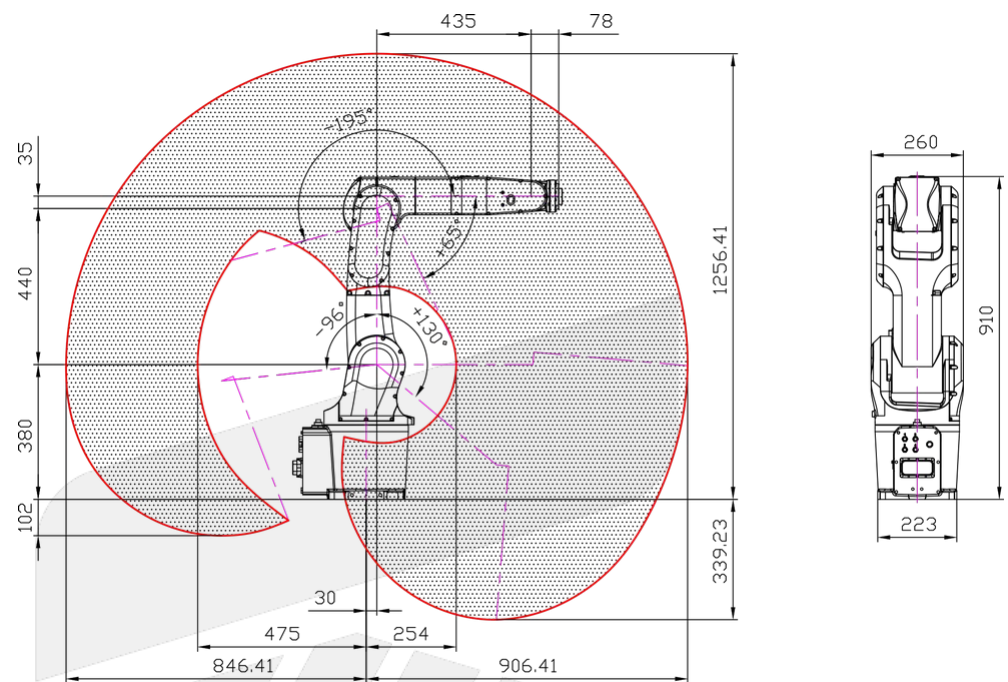
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LRA707-7-6H-R The working space of the robot is shown in the following figure:



LRA906-7-6H-R The working space of the robot is shown in the following figure:



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Reminder

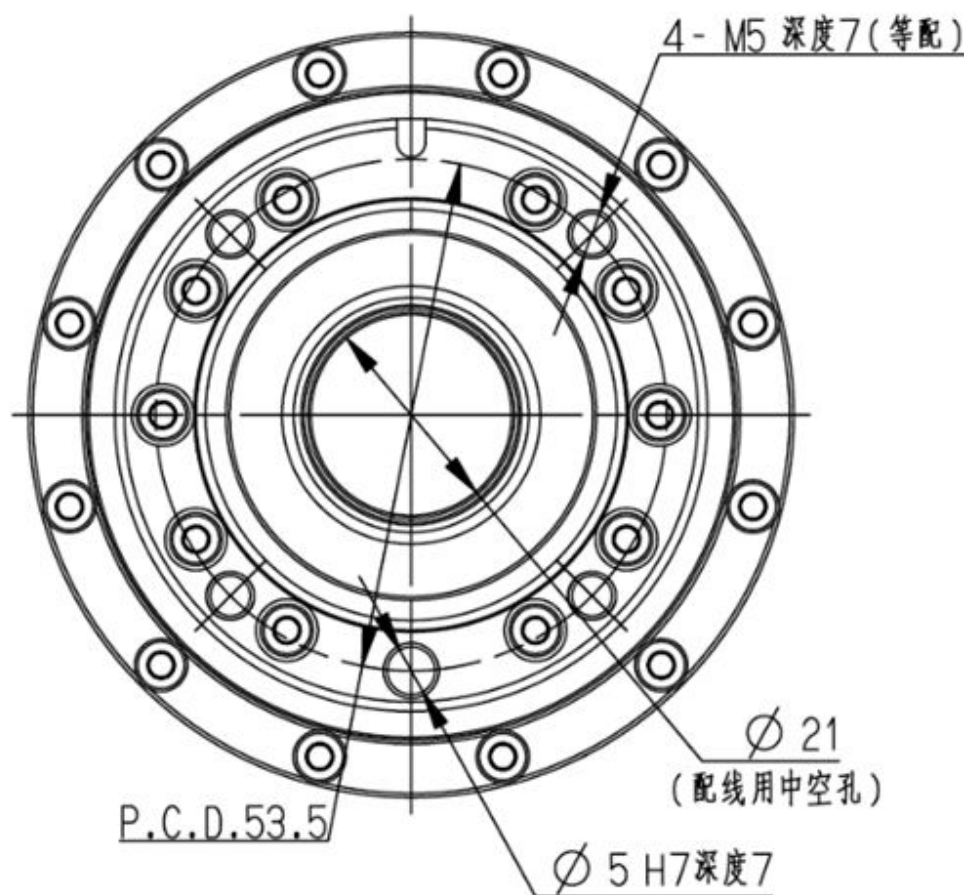
In practice, consider the impact of installation on the workspace

4.3 3.3 The flange

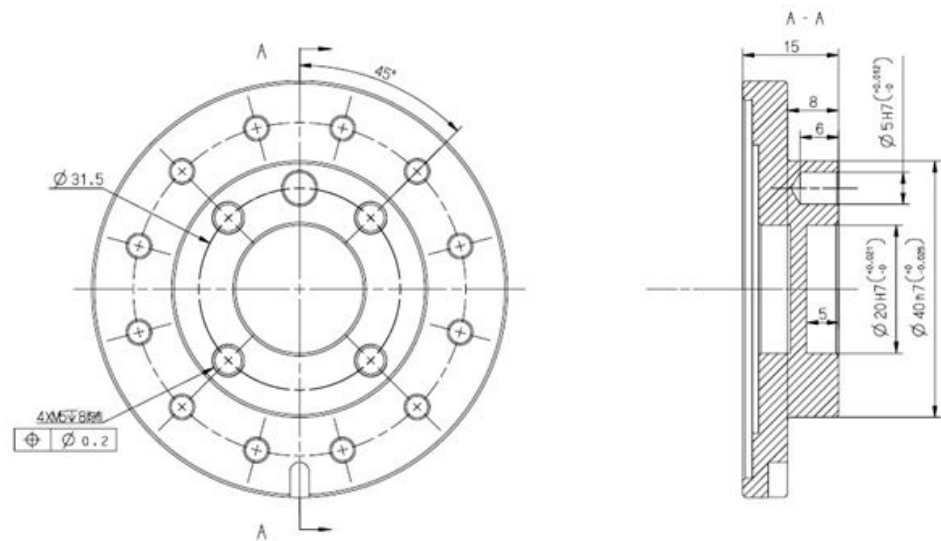
Instructions

Please make robot end fixture by yourself according to actual needs and connect it to the output flange of the wrist. The size of the output flange is shown below. The strength of the fixed hexangular set screw is grade 12.9. The shape and size of the fixture installed on the output flange may affect the rotation range of the robot shaft. Please pay attention to the interference area at the end of the fixture in the design.

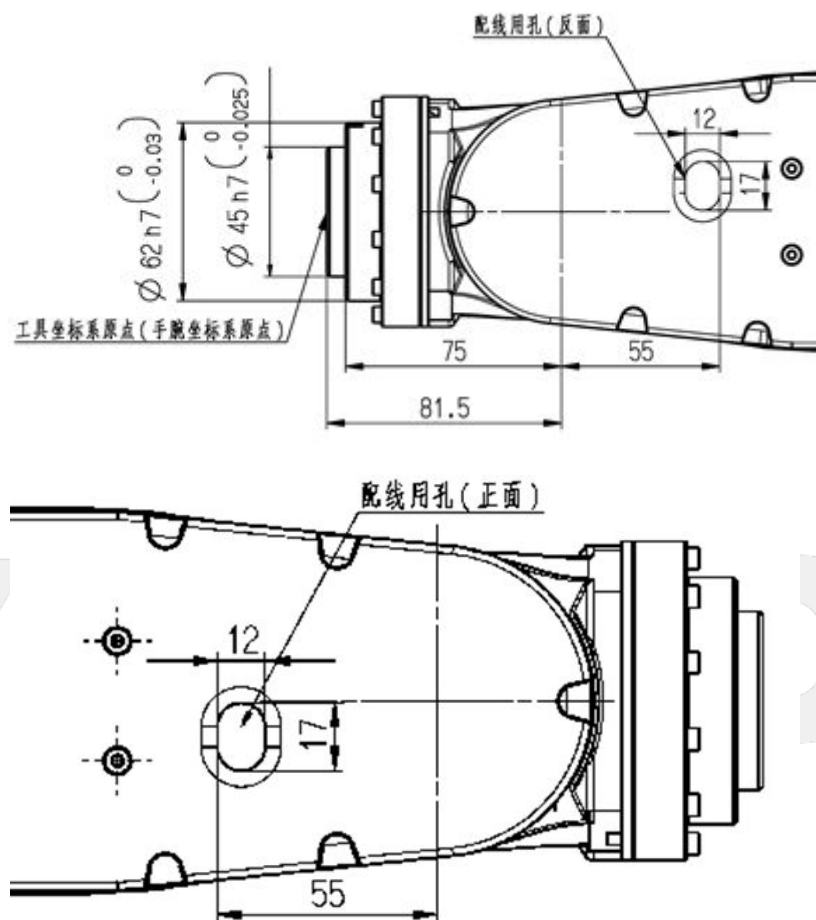
LRA596-4-6A-R The output flange of the robot is shown in the figure below:

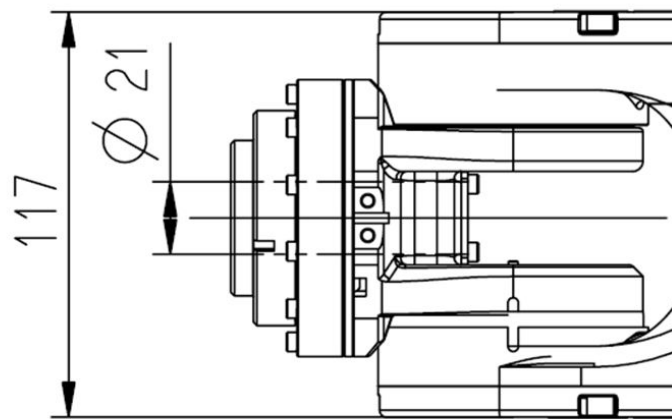
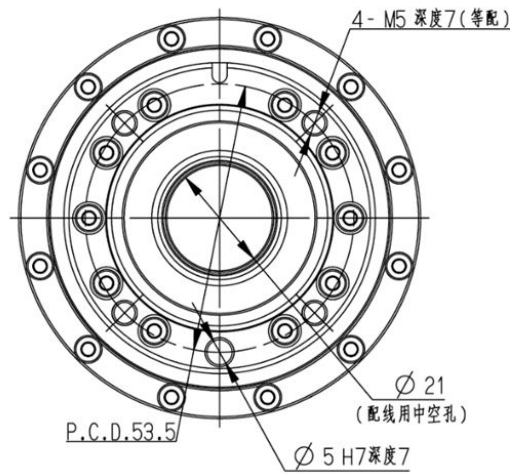


LRA707-7-6A-R/LRA906-7-6A-R The output flange of the robot is shown in the figure below:

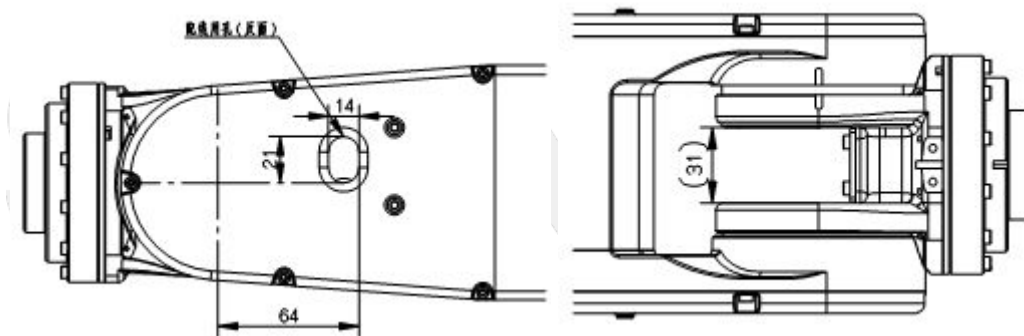


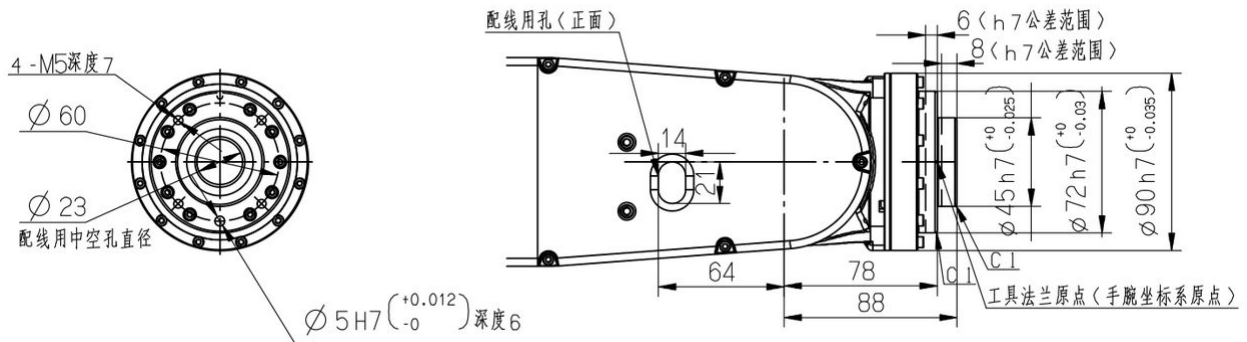
LRA596-4-6H-R The output flange of the robot is shown in the figure below:





LRA707-7-6H-R/LRA906-7-6H-R The output flange of the robot is shown in the figure below:





4.4 3.4 Load diagram



Warning

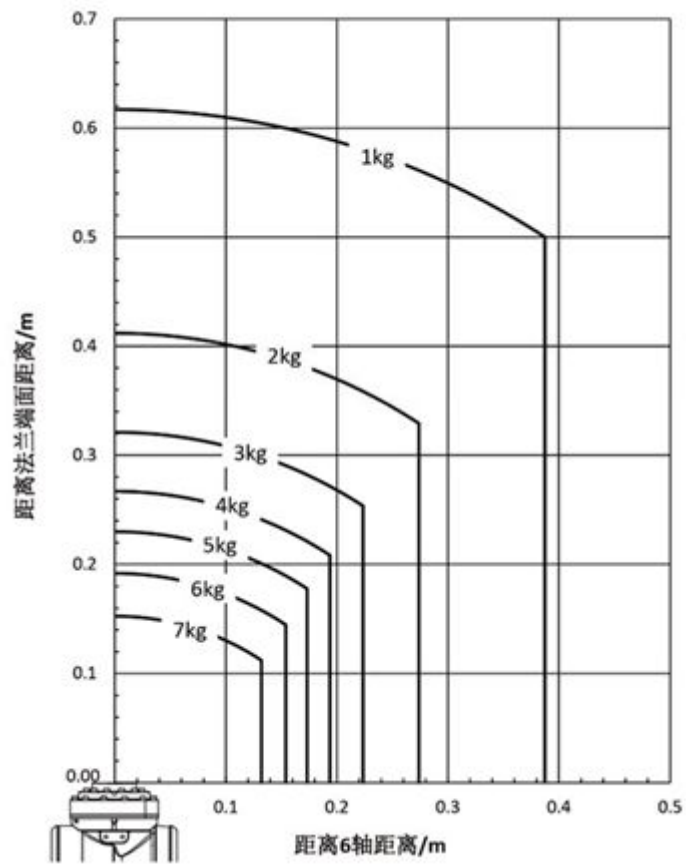
Using incorrect load data may cause the robot to overload!

If a load other than the load diagram is used, the motor, reducer and other parts of the robot may be damaged due to overload!

LRA707-7-6A-R/LRA906-7-6A-R Load diagram

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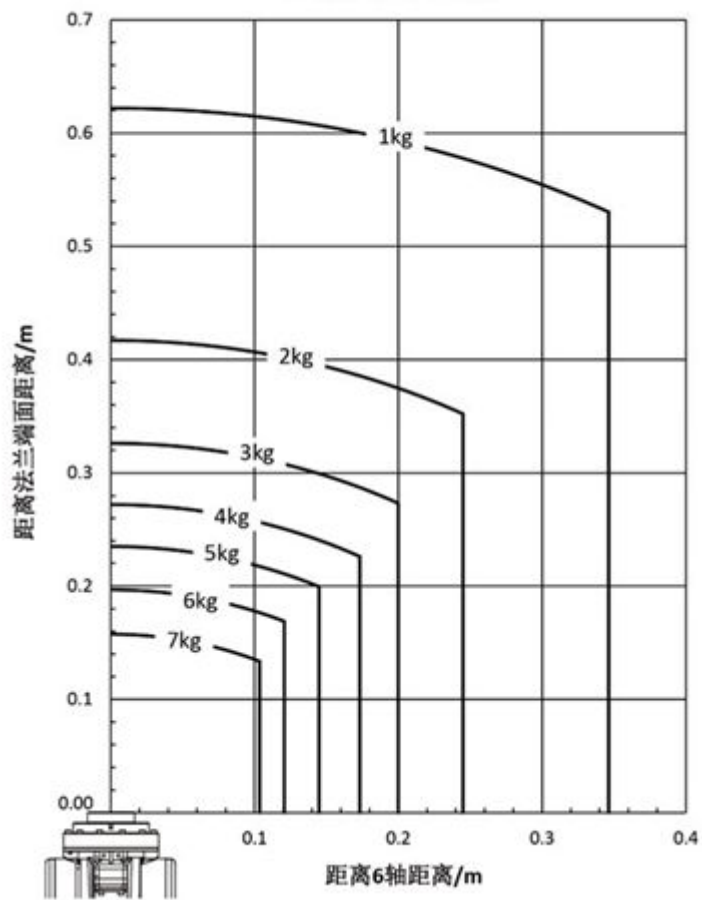
手腕负载曲线图



LRA707-7-6H-R/LRA906-7-6H-R Load diagram

SYNTEC

手腕负载曲线图



SYNTEC

5 4 The installation

5.1 4.1 Environmental Conditions

Description

The working environment of the robot shall meet the following conditions:

Item	Conditions
Temperature	0°~+40°
Relative humidity	20%~80%, Shall not be dew
Circumstance	<ul style="list-style-type: none"> • Indoor installation • Avoid sunlight • Keep away from dust, fume, salt, iron filings, etc • Stay away from flammable, corrosive liquids and gases • Do not contact with water • Do not transmit shocks and vibrations • Stay away from electrical interference sources



Reminder

At low temperatures (<10°C), the grease (or lubricating oil) in the reducer (or gearbox) is of high viscosity, which may cause shutdown or inefficient operation of the robot. It is recommended that the robot preheat together with other supporting equipment.

5.2 4.2 On-site installation

4.2.1 Handling

Description

When handling, in principle should use crane and other lifting equipment, in the absence of lifting equipment can also be considered by manual handling. The handling of a device should be carried out by at least 2 people at the same time. It is necessary to pay attention to safety and handle the device lightly at the same time to avoid damage to the equipment and the surface of the robot.



Warning

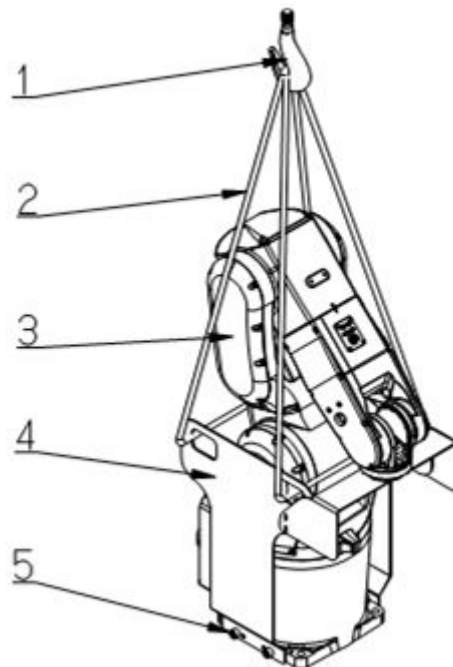
The body of the robot weighs about 52kg, Be sure to use rings with M6×10 threads and hooks and ropes with a load of over 100kg. Sling or wire rope with protection is recommended to prevent the sling from damaging the body paint. Lifting a robot in any position other than the recommended position may cause the robot to tip over and cause serious damage or injury!

**Warning**

Under any circumstances, no person is allowed to be under the lifting robot.

**Danger**

Make sure to turn off all power, hydraulic and air sources of the robot during transportation.



1 Driving 2 Sling 3 Lifting Limit Bracket 4 Lifting Bracket 5 ScrewM5×20

5.2.1 4.2.2 Installation

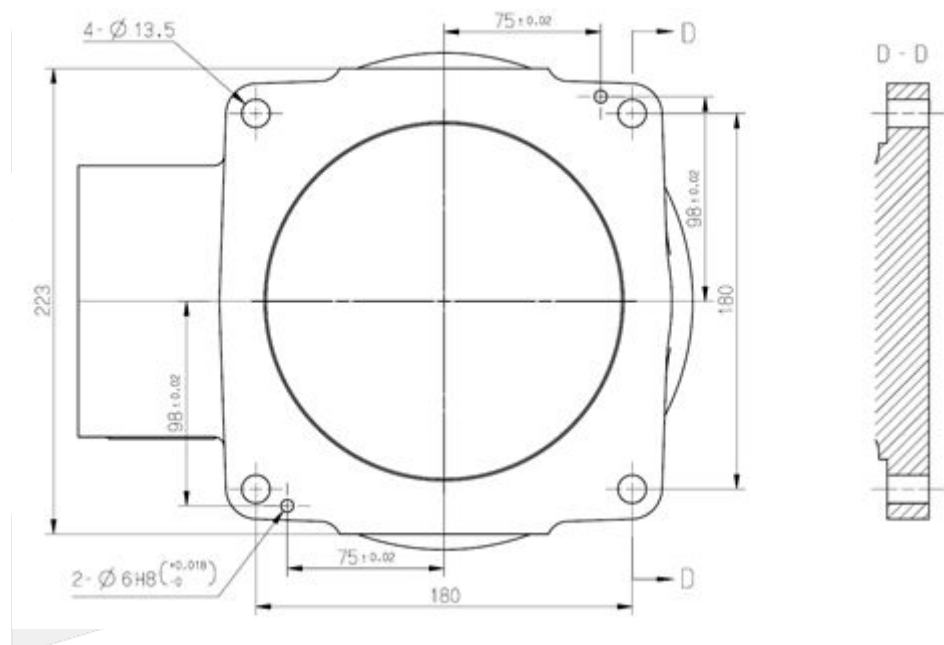
Installation Instructions

When the robot accelerates or decelerates, a large reaction force will be generated in all directions of the base. Therefore, in the installation of the robot, the foundation must be able to bear the static load and the reaction force during acceleration and deceleration to ensure that the base of the robot is firm and does not move. Robot base by 2 - Φ 6 pin positioning (recommended with the convenient disassembly threaded cylindrical pin, GB/T 120.1 2000), And fasten it with 4-M12 screws (in order to prevent screw loosening, it must be used with flat pad and spring pad). See the table below for screw requirements.

Screw	M12×35
Quantity	4
Strength Level	12.9
Tightening torque	55±5Nm

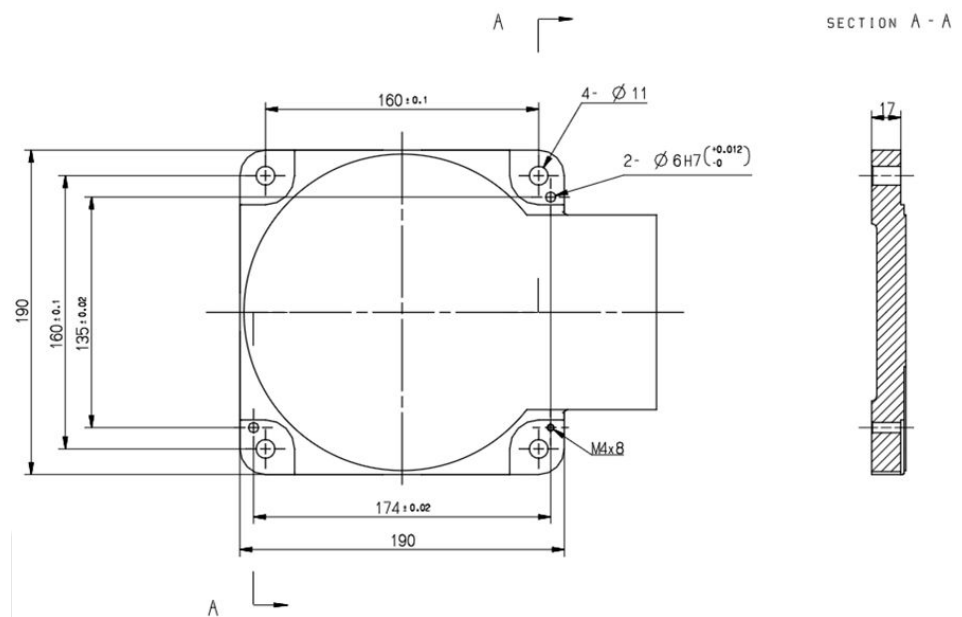
Base hole size

LRA707-7-6A-R/LRA906-7-6A-R/LRA707-7-6H-R/LRA906-7-6H-R The bottom hole size of the robot is shown in the figure below:



LRA596-4-6A-R/LRA596-4-6H-R

SYNTEC



Reminder

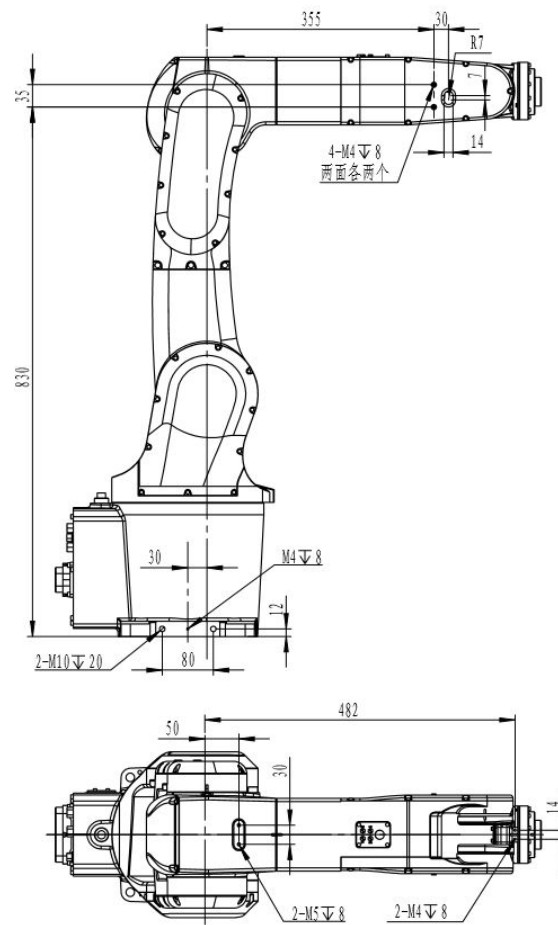
To avoid deformation of the robot base during installation, please control the flatness of the installation panel within 0.2mm. In addition, the screw hole for the ground wire of the base is M4, and the ground wire connection method is shown in 4.3.2.

5.2.2 4.2.3 Mechanical Interface

5.2.3 Mechanical Interface

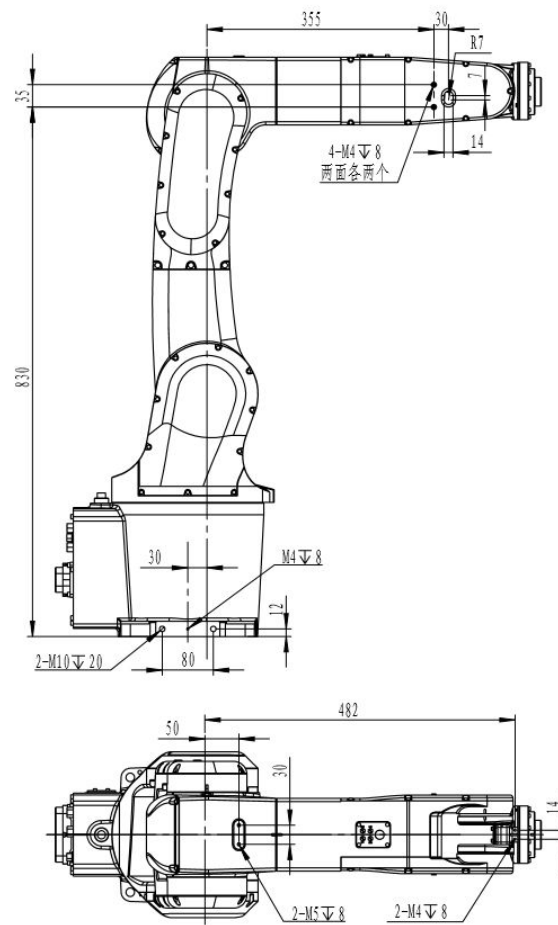
robot's wrist, upper arm, lower arm and waist joints can add extra load. The installation interface is shown in the figure below. To ensure the service life of the thread, do not remove the interface mounting screw frequently. The total load of the wrist and forearm should not exceed 7kg. For example, if the wrist load is 6kg, the extra load on the forearm should be controlled within 1kg.

LRA707-7-6A-R External interface diagram:



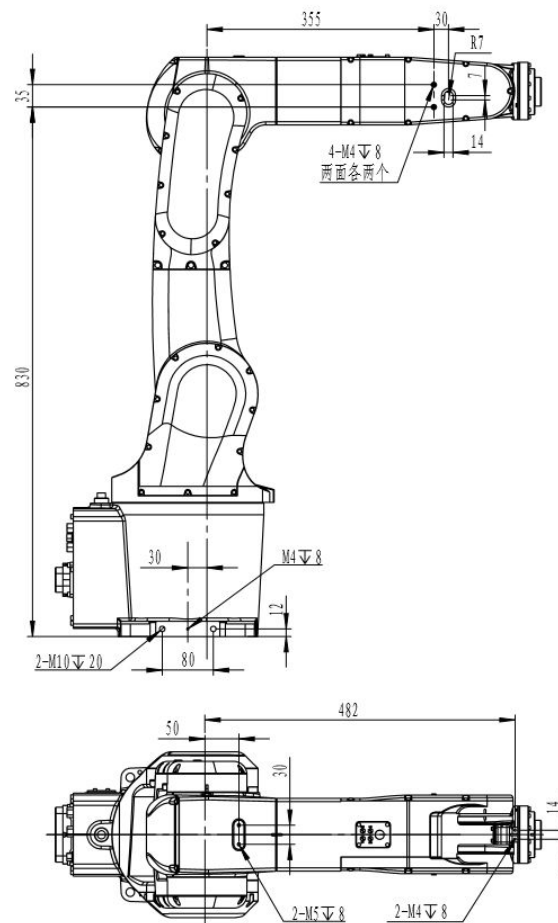
LRA906-7-6A-R External interface diagram:

SYNTEC



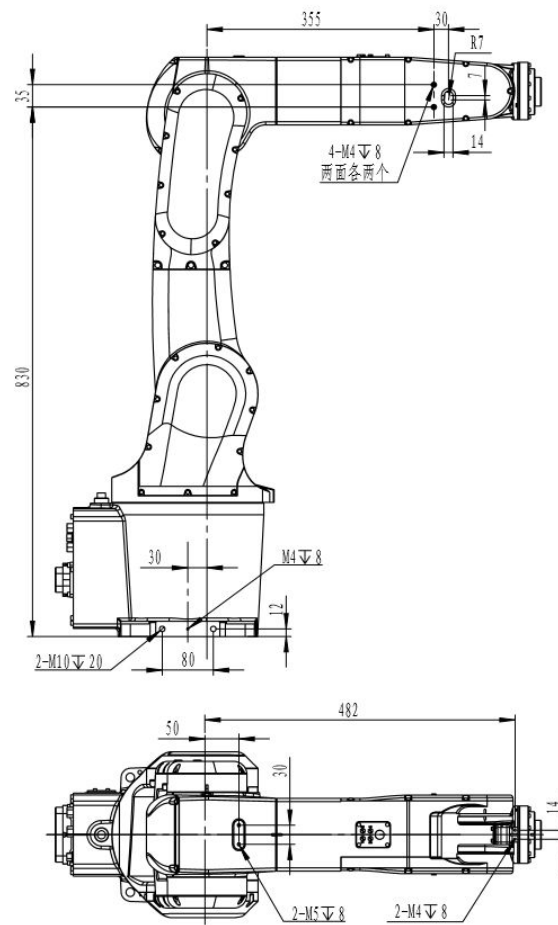
LRA596-4-6A-R External interface diagram:

SYNTEC



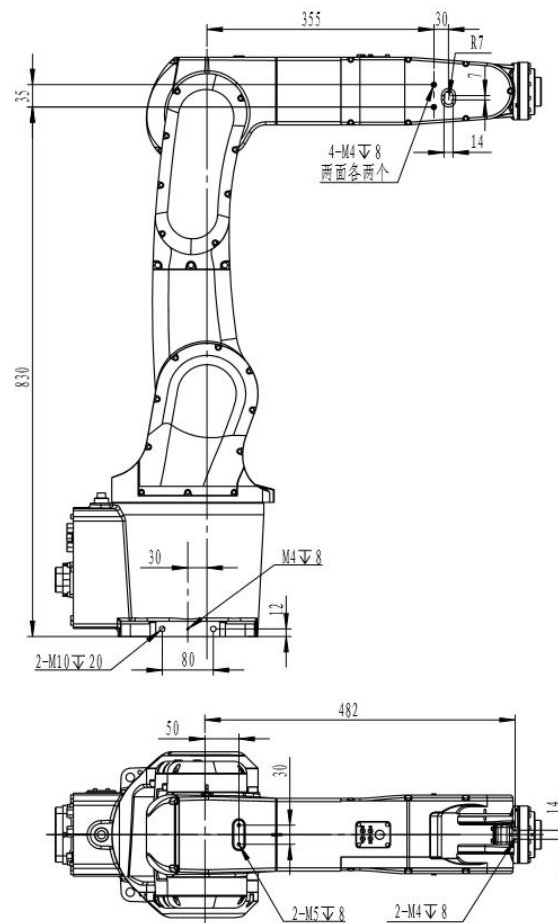
LRA596-4-6H-R External interface diagram:

SYNTEC



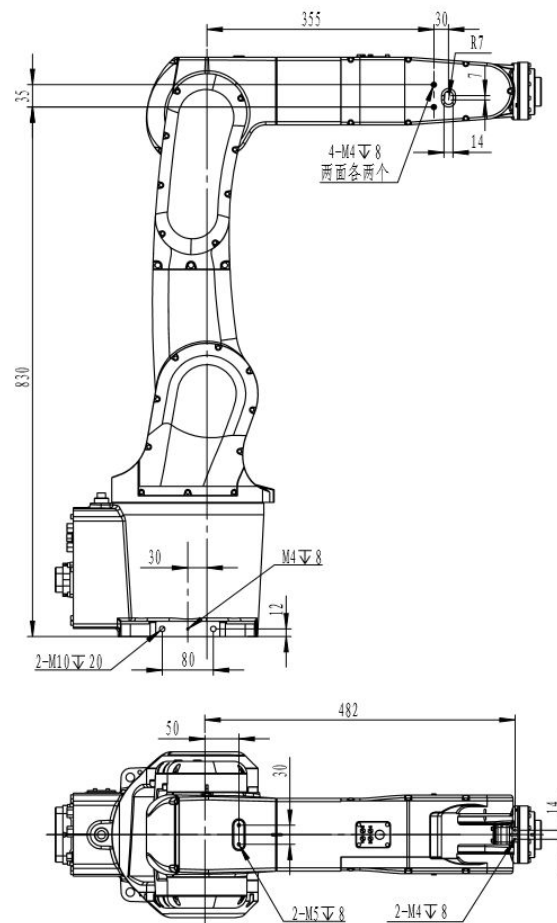
LRA707-7-6H-R External interface diagram:

SYNTEC



LRA906-7-6H-R External interface diagram:

SYNTEC



5.3 4.3 Electrical connections

4.3.1 Wiring connection



Warning

- Do not mistake the connection when connecting the robot to the controller. If the wrong connection is made, not only will the robot system not be able to operate normally, but it may also cause security problems. Please refer to the controller manual for details.
- Only certified operators or personnel should perform wiring job. If the wiring job is performed by a person who do not have relevant knowledge, it may result in injury or malfunction.



Beware of electric shocks

- Be sure to perform replacement work after turning off the controller and related equipment and unplugging the power plug. If you work with the power on, it may cause electrical shock or malfunction.

- Be sure to connect the AC power cable to the power plug. Do not connect directly to the plant power supply. Turn off the power to the robot system by unplugging it. AC power cables are extremely dangerous to operate when connected to factory power and may cause electrical shock and/or robot system failure
- Be careful not to forcibly bend the cable, etc. to avoid applying load to the cable. In addition, do not place heavy objects on the cable, forcibly bend or pull the cable. Otherwise, it may cause cable damage, disconnection, or poor contact, resulting in electrical shock or abnormal system operation.
- Before wiring, turn off the power supply of the controller and related devices and pull up the warning sign (e.g. never switch on the power). Wiring while energized is extremely dangerous and may cause electrical shock and/or robotic system failure.

5.3.1 4.3.2 User Wiring

Wiring



Warning

Only certified operators or personnel should perform wiring job. If the wiring job is performed by a person who do not have relevant knowledge, it may result in injury or malfunction.



Danger

- The ground terminal must be connected to the ground pole (5.5mm² diameter or above is recommended), otherwise, fire and electric shock may occur.
- Before wiring, turn off the power supply of the controller and related devices and pull up the warning sign (e.g., never switch on the power). Wiring while the power is on is extremely dangerous and may cause electric shock and/or malfunction of the robotic system failure.

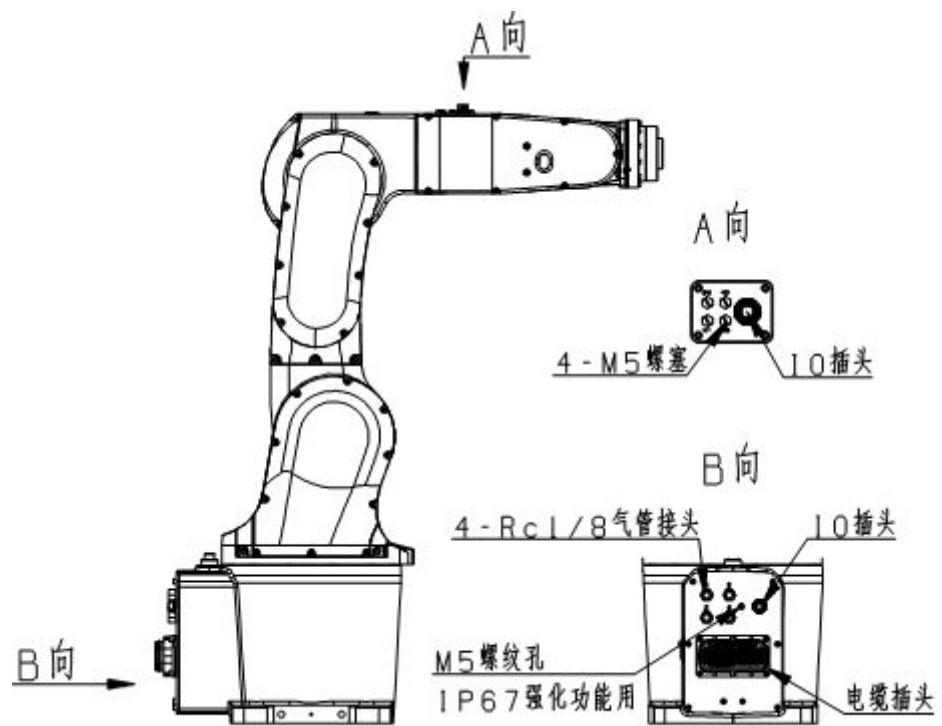
For user wiring, please refer to the position of each pipeline interface in the figure below. The specifications of the IO cable plug and air hose are shown in the table below.

When using, please replace the M5 screw plug in the view A with an M5 threaded air pipe connector (recommended to use the KQ2S04-M5A quick-change connector of SMC);

when connecting the air hose to the B direction, please remove the plug first, and then install the Rc1/8 air pipe connector (It is recommended to use SMC's KQ2H04-01S

straight-through connector). When using the IP67 enhanced function, you need to enable the reserved start interface and use the air source processing component. For details, please contact Leantec.

Name	Specification
IO cable	8 core
Air hose	Φ4



5.3.2 4.3.3 IO Wiring Definition

The IO connection method of the electric cabinet of R series arm is to transfer 16 I points and 16 O points to the side panel of the electric cabinet. The sheet metal opening is provided with 4 rows of IO external interfaces and two rows of common terminal interfaces. The top row is the 24V common terminal and the bottom row is the 0V common terminal, as shown in the figure below:



The I board module has two connection methods, one is the PNP connection method, the common terminal on the I board is connected to the power supply 0V, 16 DI ports receive high-level signals as valid signals; the other connection method is NPN connection The common terminal on the I board is connected to the power supply 24V, and 16 DI ports receive low-level signals as valid signals;

6 5 Maintenance

6.1 5.1 About safety during maintenance

Instruction



Warning

- Please strictly follow the maintenance steps and do not disassemble robot parts.
- Maintenance operations should be performed by designated professionals.
- If not trained, stay away from the robot when the power is switched on. Also, do not enter the action area. Even if the robot appears to have stopped moving, a robot in an energized state may still act accidentally and pose a serious safety problem.
- Be sure to confirm the robot action after the replacement of the component outside the security fence. Otherwise, the robot before action confirmation may perform unexpected actions and may cause serious safety problems.
- Before entering normal operation, please confirm that the emergency stop switch and safety guard switch operate normally. If the switch cannot be operated normally, it will be unable to perform the safety function in case of emergency, which may lead to serious injury or significant damage, which is very dangerous.



Beware of electric shock

Maintenance, replacement and wiring must be carried out after the power supply of the controller and related devices is turned off and the power plug is unplugged, otherwise power contact or failure may occur

6.2 5.2 Maintenance plan

Instruction

In order for the robot to maintain high performance for a long time, it must be maintained regularly. Maintenance personnel shall compile maintenance plans and strictly implement them.

In addition, the overhaul must be carried out every 20,000 hours or within a shorter period of 4 years. If you have any questions, please contact our after-sales service department

6.2.1 5.2.1 Check interval

Inspection instructions

S/ N	Item check	Position	Interval
---------	------------	----------	----------

			Us ua l	1 month	3 mont hs	6 month s	12 months
1	If the screw is loose, tighten it (Tightening torque refer to 5.2.2 Tightening of hexagon socket screw)	External visible screw	●				
		Screw around the shaft					●
		Screws for motor, reducer, etc					●
2	If the plug is loose, please press it tightly	External connectors on the robot	●				
		Robot cable		●			
3	Check for external damage and remove dust from the surface	Robot appearance	●				
		The external cable		●			
4	If the belt is loose, please tighten it again	2/3/4/5/6 axis				●	
5	Encoder battery cell	In the case of a low battery error warning when the software starts, or replace the battery every 1.5 years. (For the IP67 protection level, the electrical installation panel needs to be coated with Tianshan 1527W sealant when replacing the battery)					

6.2.2 5.2.2 Tightening of hexagon socket screws

Tighten instructions

Use hexagon socket head screws (hereinafter referred to as screws, class 12.9) where connection strength is required. When assembling, tighten the screws according to the fastening torque shown in the following table. Except as specifically specified, when

refastening these screws in the operations described in this manual, use a torque wrench to tighten the screws by the tightening torque values shown in the table below.

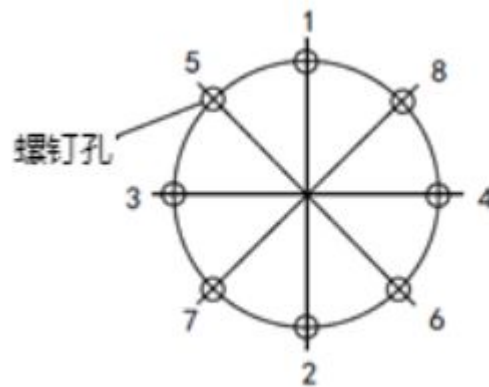
S/N	Hex cylinder head screw	Torque (N•m)
1	M2	0.5
2	M3	2
3	M4	4
4	M5	9
5	M6	15
6	M8	35
7	M10	70
8	M12	125

Please refer to the following table for the torque of the setting screw used in belt pulley installation: :

S/N	Hex cylinder head screw	Torque (N•m)
1	M4	2
2	M5	3.9

It is recommended to fix the screws on the circumference in diagonal order as shown in the figure below. When fixing, do not tighten the screw once, but use hexagon wrench to tighten it 2~3 times, and then use torque wrench to tighten it according to the tightening torque value as shown in the table above.

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6.3 5.3 The maintenance of synchronous belt

Reminder



Reminder

Synchronous belt adjustment and maintenance require professional staff to use professional tools to operate, after the replacement of the robot to zero calibration! If you have any problem during the adjustment, please call us!

LRA707-7-6H-R/LRA906-7-6A-R Robot 2, 3, 4, 5, and 6 axis should be used in synchronous belt transmission, loose when may lead to abnormal sound, precision decline, such as fault, so for every six months inspection on synchronous belt, prevent synchronous belt loose lead to failure.

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同步带型号-张紧力-单位重量设置总表				
宽度 型号	4mm	6mm	9mm	单位重量
2GT	9.4±1N	15.8±1.6N	25.2±2.5N	1.3
3GT	20±2N	29±3N	44±5N	2.5
5GT			55±6N	4

序号	位置	同步带名称	张力计设置张紧力	张力 (Nm)	螺栓	双面齿锁紧垫片	扭力
1	2轴	365-5GT-9	M4 + W9 + S108	55±6	3-M5x16	3-M5	9Nm
2	3轴	399-3GT-6	M2.5 + W6 + S128	29±3	3-M4x12	3-M4	4Nm
3	4轴	195-3GT-6	5kg重块垂直挂在M3x30螺栓	29±3	2-M4x16	2-M4	4Nm
4	5轴	255-3GT-4	M2.5 + W4 + S121	20±2	2-M4x16	2-M4	4Nm
5	6轴	339-3GT-4	M2.5 + W4 + S77	20±2	2-M4x16	2-M4	4Nm

序号	位置	同步带名称	张力计设置张紧力	张力 (Nm)	螺栓	双面齿锁紧垫片	扭力
1	2轴	385-5GT-9	M4 + W9 + S118	55±6	3-M5x16	3-M5	9Nm
2	3轴	432-3GT-9	M2.5 + W9 + S144	44±5	3-M5x16	3-M5	9Nm
3	4轴	201-3GT-6	M2.5 + W6 + S49	29±3	2-M4x20	2-M4 (双+平)	4Nm
4	5轴	309-3GT-4	M2.5 + W4 + S107	20±2	2-M4x16	2-M4	4Nm
5	6轴	309-3GT-4	M2.5 + W4 + S107	20±2	2-M4x16	2-M4	4Nm

序号	位置	同步带名称	张力计设置张紧力	张力 (Nm)	螺栓	双面齿锁紧垫片	扭力
1	3轴	490-5GT-9	M4 + W9 + S170	55±6	4-M5x16	4-M5	9Nm
2	4轴	225-3GT-9	M2.5 + W9 + S48	44±5	3-M5x16	3-M5	9Nm
3	5轴	303-3GT-6	M2.5 + W6 + S103	29±3	2-M4x16	2-M4	4Nm
4	6轴	303-3GT-6	M2.5 + W6 + S103	29±3	2-M4x16	2-M4	4Nm

序号	位置	同步带名称	张力计设置张紧力	张力 (Nm)	螺栓	双面齿锁紧垫片	扭力
1	3轴	500-5GT-9	M4 + W9 + S175	55±6	3-M5x20	3-M5 (双+平)	9Nm
2	4轴	225-3GT-9	M2.5 + W9 + S48	44±5	2-M5x20	3-M5 (双+平)	9Nm
3	5轴	339-3GT-6	M2.5 + W6 + S116	29±3	2-M4x16	2-M4 (双+平)	4Nm
4	6轴	339-3GT-6	M2.5 + W6 + S116	29±3	2-M4x16	2-M4 (双+平)	4Nm

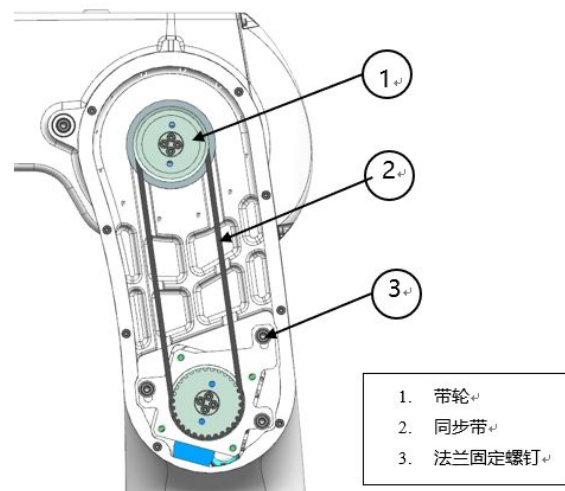
序号	位置	同步带名称	张力计设置张紧力	张力 (Nm)	螺栓	双面齿锁紧垫片	扭力
1	3轴	500-5GT-9	M4 + W9 + S175	55±6	3-M5x20	3-M5 (双+平)	9Nm
2	4轴	225-3GT-9	M2.5 + W9 + S48	44±5	2-M5x20	3-M5 (双+平)	9Nm
3	5轴	339-3GT-6	M2.5 + W6 + S116	29±3	2-M4x20	2-M4 (双+平)	4Nm
4	6轴	339-3GT-6	M2.5 + W6 + S116	29±3	2-M4x20	2-M4 (双+平)	4Nm

备注：
1. 由于张力计上的切线长度不能设置小数，所以参数s全部根据实际长度进行圆整（四舍五入）；

6.3.1 5.3.1 3rd-axis synchronous belt maintenance

Instruction





Remove the left cover of the boom and measure the tension of the belt with a belt tension meter.

The standard tension of the timing belt is between $55\pm 6\text{N}$ (the tension of the timing belt will drop to about 70% of the recommended value after 20 hours of operation).

At this time, please install 70% of the recommended value to adjust the tension). If the measurement result is not within this range, adjust according to the following steps:

- Loosen the flange fixing screw (3 M4 in total, loosen until the belt wheel can move freely).
- Tighten the belt and measure the tension of the belt until the tension reaches the design requirements.
- Tighten the flange fixing screw (tightening torque: see "5.2.2 Tightening of hexagon socket screw").
- Remove tensioning screws and tool screws.
- Install upper arm right cover.

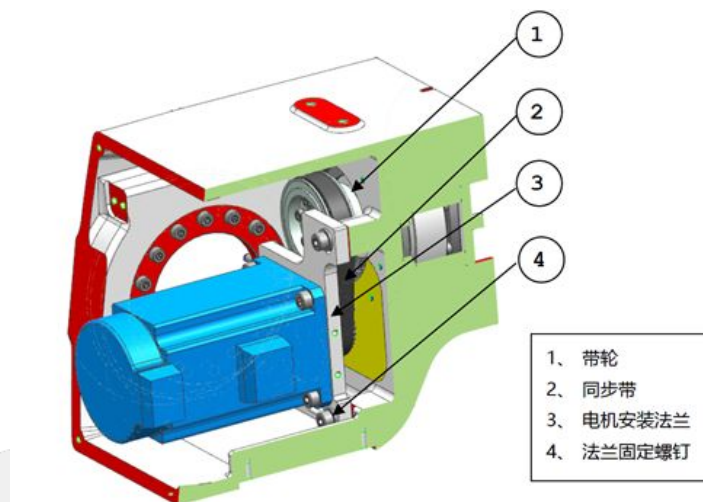
Note: For products with IP67 protection grade, it is necessary to clean the residual glue of the right arm cover and install the right arm cover after using the new sealant between the cover plate and body.

If the synchronous belt is found to be damaged, please replace it in time. After the replacement, zero calibration of the robot shall be performed again.

6.3.2 5.3.2

6.3.3 4th axis synchronous belt maintenance

Instructions



Remove the small cover at the lower part of the forearm, and measure the tension of the belt with a belt tension meter.

The standard tension of the synchronous belt is $44 \pm 5\text{N}$ (the tension of the synchronous belt will drop to 70% of the recommended value after 20 hours of operation).

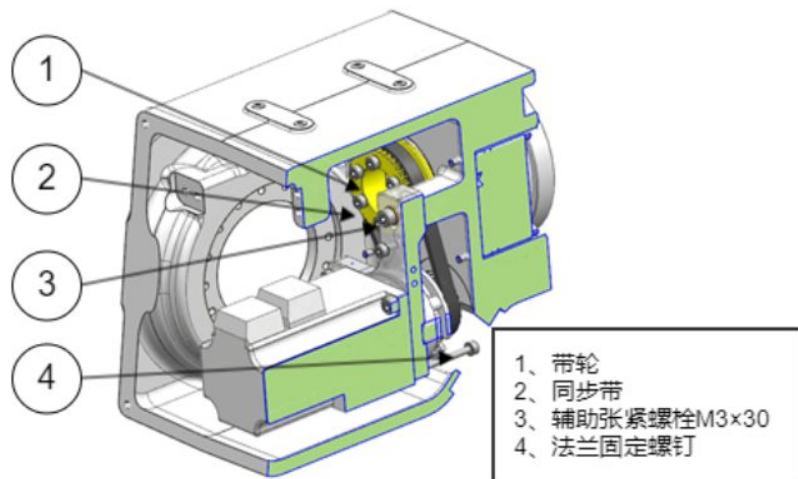
At this time, please adjust the tension by 70% of the recommended value). If the measurement result is not within this range, adjust according to the following steps:

- Loosen the flange fixing screws (3 in total, so that the pulley can move freely);
- Use a spring balance (maximum tension 200N) to tighten the motor flange tensioning screws (the lower end of the flange has M3 screw mounting holes), and adjust the tension to the specified value;
- Tighten the flange fixing screws (see "5.2.2 Tightening of Hexagon Socket Screws" for the tightening torque);
- Install the small cover;

Note: For products with IP67 protection grade, it is necessary to clean the residual glue of the right arm cover and install the right arm cover after using the new sealant between the cover plate and body.

If the synchronous belt is found to be damaged, please replace it in time. After the replacement, zero calibration of the robot shall be performed again

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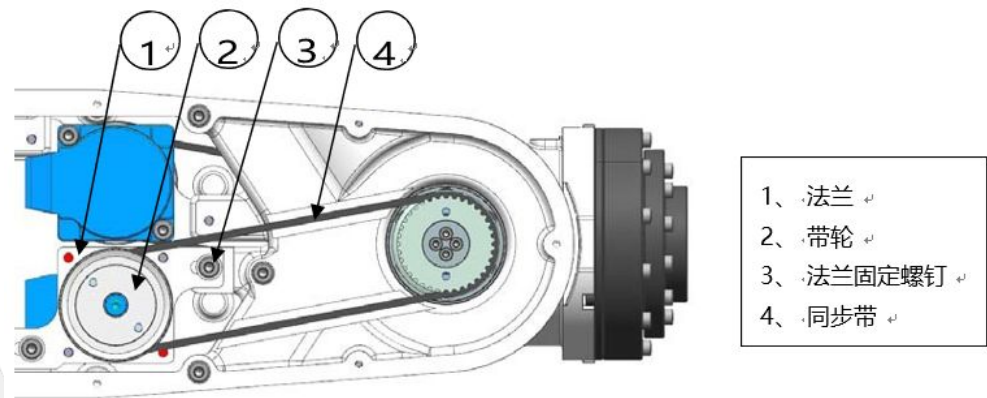


6.3.4 5.3.3

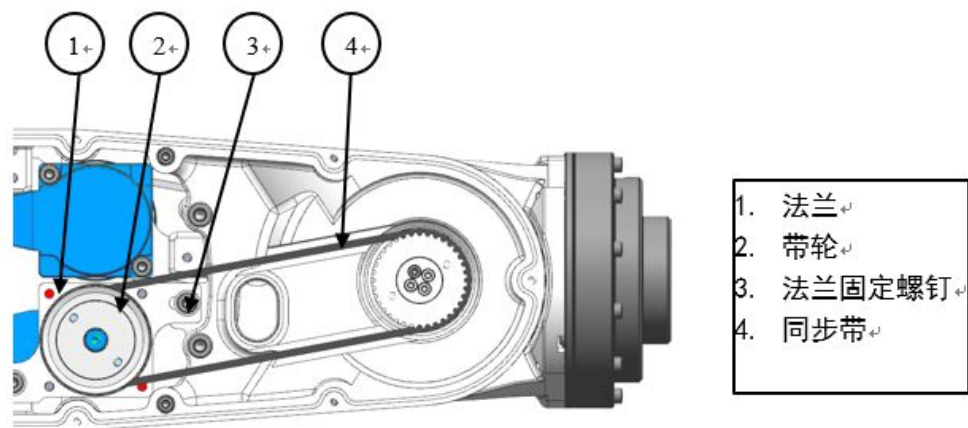
6.3.5 5/6th axis synchronous belt maintenance

Instruction

LRA596-4-6A-R/LRA707-7-6A-R/LRA906-7-6A-R The five and six-axis maintenance of the robot is shown in the figure below:



LRA596-4-6H-R/LRA707-7-6H-R/LRA906-7-6H-R The five and six-axis maintenance of the robot is shown in the figure below:



Remove the cover on the right side of the front section of the forearm, and measure the tension of the belt with a belt tension meter (tension meter setting: M2.5 + W6 +S116). The standard tension of the synchronous belt is $29\pm 3N$. If the result is not within this range, Adjust it follow the step as below:

- Loosen the flange fixing screws (2 in total, just loosen until the pulley can move freely)
- Tighten the pulley with a spring balance to adjust the tension to the specified value;
- Tighten the flange fixing screws (see "5.2.2 Tightening of Hexagon Socket Screws" for the tightening torque);
- Install the O-ring into the arm groove before installing the side cover;

If you find that the timing belt or the sealing ring is damaged, please replace it in time.

The structure of the five-axis and six-axis pulleys is the same, so the maintenance of the six-axis pulley can refer to the five-axis.

6.4 5.3

6.5 Troubleshooting

Instruction

When the robot breaks down, please do not continue to run, you should immediately contact the operator who has received the required training, who will carry out the failure analysis, clearly grasp the phenomenon and determine which part is abnormal. If you need to replace parts, please contact our company's service department, do not disassemble the robot at will.

7 6 The zero point calibration

7.1 6.1 About mechanical zero point calibration

What is mechanical zero point calibration

The robot is designed with an initial attitude defined in advance, under which the Angle of each joint is 0. From a mechanical point of view, the zero point attitude refers to the attitude when a particular Angle is formed between adjacent links. From the perspective of software angular, since the robot USES an encoder to record joint angles, the zero-point attitude refers to the robot's attitude when the servo motor rotates to a specific encoder value.

So mechanical zero can actually be interpreted in two ways. From the perspective of the observer, the mechanical zero point is the robot attitude corresponding to the movement of each joint of the robot to a specific position. From the point of view of the control system, the mechanical zero is the value of several encoders. Zero is the reference point of the robot coordinate system. Without zero, the robot cannot judge its own position. Therefore, in order to obtain the highest absolute positioning accuracy, zero must be calibrated for the robot to make the mechanical zero and the algorithm zero as close as possible.

Under what circumstances should the mechanical zero be calibrated

In general, it is necessary to recalibrate the zero point under the following circumstances:

- After the replacement of motor, synchronous belt, reducer and other mechanical system parts.
- After a violent collision with a workpiece or environment.
- Manually move robot joints without control of the controller.
- Reinstall the entire system.
- Encoder battery after discharge.

7.2 6.2 Zero point calibration

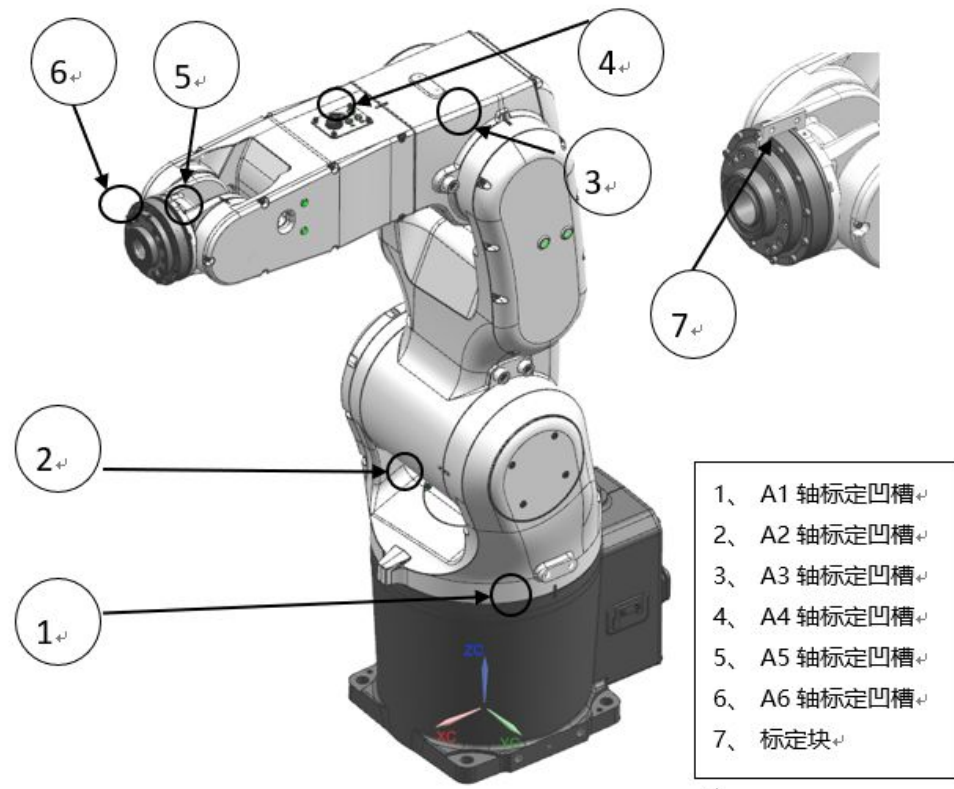
Instruction

The purpose of zero calibration is to make the theoretical zero of the control algorithm coincide with the actual mechanical zero so that the mechanical connecting rod system can correctly respond to the position and speed instructions of the control system.

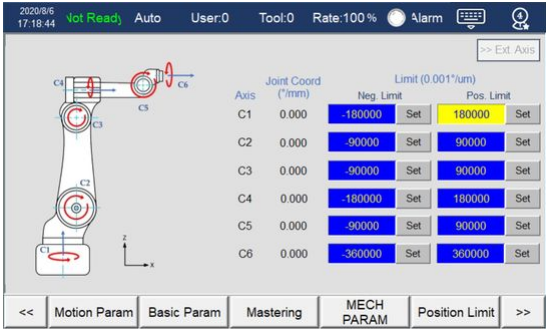
More generally speaking, zero-point calibration is a process in which each joint of the robot is rotated to a specific Angle by using some pre-designed positioning devices on the mechanical body, and the control system is informed to record the numerical values of the motor encoder of each joint at this time.

All joints of R series robots are calibrated by key-code plate, and only one axis can be calibrated at a time. During the calibration, the corresponding joint shall be slowly rotated until the two grooves coincide and a special calibration key shall be inserted (or the standard 3mm wide flat key can be used instead). At this time, the position shall be the zero point position of the axis.

For the six axes, special tools are used to calibrate the zero points as shown in the figure below when leaving the factory. If the user has a high requirement on the path trajectory accuracy and needs to accurately calibrate the zero point of six-axis, it is suggested that the user leave a keyway of 3(+0.01,+0.03)mm in the end tool flange for use with the standard zero calibration block



Calibration steps

	Operate	Deascription																														
1	<p>Log in the system with users above Expert level and enter the zero-point calibration interface。</p>	<p>Zero calibration can only be done in manual mode with no program running.</p> <p>The zero calibration interface is located in the "calibration" classification.</p>  <table border="1" data-bbox="880 1518 1428 1848"> <thead> <tr> <th rowspan="2">Axis</th> <th rowspan="2">Joint Coord (°/mm)</th> <th colspan="2">Limit (0.001°/um)</th> </tr> <tr> <th>Neg Limit</th> <th>Pos Limit</th> </tr> </thead> <tbody> <tr> <td>C1</td> <td>0.000</td> <td>-180000</td> <td>180000</td> </tr> <tr> <td>C2</td> <td>0.000</td> <td>-90000</td> <td>90000</td> </tr> <tr> <td>C3</td> <td>0.000</td> <td>-90000</td> <td>90000</td> </tr> <tr> <td>C4</td> <td>0.000</td> <td>-180000</td> <td>180000</td> </tr> <tr> <td>C5</td> <td>0.000</td> <td>-90000</td> <td>90000</td> </tr> <tr> <td>C6</td> <td>0.000</td> <td>-360000</td> <td>360000</td> </tr> </tbody> </table>	Axis	Joint Coord (°/mm)	Limit (0.001°/um)		Neg Limit	Pos Limit	C1	0.000	-180000	180000	C2	0.000	-90000	90000	C3	0.000	-90000	90000	C4	0.000	-180000	180000	C5	0.000	-90000	90000	C6	0.000	-360000	360000
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	Operate	Description
2	In Jog mode ,robot joint was calibrated from axis 1.	Different robots have different auxiliary devices for zero-point calibration. Please refer to the mechanical body description of the corresponding robot.
3	When the corresponding axis moves to the zero position, click the "calibration" button of the corresponding joint on the HMI to complete the calibration of the joint, and then move on to the next joint.	It is recommended to wait for the calibration of the previous joint to be completed before calibrating the "calibration" button of the next joint
4	Repeat step 3 until all joints of the robot have been calibrated	

**Reminder**

Due to the flexibility of robot joints and connecting rods, in order to ensure higher calibration accuracy, please follow the calibration method from low to high

Read more

For more information about the use, programming and parameter setting of robots, teaching AIDS and control cabinets, please refer to the Operation Manual of New Generation Robot Control System.

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