LA1206-10 Product Manual

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LEANTEC INTELLIGENCE

TRUSTED INTELLIGENT MANUFACTURING SERVICE

Poduct manual

Installation and maintenance

R series

·LA1206-10

About this user manual

Thank you for buying our robot products.

The manual records the precautions for correct installation and use of the solution.

Please read the manual and other related manuals carefully before install and use the solution.

Please keep properly after reading the manual for future accessible anytime.

Unauthorized copy or reproduction of partial or full contents of this manual is prohibited.

The contents of this manual are subject to change at any time without prior notice.

Please correct us if you found any wrong contents or anything which is needed for improvement.

Except as expressly stated in this manual, any contents in this manual shall not be construed as any warranty or guarantee by the Company for personal loss, damage to property, or specific applicability, etc.

The Company shall not be liable for accidental or consequential injury arising out of the use of this manual and the products described therein.

Manual content

This manual contains the following instructions:

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

Reading object

This manual is oriented toward:

- Installers
- Technician

Warranty

The robot and its optional components are delivered after go through 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 provide free repairs for malfunctions that occurred during normal use. (For warranty period, please consult your regional salesperson.)

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

1. Damages or failures caused by improper use and incorrect use without following the manual.

2. Failures caused by the customer's unauthorized disassembly.

3. Damages caused by improper adjustment or unauthorized repair.

4. Damages caused by natural disasters such as earthquake and flood.

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

1 Contents

2 Safety

Personal Safety

Basic Principle

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

- All of the operating procedures must be professionally evaluated and based on relevant industrial safety regulations.
- Operators who work with robots must wear safety equipment suitable for the working environment before performing operations, such as safety vests, safety shoes and safety helmets.
- When personnel encounter danger or other emergency and abnormal situations due to the robot, please press the emergency stop button for the first time, and use the manual mode to move the robot away from the dangerous situation at low speed.
- A safety area must be set outside the working area of the robot, and appropriate safety devices must be used to prevent unauthorized personnel from entering.
    - The operator must be outside the safe area to operate the robot.
    - 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 teach pendant 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.
- Be aware of work piece surface or robot body. The temperature of robot motor and outer shell may be very high after working for long time.
- Pay attention to the robot's gripper 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.
- Pay attention to the electrical components inside the robot and control cabinet. Even if the power has been cut, the energy retained in the device can be very dangerous.
- Climbing on robot is prohibited.

 Warning

- Relevant education training and permission is a must for the person installing the robot.
- In order to protect personal safety, the installation procedures in this manual and related industrial safety regulations must be followed.
- Control box should be away from high voltage and other component that generate electromagnetic field, to prevent the electromagnetic interference which may cause deviation or malfunction of the robot.
- The robot may damage or malfunction if non-original manufacture components used.
- Be careful of the heat source generated by the controller and servo motor.
- Do not excessively bend the power signal cable. Otherwise, it may cause unexpected danger.

- The teach pendant removed from the control cabinet should be properly stored in a safe place away from the robot workstation or control cabinet. The operator should not be misled to think that the teach pendant is still connected to the control cabinet and try to use the unconnected teach pendant to stop the robot when facing dangerous situation.

Precautions for using hydraulic and pneumatic

 Danger

- When using hydraulic and pneumatic in operation, the clamped workpiece may fall due to insufficient pressure or gravity.
- The hydraulic and pneumatic systems need to be equipped with safety valves for emergency use.

2.1 Operate the teach pendant

Instruction

The teach pendant 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 teach pendants 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 teach pendant controller will not cause personal injury or damage in normal use.

Operation and cleaning

 Danger

The programming must be performed outside the safety fence. If you need to enter the safety fence for operation, you must press the emergency stop button.

- Handle it lightly to avoid falling, throwing or a strong impact on teach pendant. Otherwise, it may cause obstacles.
- If the teach pendant experiences a strong shock, verify that the enable switch and emergency stop button are still in normal working conditions 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 teach pendant.
- Do not operate the touch screen with sharp objects, such as a 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 teach pendant. Use a soft cloth and a small amount of water to scrub.

- When not using the USB interface, the protective adhesive cap must be properly fastened. Otherwise, exposure to dust may cause interface failure.

Pendant cable

- Ensure that the staff does not trip over the teach pendant cable and causes the teach pendant to fall.
- Do not squeeze the teach pendant cable. Otherwise, it may damage the inner core.
- Do not place the teach pendant cable at sharp edges, as this may damage the cable sheath.

2.2 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 safety devices such as safety gates, safety light curtains, etc. have some type of safety locking mechanism. If your robot workstation uses an external safety device, 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 "Servo Ready" button on the teach pendant to restore the system from a non-ready state.

2.3 Safety Considerations For Manual Mode

About manual mode

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

Manual mode is used for robot program writing and debugging and participating in the commissioning of the workstation.

Bypass external safety signals

In manual mode, signals from external safety devices such as safety doors and safety light curtains will be bypassed. The system will not be in emergency stop state even if the safety door is opened in manual mode to facilitate commissioning.

2.4 Safety Considerations For Automatic Mode

About automatic mode

The automatic mode is used to run the robot program during the formal production process.

The enable switch will be bypassed in automatic mode, so the robot can operate automatically without personnel involved.

Enable external safety signals

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

Safe fault recovery in processing production

In most cases, robots are part of a production line. Therefore, when robots malfunction, it not only affects the robot workstation itself but also may impact other parts of the production line when issues occur in those areas. Therefore, failures recovery plan should be designed by personnel who is very familiar with the production line to improve safety.

For example, on a production line, the robot needs to grab the workpiece from a conveyor belt. In case of a 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.

Another example, when a welding robot is removed from a production line for routine maintenance, other robots associated with the same process must also be stopped to prevent human injury.

2.5 Emergency Handle

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 a 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 an 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 electrocuted person directly. Otherwise, the rescue personnel may also be electrocuted!

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

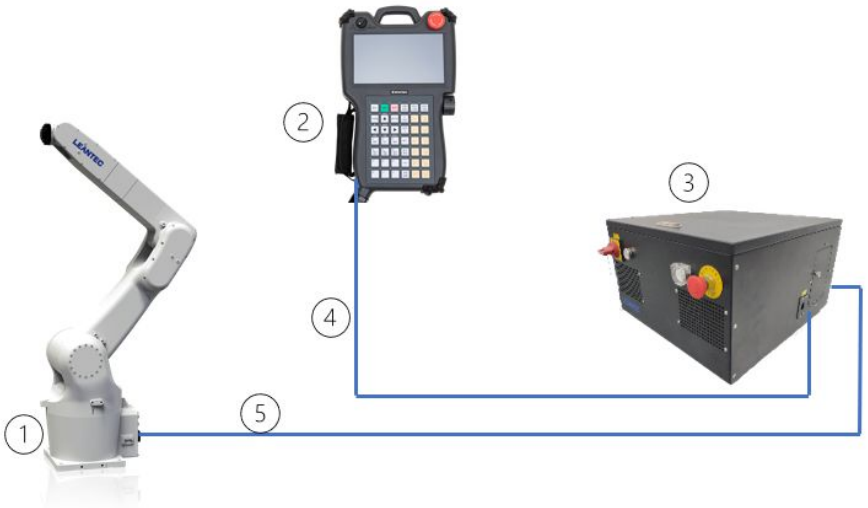
- If the power switch or button is close to the shock point, pull the switch quickly and cut off the power.
- If the power switch or button is far away from the electric shock location, insulated pliers or axes, knives and shovels with dry wooden handle can be used to cut off the power side (i.e., where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

When the wire is attached to or under the body of the electrocute, dry wooden sticks, wooden boards, bamboo poles or other tools with an 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 electrocute.

Treatment of electrocuted wounded person

- 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 ambulance 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.

3 Product Introduction



3.1 Robot System Introduction

System Introduction

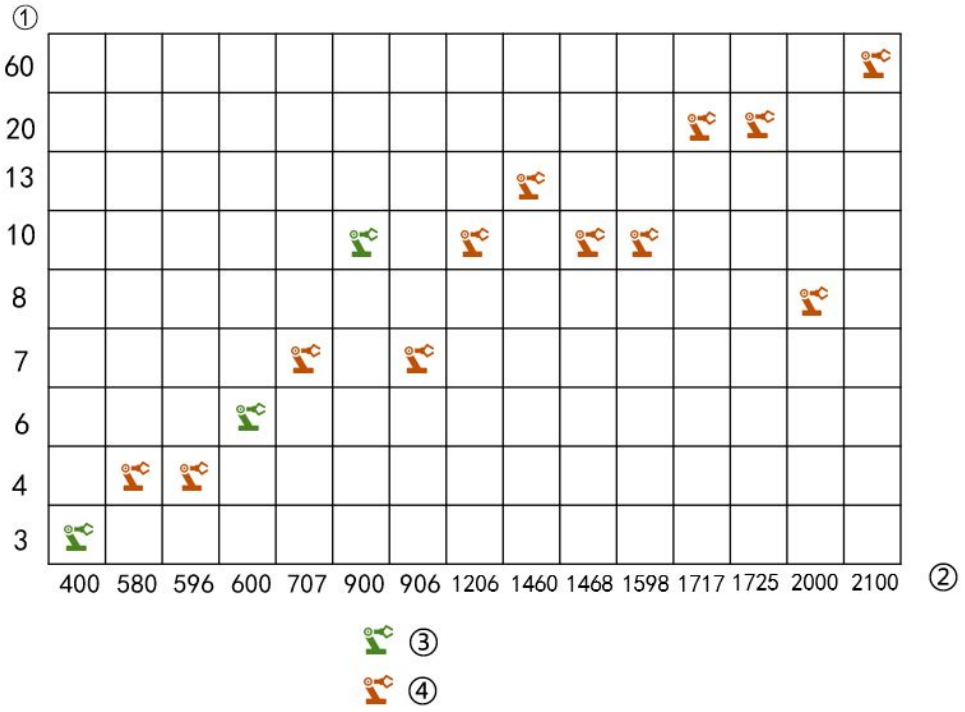
A complete robotic system consists of the robot itself, the controller, the teach pendant, connecting cables, software, end effectors, and other accessories, as shown in the diagram above.

The numbers in the diagram correspond to the following:

- 1 represents the robot.
- 2 represents the handheld teach pendant.
- 3 represents the control cabinet.
- 4 represents the pendant cable.
- 5 represents the cabinet-to-cabinet cable.

3.2 Robot Load Capacity

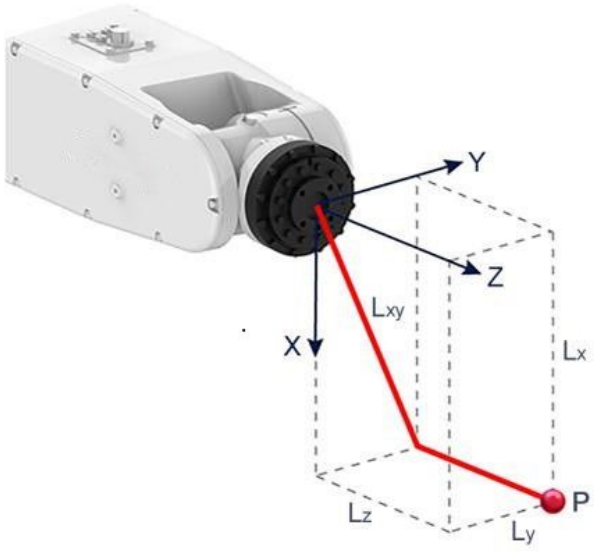
The overall diagram of robot arm load capacity is as follows:



No.	Name
①	Load capacity (KG)
②	Working range (mm)
③	Four-joint robot
④	Six-joint robot

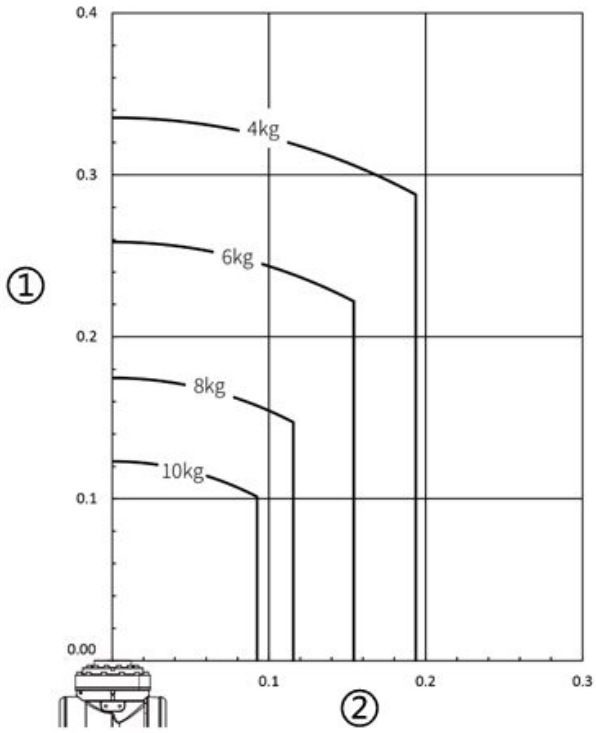
3.2.1 Load Curve

The position of the load center of gravity, point P is determined by the distance from the load center of gravity to the flange surface. The distances in each direction of the load center of gravity are defined as shown in the diagram, and the rated distances for each load are found in the wrist load chart.



No.	Explanation
P	Load center of gravity
L_z	Distance between the load center of gravity and the output flange mounting surface
L_{xy}	Distance between the load center of gravity and the A6 axis

LA1206-10 Wrist Load Diagram as following:



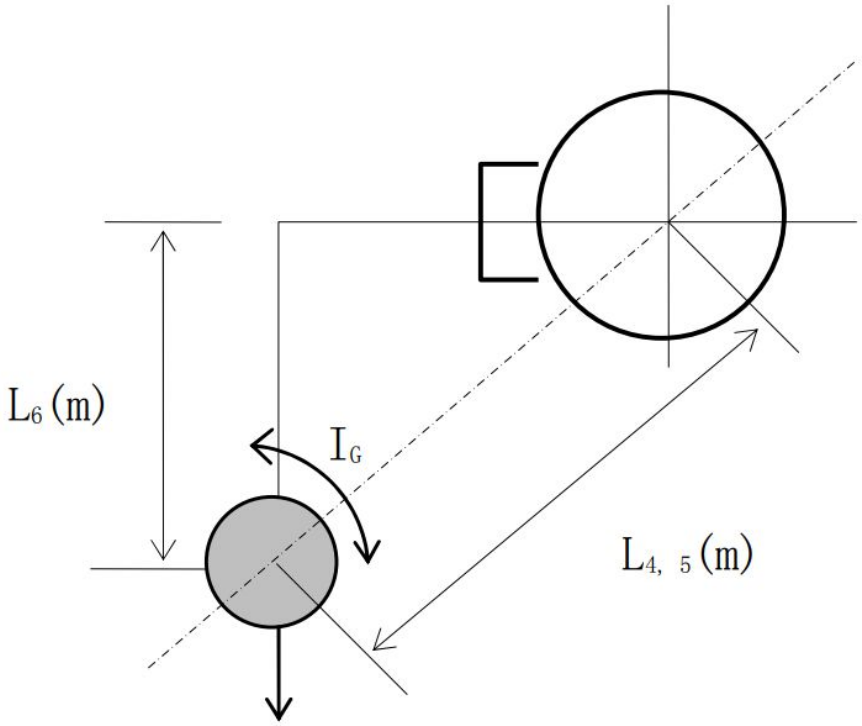
Note: ①: L_z; ②: L_{xy};

3.2.2 Permissible Torque and Inertia

To fully utilize the robot's performance and prevent robot failures and damage caused by overloading, the effective payload installed on the robot must not exceed the permissible torque and permissible inertia.

Axis No.	Permissible Torque N*m	Permissible Inertia kg*m^2
Axis 4	16.6	0.4
Axis 5	16.6	0.4
Axis 6	9.4	0.15

Counting method as following:



L: Distance from the center of rotation axis (JT4/5/6) to the load center (m);

$I_{G:}$ Moment of inertia about the center of gravity (kg*m $^{2)}$;

Load weight: M≤M (MAX)=7kg;

Load torque: T=9.8*M*L (N*m);

Load moment of inertia: $I=M*L^{2}+I_{G}$ (kg*m^2);

3.3 Robot Functions and Planned Applications

Functions and Applications

Industrial robotic arms are electromechanical devices designed to mimic human arms, wrists, and hand functions. They can move any object or tool in accordance with time-varying spatial poses (position and orientation) requirements, thus fulfilling the operational requirements of industrial production. The applications of Leantec industrial robotic arms include: holding welding clamps or welding guns for spot or arc welding on car or motorcycle bodies; handling die-cast or stamped parts or components; performing laser cutting; painting; assembling mechanical components, and so on.

3.4 Basic Principles of the Arm and Key Technologies for Applications

Principles and Technologies

Working Principles: Leantec robotic arm consists of three parts - the six-joint arm, the power distribution cabinet, and the 81R teach pendant controller. The hand-held controller sends commands to two Syntec three-in-one drivers, which drive the six motors on the arm to rotate in a regular pattern, thereby controlling the movement path of the sixth-axis end effector's rotation center.

Key Technologies:

1.High-speed and High-precision Control:

After user programs through the teach pendant's human-machine interface, corresponding action programs are generated. After high-speed and high-precision motion planning, the position commands are transmitted to the lower-level controller (driver) at each interpolation time via serial communication, allowing the lower-level controller to perform servo motor command planning.

2.Servo Motor Control:

Upon receiving position commands from the upper-level controller, the driver further plans motor commands, sending motor commands for each interpolation interval to the servo motor and drive the gearbox.

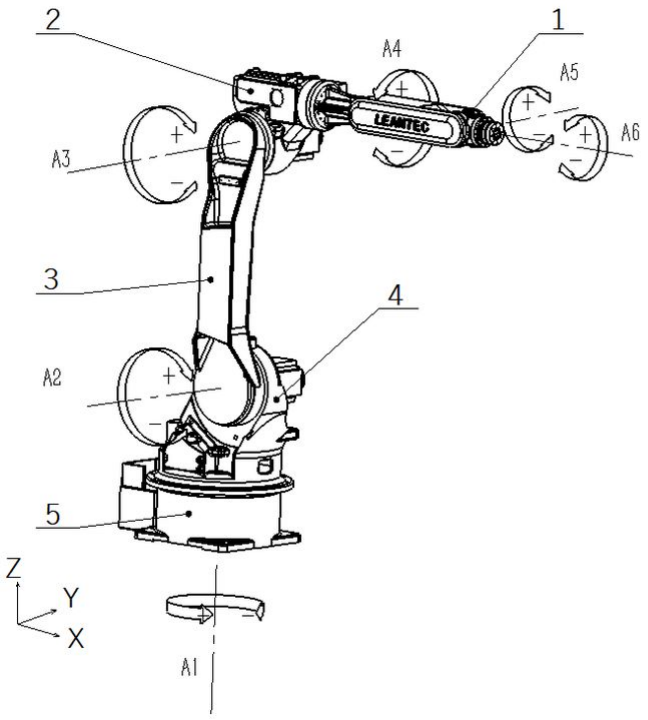
3.By completing the above two steps, the arm body is operated by the gearbox, executing the motions edited by the user to meet the requirements of welding, handling, and other application scenarios.

3.5 Robot Main Body Introduction

Main Body Introduction

The robot's main body primarily consists of cast aluminum alloy components, with a total of 6 degrees of freedom, and each joint motor is equipped with a brake. The main body is composed of the following parts:

- Wrist - The wrist has three degrees of freedom and is located at the robot's output end, including Axis 4, Axis 5, and Axis 6.
- Forearm - The forearm is located between the upper arm and the wrist joint, driven by the Axis 3 motor.
- Upper Arm - The upper arm is situated between the forearm and the waist joint, driven by the Axis 2 motor.
- Waist - The waist is located between the upper arm and the base, driven by the Axis 1 motor.
- Base - The base serves as the foundation of the entire robot, with its rear housing the robot's electrical interfaces.



Movements of Each Axis:

- Axis A1: Rotation of the entire robotic arm.
- Axis A2: Pitch of the upper arm.
- Axis A3: Pitch of the forearm.
- Axis A4: Rotation of the forearm.
- Axis A5: Swing of the wrist. Axis
- A6: Rotation of the wrist.

4 Technical Specifications

4.1 Specification Parameters

Performance Parameters Table

The performance parameters of the robot are as shown in the table.

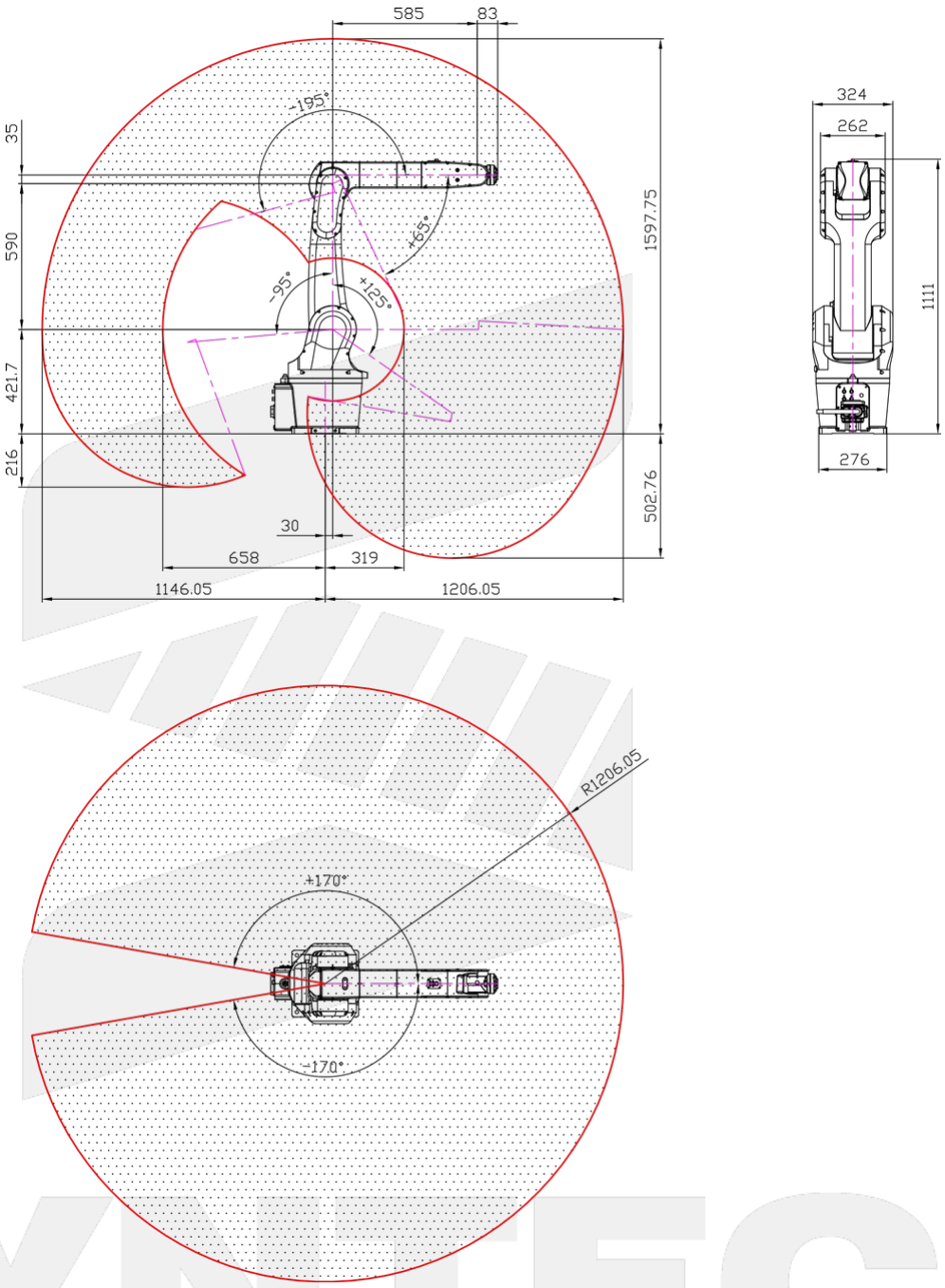
Model		**LA1206-10**
Degrees of Freedom		6
Drive Mode		AC servo drive
Maximum Working Radius		1206mm
Repeatability		±0.05mm
Maximum Wrist Payload		10kg
Operating Range	Axis 1	+170°~-170°
	Axis 2	+125°~-95°
	Axis 3	+65°~-195°
	Axis 4	+170°~-170°
	Axis 5	+120°~-120°
	Axis 6	+360°~-360°
Maximum Speed	Axis 1	297°/s
	Axis 2	223°/s
	Axis 3	220°/s
	Axis 4	480°/s
	Axis 5	360°/s

Model		**LA1206-10**
	Axis 6	705°/s
Operating Temperature		0℃~+45℃
Storage Temperature		-10℃~+55℃
Protection Rating		IP54
Installation Method		ground, suspension, tilt
Base Dimensions		270mm×270mm
Base Holes		230mm×230mm
Noise Level		≤70dB(A)
Body Mass		About 76kg

4.2 Workspace

Robot Workspace

The workspace of the LA1206-10 robot is shown in the diagram below:

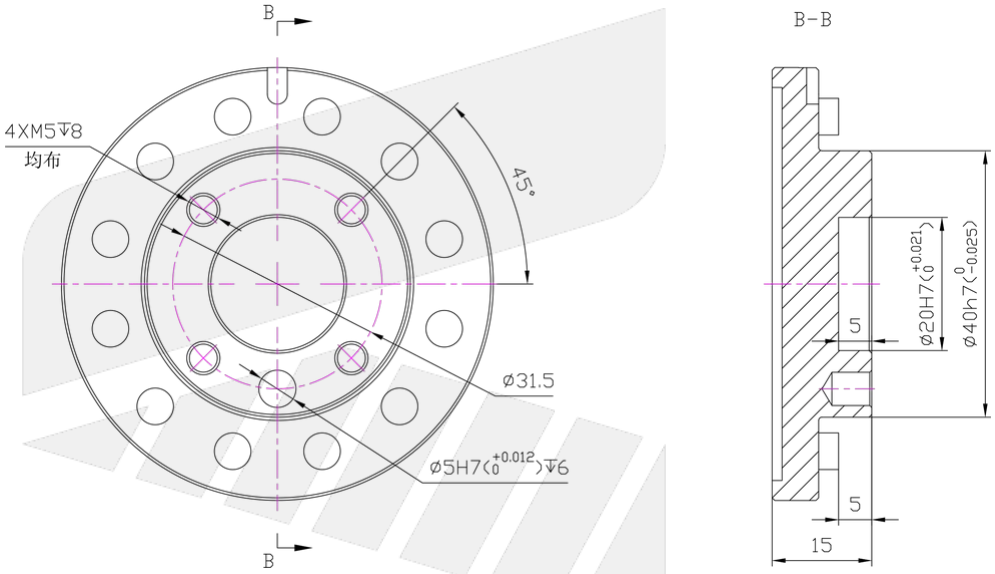


Reminder
In practical application, please consider the impact of the installation method on the workspace.

4.3 Output Flange

Explanation

Users are advised to create their own end effector according to their specific needs and connect it to the wrist output flange. The dimensions of the output flange are shown in the diagram below. The fixed internal hexagon screws have a strength grade of 12.9. The shape and size of the end effector mounted on the output flange may affect the robot's axis range of motion. Please take into account potential interference zones at the end effector when designing.



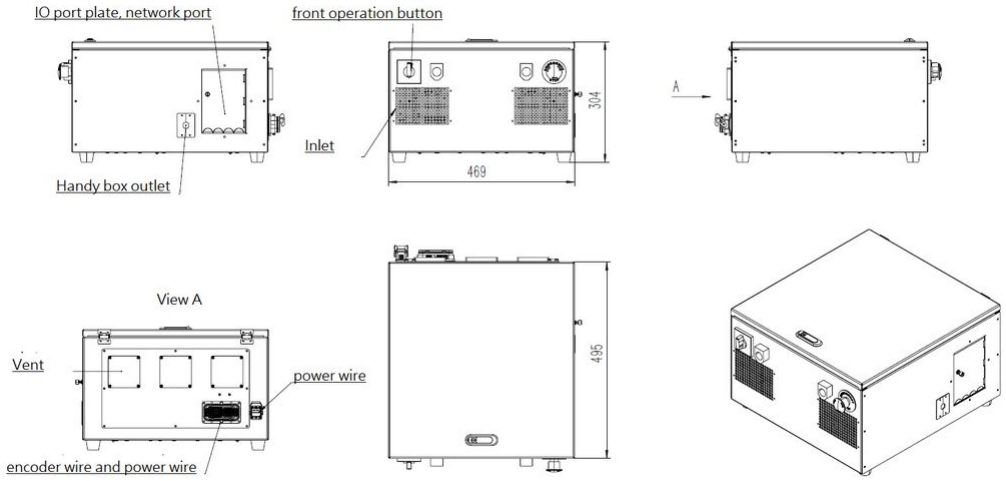
4.4 Electronic Control Box Specifications

The standard specifications of the electric control box are listed below.

	Electronic Box R1
Entity diagram of electronic control box	

	Electronic Box R1
Corresponding Model	LA596, LA707, LA906, LA1206
Power Supply	Single-phase 200-230VAC, 50Hz/60Hz • LA596：1.25KW/220V，10.65A • LA707/906：2.3KW/220V，18.41A • LA1206：2.8kW/220V，18.45A
Input/Output Signals	16I/16O
Analog Input/Output*	0
Size	480mm x 500mm x 280mm
Weight (kg)	20
Remarks	*Optional

The dimensions of the electric control box are shown in the following figures.



5 Installation

5.1 Environmental Conditions

Description

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

Item	Conditions
Ambient temperature	Work: 0℃~+45℃ Store/transportation: -10℃~+55℃
Ambient humidity	Usually under 75%RH（No frost） short term under 90%RH（in one month）
Allowable height	Altitude below 1000m
Allowable vibration	4.9m/s^2 Under 0.5G
Circumstance	• 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 lower 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 equipment, and also suggested to preheat at a low speed.

It is not allowable to use under the following circumstances

Danger

- A Potentially explosive environment.
- A corrosive environment.
- A flammable environment.

- A radioactive environment.
- An environment without risk assessment.
- Used for the transportation of humans and animals.
- `Operation uses non-allowed parameters.`

5.2 On-site Installation

5.2.1 Transportation

Description

When handling, it is advisable to use lifting equipment such as overhead cranes. In the absence of lifting equipment, manual handling can be considered. The transportation of a piece of equipment requires the coordination of at least two people simultaneously. Attention should be paid to safety, and the equipment should be handled with care to prevent damage and avoid causing harm to the surface of the robot.

 Warning

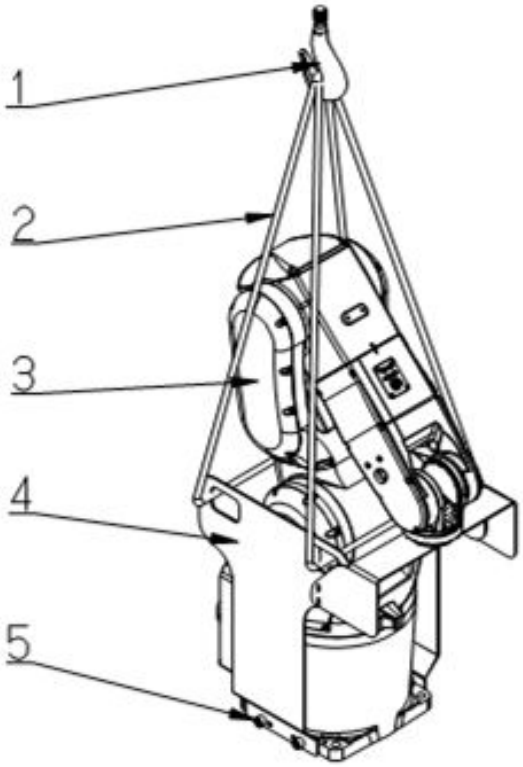
The body of the R-series robot weighs is about 20-60kg. Please use rings with M6×10 threaded lifting eyes and hooks and ropes with a load of over 100kg. Sling or wire rope with protection is recommended to prevent the sling from damaging the body paint. Lifting a robot in any position other than the 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 Lifting Equipment 2 Sling 3 Lifting Limit Bracket 4 Lifting Bracket 5 Fixed Screw

5.2.2 Installation

Warning
Do not install or operate a robot with damaged or missing components, as it may result in personal injury, equipment damage, and accidents.
After setup is complete, it is essential to remove any transport or fixing fixtures before the initial power-up to avoid damaging the drive components.

Danger
Please set up safety barriers, as failure to do so may result in personal injury and equipment damage.
Ensure that safety barriers are not within the working range of the robot's end effector and jig to prevent potential accidents resulting in personal injury or equipment damage.
Do not power up or operate the robot when it is not securely fixed, as this may lead to tipping over, causing personal injury and equipment damage.

Safety Devices

According to People Republic of China standard GB11291-XXXX《industrial robot safe specification（draft for approval）》 section 7.3 safeguard protective device measures regulation：“Industrial robot in automatic operation may cause danger to robot. So

safeguard like fence to prevent user from accessing is required.” To avoid equipment damage, operator injury and surrounding person harm, please set demanded safeguard equipment including safe fence, door, plug and slot and other protective devices.

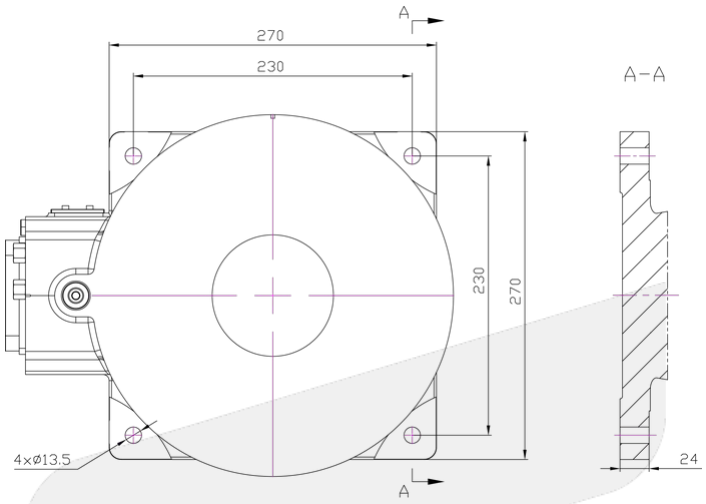
Installation Instructions

The proper installation of the robot is crucial for its optimal functionality. It is especially important to ensure that the base is securely anchored and capable of withstanding the dynamic loads during the robot's acceleration and deceleration, as well as the static weight of the robot and its end effector. Additionally, an uneven installation surface can lead to robot deformation and affect its performance.

During acceleration and deceleration, the robot generates significant reactive forces in all directions on the base. Therefore, when installing the robot, the foundation must be able to support both static loads and the reactive forces during acceleration and deceleration to ensure the robot's base remains stable and immovable. The robot's base is positioned using 2-Φ6 pins (it is recommended to use easy-to-remove threaded cylindrical pins, GB/T 120.1-2000) and secured with 4-M12 screws (to prevent loosening of the screws, it is necessary to use flat washers and spring washers). Screw requirements are detailed in the table below.

Screws	**M12×50**
Quantity	4
Strength Grade	12.9
Tightening Torque	55±5Nm

Base Hole Dimensions

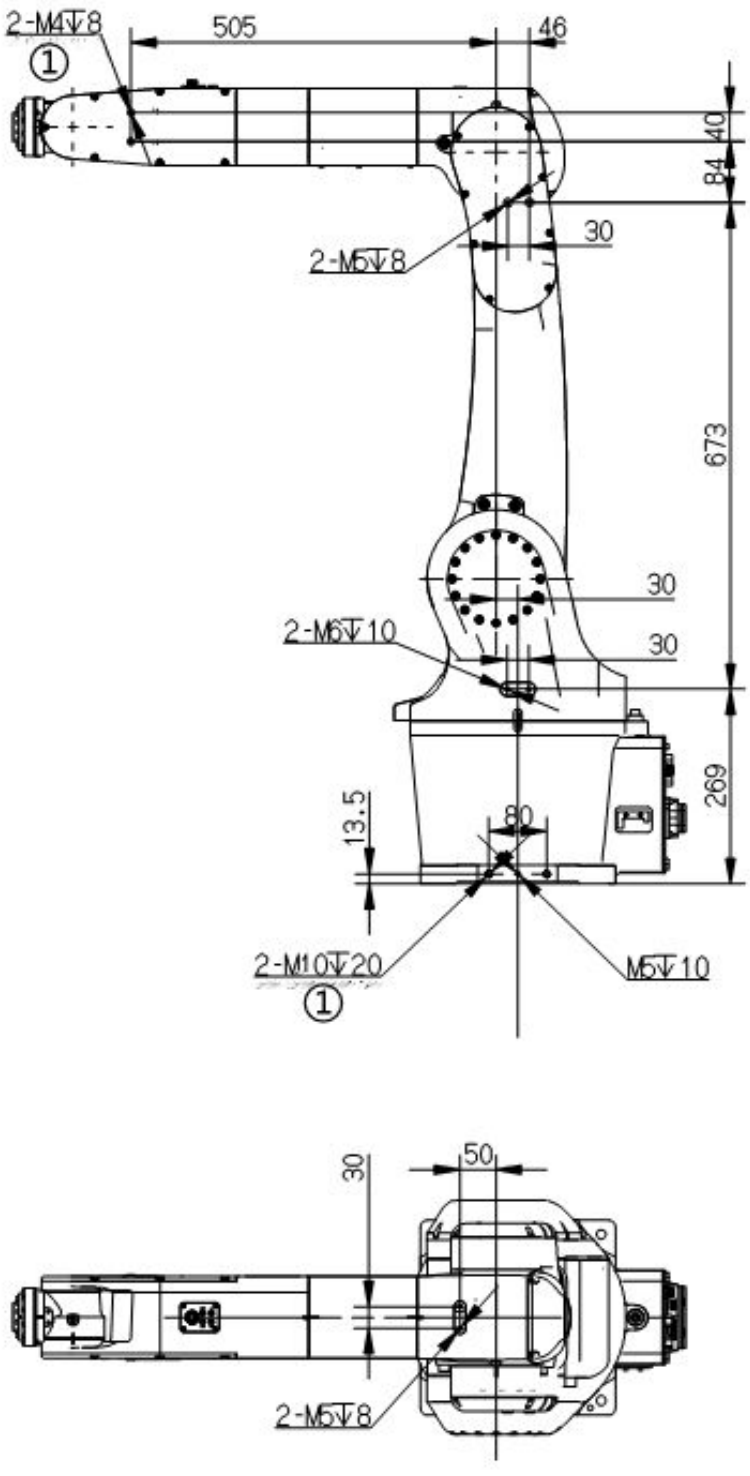


Reminder
During installation, to prevent deformation of the robot's base, ensure that the flatness of the mounting surface is within 0.2mm. Additionally, the grounding wire for the base uses M4 screws, and the grounding connection method is described in section 4.3.3.

5.2.3 Mechanical Interfaces

Mechanical Interfaces

The wrist, upper arm, lower arm, and waist joints of the LA1206-10 robot can support additional loads, and their mounting interfaces are shown in the diagram below. To ensure the longevity of the threads, please avoid frequent disassembly of the interface installation screws. The combined load on the wrist and lower arm must not exceed 10kg. For example, if the wrist load is 9kg, the additional load on the lower arm should be kept within 1kg.



Note: ①: Two locations on opposite sides;

5.3 Electrical Connections

5.3.1 Wiring connection


Warning

- Do not make mistakes on 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 safety issues. Please refer to the controller manual for details.
- Only certified technicians or personnel should perform a wiring job. If the wiring job is performed by a person who does not have the relevant knowledge, it may result in injury or malfunction.


Beware of electric shocks

- Please make 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 the 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 put on a 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.

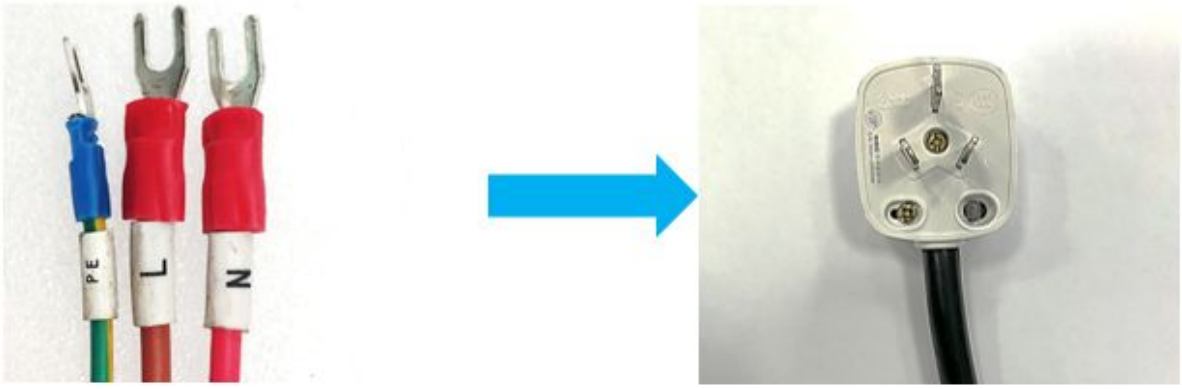
5.3.2 Grounding Instructions

1.Robot main body grounding:

The grounding should be done by the user. Depending on the actual conditions on-site, spatial positioning, and other factors, the user should use terminals to ensure proper grounding of the robot body.

2.electrical cabinet grounding:

electrical cabinet grounding wire 220V



R series electrical cabinet power wire is three-core cable, which is L/N/PE;

L/N： neutral wire/live wire（single phase 220V）PE： ground wire

R series electrical cabinet standard optional with three hole plug. Simply insert the plug into the three-hole socket during use. (Note: Three-hole socket needs to be grounded)

5.3.3 User Wiring

Wiring

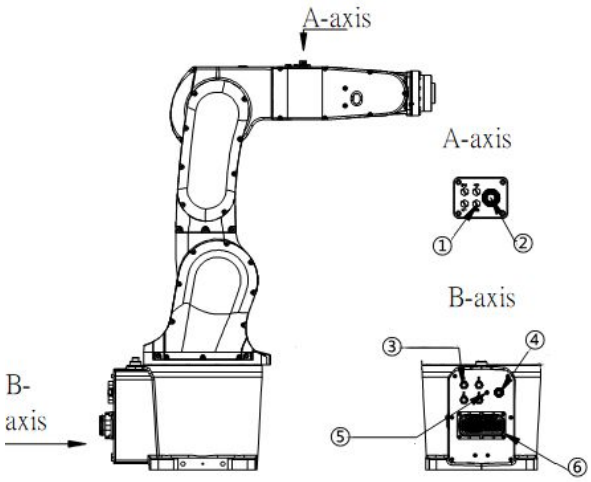
Warning
Only certified operators or personnel should perform a wiring job. If the wiring job is performed by a person who does not have the relevant knowledge, it may result in injury or malfunction.

Danger

- The ground terminal must be connected to the ground pole (5.5mm^2 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.

For wiring, please refer to the positions of various connects in the diagram below. The specifications of the IO cable connector and air tube are provided in the table below. When using, replace the M5 plug on side A with an M5 threaded air tube connector (recommended to use SMC's KQ2S04-M5A quick-change connector); when connecting the air tube on side B, remove the plug first and then install the Rc1/8 air tube connector (recommended to use SMC's KQ2H04-01S straight connector). When using the IP67

enhanced function, activate the reserved start interface and use the air source processing component. For details, please consult Leantec.



①: 4-M5 screw plug

②: IO plug

③: 4-Rcl/8 pneumatic connections

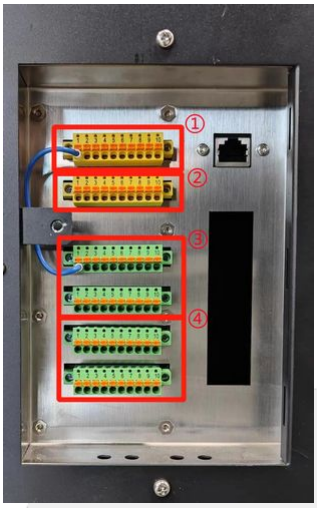
④: IO plug

⑤: M5 screw hole IP67 for strength function

⑥: cable plug

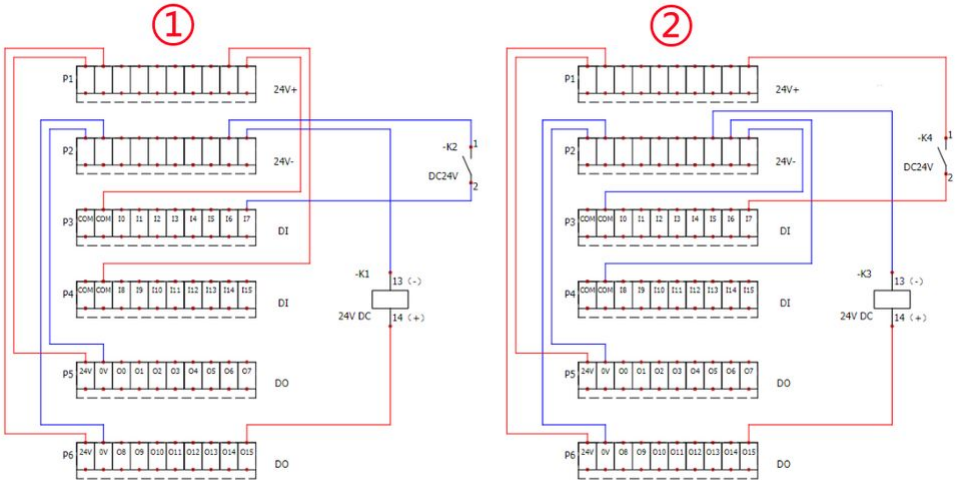
5.3.4 IO Wiring Definition

The IO connection method of the electric cabinet of the 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 COM port interfaces. The top row is the 24V COM port and the bottom row is the 0V COM port, as shown in the figure below:



Notice: ①: 24V common terminal ; ②: 0V common terminal ; ③: two COM port and 16 I point ; ④: The first two are 24V and 0V respectively, and the rear is 16 O-points.

The I-board module has two connection methods, one is the PNP connection method, the COM port 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 COM port on the I-board is connected to the power supply 24V, and 16 DI ports receive low-level signals as valid signals;
Customers can choose the appropriate connection method according to the type of sensor they use. The outgoing connection method of Leantec is NPN connection method;

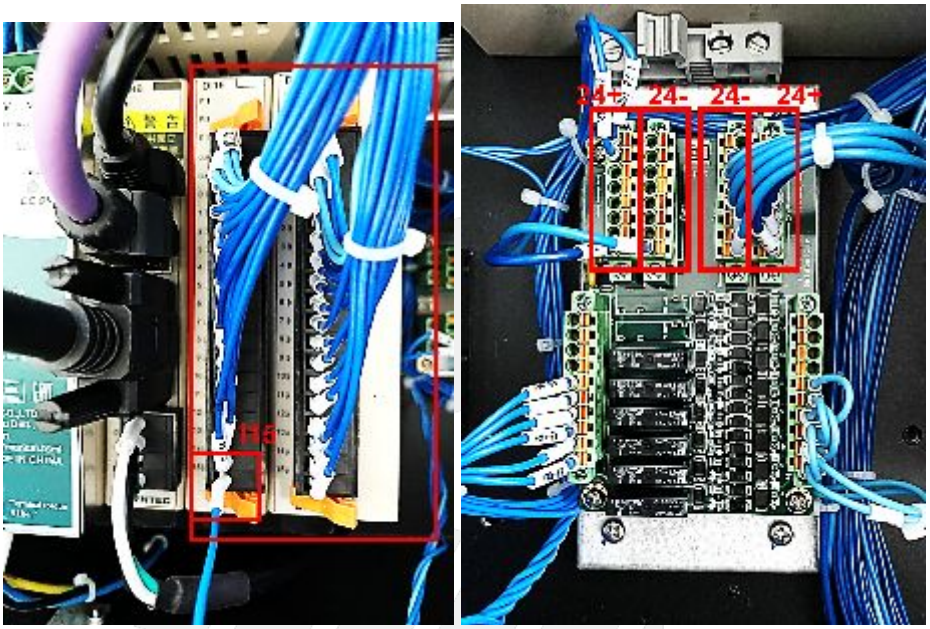


Note:

Picture ① is NPN wiring method; Picture ② is PNP wiring method;

If you want to replace the PNP connection method, in addition to replacing 24V with 0V to connect to the common point of the I board, you also need to pay attention to the I15 port of the R series of cabinet emergency stop button, so you also need to

change the 0V interface of the emergency stop to a 24V interface (NPN low level is valid, PNP high level is valid) as shown in the following figure:



5.4 Function Test

5.4.1 Check before Power-on

Before powering on, check if the installation environment meets the environmental conditions in chapter 4.1. The items include: Check whether the robot body is firmly fixed, whether the aviation plug of the power cable and the encoder cable is firmly inserted, whether the wiring terminals in the electric cabinet are inserted firmly, and whether the single-phase voltage of the main power cable in the electric cabinet is 220V and the ground wire is connected firmly.

5.4.2 Power-on abnormality check

Power on the electric cabinet after completing pre-power-on check. Observe whether there are any abnormal alarms on the teach pendant controller. If the emergency stop is pressed, the teach pendant controller will display the alarm R44.0. If there are other abnormal alarms, please contact Leantec engineers for analysis and solution.

5.4.3 Check the Mastering position, direction and soft limit of each axis of the robot

JOG each joint according to the direction shown in the figure and check whether the direction of each axis is correct. If the graphic direction is opposite to the actual direction, you can adjust the direction of each axis by modifying parameters 0 or 1 of parameters Pr41~Pr46. Check if the zero point position of each axis is consistent

with the zero point label. If not, reset the zero point of axes base on the zero point label and check the positive and negative software position limit of each axis.

5.4.4 Test procedure of Automatic Mode

Automatically run a random test program, and listen for any abnormal noise from the robot. If there is abnormal noise, stop the robot and test each joint motion separately. The normal joint motion is smooth, no stutter, and the sound fluctuation is minimal. After confirming the abnormal joint, please contact Leantec engineers for assistance. With this, the pre-use inspection of the robot is complete.

6 Maintenance

6.1 About safety during maintenance

Instruction

Warning

- Please strictly follow the maintenance steps and do not simply 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 working area. Even if it appears that the robot stopped moving, a robot in an energized state may still act accidentally and cause a serious safety problem.
- Please confirm the robot action outside the safety enclosure after the replacement of the robot components. Otherwise, the robot may perform unexpected actions before confirmation, potentially causing serious safety issues.
- 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 an 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 are turned off and the power plug is unplugged. Otherwise, power contactor failure may occur.

Notice during maintenance

Danger

- If there is a need to perform maintenance procedures not specified by LEANTEC, please contact our company.
- If you need to replace parts not specified by LEANTEC, please contact our company.
- Please perform regular maintenance, otherwise, it will affect the life of the robot or cause other unexpected dangers.
- Before performing overhaul and maintenance, please turn off all power supplies.
- Maintenance or overhaul must be carried out by qualified personnel and with a clear understanding of the installation procedures of the entire system and other possible risks.
- When replacing parts, please avoid other foreign objects from entering the robot.

6.2 Troubleshooting

Instruction

In case of a robot malfunction, do not continue operation. Immediately contact trained personnel to conduct a fault analysis, understand the symptoms, and determine which component is experiencing an issue. If parts need replacement, contact our company's service department. Avoid disassembling the robot without proper authorization.

6.3 Maintenance plan

Instruction

In order for the robot to maintain high performance for a long time, it must be maintained regularly. Maintenance personnel must formulate a maintenance plan and strictly adhere to it.

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.

6.3.1 Check interval

Inspection instructions

Regular maintenance can prevent failures and improve durability and safety. To maintain the robot's long-term efficient performance, regular maintenance is necessary. Maintenance personnel must develop a maintenance plan and strictly adhere to it.

The maintenance can be divided into various stages as shown in the following table and the necessary maintenance items in each stage.

For the setting of the maintenance interval time, please calculate according to the servo power-on time.

The maintenance time in the table is based on arc welding operations. In cases of other applications or specific usage conditions, it is necessary to analyze and draw conclusions separately. It is particularly important to note that for high-frequency operations such as handling tasks, the maintenance interval should be shortened.

The maintenance cycle of the robot can be divided into daily, 1,000 hours, 5,000 hours, 12,000 hours, and 24,000 hours. The details are as follows :

Maintenance Cycle	**Inspection and Maintenance Content**	**Remarks**
Daily	Mastering position marking	Same as robot Mastering position
	Abnormal noise and vibration	

Maintenance Cycle	Inspection and Maintenance Content	Remarks
	The function of the motor brake	Listen to the sound of each motor when releasing the brake
	Oil leaking inspection	Inspect the installation surface of each gearbox and the external surface of each joint.
	Externally visible screws	Fixing screws on a robot arm body
1000 hr	Screw bolt of the robot base	
	`External cable`	Check the condition of the cable (cleanliness, damage, etc.)
5000 hr	Remove dust and debris	Especially the ventilation cooling system and electrical box
	Timing belt	Inspect the timing belt condition (Tension, wears down, etc.)
12000 hr	Battery replacement of Robot	In the event of a low battery warning during system startup, or replace the battery annually.
	Checking internal cable	Port connectivity, Wear of metal contact parts
	Surrounding screws of the axis	
	Screws for motors, reducers, etc.	
24000 hr	`Internal cable`	Replace

6.3.2 Tightening of hexagon socket screws

Tightening instructions

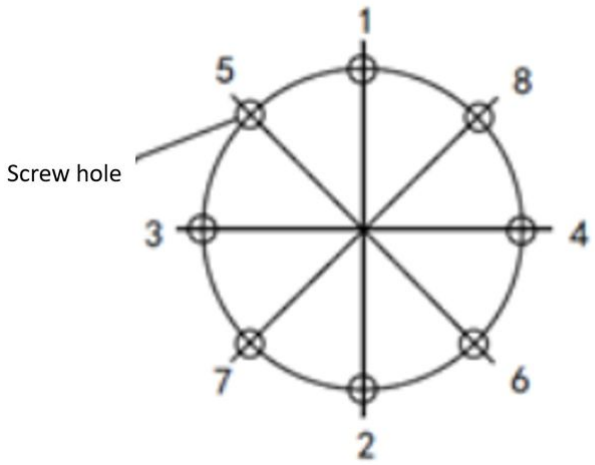
Use hexagon socket head screws (hereinafter referred to as screws, class 12.9) where connection strength is required. When assembling, tighten the screws according to the fastening torque shown in the following table. Unless specified, when refastening these screws in the operations described in this 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 set 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 fasten the screws on the circumference in diagonal order as shown in the figure below. Use a hexagon wrench to loosely tighten it 2~3 times and then use a torque wrench to tighten it according to the tightening torque value as shown in the table above.



6.4 Synchronous Belt Maintenance

Hint

Reminder
Adjustment and maintenance of the synchronous belt require professional personnel to operate with specialized tools, and recalibration the zero point of the robot is necessary after replacement! If there are any issues during the adjustment, please contact our company!

The LA1206-10 robot employs synchronous belt drives for axes 2, 3, 4, 5, and 6. When these belts become loose, it can result in abnormal sounds and reduced precision. Therefore, it is recommended to inspect the synchronous belts every 6 months to prevent issues arising from belt slack.

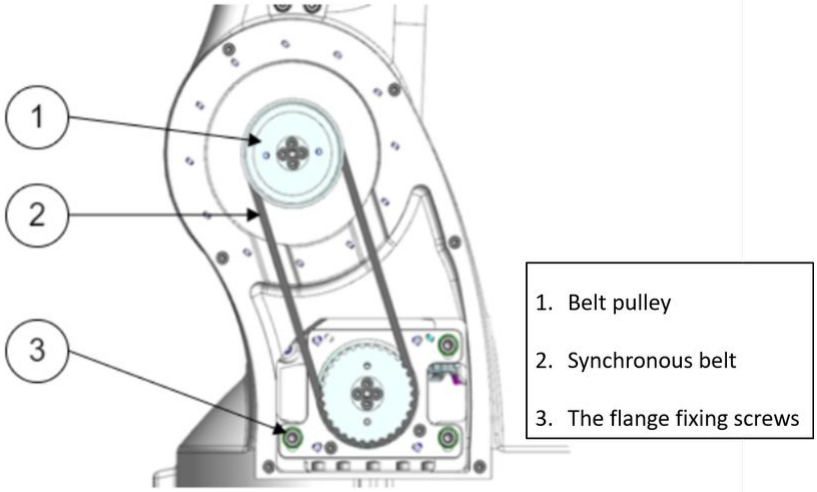
6.4.1 2nd-axis Synchronous Belt Maintenance

Instruction

Remove the left cover of the waist and measure the tension of the belt with a belt tension meter. The standard tension of the timing belt is between 55±6N (for timing belts that have been in operation for over 20 hours, the tension should be adjusted to the standard tension * 0.7). If the measurement result is not within this range, adjust according to the following steps:

- Loosen the flange fixing screw (3 M5 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 "**Tightening of hexagon socket screw**").
- Remove tensioning screws and tool screws.
- Install waist right cover.

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。



6.4.2 3rd-axis Synchronous Belt Maintenance

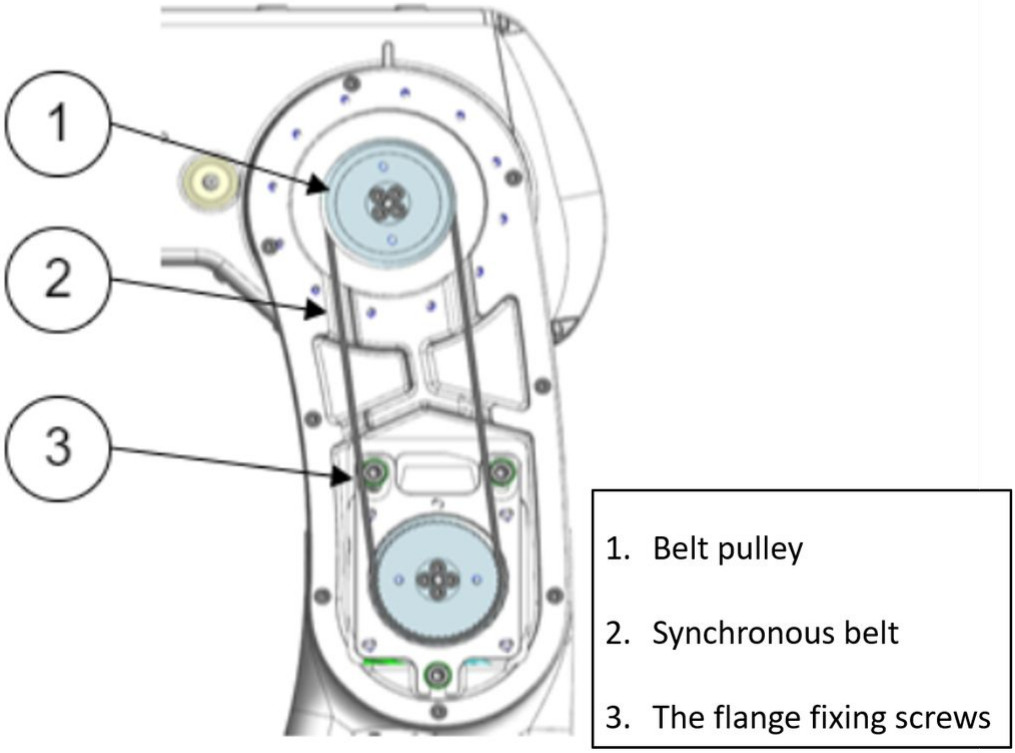
Instruction

Remove the right cover of the upper arm and measure the tension of the belt with a belt tension meter.
The standard tension of the timing belt is between 44±5N (for timing belts that have been in operation for over 20 hours, the tension should be adjusted to the standard tension * 0.7). 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 "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 off 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.

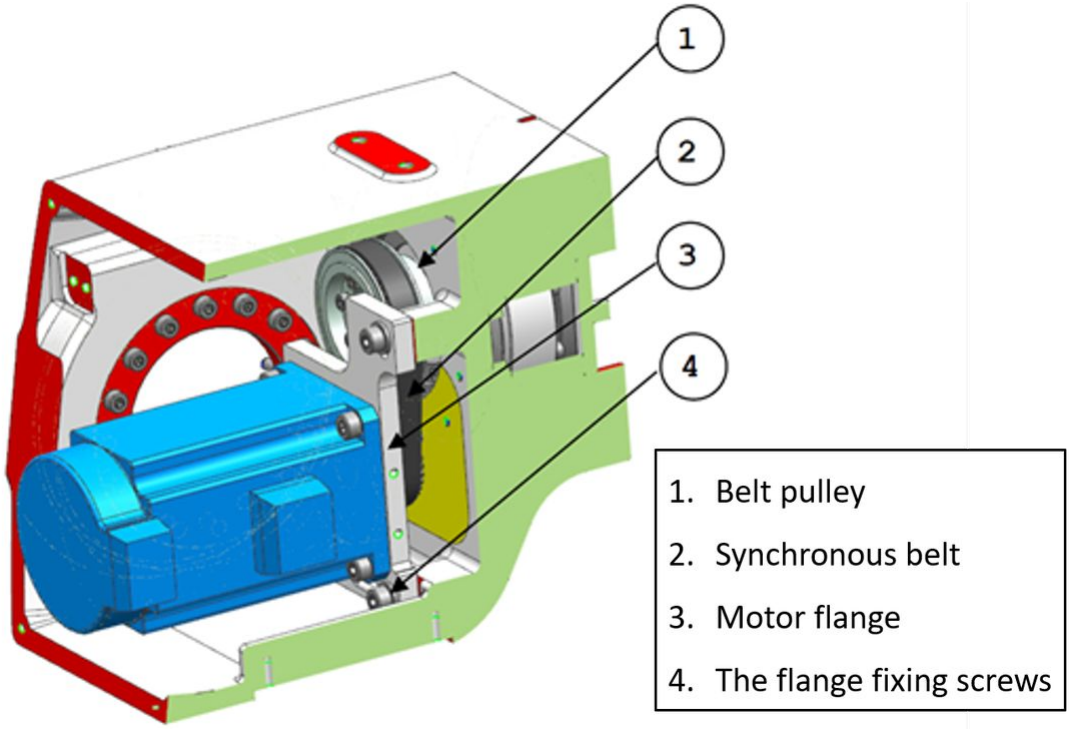


6.4.3 4th-axis Synchronous Belt Maintenance

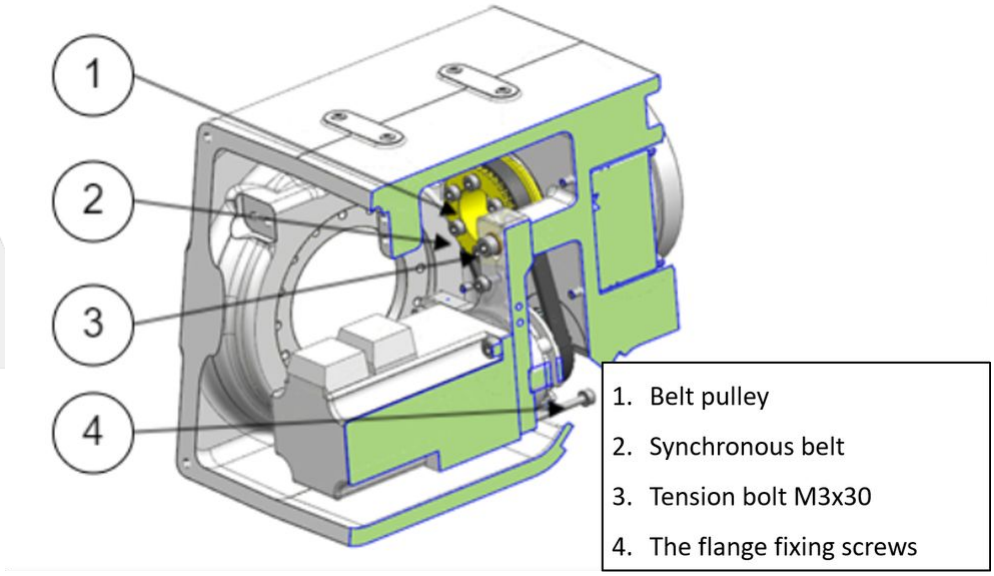
Remove the small cover at the lower part of the forearm, and measure the tension of the belt with a belt tension meter.
The standard tension of the synchronous belt is 20±2N (After the timing belt has been in operation for 20 hours, the tension will decrease to around 70% of the recommended value. At this point, please adjust the tension to 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 small 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



6.4.4 5th/6th-axis Synchronous Belt Maintenance

Instruction

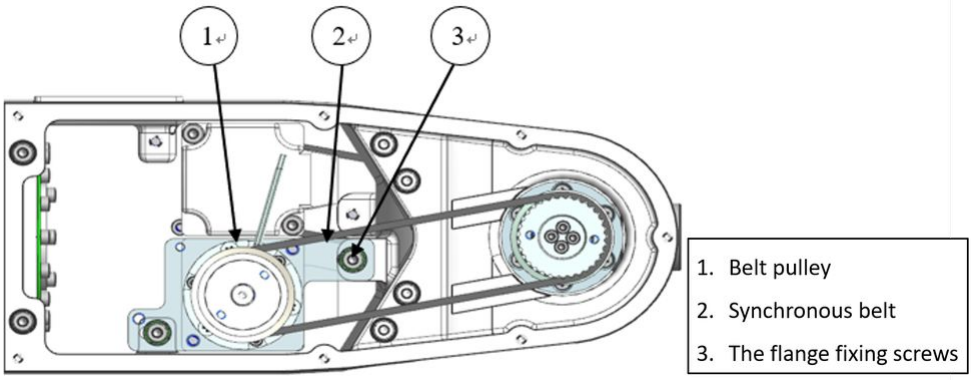
Remove the front cover of the forearm and measure the tension of the belt with a belt tension meter.

The standard tension of the timing belt is between 20±2N (for timing belts that have been in operation for over 20 hours, the tension should be adjusted to the standard tension * 0.7). If the measurement result is not within this range, adjust according to the following steps:

- Loosen the flange fixing screw (2 in total, loosen until the belt wheel can move freely).
- Tighten the flange fixing screw (tightening torque: see "**Tightening of hexagon socket screw**").
- Install upper arm right cover.

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。

The structure of the 5th-axis and 6th-axis pulley is the same, so the maintenance of the 6th-axis pulley can refer to the 5th-axis.



6.5 Battery Replacement Instructions

Description:

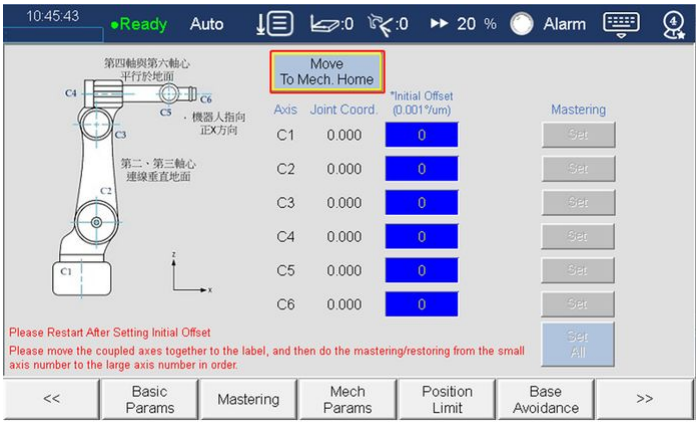
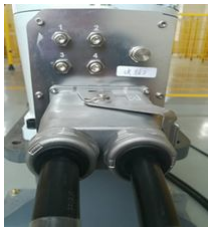
The battery on the robot body is used to store data for each axis encoder. Therefore, the battery needs to be replaced every 1000 hours. When the battery voltage drops and an alarm occurs, users are allowed to replace the battery. If not replaced promptly, the original position may be lost.

The specific steps as follow:

1. Power-off homing:

a. Before change the battery, start the robot and drive the robot to the zero point; homing operation: After start the robot, the controller would stay at "ready" "permission 4" "teaching" status. Open the controller "setting"–"mechanical arm"----"original point setting" and enter "original point setting" page. Long press "safety switch" at the back of teaching pendent and press "return mechanical point" button for robot homing;

b. Cut power. Remove robot "reload connector lower cover".

1. Click setting in “ready” “permission 4” “teaching” status	**2.Original point setting page**
	
3.Reload connector lower cover	**4.Status after remove**
	

2.Remove battery box

a. Loosening robot back cover screw "6-hexagon screw". Open the back cover. Notice： do not pull out the back cover. Slightly open is sufficient;

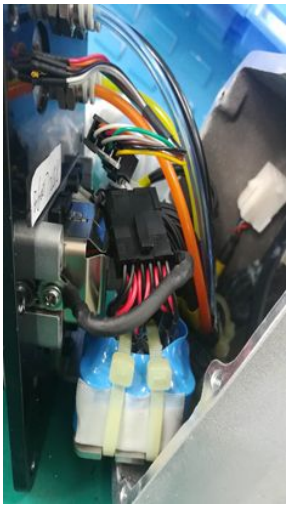
b. Gently shake the electrical installation board from left to right, pull the main harness out by about 50mm-100mm, exposing the battery pack. Disconnect the black 12-pin plug, and use diagonal pliers to cut off the two fixed straps on the battery pack.

3. Install battery box

a. Fix the new battery box to the position and secure the new battery pack with a matting strap;

b. Re-plug black 12 pins plug. Aware the direction and fix the electrical installation plate;

c. Attach the back cover to the base and fasten with "6-hexagonal screws";

1.6-Hexagon socket head screws	2.Open the back cover status
	

4. Power on test

a. Connect robot “reload connector lower cover” and power on;

b. Power on and start. If there is a low encoder battery voltage alarm with a position loss, power off and restart the system.

c. After the restart, the system reports that all six axes are not calibrated to the origin because the robot had already returned to the origin before replacing the battery. You can use a one-button command to calibrate the origin for all six axes.

5. Zero point recording method: After replacing the battery, record the zero point without running the robot after powering on.

a. Put the controller in the 'Ready,' 'Authorization 4,' and 'Teaching' states. In the teach pendant, open 'Setting,' then 'Origin Setting' to enter the 'Origin Setting' page. Click 'Calibrate Origin for All Axes' (or calibrate each axis individually).

b. After confirming the completion of the zero-point recording, press and hold the 'Safety Switch' on the back of the controller, then press the 'Back to

Mechanical Origin' button. If the robot does not move, the current position of the robot is considered its zero-point state.

c. After successful origin calibration, alarms are cleared, and there are no warnings. Manually moving the robot is functioning correctly. Check the teach pendant for any alarm messages, release the emergency stop, enable the robot in manual mode, and test the movements of all six axes, ensuring there are no alarms. The battery replacement process is complete.

7 Zero Point

7.1 About mechanical home

What is a mechanical home

When designing a robot, a predefined initial posture is established, where the angles of each joint are set to 0 in this posture. From a mechanical perspective, the zero-point posture refers to the position achieved when a specific angle is formed between adjacent links. From a software perspective, as robots use encoders to record joint angles, the zero-point posture refers to the robot's position when the servo motors rotate to a specific encoder value

Therefore, the mechanical zero point can actually have two interpretations. From the perspective of observers, the mechanical zero point is the posture of the robot corresponding to specific positions reached by each joint of the robot. From the standpoint of the control system, the mechanical zero point comprises values from several encoders. The zero point serves as the reference for the robot's coordinate system. Without a zero point, the robot cannot determine its own position. Hence, in order to achieve the highest possible absolute positioning accuracy, it's necessary to calibrate the robot's zero point, aligning the mechanical zero point as closely as possible with the algorithmic zero point.

Under what circumstances should the mechanical home be calibrated

The situations where recalibrating the zero point is generally necessary include:

- After the replacement of the 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 Zero point calibration

Instruction

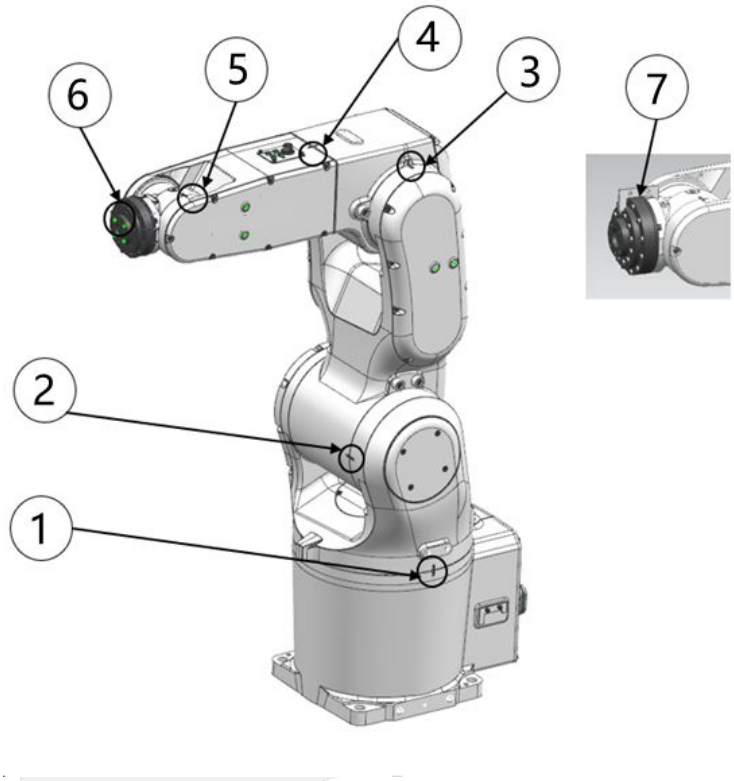
The purpose of mastering is to make the theoretical zero of the control algorithm coincide with the actual mechanical home so that the mechanical connecting linkage system can correctly respond to the position and speed instructions of the control system.

More generally speaking, mastering 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.

The LA1206-10 series robot employs encoder plate calibration for all its joints, and each axis can only be calibrated one at a time. During calibration, it's necessary to slowly rotate the corresponding joint until the two recesses align, then insert a specially

designed calibration key (or a standard 3mm wide key can be used as a substitute). At this moment, the position represents the zero point for that axis.

For all six axes, a specific tool is used for zero point calibration at the factory, as shown in the diagram. If users have high precision requirements for path accuracy and need to accurately calibrate the zero points of all six axes, it is recommended to leave a 3 (+0.01, +0.03) mm keyway in the end tool flange and use it in combination with the provided zero point calibration block.



①: A1 axis calibration keyway

②: A2 axis calibration keyway

③: A3 axis calibration keyway

④: A4 axis calibration keyway

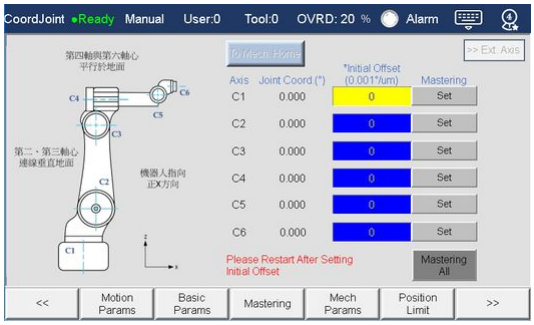
⑤: A5 axis calibration keyway

⑥: A6 axis calibration keyway

⑦: Calibration block

7.3 Calibration Steps

Calibration steps

	Operate	Description
1	Log in to the system with users above the Expert level and enter the zero-point calibration interface.	Zero calibration can only be done in manual mode with no program running. The zero calibration interface is located in the "calibration" classification. 
2	In joint coordinate jog mode, please calibrate the robot starting from axis 1.	Different robots have different mastering calibration tool. Please refer to the manual for 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.	