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BASIC TECHNIC

This volume contains information for setup and operation of UI-SR series robots.
Please read this volume thoroughly before setting up and operating the robot.
1.0 SAFETY

Installation and transportation of robots and robotic equipment shall be performed by qualified personnel and should conform to all national and local codes. Please read this manual and other related manuals before installing the robot system. Keep this manual handy for easy access at all time.

1.1 Conventions

Important safety considerations are indicated throughout the manual by the following symbols. Be sure to read the descriptions shown with each symbol.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Warning" /></td>
<td>★ This symbol indicates that a danger of possible serious injury or death exists if user not follow the associated instructions.</td>
</tr>
<tr>
<td><img src="image" alt="Warning" /></td>
<td>★ This symbol indicates that a danger of possible serious injury or death caused by electric shock exists if user not follow the associated instructions.</td>
</tr>
<tr>
<td><img src="image" alt="Caution" /></td>
<td>★ This symbol indicates that a danger of possible harm to people or physical damage to equipment and facilities exists if user not follow the associated instructions.</td>
</tr>
</tbody>
</table>
1.2 Design and Installation Safety

Only trained personnel should design and install the robot system. Trained personnel are defined as those who have taken robot system training and maintenance training classes held by the manufacture, dealer or local representative company, or those who understand the manuals thoroughly and have the same knowledge and skill level as those who have completed the training courses.

To ensure safety, a safeguard must be installed for the robot system.

The following items are safety precautions for design personnel:

<table>
<thead>
<tr>
<th>Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ The robot and controller must be used within the environmental conditions described in their respective manuals. This product has been designed and manufactured strictly in a normal indoor environment. Using the product in an environment that exceeds the specified environmental conditions may not only shorten the life cycle of the product but may also cause serious safety problems.</td>
</tr>
<tr>
<td>★ The robot system must be used within the installation requirements described in the manuals. Using the robot system outside of the installation requirements may not only shorten the life cycle of the product but also cause serious safety problems.</td>
</tr>
</tbody>
</table>
1.3 Operation Safety

The following items are safety precautions for qualified Operator personnel:

<table>
<thead>
<tr>
<th>Warning</th>
<th>★ Do not enter the operating area of the robot while the power is ON. Entering the operating area with the power ON is extremely hazardous and may cause serious safety problems as the robot may move even if it seems to be stopped.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning</td>
<td>★ Before operating the robot system, make sure that no one is inside the safeguarded area. The robot system can be operated in the mode for teaching even when someone is inside the safeguarded area. The motion of the robot is always in restricted (low speeds and low power) status to secure the safety of an operator. However, operating the robot system while someone is inside the safeguarded area is extremely hazardous and may result in serious safety problems in case that the robot moves unexpectedly.</td>
</tr>
<tr>
<td>Caution</td>
<td>★ To shut off power to the robot system, pull out the power plug from the power source. Be sure to connect the AC power cable to a power receptacle. Do not connect it directly to a factory power source.</td>
</tr>
<tr>
<td>Caution</td>
<td>★ Before performing any replacement procedure, turn off the controller and related equipment, and then pull out the power plug from the power source. Performing any replacement procedure with the power ON is extremely hazardous and may result in electric shock and malfunction of the robot system.</td>
</tr>
<tr>
<td>Caution</td>
<td>★ Do not pull out the motor connectors while the power is ON. Pulling out the connectors while the power ON is extremely hazardous and may result in serious bodily injury as the robot may move abnormally, and also may result in electric shock and malfunction of the robot system.</td>
</tr>
<tr>
<td>!</td>
<td>★ Whenever possible, only one person should operate the robot system. If it is necessary to operate the robot system with more than one person, ensure that all people involved communicate with each other as to what they are doing and take all necessary safety precautions.</td>
</tr>
</tbody>
</table>
1.4 Emergency Stop

If the robot moves abnormally during operation, press the emergency stop immediately. Stops the power supply to the motor, the arm stops in the shortest distance.

However, avoid pressing the emergency stop switch unnecessarily while the robot is running normally. Otherwise, the robot may hit the peripheral equipment and the track may be different from that in normal operation. It may also reduce the life of the robot system.

To place the system in emergency mode during normal operation, press the emergency stop switch when the robot is not moving.

Do not press the emergency stop switch unnecessarily while the robot is operating.

Do not turn off the controller when the robot is running.

If user stop the robot by turning off the controller, be aware of the following:

- It may reduce the life of robot and damage reduction gear;
- It may results in gaps between joint.

The robot is forced to stop when it is running because the power to controller is off, user need to check the following after the power is on:

- Whether the joint is in the right place.

Before using the emergency stop switch, be aware of the following:

- The emergency stop switch should be used to stop the robot only in case of emergency.
- To stop the robot operating the program except in emergency, use stop commands.
- For safeguard system, do not use the circuit of emergency stop.
1.5 Emergency Movement Without Drive Power

When the system is placed in emergency mode, push the arm or joint by hand gently as shown below:

- **Joint #1**: Push the arm by hand.
- **Joint #2**: Push the arm by hand.
- **Joint #3**: Rotate the shaft by hand.
- **Joint #4**: Rotate the shaft by hand.
1.6 Labels

The following labels are attached near the location of robot where specific dangers exits.

Be sure to comply with descriptions and warnings on the labels to operate and maintain the robot safely.

To operate and maintain the robot system, please comply with notice and warning contents recording in warning labels. Do not tear, damage, or remove the labels.

<table>
<thead>
<tr>
<th>Labels</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>Before loosening the base mounting screws, hold the arm and secure it tightly with a band to prevent hands or fingers from being caught in the robot.</td>
</tr>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>Do not enter the operation area while the robot is moving, or robot arm may collide against the operator. This is extremely hazardous and may result in serious safety problems.</td>
</tr>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>To avoid electric shock, do not touch any internal electric parts when the power is on.</td>
</tr>
<tr>
<td><img src="image" alt="WARNING" /></td>
<td>User may catch their hands or fingers between the shaft and cover when bringing their hands close to moving parts.</td>
</tr>
</tbody>
</table>
### 2.0 SPECIFICATION

#### 2.1 Features of UI-SR series

UI-SR series robot is an high performance robot with high speed and cost performance. The features of UI-SR series robot are as follows:

- **No Electric Cabinet**
  All joint motors use drive control integrated machine which can result in simple wiring.

- **Large Capacity**
  It supports the U-axis allowable moment up to 0.05 kg·m² (SR XXX0L).
  It stably handles large loads by optimized control based on the each load.

- **Tact Time Improvement by High-speed Motion**
  It improves the tact time of long-range movements by readjusting the highest speed.
2.2 Model Number

UI - SCR 4 150 L

- **Payload**
  - L: 1kg
  - H: 3kg

- **Joint #3 Stroke**
  - 120: 120mm
  - 150: 150mm
  - 170: 170mm
  - 200: 200mm

- **Arm Length**
  - 4: 400mm
  - 6: 600mm

- **SCARA Robot**

- **UIRobot**

For details on the specifications, refer to 2.4 Specifications.
2.3 Part Names and Outer Dimensions

UI-SR 4150LS

While the LED lamp is on, the current is being applied to the robot. Performing any work with the power ON is extremely hazardous and it may result in electric shock and/or improper function of the robot system. Make sure to turn OFF the controller power before the maintenance work.
UI-SR 4150LS Standard-Model

Unit: mm
## 2.4 Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>SR4150LS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arm Length</strong></td>
<td></td>
</tr>
<tr>
<td>Arm #1,#2</td>
<td>400 mm</td>
</tr>
<tr>
<td>Arm #1</td>
<td>222 mm</td>
</tr>
<tr>
<td>Arm #2</td>
<td>178 mm</td>
</tr>
<tr>
<td><strong>Max. Operating Speed</strong></td>
<td></td>
</tr>
<tr>
<td>Joint #1,#2</td>
<td>4000 mm / s</td>
</tr>
<tr>
<td>Joint #3</td>
<td>800 mm / s</td>
</tr>
<tr>
<td>Joint #4</td>
<td>360 deg / s</td>
</tr>
<tr>
<td><strong>Repeatability</strong></td>
<td></td>
</tr>
<tr>
<td>Joint #1,#2</td>
<td>± 0.05 mm</td>
</tr>
<tr>
<td>Joint #3</td>
<td>± 0.02 mm</td>
</tr>
<tr>
<td>Joint #4</td>
<td>± 0.02 deg</td>
</tr>
<tr>
<td><strong>Payload</strong></td>
<td></td>
</tr>
<tr>
<td>Rated</td>
<td>1kg</td>
</tr>
<tr>
<td>Max.</td>
<td>3kg</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td></td>
</tr>
<tr>
<td>Joint #1</td>
<td>0.0036 deg / pulse</td>
</tr>
<tr>
<td>Joint #2</td>
<td>0.0036 deg / pulse</td>
</tr>
<tr>
<td>Joint #3</td>
<td>0.004 mm / pulse</td>
</tr>
<tr>
<td>Joint #4</td>
<td>0.045 deg / pulse</td>
</tr>
<tr>
<td><strong>Shaft Diameter</strong></td>
<td></td>
</tr>
<tr>
<td>Installing</td>
<td>ø 16mm</td>
</tr>
<tr>
<td>Through Hole</td>
<td>ø 9mm</td>
</tr>
<tr>
<td><strong>Mounting Hole</strong></td>
<td>130 × 120mm ; 120 × 15mm</td>
</tr>
<tr>
<td></td>
<td>6-M8</td>
</tr>
<tr>
<td><strong>Weight (cables not included)</strong></td>
<td>13kg</td>
</tr>
<tr>
<td><strong>Standard Cycle (300mm*25mm)Time</strong></td>
<td>No-load : 105 times/min; 1kg : 90 times/min</td>
</tr>
<tr>
<td><strong>Driving Method</strong></td>
<td>All Joints : Integrated close-loop stepper servo system</td>
</tr>
<tr>
<td><strong>Motor Energy Consumption</strong></td>
<td>Joint #1 : 200W</td>
</tr>
<tr>
<td></td>
<td>Joint #2 : 150W</td>
</tr>
<tr>
<td></td>
<td>Joint #3 : 60W</td>
</tr>
<tr>
<td></td>
<td>Joint #4 : 60W</td>
</tr>
<tr>
<td><strong>Joint #3 Down Force</strong></td>
<td>100N</td>
</tr>
<tr>
<td><strong>Environmental Requirements</strong></td>
<td>Ambient Temp. : 5 ~ 40 °C (with minimum temperature variation)</td>
</tr>
<tr>
<td></td>
<td>Ambient relative humidity : 10 ~ 80% (no condensation)</td>
</tr>
<tr>
<td>*<em>Noise Level <em>1</em></em></td>
<td>L_{Aeq} = 70 dB (A)</td>
</tr>
<tr>
<td><strong>MTBF</strong></td>
<td>2 years</td>
</tr>
<tr>
<td>Item</td>
<td>SR 4150L</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Max. motion range</td>
<td></td>
</tr>
<tr>
<td>Joint #1</td>
<td>±135 deg</td>
</tr>
<tr>
<td>Joint #2</td>
<td>±135 deg</td>
</tr>
<tr>
<td>Joint #3</td>
<td>150 mm</td>
</tr>
<tr>
<td>Joint #4</td>
<td>±180 deg</td>
</tr>
<tr>
<td>Max. pulse range</td>
<td></td>
</tr>
<tr>
<td>Joint #1</td>
<td>±38250 pulse</td>
</tr>
<tr>
<td>Joint #2</td>
<td>±38250 pulse</td>
</tr>
<tr>
<td>Joint #3</td>
<td>±25000 pulse</td>
</tr>
<tr>
<td>Joint #4</td>
<td>±4000 pulse</td>
</tr>
</tbody>
</table>

*1: Conditions of robot during measurement as follows:

**Operating conditions** : Under rated load, 4-joints simultaneous motion, maximum speed, maximum acceleration, duty 50%.

**Measurement point**: In front of the robot, 1000mm apart from the motion range, 50mm above the base-installed surface.
UIROBOT SCARA Robot

2.5 Recommendations for Users

UI SCARA robot has better performance in the following conditions:

- **Range of main arm:** the angle difference between starting and end points is less than 50 degree;
- **Maximum distance of SR 4150L tool side:** 450mm;
- **Load range:** less than 1kg (including fixture tools).

**Range of main arm:**

When selecting starting and end points of robot movement, considering the relationship between swing angles of main arm and vice arm can achieve the best performance. Assuming the ratio coefficient \( \frac{C}{\theta_1} = \frac{\theta_2}{\theta_1} \), \( \theta_1 \) and \( \theta_2 \) are swing angles of main arm and vice arm respectively. When \( 2.6 < C < 3.2 \), robot can achieve the best performance.

For example, to achieve the standard cycle 300mm movement from starting point (400,0), when set point (235, -252) as end point, the robot has the fastest speed.

**Distance of SR 4150L tool side**

Selecting SR 4150L serie of UI SCARA robot, the users should take notice of the maximum distance of robot tool side move on the countertop. We propose you to choose the robot whose movement distance is less than 450mm that can achieve the best performance.
2.6 How to Set the Model

The robot model for your system has been set before shipment from the factory. It is normally not required to change the model when you receive your system.

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
</table>

★★ When you need to change the setting of the robot model, be sure to set the robot model properly. Improper setting of the robot may result in abnormal or no operation of the robot and/or cause safety problems.

<table>
<thead>
<tr>
<th>NOTE</th>
</tr>
</thead>
</table>

If an MT label is attached to the rear of a robot, the robot has custom specifications. The custom specifications may require a different configuration procedure, check the custom specifications number described on the MT label and contact us when necessary.
UIROBOT SCARA Robot

3.0 ENVIRONMENTS AND INSTALLATION

3.1 Environmental Conditions

A suitable environment is necessary for the robot system to function properly and safely. Be sure to install the robot system in an environment that meets the following conditions:

<table>
<thead>
<tr>
<th>Item</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient temperature</td>
<td>-20～60℃（with minimum temperature variation）</td>
</tr>
<tr>
<td>Ambient relative humidity</td>
<td>10～80%（No Condensation）</td>
</tr>
<tr>
<td>First transient burst noise</td>
<td>2kV or less</td>
</tr>
<tr>
<td>Electrostatic Noise</td>
<td>6kV or less</td>
</tr>
<tr>
<td>Environment</td>
<td>- Install indoors</td>
</tr>
<tr>
<td></td>
<td>- Keep away from direct sunlight</td>
</tr>
<tr>
<td></td>
<td>- Keep away from dust, oily smoke salinity, metal</td>
</tr>
<tr>
<td></td>
<td>- Keep away from flammable or corrosive solvents and gases</td>
</tr>
<tr>
<td></td>
<td>- Keep away from water</td>
</tr>
<tr>
<td></td>
<td>- Keep away from shocks or vibrations</td>
</tr>
<tr>
<td></td>
<td>- Keep away from sources of electric noise</td>
</tr>
</tbody>
</table>

Robots are not suitable for operation in harsh environments such as painting areas etc. When using robot in inadequate environments that do not meet the above conditions, please contact us.

*1 The ambient temperature conditions are for the robots only.

Special Environmental Conditions

The surface of the robot has general oil resistance. However, if your requirements specify that the robot must withstand certain kinds of oil, please consult your distributor.

Rapid change in temperature and humidity can cause condensation inside the robot. If your requirements specify that the robot handles the food, please consult your distributor to check whether the robot gives damage to the food or not.

The robot cannot be used in corrosive environments where acid or alkaline is used. In a salty environments where the rust is likely to gather, the robot is susceptible to rust.

★ When cleaning the robot, do not rub is strongly with alcohol or benzene. It may lose luster on the coated face.

Caution
3.2 Base Table

A base table for anchoring the robot is not supplied. Please make or obtain the base table for your robot. The shape and size of the base table differs depending on the use of the robot system. For your reference, we list some robot table requirements here.

The torque and reaction force produced by the movement of the robot are as follows:

<table>
<thead>
<tr>
<th></th>
<th>SR 4150LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Reaction torque on the horizontal plate</td>
<td>50 Nm</td>
</tr>
<tr>
<td>Max. Horizontal reaction force</td>
<td>300 N</td>
</tr>
<tr>
<td>Max. Vertical reaction force</td>
<td>300 N</td>
</tr>
</tbody>
</table>

The threaded holes required for mounting the robot base are M8. Use mounting bolts with specifications conforming to ISO898-1 property class: 10.9 or 12.9.

For dimensions, refer to: Mounting Dimensions.

The plate for the robot mounting face should be 20mm thick or more and made of steel to reduce vibration. The surface roughness of the steel plate should be 25μm or less.

The table must be secured on the floor or wall to prevent it from moving.

The robot must be installed horizontally.

When using a leveler to adjust the height of the base table, use a screw with M16 diameter or more.
3.3 Mounting Dimensions

The maximum space described in figures shows that the radius of the end effector is 60mm or less. If the radius of the end effector exceeds 60mm, define the radius as the distance to the outer edge of maximum space.

If a camera or solenoid valve extends outside of the arm, set the maximum range including the space that they may reach.

Be sure to allow for the following extra spaces in addition to the space required for mounting the robot and peripheral equipment.

- Space for teaching
- Space for maintenance and inspection
- Space for cables

The minimum bend radius of the power cable is 90mm. When installing the cable, be sure to maintain sufficient distance from obstacles. In addition, leave enough space for other cables so that they are not bent forcibly.

Ensure distance to the safeguard from the maximum motion range is more than 100mm.

Standard-Model: SR 4150LS
3.4 Unpacking and Transportation

The installation should be performed by qualified installation personnel and should conform to all national and local codes.

- Using a cart or similar equipment, transport the robot in the same manner as it was delivered.

- After removing the bolts securing the robot to the delivery equipment, the robot may fall. Be careful not to get hands or fingers caught.

- To carry the robot, have two or more people to work on it and secure the robot to the delivery equipment or hold the areas indicated in gray in the figure (bottom of Arm#1 and bottom of the base) by hand. When holding the bottom of the base by hand, be very careful not to get your hands or fingers caught.

- When transporting the robot for a long distance, secure it to the delivery equipment directly so that the robot never falls. If necessary, pack the robot in the same style as it was delivered.
UIROBOT SCARA Robot

3.5 Installation Procedure

| Caution | ★ The robot system must be installed to avoid interference with buildings, structures, utilities, other machines and equipment that may create a trapping hazard or pinch points. |
| Caution | ★ Install the robot with two or more people. Be careful not to get hands, fingers or feet caught and/or have equipment damaged by a fall of the robot. |

Secure the base to the base table with six bolts.

Use the bolts with specifications conforming to ISO898-1 property class 10.9 or 12.9
3.6 Connecting the cables

<table>
<thead>
<tr>
<th>Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ To shut off power to the robot system, pull out the power plug from the power source. Be sure to connect the AC power cable to a power receptacle. Do not connect it directly to a factory power area.</td>
</tr>
<tr>
<td>★ Before performing any replacement procedure, turn off the controller and related equipment, and the pull out the power plug from the power source. Performing any replacement procedure with the power on is extremely hazardous and may result in electric shock and/or malfunction of the robot system.</td>
</tr>
<tr>
<td>★ Be sure to connect the cables properly. Do not allow unnecessary strain on the cables. The unnecessary strain on the cables may result in damage to the cables, disconnection, and/or contact failure.</td>
</tr>
<tr>
<td>★ Grounding the robot is done by connecting with the controller. Ensure that the controller is grounded and the cables are correctly connected. If the ground wire is improperly connected to ground, it may result in the fire or electric shock.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ When connecting the robot to the controller, make sure that the serial numbers on each equipment match. Improper connection between the robot and controller may not only cause improper function of the robot but also serious safety problems. The connection method varies with the controller used.</td>
</tr>
</tbody>
</table>

Cable Connections

- Signal Connector
- Power Connector
3.7 Relocation and Storage

3.7.1 Precautions of relocation and storage

Observe the following when relocating, storing and transporting the robot. The installation should be performed by qualified installation personnel and should conform to all national and local codes.

- Before relocating the robot, fold the arm and secure it tightly with a wire tie to prevent hands or fingers from being caught in the robot.
- When removing the anchor bolts, support the robot to prevent falling. Removing the anchor bolts without support may result in fall of the robot, and then get hands, fingers, or feet caught.
- To carry the robot, have two or more people to work on it and secure the robot to the delivery equipment or hold the bottom of Arm #1, the bottom of the main cable fitting, and the bottom of the base by hand. When holding the bottom of the base by hand, be very careful not to get hands or fingers caught.
- Stabilize the robot with your hands when hoisting it. Unstable hoisting is extremely hazardous and may result in fall of the robot.

When transporting the robot for a long distance, secure it to the delivery equipment so that the robot can not fall.

If necessary, pack the robot in the same way as it was delivered.

When the robot is used for the robot system again after long-term storage, perform a test run to verify that it works properly, and then operate it thoroughly.

Transport and store the robot in the range of -25°C to +55°C. Humidity within 10% to 90% is recommended.

When condensation occurs on the robot during transport or storage, turn on the power only after the condensation dries.

Do not shock or shake the robot during transport.

3.7.2 Relocation

- Install or relocate the robot with two or more people. Be careful not to get hands, fingers, or feet caught and/or have equipment damage by a fall of the robot.

(1) Turn off the power on all devices and unplug the cables.

Remove the mechanical stops if using them to limit the motion range of Joint #1 and #2.

For the details on the motion range, refer to 5.2 Motion Range Setting By Mechanical Stops.

(2) Support the bottom of Arm #1 to avoid the falling of the robot, then remove the setting screw, the robot can be removed from the base table.
4.0 SETTING OF END EFFECTORS

Users are responsible for making their own end effectors. Before attaching an end effector, observe these guidelines.

★ If you use an end effector equipped with a gripper or chuck, connect wires and/or pneumatic tube properly so that the gripper does not release the work piece when the power to the robot system is turned off. Improper connection of the wires and/or pneumatic tubes may damage the robot system and/or work piece as the work piece is released when the Emergency Stop switch is pressed. I/O outputs are configured at the factory so that they are automatically shut off by power disconnection, the emergency stop switch, or the safety features of the robot system.

Shaft
- Attach an end effector to the lower end of shaft.
  For the shaft dimensions, and the overall dimensions of the robot, refer to 2.0 Specification.
- Use a split muff coupling with an M4 bolt or large to attach the end effectors to the shaft.

Layout
- When you operate the robot with an end effector, the end effector may interfere with the robot because of the outer diameter of the end effector, the size of the work piece, or the position of the arms. When designing your system layout, pay attention to the interference area of the end effector.

The shaft may be lowered by the weight of the end effector.
When the motion range is preset at the factory.

There are three methods for setting the motions range described as follows:

1. Setting by pulse range (for all joints)
2. Setting by mechanical stops (for Joint #1 to #3)
3. Setting the rectangular range in the X,Y coordinate system of the robot (for Joint #1 and #2).

When the motion range is changed due to layout efficiency or safety, follow the descriptions in 5.1 to 5.2 to set the range.

5.1 Motion Range Setting by Pulse Range

Pulses are the basic unit of robot motion. The motion range of the robot is controlled by the pulse range between the pulse lower limit and upper limit of each joint. Pulse values are read from the encoder output of the motor.

For the maximum pulse range, refer to the following sections. The pulse range must be set inside of the mechanical stop range.

5.1.1 Max. Pulse Range of Joint #1
5.1.2 Max. Pulse Range of Joint #2
5.1.3 Max. Pulse Range of Joint #3
5.1.4 Max. Pulse Range of Joint #4

Once the robot receives an operating command, it checks whether the target position specified by the command is within the pulse range before operating. If the target position is out of the set pulse range, an error occurs and the robot does not move.
5.1.1 Max. Pulse Range of Joint #1

The 0 pulse position of Joint #1 is the position where Arm #1 faces towards the positive direction on the X-coordinate axis. When the 0 pulse is starting point, the anticlockwise pulse value is defined as the positive(+) and the clockwise pulse value is defined as the negative(-).

<table>
<thead>
<tr>
<th></th>
<th>A: Max. Motion Range</th>
<th>B: Max. Pulse Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 4150LS</td>
<td>±135 deg.</td>
<td>±38250 pulse</td>
</tr>
</tbody>
</table>

5.1.2 Max. Pulse Range of Joint #2

The 0 pulse position of Joint #2 is the position where Arm #2 is in-line with Arm #1. With the 0 pulse as a starting point, the anticlockwise pulse value is defined as the positive(+) and the clockwise pulse value is defined as the negative(-).

<table>
<thead>
<tr>
<th></th>
<th>A: Max. Motion Range</th>
<th>B: Max. Pulse Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 4150LS</td>
<td>±135deg.</td>
<td>±38250 pulse</td>
</tr>
</tbody>
</table>
UIROBOT SCARA Robot

5.1.3 Max. Pulse Range of Joint #3

The 0 pulse position of Joint #3 is the position where the shaft is at its upper limit. The pulse value is always negative because Joint #3 always moves lower than the 0 pulse position.

<table>
<thead>
<tr>
<th></th>
<th>Joint #3 Stroke</th>
<th>Lower Limit Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 4150LS</td>
<td>150mm</td>
<td>±25000 pulse</td>
</tr>
</tbody>
</table>

5.1.4 Max. Pulse Range of Joint #4

The 0 pulse position of Joint #4 is the position where the flat near the end of the shaft faces towards the end of the Arm #2. With the 0 pulse as a starting point, the anticlockwise pulse value is defined as the positive(+) and the clockwise pulse value is defined as the negative(-).

SR XXX0L:+X 0 pulse ±4000 pulse
5.2 Motion Range Setting by Mechanical Stop

Mechanical stops physically limit the absolute area that the robot can move. Both Joint #1 and #2 have threaded holes in the positions corresponding to the angle for the mechanical stop settings. Install the bolts in the holes corresponding to the angle that you want to set. Joint #3 can be set to any length less than the maximum stroke.
UIROBOT SCARA Robot

Both Joint #1 and #2 have threaded holes in the positions corresponding to the angle for the mechanical stop settings. Install the bolts in the holes corresponding to the angle that you want to set.

Install the bolts for the mechanical stop to the following position.

Mechanical Stops of Joint #1

<table>
<thead>
<tr>
<th>Setting Value</th>
<th>Setting Angle</th>
<th>Pulse Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 4150L</td>
<td>135 deg.</td>
<td>38250 pulse</td>
</tr>
</tbody>
</table>

Mechanical Stops of Joint #2

<table>
<thead>
<tr>
<th>Setting Value</th>
<th>Setting Angle</th>
<th>Pulse Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 4150L</td>
<td>135 deg.</td>
<td>38250 pulse</td>
</tr>
</tbody>
</table>
SPECIFIC OPERATION

Steps and precautions during using UI-SR series robots.
1.0 INSTALLATION AND UNINSTALL OF SCARA SOFTWARE

1.1 Installation of SCARA Software

Copy the installation file “SCARASsetup.exe” to your computer’s hard drive and double click the file to install. The computer screen will appear the installation interface with words of “welcome to use ‘SCARA 1.0’”.

Click the “NEXT” button to select the installation location of SCARA software.
If you want to modify the installation directory, click the “BROWSE” button, if not, just click the “INSTALL” button.

It starts to install the software, waiting for the installation to be completed.

After the installation, appears a interface with words of “SCARA 1.0 have been installed”, click the “FINISH” button.
After the installation according to the default directory, 8 folders will appear in the installation directory:

- **DLL**: The folder includes SDK calling dynamic library;
- **Include**: The folder includes head file to call SDK dynamic library;
- **LIB**: The folder includes files required for SDK static calling;
- **ExampleCode**: The folder includes source codes to call SDK dynamic library examples;
- **UIRobotWebsite**: Listing to UIROBOT company, welcome to advice if you need help;
- **SCARA.exe**: Start program of SCARA;
- **Uninst.exe**: Uninstall program of SCARA;
- **libUIScara.dll, UIRobotSdkFunc.dll**: All files required for program running;
1.2 Uninstall of SCARA Software

Double click the “uninst.exe” file in the installation directory to uninstall the software, as shown in the following figure:

Click the “YES” button, all the files in the installation directory will be cleared. The uninstallation is completed.
2.0 SCARA SOFTWARE OPERATION

SCARA software is a kind of graphical user interface, which can be used by users to operate robots, run the existing robot program or to easily create new programs.

2.1 Start Program

After the success of SCARA software SCARA installation, double click the SCARA icon, then enter the login screen:

There are 3 kinds of mode for users to login:

- **Offlin mode** --- not communicate with robot but can write and modify robot program;
- **Bluetooth connection mode** --- communicate with robot through Bluetooth;
- **Network connection mode** --- communicate with robot through network.
2.2 Login In

**Bluetooth connection:** Select serial number of bluetooth device that have communicated with robot in the serial numbers drop-down menu. Click the “open serial port” button to establish the communication, then enter main menu interface.

**Network connection:** Import IP address and correct password, then click the “sure” button. The communication is established and enter main menu interface. The IP address of testing robot is 192.168.1.6, and the password of that is 1234.
2.3 Main Menu

Users interface of SCARA: the lower status bar of the screen shows the feedback information from robot after the execution of instructions; the left middle lower part of the screen shows the current running state of robot; on the right side of the screen are function buttons, including “running program”, “robot programming”, “robot setup”, “close robot” and “about”, click on any button you can enter the corresponding interface.
2.4 Running Program

Click the “running program” button in the main menu screen, then enter running program interface.

Through the running program interface, the function of simulation, simulation running and running for users program can be achieved; through the program list, can check or delete the internal program list in robot.

![Running Program Interface]

Operation description: select one program within the program list, then

- Click “simulation” button, the left 3D demonstration box will display the simulation of programs users programming;
- Click “simulation running” button, robot will run in 30% speed set by user’s program;
- Click “running” button, robot run the users program;
- Click “stop” button, stop the user’s program;
- Click “set as default” button, robot runs with the default program;
- Click “clear default” button, default programs are cleared;
- Click “delete” button, delete the user’s program;
- Click “return” button, switch back to main menu interface.
2.5 Robot Programming

Click the “robot programming” button on the main menu, enter robot programming interface, which contains six parts: program, install, move, I/O, camera mode and log.

2.5.1 Program

Click “program” button, enter programming interface, and can achieve functions as: “new program”, “loading program from local”, “loading program to robot” and “download program from robot”.

New Program

Click “new program” button, enter simple programmer interface, in which users can write programs.
The left of the simple programmer interface is a programming window, and the right of that contains a simulation window, tool and function buttons.

Tool buttons contain “up”, “down”, “copy”, “delete” and “simulation” buttons.

Select one program from program editing window, click “up” button, move up the selected program.

Select one program from program editing window, click “down” button, move down the selected program.

Select one program from program editing window, click “copy” button, copy the selected program.

Select one program from program editing window, click “delete” button, delete the selected program.

Click “simulation” button, simulate the programs that users write and display in the simulation window.


**While**
UIROBOT SCARA Robot

Click “While” button, program editing window display while loop statement:

```
While (loop judge condition) {
    Execute code;
    Condition of jumping out of the loop;
}
```

Double click while statement in program editing window, automatically eject loop judge condition input interface. Constants, variables, port input are available to be taken as loop judge condition to constraint program.

**If...else statement**

```
if (expression) statement1 else statement2
```
Users can write statements through loop judge condition input interface and assignment interface.

New variable

Click “new variable” button in simple programmer interface, enter new variable interface in which users can customize, add, delete integer variable.

Assignment
After new-built a variable in “new variable”, click “assignment” button in simple programmer interface, then users can write loop condition.

**Linear motion**

Click “linear motion” button in simple programmer interface, users can write linear motion. Default linear motion from user program generally have two groups of points, each group has four values. If user need more points, can select one group of poits and click “copy” button on the right side to add a group of points.

**Curvilinear motion**

Click “curvilinear motion ” button in simple programmer interface, user can write curvilinear motion. The default linear motion in user program generally has three group of points, each group has four values. If user need more points, can select one group of points and click “copy”
on the right side to add a group of points.

![Image](image1.png)

**Points**

Select one internal point in linear motion or curvilinear motion, double click that point or click “point” button, enter point editing interface. In point editing interface, user can coordinate robot to fast and easily pick up robot coordinate point through three kinds of ways that are dimensional coordinate, axis rotation angle and manual control.

Long press “teach” button, robot is in offline state, user can manually control robot coordinates. If this is set, click “read” button, then get the robot coordinates.

Notice: teaching requires two persons to operate, one often press “teach” button, another one manually coordinate robot’s points.

![Image](image2.png)

**Set up**

Click “set up” button in simple programmer interface, enter programing inteface, in which
UIROBOT SCARA Robot

user can set up high and low output of 8 output ports according to actual needs.

Waiting

Click “waiting” button in simple programmer interface, enter programming waiting interface in which user can set up time waiting or IO input waiting according to demand.

Save

Click “save” button in simple programmer interface, user can save edited program.
Load program from local

Click “load program from local” button in robot programming interface, eject file location selection dialog. User can open and edit program in the computer.

Load program to robot

Click “load program to robot” in robot programming interface, eject file location selection dialog. User can load robot program from computer to robot, and can run the loaded program in program running interface.
Download program from robot
Click “download program from robot” button, eject robot program list. User select the program need to download, click “OK”, the program is downloaded to computer.

2.5.2 Install

Click “install” button in main menu, enter robot tool center point setting interface.

When the center point of user installation tool does not coincide with the center point of robot itself, the corresponding data can be input X,Y and Z after the offset distance is measured.
2.5.3 Move

Click “move” button in the main menu, enter robot movement interface.

**Tool position:** Set up the coordinate parameter of X, Y, Z and RZ axis to adjust robot position.

**Movement joint:** Set up the angle of big arm, small arm, tool and wrist to adjust robot position.

**3D display:** After the tool coordinates are setted or the joint coordinates are moved, the 3D demon interface will follow the simulation result for customer observation.

**Speed button:** The scope is 0-100% of original speed. If set to 30%, the interface simulation and actual robot movement will run in 30% original speed.

**Tech:** Press “teaching” button, robot is in offline state, user can manually adjust robot position to read the coordinate point.

Notice: teaching requires two persons, one often press “teaching” button, another one manually adjust robot point.

**Clear:** Click “clear” button, tool position and data of movement joint are overall cleared.

**Confirm:** After the setting of tool position and movement joint position, click “ok”, the robot move to the setting position.

**Emergency stop:** Click “emergency stop”, robot will stop the running motion.

**Movement tool:** Long press direction arrow button, robot will move according to the arrow direction not stop until to the limit position. Put the mouse into the arrow, ther will display arrow running direction.

Up and down movement of the third joint.

Combined movement of first and second joints, in which the up and down arrows indicate Y direction, the left and right
2.5.4 I/O

Click “I/O” button in the main menu, enter robot I/O interface.

SCARA robot have 8 input ports, 16 output ports. In the interface user can query the state of each port.

2.5.5 Camera Mode

Click “camera mode” button in robot programming interface, enter robot camera mode interface.

2.5.6 Log

Click “Log” button in the main menu, enter robot log interface.
Log interface: Detailed record the feedback information after sending instructions to robot. User can query the robot running state in real time.

### 2.6 Robot Setting

Click “robot setting” button in user interface to enter robot setup interface.

#### 2.6.1 Reset Setting

Click “reset setting” button, then enter reset setting interface.
Click “reset” button, the robot automatically returns to the original point.

**2.6.2 Password Setting**

Click “password setting” button, enter login password setting interface.

In password setting interface, the default original password is 1234, user can customize new password according to demand, click “OK” to complete password setting. Re-login the software after password setting, the password can take effect.

**2.6.3 Network Setting**

Click “network setting” button, enter robot network setting interface.
In network setting interface, user can change robot’s internal IP through setting of IP address, subnet mask and default gateway for easy network communication.

### 2.6.4 Time Setting

Click “time setting” button, enter robot time setting interface.

In the time setting interface, user can set up time for robot.
2.7 Close Robot

Click “close robot” button, pop-up a dialog box “confirm to close robot”, click “YES” to close the robot.

2.8 About

Click “about” button, the screen will pop-up the current version number information of robot.
MAINTENANCE

Steps and Precautions During Maintenance of UI-SR series robots.
UIROBOT SCARA Robot

1.0 SAFETY OF MAINTENANCE

Prior to maintenance, please read carefully “safety of maintenance”, this manual and related manuals, and be familiar with maintenance methods.

The robot system should be maintained by trained personnel.

Trained personnel are defined as those who have taken robot system training and maintenance training classes held by the manufacturer, dealer or local representative company, or those who understand the manuals thoroughly and have the same knowledge and skill level as those who have completed the training courses.

Training personnel refers to those who have been trained by safety training which is regulated by laws and regulations of each country in order to train workers engaged in industrial robots-related business. The safety training contains knowledge of industrial robots, knowledge of operation and teaching, knowledge of business operation such as inspection and related laws and regulations. Our company’s training personnel is those who have completed introduction training and maintenance.

| ★ | Do not disassemble the parts that are not disclosed in this manual. It is not recommended to carry out maintenance in a different way from the public. Failure to perform proper disassembly or maintenance may result in serious safety problems. |
| ★ | Untrained personnel should not close to powered robot, all personnel are prohibited from entering action area of powered robot. Even if the robot seems to stop, but the powered robot may be an accident, potentially cause a serious safety problem. |
| ★ | Please check the robot actions after changing parts outside the safety guard. Failure to do so may result in serious safety problem due to unexpected actions by robot before the action is confirmed. |
| ★ | Before formal operation, make sure the emergency stop switch and safety door switch are in normal state. If the switches do not operate normally, the safety function can not be performed in emergency event, which may result in serious injury or serious damage. |

| ★ | Unplug the power plug to ensure that the power supply is locked. Be sure to connect the AC power cable to the power plug, not directly to the factory power supply and so on. |
| ★ | Be sure to do replacement operation after powering off the robot and related equipments and unplugging the power plug. If you |
operate the robot while the power is on, it may cause electric shock or malfunction.

Please connect the cable reliably. In addition, do not place heavy object on the cable, do not extremely bend, forcibly pull or nip the cable, otherwise it may cause damage, disconnection or poor contact of cable, malfunction of the system, or electric shock.

2.0 MAINTENANCE SUMMARY

In order to prevent malfunction and ensure safety, it is required to reliably carry out inspection operation. Check schedule and contents are as follows. Please follow the schedule to check.

2.1 Check Schedule

Check items are divided into 5 stages of daily, 1 month, 3 months, 6 months and 12 months, and add the item by stage. If the operation time is longer than 250 hours in 1 month, add check items by 250 hours, 750 hours, 1,500 hours and 3,000 hours.

<table>
<thead>
<tr>
<th></th>
<th>Daily</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 month (250h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 months (500h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 months (750h)</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 months (1000h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 months (1250h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 months (1500h)</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 months (1750h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 months (2000h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 months (2250h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 months (2500h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 months (2750h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months (3000h)</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>13 months (3250h)</td>
<td>√</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 2.2 Check Contents

### 2.2.1 Check When Power is Off (No Operation)

Please pay attention to the following conditions when transferring/storing/transporting.

<table>
<thead>
<tr>
<th>Check Item</th>
<th>Check Position</th>
<th>Daily</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirm whether bolts are loose/shaking, if there are, then tightening ( please refer to &quot;2.4 Fastening of Hexagon Socket Head Bolts&quot; for fastening torque )</td>
<td>Mounting bolts at the end of clamps</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Setting bolts for robot</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>bolts around the shaft</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Confirm whether the connector is loose, if so, press in</td>
<td>External side of robot (connector board, ect.)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Cable unit</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Scar check car check remove attached dust and so on</td>
<td>Overall</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>External cables</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Correction of deformation and position offset</td>
<td>Safety guards</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Make sure the belt has no slack, if so, re-tension</td>
<td>Inside jib</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Status of grease</td>
<td></td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Confirm operation area</th>
<th>Joints</th>
<th>daily</th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>

### 2.2.2 Check When Power is ON (during operation)

Please pay attention to the following conditions when transferring/storing/transporting.
2.3 Grease Filling

Ball screw splines require periodic greasing. Be sure to use the specified grease.

<table>
<thead>
<tr>
<th>Part</th>
<th>Period</th>
<th>Grease</th>
<th>Method of grease filling</th>
</tr>
</thead>
<tbody>
<tr>
<td>The third joint</td>
<td>Ball screw splines shaft</td>
<td>After moving 50km for the first time, then move each 100km</td>
<td>LUBE 6.0 ball screw splines unit</td>
</tr>
</tbody>
</table>

Please pay attention to avoid grease running out. If the grease is used up, the sliding part may cause scratches and the like, and not only can it not perform well, but the repair will take a lot of time and expense.

2.4 Fastening of hexagon socket head bolts

Use the hexagon socket head bolts (hereinafter simply “bolts” for short) where mechanical strength is required. When assembling, tighten the bolts follow the tightening torques shown
UIROBOT SCARA Robot

in the table below.

When re-tightening these bolts in the work described in this manual, use a torque wrench or
the like to tighten to the torque values shown in the table below, unless otherwise specified.

For locking screws, refer to the following. 为

<table>
<thead>
<tr>
<th>Bolts</th>
<th>Tighten Torque Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3</td>
<td>245 N cm (25 kgf cm)</td>
</tr>
<tr>
<td>M4</td>
<td>490 N cm (50 kgf cm)</td>
</tr>
<tr>
<td>M5</td>
<td>980 N cm (100 kgf cm)</td>
</tr>
<tr>
<td>M6</td>
<td>1,760 N cm (180 kgf cm)</td>
</tr>
<tr>
<td>M8</td>
<td>3,720 N cm (380 kgf cm)</td>
</tr>
<tr>
<td>M10</td>
<td>7,350 N cm (750 kgf cm)</td>
</tr>
<tr>
<td>M12</td>
<td>12,740 N cm (1,300 kgf cm)</td>
</tr>
</tbody>
</table>

As shown in the figure, bolts arranged on the circumference are fixed in diagonal order.

Do not fasten the bolts once, but fasten them with a hexagonal wrench in two or three turns, and then use a torque wrench or the like to fasten them follow the torque as shown in the table.

2.5 Origin Position

If the integrated machine, belt, ect. are replaced, deviration occurs between origin stored in robot and the origin stored in controller, and the robot can not be controlled correctly. Therefore, after the replacement origin adjustment (calibration) is required, so that the two origin points are the same.

2.6 Configuration of Maintenance Components
3.0 ENCLOSER

The general encloser removal/mounting methods of each part are described in the following section.

- Do not load and unload the motor connector while the power is on, otherwise it may cause abnormal action, which is very dangerous. In addition, when the power is on, the operation of robot may result in electric shock or malfunction.

- Unplug the power plug to ensure that the power supply is locked. Be sure to connect the AC power cable to the power plug, not directly to the factory power supply and so on.

- Be sure to do replacement operation after powering off the robot and related equipments and unplugging the power plug. If you operate the robot while the power is on, it may cause electric shock or malfunction.

- Do not allow foreign matter into robot internal and connect terminal.
If the robot is turned on with a foreign matter entered, it may lead to electric shock or malfunction, which is very dangerous.

3.1 User Board

Disassembly of user board
Tighten the fixing bolts (6 in total) for user board, and unplug the internal wire connector to remove the user board.

**Installation of user board**

Connect the internal wire connector, insert the user board into the upper enclose, align the screw holes, and then secure with fixing screws.

### 3.2 Upper Encloser

| | ★ Do not pull the upper encloser firmly, otherwise it may cause damage, disconnection or poor contact of cables, malfunction of the system, or electric shock.  
| | ★ Do not nip the cable or force it to bend during the installation of upper encloser, otherwise it may cause damage, disconnection or poor contact of cables, malfunction of the system, or electric shock. When removing the cables, please check the cable configuration and return to normal wiring while the cover is disassembled.  

**Disassembly of upper encloser**

Unscrew the fixing bolts in upper encloser, and remove the cover.

During the disassembly, please pay attention to the user wiring and piping.

**Installation of Upper Encloser**
UIROBOT SCARA Robot

Attach the encloser to the robot arm, and secure it with fixing bolts.

After the upper encloser is secured, please make sure the lower mechanical block does not interfere the cylindrical part of the upper encloser.

### 3.3 Under Encloser

Disassemble the fixing bolts of under cover, and remove the encloser downwards.

If the clamp tip is fitted, it may not be possible to remove the under encloser from the shaft.

If you want to replace ball screw spline unit, please disassemble the clamp tip and then completely remove the under enclose.

When it not need to be disassembled, please put the shaft down to lower limit position, and then remove the under encloser for maintenance and inspection.

### 3.4 Interface Board

<table>
<thead>
<tr>
<th>注意</th>
</tr>
</thead>
<tbody>
<tr>
<td>★ Do not pull the interface board hard, otherwise it may cause damage, disconnection or poor contact of the cables, malfunction of the system, or electric shock.</td>
</tr>
<tr>
<td>★ Do not nip the cable or force it to bend, otherwise it may cause damage, disconnection or poor contact of cables, malfunction of the system, or electric shock. When removing the cables, please check the cable configuration and return to normal wiring while the interface board is disassembled.</td>
</tr>
</tbody>
</table>
Unscrew the fixing bolts of interface board then open the it.

Notice: There is electrical interface on the inner side of interface board, please slowly open the interface board from up to down to avoid cable damage caused by forcible pulling.
4.0 CABLE

**Warning**

★ Do not load and unload the motor connector while the power is on, otherwise it may cause abnormal action, which is very dangerous. In addition, when the power is on, the operation of robot may result in electric shock or malfunction.

★ Unplug the power plug to ensure that the power supply is locked. Be sure to connect the AC power cable to the power plug, not directly to the factory power supply and so on.

★ Be sure to do replacement operation after powering off the controller and related equipments and unplugging the power plug. If you operate the robot while the power is on, it may cause electric shock or malfunction.

★ Do not allow foreign matter into robot internal and connect terminal. If the robot is turned on with a foreign matter entered, it may lead to electric shock or malfunction, which is very dangerous.

**Notice**

★ Please connect the cable reliably. In addition, do not place heavy object on the cable, do not extremely bend, forcibly pull or nip the cable, otherwise it may cause damage, disconnection or poor contact of cable, malfunction of the system, or electric shock.

### 4.1 Replacement of Cable Unit

Because each motor is powered by a backup battery, the position data will be maintained even if the controller is powered off. The position data will disappear if the signal connector of internal cables is removed. When turning the controller power again, error information of encoder alarm will be displayed.

After the cable is replaced, do the origin point adjustment. Details are described in “8.0 Origin Adjustment”

<table>
<thead>
<tr>
<th>Maintenance components</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable unit</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lithium battery</td>
<td>4</td>
<td>ER3V</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tools</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagonal wrench</td>
<td>1 (double-sided width is 2.5mm)</td>
<td></td>
<td>For M3 screw</td>
</tr>
<tr>
<td>Cross screwdriver</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torque wrench</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nipper</td>
<td>1</td>
<td></td>
<td>For cutting ties</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Materials</th>
<th>Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tie</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>★</td>
<td>To replace the cable unit, if the interface board has been disassembled, please refer to wiring table and reconnect properly; if the connection is made incorrectly, the system may not be able to operate normally.</td>
<td></td>
</tr>
<tr>
<td>★</td>
<td>To install the cover, do not nip the cable or forcibly bend it, otherwise it may cause damage, disconnection or discontact of the cable, malfunction of the system, or electric shock. When removing the cables, please check the cable configuration and return to correct wiring while the cover is removed.</td>
<td></td>
</tr>
<tr>
<td>★</td>
<td>Please connect the cable reliably. In addition, do not place heavy object on the cable, do not extremely bend, forcibly pull or nip the cable, otherwise it may cause damage, disconnection or poor contact of cable, malfunction of the system, or electric shock.</td>
<td></td>
</tr>
</tbody>
</table>

Before the operation, please refer to disassembly steps, and put down the shaft to the lower limit position beforehand.

**Disassembly of cable unit**

1. Press the emergency switch, make sure the clamp tip does not interfere the peripheral devices, and put down the shaft to the lower limit position.

2. Unscrew the fixing screws of the interface board.
（3）Slowly open the interface board from up to down, unplug the network connector of controller inside the base, interface X3 and interface X4. Refer to “4.2 wiring table” for details about interface.

（4）Use a flat-blade screwdriver to unscrew the two groups of wires (8 in total) under the interface board. The color of each group of wires is red, black, white and blue respectively. One group from the controller and the other from Bellows. Disassemble the wiring, you can remove the interface board.

（5）Disassemble the fixing bolts of the user board and gently pull out the user board. Details are described in “3.1 user board”.

（6）Unplug the MT2, MT3, MT4 interface on the inner side of user board and you can remove the user board.
Please check the cable configuration to ready for reconnection after replacement.
Installation of cable unit

（1）Corresponding connect cable of each integrated machine inside the jib to interface MT2, MT3 and MT4 respectively.

（2）Put the user board on the encloser, align screw holes and secure it by fixing bolts.

（3）Place the two sets of wires in the connectors on the interface board, and use a flat-blade screwdriver to tighten the cables.

Notice: 48V: red, 0V: black, CH: white, CL: blue.

（4）Connect the network connector of interface board, interface X3 and interface X4 to controller inside the base respectively.

Refer to “4.2 wiring table” for details about interface.

（5）Close the interface board, align screw holes and secure the interface board.

（6）Release the emergency switch.

（7）If the lithium battery connector is unplugged, you need to do origin adjustment for the corresponding joint.
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4.2 Wiring Table

Power supply conditions of UI-SR series robot body:
   Voltage: 48VDC±1%; Power: ≥1500VA

Power supply conditions of UI-SR series robot power module:
   Voltage: 180〜264VAC（47〜63Hz）or 254〜370VDC; Power: ≥1500VA

The UI-SR series robot electrical terminal have two parts: the top of the jib and the side of the pedestal.

Top of Jib
Output Port (X3, X5):

Internal Ports:

Side of Pedestal
Multi-function input and output ports (X4):

![Diagram showing top and side of robot terminal]
Detailed description for each port:

### X1 Power Interface

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+48V</td>
<td>Positive Input of Power</td>
</tr>
<tr>
<td>2</td>
<td>+48V</td>
<td>Positive Input of Power</td>
</tr>
<tr>
<td>3</td>
<td>GND</td>
<td>Ground Input of Power</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground Input of Power</td>
</tr>
</tbody>
</table>

### X3 Output Interface

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G0</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>O1</td>
<td>Collector Open-Drain Output of Signal 1</td>
</tr>
<tr>
<td>3</td>
<td>O2</td>
<td>Collector Open-Drain Output of Signal 2</td>
</tr>
<tr>
<td>4</td>
<td>O3</td>
<td>Collector Open-Drain Output of Signal 3</td>
</tr>
<tr>
<td>5</td>
<td>O4</td>
<td>Collector Open-Drain Output of Signal 4</td>
</tr>
</tbody>
</table>

Notice: The output of switch value signal is the collector open-drain output, the maximum on-off voltage is 50V, the maximum on-off current is 500mA.

### X4 Multi-function Interface
# UIROBOT SCARA Robot

<table>
<thead>
<tr>
<th>Pin Number</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>G0</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>2</td>
<td>O1</td>
<td>Collector Open-Drain Output of Signal 1</td>
</tr>
<tr>
<td>3</td>
<td>O2</td>
<td>Collector Open-Drain Output of Signal 2</td>
</tr>
<tr>
<td>4</td>
<td>O3</td>
<td>Collector Open-Drain Output of Signal 3</td>
</tr>
<tr>
<td>5</td>
<td>O4</td>
<td>Collector Open-Drain Output of Signal 4</td>
</tr>
</tbody>
</table>

**Notice:**

1. The maximum input voltage of switch value input signal is 30V.
2. Switch value output signal has been connected with series 499Ω resistor, the maximum on-off voltage is 30V, the maximum on-off current is 50mA.

<table>
<thead>
<tr>
<th>X5 Output Port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin Number</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

**Notice:**

The output of switch value signal is the collector open-drain output, the maximum on-off voltage is 50V,
the maximum on-off current is 500mA.

Wiring Diagram:

Wiring Diagram of Output Port (X3 or X5):

Wiring Diagram of Multi-Function Interface (X4):

Figure 1

Figure 2

Figure 3
5.0 DISASSEMBLY AND INSTALLATION OF JOINTS

![警告]
★ Do not load and unload the motor connector while the power is on, otherwise it may cause abnormal action, which is very dangerous. In addition, when the power is on, the operation of robot may result in electric shock or malfunction.

★ Unplug the power plug to ensure that the power supply is locked. Be sure to connect the AC power cable to the power plug, not directly to the factory power supply and so on.

★ Be sure to do replacement operation after powering off the controller and related equipments and unplugging the power plug. If you operate the robot while the power is on, it may cause electric shock or malfunction.

![注意]
★ Be careful not to apply excessive shock to the motor shaft during the replacement operation, otherwise it may result in a short service life or damage of the motor or encoder.

★ Do not disassemble the integrated machine. If it is disassembled, there will be a dislocation and it can not be used.

If the robot components (integrated machine, synchronous belt, ball screw spline, etc.) are replaced, there will be deviation between the origin stored in integrated machine and the origin stored in controller, and it is unable to control correctly.

Therefore, after the components replaced, it is necessary to carry out the operation of aligning the two origin points.

The operation of aligning the two origin points is called "origin adjustment (calibration)".

After the replacement, please refer to “8.0 Origin Adjustment” to perform the origin adjustment.
## 5.1 The First Joint

![Integrated speed reducer of the first joint](image)

<table>
<thead>
<tr>
<th>Maintenance components</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Integrated speed reducer of the first joint</td>
<td>1</td>
<td>UIM62H08A-8678X</td>
</tr>
<tr>
<td></td>
<td>Grease</td>
<td>-</td>
<td>NS2</td>
</tr>
<tr>
<td>Tools</td>
<td>Hexagonal wrench (double-sided width is 2.5mm)</td>
<td>1</td>
<td>For M3 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 3mm)</td>
<td>1</td>
<td>For M4 screws</td>
</tr>
<tr>
<td></td>
<td>Torque wrench</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rag</td>
<td>1</td>
<td>For grease wiping</td>
</tr>
</tbody>
</table>
UIROBOT SCARA Robot

Disassembly of the Integrated Speed Reducer of the First Joint

(1) Turn off the power.

(2) Unscrew the interface of bellows at the cylindrical pedestal.

(3) Remove the bellows cover plate, and unscrew the fixing screws of the arm under the bellows cover plate.

(4) Remove the outer ring screws at the cover plate of cylindrical pedestal and take out integrated speed reducer from the cylinder.
(5) Remove the inner ring screws at the cover plate of cylindrical pedestal to complete the disassembly of integrated speed reducer.
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Installation of integrated speed reducer of the first joint

(1) Place the cylindrical pedestal cover plate on the integrated speed reducer of the first joint, align the holes, and then tighten the fixing bolts.

(2) Place the assembled integrated speed reducer and the cover plate into the cylindrical pedestal, align the screw holes, and screw the corresponding screws.

(3) Place the arm on the top of the cylindrical pedestal, align the screw holes, and tighten the corresponding screws.
(4) Cover the bellows cover, align the screw holes, and tighten the corresponding screws. The free end of the bellows rotatably screw on the interface of the cylindrical pedestal.

5.2 The Second Joint

<table>
<thead>
<tr>
<th>Maintenance components</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated speed reducer of the second joint</td>
<td>UIM62H08A-5776X</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Grease</td>
<td>FS2</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Hexagonal wrench (double-sided width is 2.5mm)</td>
<td>For M3 screws</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Before any operation, please refer to disassembly steps, and put the shaft down to the lower limit position.

Disassembly of Integrated Speed Reducer of the Second Joint

（1）Turn off the power.

（2）Remove the user board.

The details are described in “3.1 User Board”

（3）Remove the upper cover.

The details are described in “3.2 Upper Encloser”.

（4）Unscrew the main arm fixing bolts (M3×18), which is used to secure jib on the main arm. After all the bolts unscrewed, you can remove the jib.

Notice : The number of bolts in that ring is 16, just 12 of them need to be removed, the rest 4 are not used to secure the jib.

（5）Unscrew the fixing bolts (M3×30) under the jib used to secure the integrated speed reducer of the second joint.
Installation of Integrated Speed Reducer of the Second Joint

(1) Place the integrated speed reducer of the second joint on the jib, align screw holes, tighten all the bolts (M3×30).

During the installation, please make the end surface of integrated reducer and that of jib maintain consistency, and take care not to cause damage.

(2) Place the jib on the main arm, align screw holes, and tighten all the bolts (M3×18).

During the installation, please make the end surface of jib and that of main arm maintain consistency, and take care not to cause damage.

(3) Install the upper enclose.

Details are described in “3.2 Upper Encloser”.

(4) Install the user board.

Details are described in “3.1 User Board”.

(5) Power on, and adjust the origin point of the second joint.
### 5.3 The Fourth Joint

![Integrated speed reducer of the fourth joint](image)

<table>
<thead>
<tr>
<th>Maintenance components</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Integrated speed reducer of the fourth joint</td>
<td>1</td>
<td>UIM62C04A-5742</td>
</tr>
<tr>
<td>Tools</td>
<td>Hexagonal wrench (double-sided width is 2mm)</td>
<td>1</td>
<td>For M2.5 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 2.5mm)</td>
<td>1</td>
<td>For M3 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 3mm)</td>
<td>1</td>
<td>For M4 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 3.5mm)</td>
<td>1</td>
<td>For M5 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 4mm)</td>
<td>1</td>
<td>For M6 screws</td>
</tr>
<tr>
<td></td>
<td>Torque wrench</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Disassembly of integrated reducer of the fourth Joint and the U2 synchronous belt

(1) Turn off the power.

(2) Remove the user board.
   Details described in “3.1 User Board”

(3) Remove the upper enclose.
   Details described in “3.2 Upper Encloser”

(4) Remove the lithium battery plate of the 4th joint integrated reducer, beside the spline screw and loosen the fixing bolts (M2.5 x 10).

(5) Unscrew the fixing bolts (M4x10) of the Z-shaft base.
   This position, the Z-shaft is secured at the top the jib.

(6) Unscrew the retainer ring at the lower part of the spline screw, remove the Z-shaft from the jib.

(7) Remove the ball plunger of the Z-shaft base, and you can move the U2 belt.

(8) Unscrew the fixing bolts (M4x14) at the retainer ring of the U2 belt.
(9) After the belt is removed, start to disassemble the integrated reducer of the 4th joint. Unscrew the fixing bolts (M4×10) for integrated reducer, and remove the integrated reducer and synchronous wheel from the Z-shaft base.

**Installation of integrated reducer of the fourth joint and the U2 synchronous belt**

(1) Place the 4th joint integrated reducer and synchronous wheel on the base of Z-shaft, align screw holes, tighten all the bolts (M4×10).

(2) Place U2 belt on the synchronous wheel of integrated reducer and spline screw, put the retaining ring on the belt, tighten the retaining ring by bolts (M4×14).

(3) After the alignment of belt, synchronous wheel and gear, install the ball head Plunger (M6 x 12) to fasten the belt.

The standard is that the motor can be moved by hand without being tilted. Extreme loosening or tightening will not apply proper tension to the belt.
(4) Place base of Z-shaft on jib, align the screw holes, tighten the bolts (M4×10).

(5) Install the retaining ring for the spline screw with bolts (M5×12).

(6) Place the lithium battery plate on the 4th joint integrated reducer, align the screw holes, tighten with bolts (M2.5 × 10).

(7) Install the upper enclose.
Details are described in “3.2 Upper Encloser”.

(8) Install the user board.
Details are described in “3.1 User Board”.

(9) Power on and adjust the origin point of the 4th joint.
Details are described in “8.0 Origin Adjustment”.

6 – M4×10
Hexagon
Socket-Head
Cap Screws

1 – M5×12
Hexagonal
Socket screws

2 – M2.5×10
Cross Head Screws
### 5.4 The Third Joint

![Integrated reducer of the third joint](image)

<table>
<thead>
<tr>
<th>Maintenance components</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Integrated speed reducer of the third joint</td>
<td>1</td>
<td>UIM62C04A-5742</td>
</tr>
<tr>
<td>Tools</td>
<td>Hexagonal wrench (double-sided width is 2mm)</td>
<td>1</td>
<td>For M2.5 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 2.5mm)</td>
<td>1</td>
<td>For M3 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 3mm)</td>
<td>1</td>
<td>For M4 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 4mm)</td>
<td>1</td>
<td>For M5 screws</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 5mm)</td>
<td>1</td>
<td>For M6 screws</td>
</tr>
<tr>
<td></td>
<td>Torgue wrench</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cutting pliers</td>
<td>1</td>
<td>For cutting the ties</td>
</tr>
</tbody>
</table>
Disassembly of integrated reducer of the third Joint and the U1 synchronous belt

(1) Turn off the power.
(2) Remove the user board.
   Details described in “3.1 User Board”.
(3) Remove the upper enclosure.
   Details described in “3.2 Upper Enclosure”.
(4) Remove the lithium battery plate of the third joint integrated reducer, beside the spline screw and loosen the fixing bolts (M2.5 × 10).
(5) Unscrew the bolts (M4×10) of Z shaft used to secure the pedestal.
   This position, the Z-shaft is secured at the top the jib.
(6) Unscrew the retainer ring (M5×12) under the spline screw, remove the Z-shaft from the jib.
   The base of Z-shaft contains spline screw and the third joint integrated reducer.
   Attention to extract the spline screw vertically, so as not to affect the accuracy due to screw damage.
(7) Remove the ball plunger of the jib to loose the U1 belt.
(8) Unscrew the fixing bolts (M4×12) of the third joint integrated reducer and remove the integrated reducer and synchronous wheel.
(9) Remove the 3rd integrated reducer and remove the jib base dust cover (green plate). The U1 belt can be removed from the jib for replacement.
Installation of Integrated Reducer of the Third Joint and the U1 Synchronous Belt

(1) Place the U1 belt into the jib and align the gears.

(2) Install the ball plunger (M6×12) at the jib to tighten the belt.

(3) Align the screw holes of jib dust cover, the 3rd integrated reducer and the jib, secure the 3rd integrated reducer bolts (M4×12).

(4) Insert the spline screw of the Z-shaft base into the spline hole of the jib, fix the Z-shaft base bolts (M4×10).

Notice: Spline screw to be placed vertically in the spline hole, so as not to affect the accuracy due to damage.

(5) Install the retaining ring (M5×12) of spling screw.

(6) Secure the lithium battery plate of the 3rd joint integrated reducer with bolts (M2.5×12).

(7) Install the upper enclose.
Details are described in “3.2 Upper Encloser”.

(8) Install the user board.
Details are described in “3.1 User Board”.

(9) Power on and adjust the origin point of the 3rd joint.
Details are described in “8.0 Origin Adjustment”.
6.0 BALL SCREW SPLINE UNIT

- ★ Do not load and unload the motor connector while the power is on, otherwise it may cause abnormal action, which is very dangerous. In addition, when the power is on, the operation of robot may result in electric shock or malfunction.

- ★ Unplug the power plug to ensure that the power supply is locked. Be sure to connect the AC power cable to the power plug, not directly to the factory power supply and so on.

- ★ Be sure to do replacement operation after powering off the controller and related equipments and unplugging the power plug. If you operate the robot while the power is on, it may cause electric shock or malfunction.

If the robot components (integrated reducer, synchronous belt, ball screw spline, etc.) are replaced, there will be deviation between the origin stored in integrated machine and the origin stored in controller, and it is unable to control correctly. Therefore, after the components replaced, it is necessary to carry out the operation of aligning the two origin points.

The operation of aligning the two origin points is called "origin adjustment (calibration)". After the replacement, please refer to “8.0 Origin Adjustment” to perform the origin adjustment.

6.1 Grease Filling of Ball Screw Spline Unit

<table>
<thead>
<tr>
<th>Maintenance components</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tools</td>
<td>Rag</td>
<td>1</td>
<td>For grease wiping (spline shaft)</td>
</tr>
<tr>
<td></td>
<td>Hexagonal wrench (double-sided width is 3.5mm)</td>
<td>1</td>
<td>Fro M5 screws</td>
</tr>
</tbody>
</table>

Please consider covering the clamp end and peripheral devices, in order to avoid grease falling.

1. Turn on the power.
2. Raise the spline screw to the upper limit position.
3. Remove the old grease from the upper part of the shaft and apply new grease.

Apply directly with your fingers to completely cover the upper slot of the shaft and wipe off any excess grease.
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(4) Put the spline screw down to the lower limit position.
(5) Remove the old grease from the lower part of the shaft and apply new grease.
(6) Press the up and down buttons on the SCARA software to move the shaft up and down several times to ensure that the grease is completely even, and then wipe off any excess grease.

Please turn off the power of the controller, and remove the upper enclose to wipe off any excess grease of the upper part of the shaft.

Details are described in “3.2 Upper Encloser”.

6.2 Replacement of Ball Screw Spline Unit

<table>
<thead>
<tr>
<th>Maintenance components</th>
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<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
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<td>All types</td>
<td></td>
</tr>
<tr>
<td>AC servo motor 100W</td>
<td>Appropriate</td>
<td>R13B010228</td>
<td></td>
</tr>
</tbody>
</table>

Tools

<table>
<thead>
<tr>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexagonal wrench (double-sided width is 3mm)</td>
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<td>For M4 screws</td>
</tr>
<tr>
<td>Torque wrench</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Cutting pliers</td>
<td>1</td>
<td>For cutting ties</td>
</tr>
<tr>
<td>Cross screwdriver</td>
<td>1</td>
<td>Limited to clean specifications only</td>
</tr>
<tr>
<td>Rag</td>
<td>1</td>
<td>For grease wiping (spline shaft)</td>
</tr>
</tbody>
</table>

Materials

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tie</td>
<td>-</td>
</tr>
</tbody>
</table>

Disassembly of Ball Screw Spline Unit

(1) Turn off the power.
(2) Remove the user board.

Details are described in “3.1 User Board”.

(3) Remove the upper encloser.

Details are described in “3.2 Upper Encloser”.

(4) Remove the lithium battery plate of the 4th joint integrated reducer, beside the spline screw and loosen the fixing bolts (M2.5 × 10).
5. Unscrew the fixing bolts (M4×10) of the Z-shaft base.
   This position, the Z-shaft is secured at the upper part of the jib.

6. Unscrew the retainer ring (M5×12) at the lower part of the spline screw.

7. Remove the upper enclose.
   Details are described in “3.3 Under Encloser”.
   Remove the Z-shaft from the jib base. The base of Z-shaft contains spline screw and the 3rd joint integrated reducer. Attention to extract the spline screw vertically, so as not to affect the accuracy due to screw damage.

8. Remove the U2 belt.
   Details are described in “7.0 The Fourth Joint”.

9. Unscrew the synchronization wheel fixing bolts (M4 × 14) on the lower screw of the Z-shaft base and remove the synchronous wheel.

10. Unscrew the bolts (M4 × 10) from the lower part of the Z-shaft base and remove the screw nut.

11. Extract the spline screw in the direction perpendicular to the Z-shaft base and remove the upper fixing ring bolt (M5×12) of the screw to replace the screw.

**Installation of Ball Screw Spline Unit**

1. Fasten the upper retaining ring of the screw to the new ball screw spline unit and fix the bolts (M5 × 12).

2. Insert the lead screw in the direction perpendicular to the Z-shaft base into the Z-shaft base spline hole.
(3) Place the screw nut in the lower part of the Z-shaft base, align the holes, and fix it with bolts (M4 × 10).

(4) Place the synchronizer wheel at the lower part of the Z-shaft base, align the holes, and fix with the bolts (M4 × 14).

(5) Install the U2 belt.
Details are described in “7.0 The Fourth Joint”.

(6) Attach the Z-shaft base to the jib. The Z-axis base here contains the spline lead screw and the third joint integrated reducer. Take care to keep the screw vertical while placing the spline screw, so as not to affect the accuracy due to screw damage.

(7) Fix the Z-shaft base with bolts (M4 × 10). Here the bolts tighten the Z-shaft to the upper part of the jib.

(8) Install the retaining ring (M5 x 12) to the lower part of spline screw.

(9) Install the lithium battery plate next to the fourth joint integrated reducer and beside the spline screw, tighten the bolts (M2.5 × 10).

(10) Mounting clamp end and wiring / piping.

(11) Install the upper enclose.
Details are described in “3.2 Upper Encloser”.

(12) Install the user board.
Details are described in “3.1 User Board”.

(13) Power on and adjust the origin point of the 4th joint.
Details are described in “8.0 Origin Adjustment”.
7.0 BATTERY

警告 ★ Do not load and unload the motor connector while the power is on, otherwise it may cause abnormal action, which is very dangerous. In addition, when the power is on, the operation of robot may result in electric shock or malfunction.

警告 ★ Unplug the power plug to ensure that the power supply is locked. Be sure to connect the AC power cable to the power plug, not directly to the factory power supply and so on.

警告 ★ Be sure to do replacement operation after powering off the controller and related equipments and unplugging the power plug. If you operate the robot while the power is on, it may cause electric shock or malfunction.

警告 ★ Please pay full attention to the use of lithium batteries. If you take the following wrong use, it may lead to heat, leakage, rupture or fire, etc., which is very dangerous In addition, it may cause security problems.
Charge Thrown into fire Short circuit (+ pole, - pole)
Disassembly Forced discharge Heating (above 85 °C)
Anti loaded Compression deformation Welding (direct to battery terminals)

警告 ★ To dispose of the batteries, please consult with a professional handling company, or dispose of them according to the laws and regulations of each country or region. Before disposing of the battery, be sure to insulate terminals even if the battery has run out. If the battery contacts with other metal or battery terminals, a short circuit may result, which will lead to heat, leakage, cracking, or fire.

If you power on the controller (software has been started) after the lithium battery has run out, an error warning of low voltage will occur. If the position data of the motor disappears, the origin adjustment is required for all the joints.

The service life of Lithium battery is 1.5 years. Please replace the lithium battery every 1.5 years even if the robot is continuously energized.

Please to connect the battery correctly, and be sure not to mistake the polarity.

<table>
<thead>
<tr>
<th>Maintenance components</th>
<th>Name</th>
<th>Quality</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Battery</td>
<td>1</td>
<td>ER3V</td>
</tr>
<tr>
<td></td>
<td>Control box</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
Replacement of the battery unit (lithium battery)

1. Remove the interface board with power applied.
   Details are described in “3.4 Interface Board”.

2. Unplug the wiring of battery in the base cylinder, remove the old battery and replace it with a new one.

3. Remove the user board.
   Details are described in “3.1 User Board”.

4. Remove the upper encloser.
   Details are described in “3.2 Upper Encloser”.

5. Unplug the battery wiring for integrated reducers of second joint, third joint and fourth joint respectively, then you can replace the batteries.

Generally in the case of power-on, the replacement of the battery will not cause the loss of the origin location data, if the origin location data is lost, the user needs to do the origin adjustment.
8.0 ORIGIN ADJUSTMENT

8.1 What Is Origin Adjustment

If the robot components (integrated reducer, synchronous belt, ball screw spline, etc.) are replaced, there will be deviation between the origin stored in integrated reducer and the origin stored in controller, and it is unable to locate correctly. Therefore, after the components replaced, it is necessary to carry out the operation of aligning the two origin points. The operation of aligning the two origin points is called "origin adjustment (calibration)". The origin adjustment is different from teaching.

Teach-in is the operation on the controller to teach the coordinate point (including the posture) arbitrarily set in the action area of the robot.

警告

★ Be sure to set up a safety guard on the robot system for safety.
★ Before operating the robot system, make sure that there is no one inside the safety guard. However, the robot system can be operated in the teaching mode even if there is a person inside the security guard. Although the operation is always limited (low speed, low power), this ensures the safety of the operator. However, when the robot performs unexpected actions, it may cause serious safety problems and is very dangerous.

You need to use the StepEva-X software provided by UI Robot company for the origin adjustment.

The following explains how to use the calibration wizard of software StepEvi-X to do the origin adjustment.

Before turning on the power you need to ensure that:
The installation of robot has been completed;
The robot has been connected to the PC with StepEvi-X software installed;
The wiring for robot is correct.

Power on the PC, open the software StepEvi-X. If there is no problem in the line connection you can see four control drive in the screen, and each control drive has a corresponding ID number, as shown below.
8.2 The Origin Adjustment Procedure of the First Joint Integrated Reducer

Click on the first joint control drive in the screen of software StepEvi-X, enter its configuration interface.

1. In the PTP interface for Motion Control, click the Offline/Enable button in the lower left corner, so that the first joint integrated reducer is offline.

2. Drag the first joint arm to the most left and record the “actual value” of the “location” in the PTP interface.

3. Drag the first joint arm to the most right and record the “actual value” of the “location” in
the PTP interface.

4. Enter the average of the recorded position values in steps 2 and 3. On the PTP screen, enter the average value in the “desired value” of “position”, and insert “desired value” of “speed”, speed generally take 5000.

5. Click the button to move the robot arm slowly to the position, and then click the button, the position is recorded as the origin of the first joint.

8.3 The Origin Adjustment Procedure of the Second Joint Integrated Reducer

Click on the second joint control drive in the screen of software StepEvi-X, enter its configuration interface.

1. In the PTP interface for Motion Control, click the Offline/Enable button in the lower left corner, so that the second joint integrated reducer is offline.
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2. Drag the second joint arm to the most left and record the “actual value” of the “location” in the PTP interface.

3. Drag the second joint arm to the most right and record the “actual value” of the “location” in the PTP interface.

4. Enter the average of the recorded position values in steps 2 and 3. On the PTP screen, enter the average value in the “desired value” of “position”, and insert “desired value” of “speed”, speed generally take 5000.

5. Click the button to move the jib slowly to the position, and then click the button , the position is recorded as the origin of the second joint.

8.4  The Origin Adjustment Procedure of the Third Joint Integrated Reducer

Click on the third joint control drive in the screen of software StepEvi-X, enter its configuration interface.

1. In the PTP interface for Motion Control, click the Offline/Enable button in the lower left corner, so that the third joint integrated reducer is offline.
2. Drag the screw lead to the top and record the “actual value” of the “location” in the PTP interface.

3. Drag the screw lead to the bottom and record the “actual value” of the “location” in the PTP interface.

4. Enter the average of the recorded position values in steps 2 and 3. On the PTP screen, enter the average value in the “desired value” of “position”, and insert “desired value” of “speed”, speed generally take 5000.

5. Click the button \(\text{\textbullet}\) to move the screw lead slowly to the position, and then click the button \(\text{\textbullet}\), the position is recorded as the origin of the second joint.

From the view of mechanical structure, origin adjustment just for the 3rd shaft can not be down, the fourth joint and the third joint should be carried out together.

### 8.5 The Origin Adjustment Procedure of the fourth Joint Integrated Reducer

Click on the fourth joint control drive in the screen of software StepEvi-X, enter its configuration interface.

1. In the PTP interface for Motion Control, click the Offline/Enable button \(\text{\textbullet}\) in the lower
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left corner, so that the fourth joint integrated reducer is offline.

2. Record the position value of the fourth joint integrated reducer when the third joint integrated reducer reach its origin position, and the stepEVA-X is used to set the point as the origin of the fourth joint integrated reducer.
### 9.0 MAINTENANCE COMPONENTS TABLE

<table>
<thead>
<tr>
<th>Name</th>
<th>Remarks</th>
<th>Referred Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable Unit</td>
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<tr>
<td>Integrated Reducer</td>
<td>The First Joint</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>The Second Joint</td>
<td>5.2</td>
</tr>
<tr>
<td>Integrated Machine</td>
<td>The Third Joint</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>The Fourth Joint</td>
<td>5.3</td>
</tr>
<tr>
<td>Synchronous Belt</td>
<td>The Third Joint</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>The Fourth Joint</td>
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<td>Lithium Batteries for Replacement</td>
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<td>Interface Board</td>
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</tr>
<tr>
<td>Control Box</td>
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</tr>
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<td>Grease</td>
<td>For Ball Screw Splines</td>
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<td>LUBE Grease</td>
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