

**SCARA Robots
YRCX/YRC Series**

Safety Instructions

REFERENCE MANUAL

OMRON

Safety Instructions

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1. Safety information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks. To ensure safe and correct use of OMRON industrial robots and controllers*, carefully read and comply with the safety instructions and precautions in this "Safety Instructions" guide. Failure to take necessary safety measures or incorrect handling may result in trouble or damage to the robot and controller, and also may cause personal (who installs, operates or maintains the products) injury including fatal accidents.

* The descriptions about the controller stated in this instruction also include the contents of the robot driver.

Before using the products, read this instruction and related manuals and take safety precautions to ensure correct handling.

The precautions listed in this manual relate to this product. To ensure safety of the user's final system that includes robots, please take appropriate safety measures as required by the user's individual system.

To use the robots and controllers safely and correctly, always comply with the safety rules and instructions.

- For specific safety information and standards, refer to the applicable local regulations and comply with the instructions.
- Warning labels attached to the robots are written in English, Japanese, Chinese and Korean. This manual is available in English or Japanese (or some parts in Chinese and Korean). Unless the robot operators or service personnel understand these languages, do not permit them to handle the robot.
- Cautions regarding the official language of EU countries
For equipment that will be installed in EU countries, the language used for the manuals, warning labels, operation screen characters, and CE declarations is English only.
Warning labels only have pictograms or else include warning messages in English. In the latter case, messages in Japanese or other languages might be added.

It is not possible to list all safety items in detail within the limited space of this manual. Please note that it is essential that the user have a full knowledge of safety and also make correct judgments on safety procedures.

Refer to the manual by any of the following methods when installing, operating or adjusting the robot and controller.

1. Install, operate or adjust the robot and controller while viewing the manual on your computer screen.
2. Install, operate or adjust the robot and controller while referring to a printout of the necessary pages from the manual.
3. Install, operate or adjust the robot and controller while referring to the printed version of the manual (available for an additional fee).

Comparison of terms used in this manual with ISO

This manual	ISO 10218-1	Note
Maximum movement range	maximum space	Area limited by mechanical stoppers.
Movement range	restricted space	Area limited by movable mechanical stoppers.
Working envelope	operational space	Area limited by software limits.
Within safety enclosure	safeguarded space	

REF "7.1 Movement range"

2. Signal symbols

The following safety alert symbols and signal words are used to provide safety instructions that must be observed and to describe handling precautions, prohibited actions, and compulsory actions. Make sure to understand the meaning of each symbol and signal word and then read this manual.

**DANGER**

This indicates an immediately hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

This indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

This indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or damage to the equipment.

**NOTE**

This indicates a supplementary explanation in the operation.

3. Warning labels

Warning labels shown below are attached to the robot body and controller to alert the operator to potential hazards. To ensure correct use, read the warning labels and comply with the instructions.

3.1. Warning labels



WARNING

If warning labels are removed or difficult to see, then the necessary precautions may not be taken, resulting in an accident.

- Do not remove, alter or stain the warning labels on the robot body.
- Do not allow warning labels to be hidden by devices installed on the robot by the user.
- Provide proper lighting so that the symbols and instructions on the warning labels can be clearly seen from outside the safety enclosure.

3.1.1 Warning label messages on robot and controller

Word messages on the danger, warning and caution labels are concise and brief instructions. For more specific instructions, read and follow the "Instructions on this label" described on the right of each label shown below.

REF "7.1 Movement range"


■ Warning label 1



DANGER

Serious injury may result from contact with a moving robot.

- Keep outside of the robot safety enclosure during operation.
- Press the emergency stop button before entering the safety enclosure.

Instructions on this label	
 <p>Stay clear of moving machine. Can cause serious injury.</p> <p>如果接触，有受重伤的危險！</p> <p>접촉하면 부상의 위험이 있음.</p> <p>接触すると重大なケガをする恐れあり。</p> <p>90K41-001470</p>	
Potential hazard to human body	Serious injury may result from contact with a moving robot.
To avoid hazard	<ul style="list-style-type: none"> • Keep outside of the robot safety enclosure during operation. • Press the emergency stop button before entering the safety enclosure.

90K41-001470


■ Warning label 2



WARNING

Moving parts can pinch or crush hands.

Keep hands away from the movable parts of the robot.

Instructions on this label	
 <p>Pinch or crush hazard.</p> <p>会被夹伤！</p> <p>협착위험.</p> <p>はさんでケガをする恐れあり。</p> <p>90K41-001460</p>	
Potential hazard to human body	Moving parts can pinch or crush hands.
To avoid hazard	Keep hands away from the movable parts of the robot.

90K41-001460

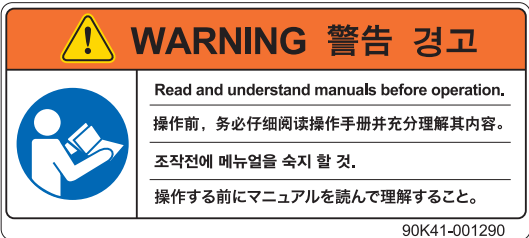
■ Warning label 3



WARNING

Improper installation or operation may cause serious injury.

Before installing and operating the robot, read the manual and instructions on the warning labels to understand the contents.

Instructions on this label	
	
<ul style="list-style-type: none"> Be sure to read the warning label and this manual carefully to make you completely understand the contents before attempting installation and operation of the robot. Before starting the robot operation, even after you have read through this manual, read again the corresponding procedures and "Safety Instructions". Do not install, adjust, inspect or service the robot in any manner that does not comply with the instructions in this manual. 	
Potential hazard to human body	Improper installation or operation may cause serious injury.
To avoid hazard	Before installing or operating the robot, read the manual and instructions on the warning labels and understand the contents.


90K41-001290

■ Warning label 4



CAUTION

Do not remove the parts on which Warning label 4 is attached. Doing so may damage the ball screw.

Instructions on this label	
	
<p>The Z-axis ball screw will be damaged if the upper end mechanical stopper on the Z-axis spline is removed or moved. Do not attempt to remove or move it.</p>	

90K41-001520

■ Warning label 5 (YRCX/YRC controllers)



WARNING


These are precautions for OMRON and distributors' service personnel.

Customers must not attempt to open the covers.



WARNING

Wait at least 100 seconds after power-off before opening the covers.

Instructions on this label	
	
<ul style="list-style-type: none"> Wait at least 100 seconds after power-off before opening the covers (*). Some parts in the controller still retain a high voltage even after power-off. Electrical shock may occur when touching those parts. 	
Potential hazard to human body	Electrical shock
To avoid hazard	Wait at least 100 seconds after power-off before opening the covers (*).

* These are precautions for OMRON and distributors' service personnel. Customers must not attempt to open the covers.

90K41-001900


Warning label 6 (YRCX/YRC controllers)

* This label is attached to the front panel.



CAUTION

Refer to the manual.

	Instructions on this label
	<p>This indicates important information that you must know and is described in the manual.</p> <p>Before using the controller, be sure to read the manual thoroughly.</p> <p>When adding external safety circuits or connecting a power supply to the controller, read the manual carefully and make checks before beginning the work. Connectors have an orientation. Insert each connector in the correct direction.</p>

93005-X0-00

3.1.2 Supplied warning labels

Some warning labels are not affixed to robots but included in the packing box. **These warning labels should be affixed to an easy-to-see location.**

- Warning label is attached to the robot body.
- Warning label comes supplied with the robot and should be affixed to an easy-to-see location on the door or gate of the safety enclosure.
- ◎ Warning label comes supplied with the robot and should be affixed to an easy-to-see location.

		SCARA robots
Warning label 1	 <p>90K41-001470</p>	<p>● *1</p> <p>○</p>
Warning label 2	 <p>90K41-001460</p>	<p>● *1</p>
Warning label 3	 <p>90K41-001290</p>	<p>● *1</p>

*1: For label positions REF "Part names" in each SCARA robot manual

3.2. Warning symbols


Warning symbols shown below are indicated on the robots and controllers to alert the operator to potential hazards. To use the robot safely and correctly, always follow the instructions and cautions indicated by the symbols.

1. Electrical shock hazard symbol



WARNING

Touching the terminal block or connector may cause electrical shock, so use caution.

	Instructions by this symbol
	<p>This indicates a high voltage is present. Touching the terminal block or connector may cause electrical shock.</p>


91006-X0-01

2. High temperature hazard symbol



WARNING

Do not touch the motors, heat sinks, and regenerative units as they become hot.

	Instructions by this symbol
	<p>This indicates the area around this symbol may become very hot. Motors, heat sinks, and regenerative units become hot during and shortly after operation. To avoid burns be careful not to touch those sections.</p>


93008-X0-00

3. Caution symbol



CAUTION

Always read the manual carefully before using the controller.

	Instructions by this symbol
	<p>This indicates important information that you must know and is described in the manual. Before using the controller, be sure to read the manual thoroughly. When adding external safety circuits or connecting a power supply to the controller, read the manual carefully and make checks before beginning the work. Connectors must be attached while facing a certain direction, so insert each connector in the correct direction.</p>

93007-X0-00

4. Precautions for each stage of life cycle

This section describes important precautions that must be observed when using robots and controllers. Be sure to carefully read and comply with all of these precautions even if there is no alert symbol shown.

4.1. Precautions for using robots and controllers

General precautions for using robots and controllers are described below.

1. Applications where robots cannot be used



DANGER

OMRON controllers and robots are designed as general-purpose industrial equipment and cannot be used for the following applications and environments.

- In medical equipment systems which are critical to human life
- In systems that significantly affect society and the general public
- In equipment intended to carry or transport people
- In environments where vibration occurs such as onboard ships and vehicles

2. Qualification of operators/workers

Operators or workers who carry out tasks for industrial robots (such as teaching, programming, movement check, inspection, adjustment, and repair) must take appropriate training and also have the skills needed to perform the tasks correctly and safely.

Those tasks must be carried out by qualified operators who meet requirements established by local regulations and standards for industrial robots. They must also read the manuals carefully and understand the contents before attempting the robot operation or maintenance.



WARNING

- It is extremely hazardous for people who do not have the above qualifications to carry out tasks for industrial robots.
- Maintenance works that require removing the cover must be carried by operators who have the above qualifications. Otherwise, an accident resulting in serious injury or death may occur.

4.2. Design

4.2.1 Precautions for robots

1. Restricting the robot moving speed



WARNING

Restriction on the robot moving speed is not a safety-related function.

To reduce the risk of collision between the robot and operators, take the necessary protective measures such as enable devices according to risk assessment by the user.

2. Restricting the movement range

REF "7.1 Movement range"



WARNING

Soft limit function is not a safety-related function intended to protect the human body.

To restrict the robot movement range to protect the human body, use the mechanical stoppers installed in the robot (or available as options).



CAUTION

If the robot moving at high speed collides with a mechanical stopper installed in the robot (or available as option), the robot may be damaged.

3. Provide safety measures for end effector (such as gripper)



WARNING

- End effectors must be designed and manufactured so that they do not cause any hazards (such as releasing the workpiece) even if power (electricity, air pressure, and so on) is shut off or power fluctuations occur.
- If the object gripped by the end effector might possibly fly off or drop, provide appropriate safety protection taking into account the object size, weight, temperature, and chemical properties.

4. Provide adequate lighting

Provide enough lighting to ensure safety during work.

5. Install an operation status light



WARNING

Install a signal light (signal tower) at an easy-to-see position so that the operator will be aware of the robot stop status (such as temporarily stop, emergency stop, error stop).

4.2.2 Precautions for controllers

1. Emergency stop input terminal



DANGER

Each controller has an emergency stop input terminal to trigger emergency stop. Using this terminal, install a safety circuit so that the system including the controller will work safely.
For the robot drivers without emergency stop input terminal, construct a safety circuit including the emergency stop function using an external circuit.

2. Maintain clearance



CAUTION

Do not bundle control lines or communication cables together or in close to the main power supply or power lines. Usually separate these by at least 100 mm. Otherwise, malfunction due to noise may result.

4.3. Carrying and installation

4.3.1 Precautions for robots

■ Installation environment

1. Do not use in strong magnetic fields



WARNING

Do not use the robot near equipment that generates strong magnetic fields. The robot may break down or malfunction if used in such a location.

2. Do not use in locations subject to possible electromagnetic interference



WARNING

Do not use the robot in locations subject to electromagnetic interference, electrostatic discharge or radio frequency interference. Otherwise, the robot may malfunction to cause hazardous situations.

3. Do not use in locations exposed to flammable gases



WARNING

The robots are not designed to be explosion-proof. Do not use the robots in locations exposed to explosive or inflammable gases, dust particles or liquid. Otherwise, serious accidents involving death or serious injury, or fire may result.

■ Carrying

1. Use caution to prevent pinching or crushing of hands or fingers



WARNING

Keep hands and fingers away from the movable parts of the robot to avoid being pinched or crushed.

As instructed in Warning label 2, use caution to prevent hands and fingers from being pinched or crushed by movable parts when carrying the robot. For details on warning labels [REF](#) "3. Warning labels"

2. Take safety measures when carrying robots

When attaching a tool on the end of the spline of the SCARA robot, remove it. When a bracket for tightening arm is supplied with the robot, use it not to move the arm (when it is not supplied, tighten the arm with rope and so on.)

To ensure safety when carrying a SCARA robot with the arm length of 500 mm or more, use the eyebolts that come supplied with the robot. Always follow the instructions in the robot user's manual.

When carrying other robots, please comply with the transport methods described in their respective user's manuals.

3. Take measures to prevent the robot from falling

When carrying the robot by lifting it with equipment such as a hoist or crane, wear personal protective gear and be careful not to carry the robot at higher than the required height. Make sure that there are no one on paths used for moving the robot.



WARNING

A robot falling from a high place and striking a worker may cause death or serious injury. When carrying the robot, wear protective gear such as helmets and make sure that no one is within the surrounding area.

■ Installation

1. Protect electrical wiring and hydraulic/pneumatic hoses

Install a cover or similar item to protect the electrical wiring and hydraulic/pneumatic hoses from possible damage.

■ Wiring

1. Protective measures against electrical shock



WARNING

Always ground the robot to prevent electrical shock.

■ Adjustment

1. Adjustment that requires removing a cover



WARNING

Adjustment by removing a cover requires specialized technical knowledge and skills, and may also involve hazards if attempted by an unskilled person. This adjustment must be carried out only by operators who have the required qualifications. [REF](#) "2. Qualification of operators/workers" in section 4.1

4.3.2 Precautions for controllers

■ Installation environment

1. Installation environment



WARNING

The robots are not designed to be explosion-proof. Do not use the robots and controllers in locations exposed to explosive or inflammable gases, dust particles or liquid such as gasoline and solvents. Otherwise, serious accidents involving death or injury, or fire may result.



WARNING

- Use the controller in locations that support the environmental conditions specified in the manual. Otherwise, electrical shock, fire, malfunction, product damage or deterioration may result.
- The controller and programming box must be installed at a location that is outside the robot safety enclosure yet where it is easy to operate and view robot movement.
- Install the controller in locations with enough space to carry out work (such as teaching, inspection) safely. Limited space not only makes it difficult to carry out work but may also cause injury.
- Install the controller in a stable, level location and secure it firmly. Avoid installing the controller upside down or in a tilted position.
- Provide sufficient clearance around the controller for good ventilation. Insufficient clearance may cause malfunction, breakdown or fire.

■ Installation

To install the controller, follow the installation conditions and method described in the manual.

1. Installation



WARNING

Securely tighten the screws to install the controller. Otherwise, the screws may come loose causing the controller to drop.

2. Connections



WARNING

- Always shut off all phases of the power supply externally before starting installation or wiring work. Otherwise, electrical shock or product damage may result.
- Do not directly touch conductive sections and electronic parts other than the connectors, rotary switches, and DIP switches on the outside panel of the controller. Touching them may cause electrical shock or breakdown.
- Securely install each cable connector into the receptacles or sockets. Poor connections may cause the controller or robot to malfunction.

■ Wiring

1. Connecting robot and controller

Check the correct combination of the robot and controller and connect them each other.

Since the software detects abnormal operation such as motor overloads, the controller parameters must be set correctly to match the motor type used in the robot connected to the controller.

2. Precautions for wiring



WARNING

Always shut off all phases of the power supply externally before starting installation or wiring work. Otherwise, electrical shock or product damage may result.



CAUTION

- Make sure that no foreign matter such as cutting chips or wire scraps get into the controller. Malfunction, breakdown or fire may result if these penetrate inside.
- Do not apply excessive impacts or loads to the connectors when making cable connections. This might bend the connector pins or damage the internal board.
- When using ferrite cores for noise elimination, be sure to fit them onto the power cable as close to the robot controller and/or the robot as possible, to prevent malfunction caused by noise.

3. Wiring method

**WARNING**

Securely install the connectors into the controller and, when wiring the connectors, make the crimp, press-contact or solder connections correctly using the tool specified by the connector manufacturer.

**CAUTION**

When disconnecting the cable from the controller, detach by gripping the connector itself and not by tugging on the cable. Loosen the screws on the connector (if fastened with the screws), and then disconnect the cable. Trying to detach by pulling on the cable itself may damage the connector and cables, and poor cable contact will cause the controller or robot to malfunction.

4. Precautions for cable routing and installation

**CAUTION**

- Always store the cables connected to the controller in a conduit or clamp them securely in place. If the cables are not stored in a conduit or properly clamped, excessive play, movement or mistakenly pulling on the cable may damage the connector or cables, and poor cable contact will cause the controller or robot to malfunction.
- Do not modify the cables and do not place any heavy objects on them. Handle them carefully to avoid damage. Damaged cables may cause malfunction or electrical shock.
- If the cables connected to the controller may possibly become damaged, then protect them with such as a cover.
- Check that the control lines and communication cables are routed at a gap sufficiently away from such as main power supply circuits and power lines. Bundling them together with power lines or close to power lines may cause faulty operation due to noise.

5. Protective measures against electrical shock

**WARNING**

Be sure to ground the terminals of the robot and controller. Poor grounding may cause electrical shock.

4.4. Safety measures

4.4.1 Safety measures

1. Referring to warning labels and manual



WARNING

- Before starting installation or operation of the robot, be sure to read the warning labels and the manual, and comply with the instructions. **REF** "3. Warning labels"
- Do not attempt any repair, parts replacement and modification unless described in the manual. These tasks require specialized technical knowledge and skills and may also involve hazards. Please contact your distributor for advice.

2. Drawing up "Work instructions" and make the operators/workers understand them



WARNING

Decide on "Work instructions" in cases where operators must carry out startup or maintenance work within the robot safety enclosure. Make sure they completely understand these "Work instructions" for the following items.

1. Robot operating procedures needed for tasks such as startup procedures and handling switches
2. Robot speeds used during tasks such as teaching
3. Methods for workers to signal each other when two or more workers carry out tasks
4. Steps that the worker should take when a problem or emergency occurs
5. Steps to take after the robot has come to a stop when the emergency stop device was triggered, including checks for cancelling the problem or error state and safety checks in order to restart the robot.
6. In cases other than above, the following actions should be taken as needed to prevent hazardous situations due to sudden or unexpected robot operation or faulty robot operation as listed below.
 - Placing a display sign on the operator panel
 - Ensuring the safety of workers performing tasks within the robot safety enclosure
 - Clearly specifying position and posture during work
 - Specifying a position and posture where worker can constantly check robot movements and immediately move to avoid trouble if an error/problem occurs
 - Taking noise prevention measures
 - Using methods for signaling operators of related equipment
 - Using methods to decide that an error has occurred and identify the type of error

Implement the "Work instructions" according to the type of robot, installation location, and type of work task.

When drawing up the "Work instructions", make an effort to include opinions from the workers involved, equipment manufacturer technicians, and industrial safety consultants, and so on.

3. Taking safety measures



DANGER

- Do not enter the robot movement range while the robot is operating or the main power is turned on. Otherwise, serious accidents involving injury or death may result. Install a safety enclosure or a gate interlock with an area sensor to keep anyone away from the robot movement range.
- When it is necessary for operators to work within the robot movement range such as for teaching or maintenance tasks, always carry the programming box with them so that they can immediately stop the robot operation in case of an abnormal or hazardous condition. Install an enable device in the external safety circuit as needed. Also set the robot moving speed to 3% or less. Otherwise, serious accidents involving injury or death may result.

REF "7.1 Movement range"



WARNING

- During startup or maintenance tasks, display a sign "WORK IN PROGRESS" on the programming box and operation panel in order to prevent anyone other than the operator from mistakenly operating the start or selector switch. If needed, take other measures such as locking the cover on the operation panel.
- Always connect the robot and controller in the correct combination. Using them in an incorrect combination may cause fire or breakdown.

4. Configuring system

When configuring an automated system using a robot, hazardous situations are more likely to occur from the automated system than the robot itself. Therefore, the system manufacturers should install the necessary safety measures required for the individual system. They should provide a proper manual for safe, correct operation and servicing of the system.



WARNING

To check the controller operating status, refer to this instruction and related manuals. Design and install the system including the controller so that it will always work safely.

5. Precautions of operation



WARNING

- Do not touch any electrical terminal. Directly touching these terminals may cause electrical shock, equipment damage, and malfunction.
- Do not touch nor operate the controller or programming box with wet hands. Doing so may result in electrical shock or breakdown.

6. Do not disassemble and modify



WARNING

Do not disassemble nor modify any part in the robot, controller, and programming box, nor open any cover. Doing so may cause electrical shock, breakdown, malfunction, injury, or fire.

4.4.2 Installing a safety enclosure

Be sure to install a safety enclosure to prevent the operators and others from entering within the robot movement range causing injury by touching the moving parts.

REF "7.1 Movement range"



DANGER

- Serious injury may result from contact with a moving robot.
- Keep outside of the robot safety enclosure during operation.
 - Press the emergency stop button before entering the safety enclosure.



WARNING

- Install an interlock that triggers emergency stop when the door or gate of the safety enclosure is opened.
- The safety enclosure should be designed so that no one can enter inside except from the door or gate equipped with an interlock device.
- Warning label 1 that comes supplied with a robot should be affixed to an easy-to-see location on the door or gate of the safety enclosure. **REF** "3. Warning labels"

4.5. Operation

When operating a robot, ignoring safety measures and checks may lead to serious accidents. Always take the following safety measures and checks to ensure safe operation.



DANGER

- No one is within the robot safety enclosure.
- The programming box is in the specified location.
- The robot and peripheral equipment are in good condition.

4.5.1 Trial operation

After installing, adjusting, inspecting, maintaining or repairing the robot, carry out trial operation using the following procedures.

1. If a safety enclosure has not yet been provided right after installing the robot:

Then rope off or chain off the robot movement range in place of the safety enclosure and observe the following points.

REF "7.1 Movement range"



DANGER

Place a "Robot is moving - KEEP AWAY!" sign to keep the operators or others from entering within the robot movement range.



WARNING

- Use sturdy, stable posts which will not fall over easily.
- The rope or chain should be easily visible to everyone around the robot.

2. Check the following points before turning on the controller.

- Is the robot securely and correctly installed?
- Are the electrical connections to the robot wired correctly?
- Are items such as air pressure correctly supplied?
- Is the robot correctly connected to peripheral equipment?
- Have safety measures (such as safety enclosure) been taken?
- Does the installation environment meet the specified standards?

3. After the controller is turned on, check the following points from outside the safety enclosure.

- Does the robot start, stop and enter the selected operation mode as intended?
- Does each axis move as intended within the soft limits?
- Does the end effector move as intended?
- Are the correct signals being sent to the end effector and peripheral equipment?
- Does emergency stop function?
- Are teaching and playback functions normal?
- Are the safety enclosure and interlocks functioning as intended?

4. Working inside safety enclosures

Always confirm that each protective function is operating correctly (**REF** the previous section 2.3) from outside the enclosure before starting work within the safety enclosure.



DANGER

Do not enter within the robot movement range while within the safety enclosure. **REF** "7.1 Movement range"



WARNING

When work is required within the safety enclosure, place a sign "WORK IN PROGRESS" in order to keep others from operating the controller switch or operation panel.



WARNING

When work within the safety enclosure is required, always turn off the controller power except for the following cases:

Exception

Work with power turned on, but robot in emergency stop

Origin position setting	Follow the precautions and procedure described in "Adjusting the origin".
Standard coordinate setting	Follow the precautions and procedure described in "Setting the standard coordinates".
Soft limit settings	Follow the precautions and procedure described in "Setting the soft limits".

Work with power turned on

Teaching	REF "5. Teaching within safety enclosure" described below
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5. Teaching within the safety enclosure

When performing teaching within the safety enclosure, check or perform the following points from outside the safety enclosure.



DANGER

Do not enter within the movement range while within the safety enclosure. **REF** "7.1 Movement range"



WARNING

- Make a visual check to ensure that no hazards are present within the safety enclosure.
- Check that the programming box or handy terminal operates correctly.
- Check that no failures are found in the robot.
- Check that emergency stop works correctly.
- Select teaching mode and disable automatic operation.

4.5.2 Automatic operation

Check the following points when operating the robot in AUTO mode. Observe the instructions below in cases where an error occurs during automatic operation. Automatic operation described here includes all operations in AUTO mode.

1. Checkpoints before starting automatic operation



DANGER

- Check the safety enclosure is securely installed with interlocks functional.
- Check that no one is within the safety enclosure.



WARNING

- Check that the programming box / handy terminal and tools are in their specified locations.
- Make sure that the signal tower lamps or other alarm displays installed for the system do not indicate that an error is occurring on the robot and peripheral devices.

2. During automatic operation and when errors occur

After automatic operation starts, check the operation status and the signal tower to ensure that the robot is in automatic operation.



DANGER

Do not enter the safety enclosure during automatic operation.



WARNING

- If an error occurs in the robot or peripheral devices, observe the following procedure before entering the safety enclosure.
- 1) Press the emergency stop button to set the robot to emergency stop.
 - 2) Place a sign on the start switch, indicating that the robot is being inspected in order to keep others from restarting the robot.

4.5.3 Precautions during operation

1. When the robot is damaged or an abnormal condition occurs



WARNING

- If unusual odors, noise or smoke occur during operation, immediately turn off the power to prevent possible electrical shock, fire or breakdown. Stop using the robot and contact your distributor.
- If any of the following damage or abnormal conditions occur on the robot, continuing to operate the robot is dangerous. Immediately stop using the robot and contact your distributor.

Damage or abnormal condition	Type of danger
Damage to machine harness or robot cable	Electrical shock, robot malfunction
Damage to robot exterior	Damaged parts flying off during robot operation
Abnormal robot operation (position deviation, vibration, etc.)	Robot malfunction
Z-axis (vertical axis) or brake malfunction	Z-axis unit falling off

2. High temperature hazard



WARNING

- Do not touch the robot body and controller during operation. They may become very hot to cause burns by touching them.
- The motor and speed reduction gear casing are very hot shortly after operation to cause burns by touching those parts. If it is necessary to touch them for inspection or servicing, turn off the controller and wait for a while to make sure that they are cool enough before touching.

3. Precautions of releasing the vertical axis (Z-axis) brake



WARNING

- The vertical axis will slide downward when the brake is released, causing a hazardous situation. Take adequate safety measures in consideration by taking the weight and shape into account.
- Before releasing the brake after pressing the emergency stop button, place a support under the vertical axis so that it will not slide down.
 - Be careful not to let the body get caught between the vertical axis and the installation base when carrying out tasks (such as direct teaching) with the brake released.

4. Precautions of Z-axis movement in the controller off or emergency stop status (for air-driven Z-axis)



WARNING

- The Z-axis starts moving upward when power to the controller or PLC is turned off, the program is reset, emergency stop is triggered, or air is supplied to the solenoid valve for the Z-axis air cylinder.
- Do not let hands or fingers get caught and squeezed by robot parts moving along the Z-axis.
 - Keep the usual robot position in mind so as to prevent the Z-axis from hanging up or binding on obstacles during raising of the Z-axis except in the case of emergency stop.

5. Precautions of the Z-axis interferes with peripheral equipment (air-driven Z-axis)



WARNING

- When the Z-axis comes to a stop due to obstruction from peripheral equipment, the Z-axis may move suddenly after the obstruction is removed, causing injury such as pinched or crushed hands. Turn off the controller and reduce the air pressure before attempting to remove the obstruction. Before reducing the air pressure, place a support under the Z-axis so that it will not drop under its own weight.

6. Precautions of Z-axis movement when air supply is stopped (air-driven Z-axis)



WARNING

- The Z-axis will slide downward when the air pressure to the Z-axis air cylinder solenoid valve is reduced, creating a hazardous situation. Turn off the controller and place a support under the Z-axis before cutting off air supply.

7. Correct parameter settings



CAUTION

The robot must be operated with the correct tolerable moment of inertia and acceleration coefficients that match the manipulator tip mass and moment of inertia. Failure to follow this instruction will lead to a premature end to the drive unit service life, damage to robot parts, or cause residual vibration during positioning.

8. Case of small rotation angle of the X-axis, Y-axis or R-axis



CAUTION

If the X-axis, Y-axis or R-axis rotation angle is set smaller than 5 degrees and always move within the same position, this restricted position makes it difficult for an oil film to form on the joint support bearing, and so may possibly damage the bearing. In this type of operation, add a range of motion so that the joint moves through 90 degrees or more, about 5 times a day.

4.6. Maintenance

Make sure to carry out daily and periodic inspections and make a pre-operation check to ensure there are no problems with the robot and related equipment. If a problem or abnormality is found, then promptly repair it or take other measures as necessary.

Record the periodic inspections and repairs, and store the record for at least 3 years.

4.6.1 Before maintenance work

1. Do not attempt any work or operation unless described in this manual.



WARNING

Do not attempt maintenance, repair, and part replacement unless described in this manual. These tasks require specialized technical knowledge and skills and may also involve hazards. If an abnormal condition occurs, please be sure to contact your distributor. Our service personnel will take appropriate action.

2. Precautions during repair and parts replacement



WARNING

When it is necessary to repair or replace parts of the robot and controller, please be sure to contact your distributor and follow the instructions they provide. Maintenance of the robot and controller by an unskilled, untrained person is extremely hazardous.

Maintenance and parts replacement require specialized technical knowledge and skills, and also may involve hazards. These tasks must be carried out only by those who have enough ability and qualifications required by local laws and regulations.



WARNING

Maintenance work by removing a cover requires specialized technical knowledge and skills, and may also involve hazards if attempted by an unskilled person. This must be carried out only by technicians who have the required qualifications [REF](#) "2. Qualification of operators/workers" in section 4.1

3. Shutting off all phases of power supply



WARNING

Always shut off all phases of the power supply externally before cleaning the robot and controller or securely tightening the terminal screws etc. Otherwise, electrical shock or product damage or malfunction may result.

4. Allowing a waiting time after power is shut off (Allowing time for temperature and voltage to drop)



WARNING

- When carrying out maintenance work of the controller under your distributor's instructions, wait at least the time (*) specified for each controller after turning the power off. Some components in the controller are very hot or still retain a high voltage shortly after operation to cause burns and electrical shock by touching those parts.
- The motor and speed reduction gear casing are very hot shortly after operation to cause burns and electrical shock by touching those parts. If it is necessary to touch them for inspection or servicing, turn off the controller and wait for a while to make sure that they are cool enough before touching.

* How long to wait after turning the power off [REF](#) the user's manual for each controller

5. Precautions during inspecting controller



WARNING

- If it is necessary to touch the terminals or connectors on the outside of the controller for inspection, always first turn off the controller power and also the power source in order to prevent possible electrical shock.
- Do not disassemble the controller nor touch any internal parts of it. Doing so may cause breakdown, malfunction, injury, or fire.

4.6.2 Precautions during service work

1. Precautions of removing the Z-axis motor



WARNING

- The Z-axis will slide downward when the Z-axis motor is removed, causing a hazardous situation.
- Turn off the controller and place a support under the Z-axis before removing the Z-axis motor.
- Be careful not to let your body get caught by the driving unit of the Z-axis or between the Z-axis drive unit and the installation base.

2. Do not remove the Z-axis upper limit mechanical stopper.



CAUTION

- Warning label 4 is attached to each SCARA robot. [REF](#) "3. Warning labels"
- Removing the upper limit mechanical stopper installed to the Z-axis spline or shifting its position will damage the Z-axis ball screw. Do not attempt such actions.

3. Precautions of handling a robot that contains powerful magnets



WARNING

- Powerful magnets are installed inside the robot. Do not disassemble the robot since this may cause injury. Devices that may malfunction due to magnetic fields must be kept away from this robot.
- [REF](#) "6. Cautions regarding strong magnetic fields"

4. Precautions of disassembling or replacing the pneumatic equipment.



WARNING

- Some parts may fly outward if pneumatic equipment is disassembled or parts replaced while air is still supplied.
- Do service work after turning off the controller, reducing the air pressure, and exhausting the residual air from the pneumatic equipment.
- Before reducing the air pressure, place a support stand under the Z-axis (when it is air driven Z-axis) since it will drop under its own weight.

5. Precautions to avoid contact with the controller cooling fan



WARNING

- Touching the rotating fan may cause injury.
- If removing the fan cover, first turn off the controller and make sure the fan has stopped.

6. Precautions for controllers



CAUTION

- Always back up the controller internal data (such as programs, point data) on an external storage device as it may be lost or deleted for unexpected reasons.
- Do not use thinner, benzene, or alcohol to wipe off the surface of the programming box. The surface sheet may be damaged or printed letters or marks erased. Use a soft, dry cloth and gently wipe the surface.
- Do not use a hard or pointed object to press the keys on the programming box. Malfunction or breakdown may result if the keys are damaged. Use your fingers to operate the keys.

4.7. Disposal

When disposing of robots and related items, handle them carefully as industrial wastes. Use the correct disposal method in compliance with your local regulations, or entrust disposal to a licensed industrial waste disposal company.

1. Disposal of lithium batteries

When disposing of lithium batteries, use the correct disposal method in compliance with your local regulations, or entrust disposal to a licensed company. We do not collect and dispose of the used batteries.

2. Disposal of packing boxes and materials

When disposing of packing boxes and materials, use the correct disposal method in compliance with your local regulations. We do not collect and dispose of the used packing boxes and materials.

3. Strong magnet



WARNING

Strong magnets are installed in the robot. Be careful when disposing of the robot.

REF "6. Cautions regarding strong magnetic fields

5. Action when a person is caught by robot

If a person should get caught between the robot and a mechanical part such as the installation base, then release the axis.

■ Emergency action

Release the axis while referring to the following section in the manual for the controller.

Controller	Manual name	Refer to:
YRC	Operator's / User's	Chapter 1 "1. Emergency action when a person is caught by robot"
YRCX	Operator's / User's	Chapter 1 "1. Emergency action when a person is caught by robot"



NOTE

Make a printout of the relevant page in the manual and post it a conspicuous location near the controller.

6. Cautions regarding strong magnetic fields

Some OMRON robots contain parts generating strong magnetic fields which may cause death, bodily injury, or device malfunction. Always comply with the following instructions.

- Those who are wearing medical electronic devices such as cardiac pacemakers or hearing aids must keep away from the robot.
- Those who are wearing ID cards, purses, and/or wristwatches must keep away from the robot.
- Do not bring tools close to the internal parts of the robot.

7. Using the robot safely

7.1. Movement range

When a tool or workpiece is attached to the robot manipulator tip, the actual movement range enlarges from the movement range of the robot itself (Figure A) to include the areas taken up by movement of the tool and workpiece attached to the manipulator tip (Figure B).

The actual movement range expands even further if the tool or workpiece is offset from the manipulator tip. The movement range here includes moving area of tools and workpieces on the manipulator tip, and solenoid valves attached to the robot arms in addition to that of the robot itself,

Movement range

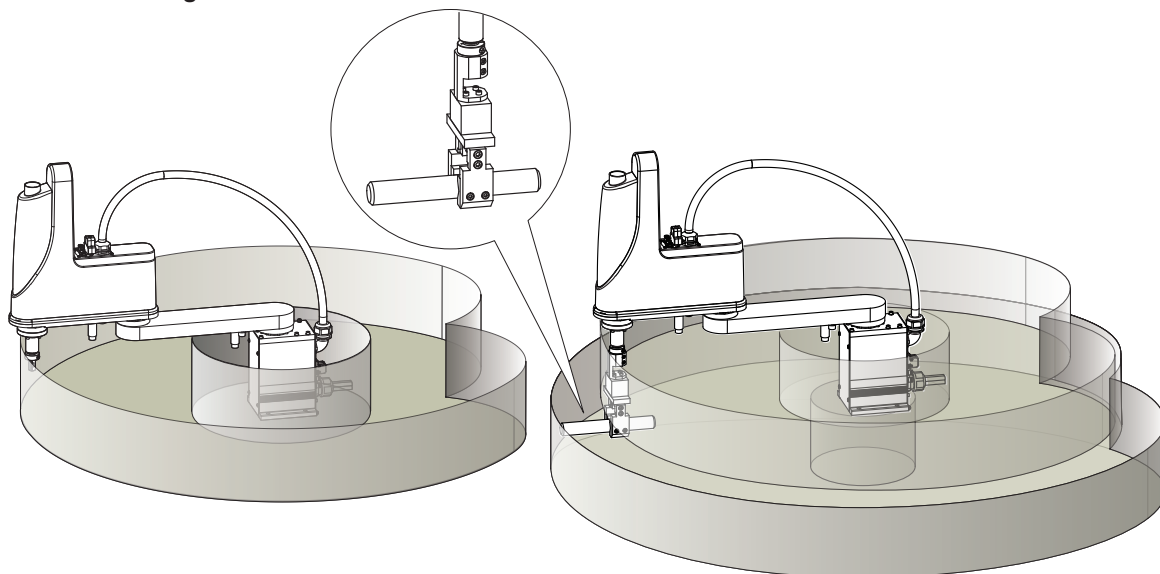


Figure A: Movement range of robot itself

Figure B: Movement range when tool and workpiece are attached to manipulator tip

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NOTE

To make the robot motion easier to understand, the above figures only show the movement ranges of the tool attachment section, tool, and workpiece. In actual operation, the movement range includes all areas where the robot arms and any other parts move along with the robot.

7.2. Robot protective functions

Protective functions for OMRON robots are described below.

1. Overload detection

This function detects overload if the robot collides or interferes, and then turns off the servo.

2. Overheat detection

This function detects an abnormal temperature rise in the driver inside the controller, and then turns off the servo.

3. Soft limits

Soft limits can be set on each axis to limit the working envelope in manual (jog) operation and automatic operation after return-to-origin. The working envelope is the area limited by soft limits.



WARNING

Soft limit function is not a safety-related function intended to protect the human body.

To restrict the robot movement range to protect the human body, use the mechanical stoppers installed in the robot (or available as options).

4. Mechanical stoppers

If the servo is turned off by emergency stop operation or protective function while the robot is moving, then these mechanical stoppers prevent the axis from exceeding the movement range. The movement range is the area limited by the mechanical stoppers.

SCARA robots

- The X and Y axes have mechanical stoppers that are installed at the ends of the maximum movement range. Some robot models have a standard feature that allows changing the mechanical stopper positions. On some other models, the mechanical stopper positions can also be changed by using option parts.
- The Z-axis has a mechanical stopper at the upper end and lower end. The stopper positions can be changed by using option parts.
- No mechanical stopper is provided on the R-axis.



WARNING

Note that axis movement does not stop immediately after the servo is turned off by emergency stop or other protective functions.



CAUTION

If the robot moving at high speed collides with a mechanical stopper installed in the robot (or available as option), the robot may be damaged.

5. Z-axis (vertical axis) brake

An electromagnetic brake is installed on the Z-axis to prevent it from sliding downward when the servo is off. This brake is working during the controller is off or the Z-axis servo power is off even when the controller is on. The Z-axis brake can be released by the programming unit / handy terminal or by a command in the program when the controller is on.



WARNING

The vertical axis will slide downward when the brake is released, causing a hazardous situation. Take adequate safety measures in consideration by taking the weight and shape into account.

- Before releasing the brake after pressing the emergency stop button, place a support under the vertical axis so that it will not slide down.
- Be careful not to let your body get caught between the vertical axis and the installation base when performing tasks (such as direct teaching) with the brake released.

7.3. Residual risk

To ensure safe and correct use of OMRON robots and controllers, system integrators and / or end users implement machinery safety design that conforms to ISO12100.

Residual risks for OMRON robots and controllers are described in the DANGER or WARNING instructions provided in each Chapter and section. Read them carefully.

7.4. Special training for industrial robot operation

Operators or persons who handle the robot for tasks such as teaching, programming, movement checks, inspections, adjustments, and repairs must receive appropriate training and also have the skills needed to perform the job correctly and safely. They must also read the manual carefully to understand its contents before attempting the robot operation or maintenance.

Tasks related to industrial robots (such as teaching, programming, movement check, inspection, adjustment, repair) must be performed by qualified persons who meet requirements established by local regulations and safety standards for industrial robots.

7.5. KC mark

KC (Korean Certification) is a system based on the Korean Radio Law. Machineries designated with this system are required to be registered as conformed certification or conformed registration, and to show KC marks. Target products are prescribed by notification of the National Radio Research Agency (RRA).

7.5.1 EMC standards

■ Cautions regarding compliance with KC mark

The OMRON robot-series product is one component that is incorporated into the customer's system (built-in equipment). We decide models by single robot product (controller, robot and peripheral device) and conform them to the EMC standards.

This does not therefore guarantee that the OMRON robot-series product conforms to the EMC standards if only the robot is used independently. The customer who incorporates OMRON robot products into the customer's final system, which will be shipped to or used in Korea, should verify that the overall system conforms to the EMC standards.

■ KC mark

The OMRON robots controllers are registered in the National Radio Research Agency (RRA) as conformed by self-test and KC marks are affixed to the controllers.

■ Related standards

- Electromagnetic Compatibility (EMC)

■ Information of conformity assessment

• Certification number list

Product	Model name	Certification number
Controller	YRC	MSIP-REM-Y3M-X240
	YRCX	MSIP-REM-Y3M-X340

- Applicant and manufacturer : OMRON

7.5.2 Examples of EMC countermeasures

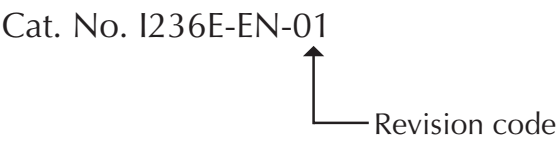
It is not necessary to take measures for ERCD and robots connecting to ERCD.

Examples of EMC countermeasures for single OMRON robot product are the same as those of CE marks. Refer to countermeasures described in the related user's manual.

Furthermore, take proper countermeasures to conform customer's final system (overall system) to EMC standards.

Revision history

A manual revision code appears as a suffix to the catalog number on the front cover manual.



The following table outlines the changes made to the manual during each revision.

Revision code	Date	Description
01	April 2020	Original production



Authorized Distributor: