YAMAHA

YAMAHA 4-AXIS ROBOT CONTROLLER

RCX340

User's Manual

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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 YAMAHA 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 injury (to installation personnel, robot operator or service personnel) including fatal accidents.

Before using this product, read this manual 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 YAMAHA robots, please take appropriate safety measures as required by the user's individual system.

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

2. Signal words used in this manual

This manual uses the following safety alert symbols and signal words to provide safety instructions that must be observed and to describe handling precautions, prohibited actions, and compulsory actions. Make sure you 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

Explains the key point in the operation in a simple and clear manner.

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. See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

■ Warning label 1 (SCARA robots, Cartesian robots)

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
• Always install a safety enclosure to keep all persons away from the robot movement range and prevent injury from contacting the moving part of the robot. • 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.

Potential hazard to human body	Serious injury may result from contact with a moving robot.
To avoid hazard	• Keep outside of the robot safety enclosure during operation. • Press the emergency stop button before entering the safety enclosure.

90K41-001470

■ Warning label 2 (SCARA robots, Cartesian robots, single-axis robots*)

* Warning label 2 is not attached to some small single-axis robots, but is supplied with the robots.

WARNING

Moving parts can pinch or crush hands.
Keep hands away from the movable parts of the robot.

Instructions on this label
Use caution to prevent hands and fingers from being pinched or crushed by the movable parts of the robot when transporting or moving the robot or during teaching.

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.

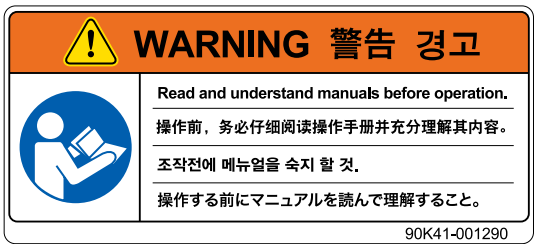
90K41-001460

■ Warning label 3 (SCARA robots, Cartesian robots, controllers*)

* Some models

WARNING

Improper installation or operation may cause serious injury.
Before installing or operating the robot, read the manual and instructions on the warning labels and understand the contents.



Instructions on this label
• 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" in this manual. • Never 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.

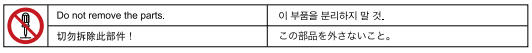
90K41-001290

■ Warning label 4 (SCARA robots*)

* This label is not attached to omnidirectional type SCARA robots.

CAUTION

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



Instructions on this label
The Z-axis ball screw will be damaged if the upper end mechanical stopper on the Z-axis spline is removed or moved. Never attempt to remove or move it.

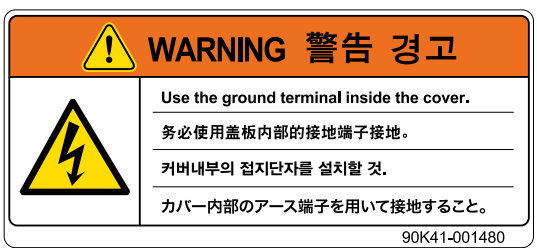
90K41-001520

■ Warning label 5 (controllers, Cartesian robots*, single-axis robots*)

* Some robot models

WARNING

Ground the controller to prevent electrical shock.
Ground terminal is located inside this cover.
Read the manual for details.



Instructions on this label
• High voltage section inside • To prevent electrical shock, be sure to ground the robot using the ground terminal.

Potential hazard to human body	Electrical shock
To avoid hazard	Ground the controller.

90K41-001480

■ Warming label 6 (controllers TS-X/TS-P)

WARNING

- **Before touching the terminals or connectors on the outside of the controller, turn off the power and wait at least 10 minutes to avoid burns or electrical shock.**
- **Motors and heatsinks become hot during and shortly after operation, so do not touch them.**

CAUTION

- **Before using the controller, be sure to read the manual thoroughly.**
- **Be sure to ground the ground terminal.**

Instructions on this label
• This indicates a high voltage is present. Touching the terminal block or connector may cause electrical shock. • This indicates the area around this symbol may become very hot. Motors and heatsinks become hot during and shortly after operation. Do not touch them to avoid burns. • This indicates important information that you must know 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. • Be sure to ground the ground terminal to avoid electrical shock.

Potential hazard to human body	To avoid hazard
Electrical shock	Do not touch the terminal section for 10 minutes after power-off.
Do not touch them to avoid burns.	Do not touch the motors and heatsinks during power-on.
Improper installation or operation may cause serious injury.	Before installing or operating the robot, read the manual and instructions on the warning labels and understand the contents.
Electrical shock	Be sure to ground the ground terminal.

90K41-000950

■ Warming label 7 (controllers RCX240, controllers RCX340)

WARNING

These are precautions for YAMAHA 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
• 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, so electrical shock may occur if those parts are touched.

Potential hazard to human body	Electrical shock
To avoid hazard	Wait at least 100 seconds after power-off before opening the covers (*).

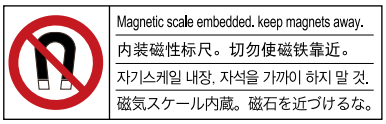
* These are precautions for YAMAHA and distributors' service personnel. Customers must not attempt to open the covers.

90K41-001390

■ Warning label 8 (single-axis linear motor robots)

CAUTION

A magnetic scale is located inside this cover. Bringing a magnet close to it may cause malfunction.

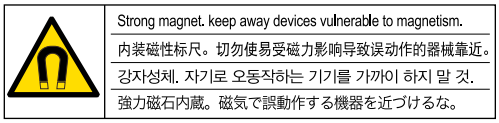
	Instructions on this label
	• To prevent the robot from operating improperly due to magnetic scale malfunction, do not bring a strong magnet to the cover. • Do not bring tools close to the magnetic scale.

90K41-001510

■ Warning label 9 (single-axis linear motor robots)

CAUTION

Powerful magnets are installed in the robot.
Do not attempt to disassemble the robot to avoid possible injury.
Do not bring any device that may malfunction due to magnetic fields close to the robot.

	Instructions on this label
	Be sure to read "6. Cautions regarding strong magnetic fields" in "Safety instructions" and make sure you fully understand its contents before handling or operating the robot.
Potential hazard to human body	Injury or death may result in some cases.
To avoid hazard	Make you understand the precautions regarding strong magnetic fields.

90K41-001500

■ Warning label 10 (Controller)*

* This label is attached to the front panel.

CAUTION

Refer to the manual.

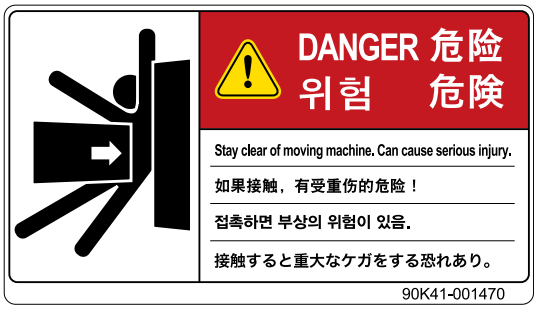
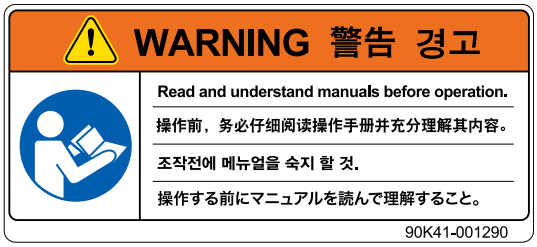
	Instructions on this label
	This indicates important information that you must know and is described in the manual. Before using the controller, be sure to read the manual thoroughly. When adding external safety circuits or connecting a power supply to the controller, read the manual carefully and make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

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	Cartesian robots	Single-axis robots
Warning label 1		●*1 ○	● ○	 ○
Warning label 2		●*1	●	●*2
Warning label 3		●*1	●	◎

*1: See "Part names" in each SCARA robot manual for label positions.
*2: This label is not attached to some small single-axis robots, but is supplied with the robots.

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 YAMAHA 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
	This indicates a high voltage is present. Touching the terminal block or connector may cause electrical shock.

93006-X0-00

2. High temperature hazard symbol

WARNING

Motors, heatsinks, and regenerative units become hot, so do not touch them.

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

93008-X0-00

3. Caution symbol

CAUTION

Always read the manual carefully before using the controller.

	Instructions by this symbol
	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.

93007-X0-00

4. Important precautions for each stage of the robot life cycle

This section describes major 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

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

DANGER

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

- **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 which are subject to vibration such as onboard ships and vehicles.**

2. Qualification of operators/workers

Operators or persons who perform tasks for industrial robots (such as teaching, programming, movement check, inspection, adjustment, and repair) must receive appropriate training and also have the skills needed to perform the tasks correctly and safely.
Those tasks must be performed by qualified persons who meet requirements established by local regulations and standards for industrial robots. They must also read the manual carefully and understand its contents before attempting the robot operation or maintenance.

WARNING

- **It is extremely hazardous for persons who do not have the above qualifications to perform tasks for industrial robots.**
- **Adjustment and maintenance that require removing a cover must be performed by persons who have the above qualifications. Any attempt to perform such tasks by an unqualified person may cause an accident resulting in serious injury or death.**

4.2 Essential precautions for the linear conveyor module

The linear conveyor module is a YAMAHA robot so safety measures must be followed and safety equipment must be installed just as required for other YAMAHA robots.
This section describes essential precautions for handling the linear conveyor module. Precautions for each stage in the robot life cycle are listed from the next section, so be sure to read the whole section of "Safety Instruction" in this manual.

1. Slider ejection

DANGER

The slider and workpieces ejected at high SPEED from the linear conveyor module may strike persons, causing serious and POSSIBLY fatal injuries. Please comply with the following points.

- Do not enter or allow the face and hands to intrude anywhere along the line where the linear conveyor guide rail may extend (not only ejection side of the conveyor but also the insertion side).
- If ejecting the slider on the linear conveyor, then install a suitable ejection mechanism (device to catch and stop the ejected slider).
- Install a structure and a mechanism to catch and retain the slider on the side where the slider is inserted.
- Install a safety enclosure outside the linear conveyor movement range. Design the safety enclosure so that the slider and workpieces from the linear conveyor are not ejected outside of the enclosure.

2. Preventing electrical shock

DANGER

Always comply with the instructions in this manual when installing, operating and inspecting the linear conveyor module. Failure to do so may lead to electrical shock, serious injury or even death. Please comply with the following items:

- Read and FOLLOW the instructions in this manual when grounding the linear conveyor module and installing the termination module.
- Do not touch the motor of the linear conveyor module when it is on.
- Always comply with the instructions in the manual when performing maintenance and be sure to turn off the power before starting maintenance tasks.
- If cracked or broken plastic motor parts are found, stop using the linear conveyor module immediately and turn off the power.

3. Strong magnetic field

WARNING

The linear conveyor module contains powerful permanent magnets and electromagnets that generate strong magnetic fields. Always comply with the precautions listed in this manual when using the linear conveyor module. Those persons wearing medical electronic devices such as cardiac pacemakers or hearing aids are at particular risk of major injury or even death.

- Always attach the magnet protective cover (supplied) when handling, shipping or storing the slider when removing it from the linear conveyor module's guide rails.
- Do not approach the motor of the linear conveyor module while the power is on. (Stay at least 100mm away.)
- Do not attempt to disassemble the linear conveyor module (including surrounding covers).
- Do not place any tools near the slider magnets and the linear conveyor motor while the power is on.

4. High temperature hazard

WARNING

The motor for the linear conveyor module is mounted on the module, and so it is easy to come into contact with. To allow heat generated during operation to DISSIPATE, install the module on a base made from good heat conducting material such as metal.
The motor reaches high temperatures during and IMMEDIATELY after operation, so touching it at those times may cause burns.
Before touching the motor, first turn off the controller power, then wait a while and check that the temperature has DROPPED sufficiently.

4.3 Design

4.3.1 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 workers, the user must take the necessary protective measures such as enable devices according to risk assessment by the user.

2. Restricting the movement range

See "7.1 Movement range" in "Safety instructions" for details on the robot's 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 (gripper, etc.)

WARNING

- End effectors must be designed and manufactured so that they cause no hazards (such as a loose workpiece or load) even if power (electricity, air pressure, etc.) is shut off or power fluctuations occur.
- If the object gripped by the end effector might possibly fly off or drop, then 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 (temporarily stopped, emergency stop, error stop, etc.).

4.3.2 Precautions for robot controllers

1. Emergency stop input terminal

DANGER

Each robot controller has an emergency stop input terminal to trigger emergency stop. Using this terminal, install a safety circuit so that the system including the robot controller will work safely.

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 100mm. Failure to follow this instruction may cause malfunction due to noise.

4.4 Moving and installation

4.4.1 Precautions for robots

■ Installation environment

1. Do not use in strong magnetic fields

WARNING
Do not use the robot near equipment or in locations that generate strong magnetic fields. The robot may BREAK DOWN or malfunction if used in such locations.

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

WARNING
Do not use the robot in locations subject to electromagnetic interference, electrostatic discharge or radio frequency interference. The robot may malfunction if used in such locations creating hazardous situations.

3. Do not use in locations exposed to flammable gases

WARNING
- YAMAHA 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. Failure to follow this instruction may cause serious accidents involving injury or death, or lead to fire.

■ Moving

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

WARNING
Moving parts can pinch or crush hands or fingers.
Keep hands away from the movable parts of the robot.

As instructed in Warning label 2, use caution to prevent hands or fingers from being pinched or crushed by movable parts when transporting or moving the robot. For details on warning labels, see "3. Warning labels" in "Safety instructions."

2. Take safety measures when moving robots

To ensure safety when moving a SCARA robot with an arm length of 500mm or more, use the eyebolts that come supplied with the robot. Always refer to the robot user's manual for details.
When moving 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 moving the robot by lifting it with equipment such as a hoist or crane, wear personal protective gear and be careful not to move the robot at greater than the required height.
Make sure that there are no persons 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 moving the robot, wear personal 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 require specialized technical knowledge and skills, and may also involve hazards if attempted by an unskilled person. This adjustment must be performed only by persons who have the required qualifications described in “2. Qualification of operators/workers” in section 4.1 of this “Safety instructions”.

4.4.2 Precautions for robot controllers

■ Installation environment

1. Installation environment

WARNING
YAMAHA 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. Failure to follow this instruction may cause serious accidents involving injury or death, and lead to fire.

WARNING
- Use the robot controller in locations that support the environmental conditions specified in this manual. Operation outside the specified environmental range may cause electrical shock, fire, malfunction or product damage or deterioration.
- The robot 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 robot controller in locations with enough space to perform work (teaching, inspection, etc.) safely. Limited space not only makes it difficult to perform work but can also cause injury.
- Install the robot 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 robot controller for good ventilation. Insufficient clearance may cause malfunction, breakdown or fire.

■ Installation

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

1. Installation

WARNING
Securely tighten the screws to install the robot controller. If not securely tightened, 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. Failure to do this may cause electrical shock or product damage.
- Never directly touch conductive sections and electronic parts other than the connectors, rotary switches, and DIP switches on the outside panel of the robot 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. Connection to robot controller

The controller parameters are preset at the factory before shipping to match the robot model. Check the specified robot and controller combination, and connect them in the correct combination.
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. Wiring safety points

WARNING

Always shut off all phases of the power supply externally before starting installation or wiring work. Failure to do this may cause electrical shock or product damage.

CAUTION

- **Make sure that no foreign matter such as cutting chips or wire scraps get into the robot 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 PC 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 robot 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 robot 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 or 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 robot controller in a conduit or clamp them securely in place. If the cables are not stored in a conduit or properly clamped, excessive play or 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 robot controller may possibly become damaged, then protect them with a cover, etc.**
- **Check that the control lines and communication cables are routed at a gap sufficiently away from main power supply circuits and power lines, etc. 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 ground terminals of the robot and controller. Poor grounding may cause electrical shock.

4.5 Safety measures

4.5.1 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 this manual, and comply with the instructions.**
- **Never attempt any repair, parts replacement and modification unless described in this manual. These tasks require specialized technical knowledge and skills and may also involve hazards. Please contact your distributor for advice.**

NOTE

For details on warning labels, see "3. Warning labels" in "Safety instructions."

2. Draw up "work instructions" and make the operators/workers understand them

WARNING

Decide on "work instructions" in cases where personnel must work within the robot safety enclosure to perform startup or maintenance work. Make sure the workers completely understand these "work instructions".

Decide on "work instructions" for the following items in cases where personnel must work within the robot safety enclosure to perform teaching, maintenance or inspection tasks. Make sure the workers completely understand these "work instructions".

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 perform 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.
   - Place a display sign on the operator panel
   - Ensure the safety of workers performing tasks within the robot safety enclosure
   - Clearly specify position and posture during work
     Specify a position and posture where worker can constantly check robot movements and immediately move to avoid trouble if an error/problem occurs
   - Take noise prevention measures
   - Use methods for signaling operators of related equipment
   - Use 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 workplace safety consultants, etc.

3. Take safety measures

DANGER

- **Never enter the robot movement range while the robot is operating or the main power is turned on. Failure to follow this warning may cause serious accidents involving injury or death. Install a safety enclosure or a gate interlock with an area sensor to keep all persons away from the robot movement range.**
- **When it is necessary to operate the robot while you are within the robot movement range such as for teaching or maintenance/inspection tasks, always carry the programming box with you so that you 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. Failure to follow these instructions may cause serious accidents involving injury or death.**

See “7.1 Movement range” in “Safety instructions” for details on the robot’s 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 person for that task 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 robot controller in the correct combination. Using them in an incorrect combination may cause fire or breakdown.

4. Install system

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

WARNING

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

5. Precautions for operation

WARNING

- Do not touch any electrical terminal. Directly touching these terminals may cause electrical shock, equipment damage, and malfunction.
- Do not touch or operate the robot controller or programming box with wet hands. Touching or operating them with wet hands may result in electrical shock or breakdown.

6. Do not disassemble and modify

WARNING

Never disassemble and modify any part in the robot, controller, and programming box. Do not open any cover. Doing so may cause electrical shock, breakdown, malfunction, injury, or fire.

4.5.2 Installing a safety enclosure

Be sure to install a safety enclosure to keep anyone from entering within the movement range of the robot. The safety enclosure will prevent the operator and other persons from coming in contact with moving parts of the robot and suffering injury.
See “7.1 Movement range” in “Safety instructions” for details on the robot’s 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 (See "3. Warning labels" in "Safety instructions") that comes supplied with a robot should be affixed to an easy-to-see location on the door or gate of the safety enclosure.

4.6 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

Check the following points before starting robot operation.

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

4.6.1 Trial operation

After installing, adjusting, inspecting, maintaining or repairing the robot, perform 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 movement range around the robot in place of the safety enclosure and observe the following points.
See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

DANGER

Place a "Robot is moving - KEEP AWAY!" sign to keep the operator or other personnel from entering within the movement range of the robot.

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 (safety enclosure, etc.) 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

Before starting work within the safety enclosure, **always confirm from outside the enclosure that each protective function is operating correctly (see the previous section 2.3).**

DANGER

Never enter within the movement range while within the safety enclosure.

See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

WARNING

When work is required within the safety enclosure, place a sign "Work in progress" in order to keep other persons 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	**SCARA robots**	Follow the precautions and procedure described in "Adjusting the origin".
Standard coordinate setting	**SCARA robots**	Follow the precautions and procedure described in "Setting the standard coordinates".
Soft limit settings	**SCARA robots**	Follow the precautions and procedure described in "Setting the soft limits".
	Cartesian robots **Single-axis robots**	Follow the precautions and procedure described in "Soft limit" in each controller manual.

Work with power turned on

Teaching	**SCARA robots** **Cartesian robots** **Single-axis robots**	Refer to "5. Teaching within safety enclosure" described below.

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

Never enter within the movement range while within the safety enclosure.

See “7.1 Movement range” in “Safety instructions” for details on the robot’s 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.**

4.6.2 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

Check the following points before starting automatic operation

DANGER

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

WARNING

- **Check that the programming box / handy terminal and tools are in their specified locations.**
- **Check that the signal tower lamps or other alarm displays installed for the system are not lit or flashing, indicating no 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

Never enter the safety enclosure during automatic operation.

WARNING

If an error occurs in the robot or peripheral equipment, 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 other persons from restarting the robot.

4.6.3 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 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 occurs the robot, then 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 fly off during robot operation
Abnormal robot operation (position deviation, vibration, etc.)	Robot malfunction
Z-axis (vertical axis) or brake malfunction	Z-axis unit falls off

2. High temperature hazard

WARNING

- **Do not touch the robot controller and robot during operation. The robot controller and robot body are very hot during operation, so burns may occur if these sections are touched.**
- **The motor and speed reduction gear casing are very hot shortly after operation, so burns may occur if these are touched. Before touching those parts for inspections or servicing, turn off the controller, wait for a while and check that their temperature has cooled.**

3. Use caution when releasing the Z-axis (vertical 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 your body get caught between the vertical axis and the installation base when performing tasks (direct teaching, etc.) with the brake released.

4. Be careful of Z-axis movement when the controller is turned off or emergency stop is triggered (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 case of emergency stop.

5. Take protective measures when 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 because the Z-axis will drop under its own weight.

6. Be careful 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 the air supply.

7. Make 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. If the X-axis, Y-axis or R-axis rotation angle is small

CAUTION

If the X-axis, Y-axis or R-axis rotation angle is set smaller than 5 degrees, then it will 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.

4.7 Inspection and maintenance

Always perform 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.
Keep a record of periodic inspections or repairs and store this record for at least 3 years.

4.7.1 Before inspection and maintenance work

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

Never attempt any work or operation unless described in this manual.
If an abnormal condition occurs, please be sure to contact your distributor. Our service personnel will take appropriate action.

WARNING

Never attempt inspection, maintenance, repair, and part replacement unless described in this manual. These tasks require specialized technical knowledge and skills and may also involve hazards. Please be sure to contact your distributor for advice.

2. Precautions during repair and parts replacement

WARNING

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

Adjustment, maintenance and parts replacement require specialized technical knowledge and skills, and also may involve hazards. These tasks must be performed only by persons who have enough ability and qualifications required by local laws and regulations.

WARNING

Adjustment and maintenance by removing a cover require specialized technical knowledge and skills, and may also involve hazards if attempted by an unskilled person. This adjustment must be performed only by persons who have the required qualifications described in "2. Qualification of operators/workers" in section 4.1 of this "Safety instructions".

3. Shut 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. Failure to do this may cause electrical shock or product damage or malfunction.

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

WARNING

- **When performing maintenance or inspection of the robot controller under your distributor's instructions, wait at least the time (*) specified for each controller after turning the power off. Some components in the robot controller are very hot or still retain a high voltage shortly after operation, so burns or electrical shock may occur if those parts are touched.**
- **The motor and speed reduction gear casing are very hot shortly after operation, so burns may occur if they are touched. Before touching those parts for inspections or servicing, turn off the controller, wait for a while and check that the temperature has cooled.**

* For information on how long you should wait after turning the power off, see the user's manual for each controller.

5. Precautions during inspection of controller

WARNING

- **When you need to touch the terminals or connectors on the outside of the controller during inspection, always first turn off the controller power switch and also the power source in order to prevent possible electrical shock.**
- **Do not disassemble the controller. Never touch any internal parts of the controller. Doing so may cause breakdown, malfunction, injury, or fire.**

4.7.2 Precautions during service work

1. Precautions when removing a motor (Cartesian robots and vertical mount single-axis robots)

WARNING

The vertical axis will slide down when the motor is removed, causing a hazardous situation.

- Turn off the controller and place a support under the vertical axis before removing the motor.
- Be careful not to let your body get caught by the driving unit of the vertical axis or between the vertical axis and the installation base.

2. Be careful when removing the Z-axis motor (SCARA robots)

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.

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

CAUTION

Warning label 4 is attached to each SCARA robot. (For details on warning labels, see "3. Warning labels" in "Safety instructions.")

Removing the upper limit mechanical stopper installed to the Z-axis spline or shifting its position will damage the Z-axis ball screw. Never attempt to remove it.

4. Use caution when 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.

See "6. Cautions regarding strong magnetic fields" in "Safety instructions" for detailed information on strong magnetic fields.

5. Use the following caution items when disassembling or replacing the pneumatic equipment.

WARNING

Air or 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 (2-axis robots with air driven Z-axis) since it will drop under its own weight.

6. Use caution 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.

7. Precautions for robot controllers

CAUTION

- Back up the robot controller internal data on an external storage device. The robot controller internal data (programs, point data, etc.) may be lost or deleted for unexpected reasons. Always make a backup of this data.
- 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.

4.8 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 industrial waste disposal 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.

See "6. Cautions regarding strong magnetic fields" in "Safety instructions" for detailed information on strong magnetic fields.

5. Emergency 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 robot controller.

Controller	Refer to:
RCX240	Section 1, "Freeing a person caught by the robot" in Chapter 1
RCX340	Section 1, "Emergency action when a person is caught by robot" in Chapter 1

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

- Persons wearing medical electronic devices such as cardiac pacemakers or hearing aids must keep away from the linear single-axis robot and linear conveyor. (Stay at least 100mm away.)
- Persons wearing ID cards, purses, and/or wristwatches must keep away from the linear single-axis robot and linear conveyor.
- Do not attempt to disassemble the linear single-axis robot and linear conveyor (including surrounding covers).
- Do not bring tools close to the internal parts of the robot and the linear conveyor magnets.
- Always attach the magnet protective cover (supplied) when handling, shipping or storing the linear conveyor's slider when removing it from the module.

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 is defined as the range of robot motion including all areas through which the robot arms, the tool and workpiece attached to the manipulator tip, and the solenoid valves attached to the robot arms move.
To make the robot motion easier to understand, the figures below only show the movement ranges of the tool attachment section, tool, and workpiece.
Please note that during actual operation, the movement range includes all areas where the robot arms and any other parts move along with the robot.

Movement range

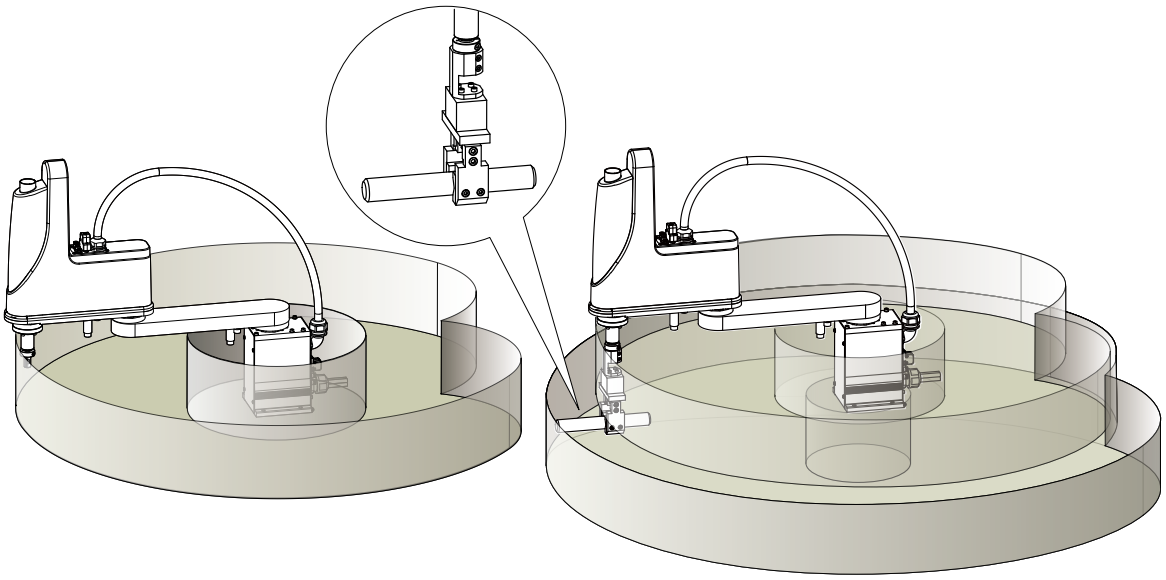


Figure A: Movement range of robot itself

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

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CAUTION

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 YAMAHA robots are described below.

1. Overload detection

This function detects an overload applied to the motor and turns off the servo.
If an overload error occurs, take the following measures to avoid such errors:

1. Insert a timer in the program.
2. Reduce the acceleration.

2. Overheat detection

This function detects an abnormal temperature rise in the driver inside the controller and turns off the servo.
If an overheat error occurs, take the following measures to avoid the error:

1. Insert a timer in the program.
2. Reduce the acceleration.

3. Soft limits

Soft limits can be set on each axis to limit the working envelope in manual operation after return-to-origin and during automatic operation. 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 both 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.
Single-axis robots **Cartesian robots**	• The linear movement axis has a mechanical stopper at both ends of the maximum movement range. The positions of these mechanical stoppers cannot be changed. • No mechanical stopper is provided on the rotational axis.

WARNING

Axis movement does not stop immediately after the servo is turned off by emergency stop or other protective functions, so use caution.

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.

DANGER

When the linear conveyor module is used to insert or eject the slider, mechanical stoppers cannot be attached to the module body due to the structural limits. So install a device to catch and stop the slider being ejected at high speed from the module, as well as other necessary safety measures.

5. Z-axis (vertical axis) brake

An electromagnetic brake is installed on the Z-axis to prevent the Z-axis from sliding downward when the servo is OFF. This brake is working when 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 (direct teaching, etc.) with the brake released.**

7.3 Residual risk

To ensure safe and correct use of YAMAHA robots and controllers, System integrators and/or end users implement machinery safety design that conforms to ISO12100.
Residual risks for YAMAHA 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 for 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 (teaching, programming, movement check, inspection, adjustment, repair, etc.) must be performed by qualified persons who meet requirements established by local regulations and safety standards for industrial robots.

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	

See “7.1 Movement range” in “Safety instructions” for details on the robot’s movement range.

Revision record

Manual version	Issue date	Description
Ver. 1.00	May 2012	First edition
Ver. 1.01	Jun. 2012	Description of "Emergency action when a person is caught by robot" was added, the work sequence for working within the safety enclosure changed, typing errors corrected, etc.
Ver. 1.02	Sep. 2012	Description of warning labels was added; descriptions of "soft limits", "mechanical stoppers" and work performed with vertical axis brake released were changed; and residual risk description was added.
Ver. 1.03	Dec. 2012	Warning on restricting the robot moving speed was added and description of warning label language was changed.
Ver. 1.04	Jun. 2013	Description of “Movement range” was added.
Ver. 1.05	Sep. 2013	Description of linear conveyor module was added.
Ver. 1.06	Apr. 2014	Description of warning labels was added and description of “Qualification of operators/workers” was changed, etc.

YAMAHA Safety Instructions

Apr. 2014
Ver. 1.06
This manual is based on Ver. 1.06 of Japanese manual.

YAMAHA MOTOR CO., LTD. IM Operations

Warranty

For information on the warranty period and terms, please contact our distributor where you purchased the product.

This warranty does not cover any failure caused by:

1. Installation, wiring, connection to other control devices, operating methods, inspection or maintenance that does not comply with industry standards or instructions specified in the YAMAHA manual;
2. Usage that exceeded the specifications or standard performance shown in the YAMAHA manual;
3. Product usage other than intended by YAMAHA;
4. Storage, operating conditions and utilities that are outside the range specified in the manual;
5. Damage due to improper shipping or shipping methods;
6. Accident or collision damage;
7. Installation of other than genuine YAMAHA parts and/or accessories;
8. Modification to original parts or modifications not conforming to standard specifications designated by YAMAHA, including customizing performed by YAMAHA in compliance with distributor or customer requests;
9. Pollution, salt damage, condensation;
10. Fires or natural disasters such as earthquakes, tsunamis, lightning strikes, wind and flood damage, etc;
11. Breakdown due to causes other than the above that are not the fault or responsibility of YAMAHA;

The following cases are not covered under the warranty:

1. Products whose serial number or production date (month & year) cannot be verified.
2. Changes in software or internal data such as programs or points that were created or changed by the customer.
3. Products whose trouble cannot be reproduced or identified by YAMAHA.
4. Products utilized, for example, in radiological equipment, biological test equipment applications or for other purposes whose warranty repairs are judged as hazardous by YAMAHA.

THE WARRANTY STATED HEREIN PROVIDED BY YAMAHA ONLY COVERS DEFECTS IN PRODUCTS AND PARTS SOLD BY YAMAHA TO DISTRIBUTORS UNDER THIS AGREEMENT. ANY AND ALL OTHER WARRANTIES OR LIABILITIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY EXPRESSLY DISCLAIMED BY YAMAHA. MOREOVER, YAMAHA SHALL NOT BE HELD RESPONSIBLE FOR CONSEQUENT OR INDIRECT DAMAGES IN ANY MANNER RELATING TO THE PRODUCT.

Important information before reading this manual

Introduction

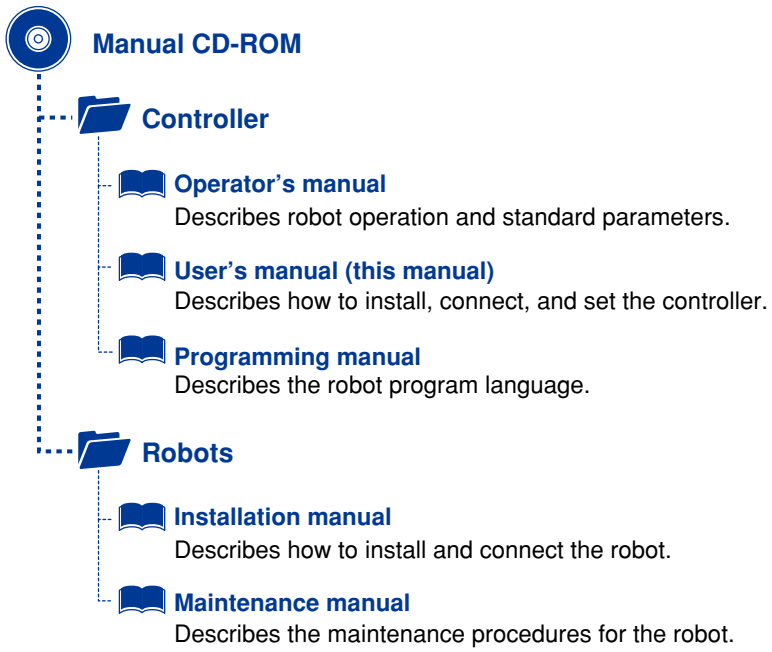
Our sincere thanks for your purchase of this YAMAHA robot controller.

Be sure to read this manual carefully as well as related manuals and comply with their instructions for using the YAMAHA robot controller safely and correctly.

Available manuals

The following manuals are included in the CD-ROM that comes supplied with the YAMAHA robot or controller.

■ Available manuals



Use any of the following approaches to this manual when installing, operating and adjusting the YAMAHA robot and/or controller so that you can quickly refer to this manual when needed.

1. Keep the printed version of this manual (available for an additional fee) handy for ready reference.
2. View the CD-ROM version of this manual on your PC screen.
3. Print out the necessary pages of this manual from the CD-ROM and keep them handy for ready reference.

About this manual

Warnings and cautions listed in this manual relate to YAMAHA robot controllers. To ensure safety of the user's final system that includes YAMAHA robots and controllers, please take appropriate safety measures as required by the user's individual system.

Industrial robots are highly programmable machines that provide a large degree of freedom in movement.
To use YAMAHA robots and controllers safely and correctly, be sure to comply with the safety instructions and precautions described in this manual.
Failure to take necessary safety measures or incorrect handling may result not only in trouble or damage to the robot and controller, but also in serious accidents involving injury or death to personnel (robot installer, operator, or service personnel). Observe the precautions given in each chapter.

To use YAMAHA robots and controllers safely and correctly, **first read "Safety Instructions" in this manual** and always comply with the safety rules and instructions.
Please note, however, this manual cannot cover all items regarding safety.
So it is extremely important that the operator or user have knowledge of safety and make correct decisions regarding safety.

Programming box display illustration shown in this manual

In this manual, the portion of the programming box display illustration shown by the ≈ mark is omitted.

Overview of the RCX340

The YAMAHA RCX340 robot controllers were developed based on years of YAMAHA experience and proven achievements in robotics and electronics. These controllers are specifically designed to operate YAMAHA industrial robots efficiently and accurately.
Despite their compact size, the RCX340 controllers operate efficiently as multi-axis controllers with a variety of functions.
Major features and functions are:

1. Multi-task function

Up to 16 tasks* can be executed simultaneously by specifying the priority. However, low priority tasks are halted while high priority tasks are running.
Programs are processed in parallel to efficiently perform various operations. Additionally, the operation efficiency of the total robot system including peripheral units is greatly improved.
(*: Refer to "Multi-tasking" in the programming manual for more details on tasks.)

2. Robot language

The RCX series controller comes with a BASIC-like high-level robot language that conforms to the industrial robot programming language SLIM*. This robot language allows easy programming even of complex movements such as multi-task operations.
(*: Standard Language for Industrial Manipulators)

3. Robot control

Up to four robots can be controlled.
Versatile motion functions are incorporated and these functions can be executed by multiple robots.

4. Applicable robots

Software servo control provides unit standardization.
The RX340 can be connected to almost all YAMAHA robots.

5. CE marking

The RCX series robot controller is designed to conform to machinery directives and EMC (Electromagnetic compatibility) directives as a YAMAHA robot series product. In this case,
For details about CE marking compliance, see the Safety standards application guide. Additionally, to make the system applicable to the CE marking, select the RCX340 CE specifications.

This manual explains how to handle and operate the YAMAHA robot controllers correctly and effectively, as well as I/O interface connections.
Read this manual carefully before installing and using the robot controller.
Also refer to the separate programming manual and robot user's manual as needed.

Before using the robot controller (Be sure to read the following notes)

Please be sure to perform the following tasks before using the robot controller.
Failing to perform these tasks will require the return-to-origin for setting the origin position each time the power is turned on or may cause abnormal operation (vibration, noise).

[1]When connecting the power supply to the robot controller

Always make a secure connection to the ground terminal on the robot controller to ensure safety and prevent malfunctions due to noise.

TIP

Refer to "3.2. Power supply and ground terminals" in Chapter 3 for detailed information.

[2]When connecting the battery cable to the robot controller

The absolute battery connector has not been connected to the controller at shipment to prevent discharge. After the controller has been installed, be sure to connect the absolute battery connector while referring to "7. Connecting the absolute battery" in Chapter 3 before connecting the robot connection cables.
An error (relating to absolute settings) is always issued if the robot controller power is turned on without connecting the absolute batteries, so the origin position cannot be detected. This means the robot connected to this controller cannot be used with absolute specifications.

[3]When connecting robot cables to the robot controller

Be sure to keep robot cables separate from the robot controller power connection lines and other equipment power lines. Using in close contact with lines carrying power may cause malfunctions or abnormal operation.

TIP

When the controller and robot connection cable are connected and the power is turned on for the first time, be sure to perform "return-to-origin". Perform absolute reset while referring to the operator's manual.
Additionally, when the robot connection cable is disconnected form the controller and it is connected again, the return-to-origin is also needed.

[4]Setting the maximum speed

When operating a ball screw driven robot, the ball screw's free length will increase as the movement stroke increases, and the resonant frequency will drop. This may cause the ball screw to resonate and vibrate severely depending on the motor rotation speed. (The speed at which resonance occurs is called the critical speed.)
To prevent this resonance, the maximum speed must be reduced depending on the robot model when the movement stroke increases. Refer to our robot catalog for the maximum speed settings.

CAUTION

Continuous operation while the ball screw is resonating may cause the ball screw to wear out prematurely.

[5]Duty

To lengthen the service life of robots, the robots must be operated within the allowable duty (50%).
The duty is calculated as follows:

$$\text{Duty (\%)} = \frac{\text{Operation time}}{\text{Operation time+ Non-operation time}} \times 100$$

If the robot duty is too high, an error such as "overload" or "overheat" occurs. In this case, increase the stop time to reduce the duty.

Chapter 1 Using the robot safely

1. Emergency action when a person is caught by robot

If a person should get caught between the robot and mechanical part such as the installation base,or get captured by the robot, free the person by following the instructions below.

1. For axis not equipped with a brake

Put the robot into the emergency stop status to shut off the motor power to the robot. Then move the axis by pushing it with hands.

2. For axis equipped with a brake

The power to the robot can be shut off by putting the controller into the emergency stop status, but the axis cannot be moved due to the action of the brake.
Release the brake by following the procedure below, then move the axis by pushing it with hands.

WARNING

THE VERTICAL AXIS OF THE VERTICAL USE ROBOT WILL SLIDE DOWN WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION.

- **PROP UP THE VERTICAL AXIS WITH A SUPPORT STAND BEFORE RELEASING THE BRAKE.**
- **BE CAREFUL NOT TO LET YOUR BODY GET CAUGHT BETWEEN THE VERTICAL AXIS AND THE SUPPORT STAND WHEN RELEASING THE BRAKE.**

Step 1 ***Press QUICK MENU on the programming box to display the "QUICK MENU" screen.***

Step 2 ***Use the cursor keys (▲/▼) to select [Servo Operation], and then press ENTER.***

The screen will change to the "SERVO OPERATION (ALL)" screen.

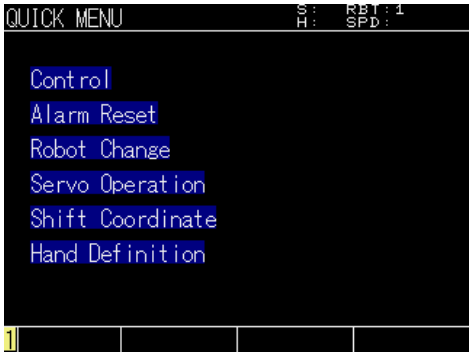
Step 3 ***Press F1 (SEP) on the "SERVO OPERATION (ALL)" screen.***

The screen will change to the "SERVO OPERATION (SEP)" screen.

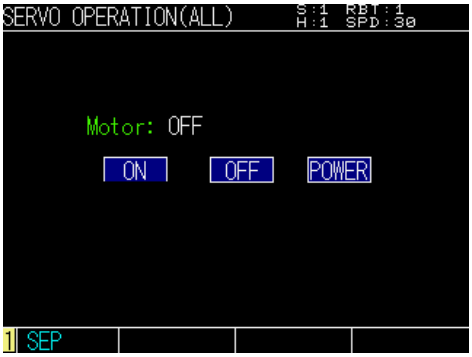
Step 4 ***On the "SERVO OPERATION (SEP)" screen, select the axis to release the brake or select [FREE] for all axes with the cursor keys (▲/▼/◀/▶), and then press ENTER.***

The brake release confirmation screen will appear.

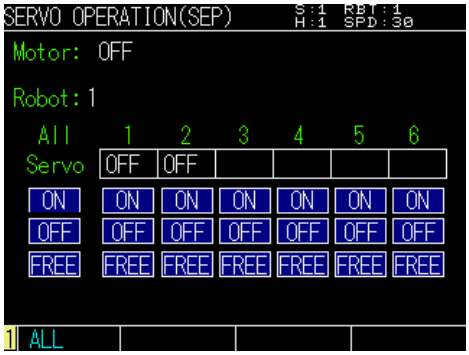
Step 1 QUICK MENU



Step 2 "SERVO OPERATION (ALL)" screen



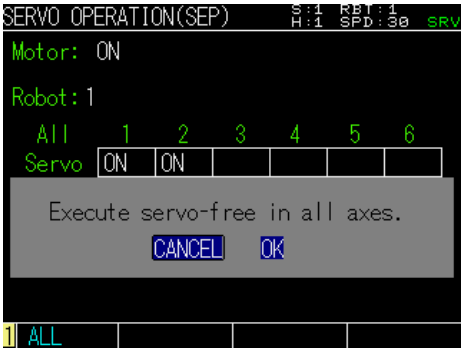
Step 4 "SERVO OPERATION (SEP)" screen



Step5 ***Use the cursor keys (◀/▶) to select [OK] and press ENTER to release the brake.***

For the vertical axis, when the brake is released, the vertical axis may drop. So, check that the vertical axis is supported by the table, etc., and then release the brake. To apply the brake again, select (OFF) on the "SERVO OPERATION" screen.

▶ **Step 5** **Brake release confirmation screen**

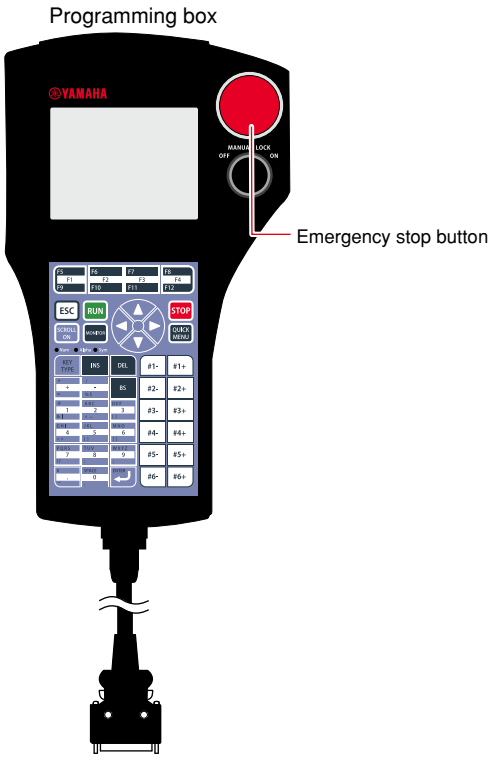


2. Emergency stop

To stop the robot immediately in case of emergency during operation, press the emergency stop button on the programming box.
Pressing the emergency stop button cuts off power to the robot.

CAUTION

In addition to the emergency stop button on the programming box, the SAFETY connector has terminals for external dedicated input (emergency stop). Refer to chapter 4 "1. I/O interface over view" for details.



2.1 Emergency stop reset and alarm reset

To return to normal operation after emergency stop, release the emergency stop button and reset the alarm.

NOTE

- Emergency stop can also be triggered by an emergency stop input from the SAFETY I/O interface. To reset the emergency stop, refer to "1. I/O interface over view" in chapter 4.
- Origin positions are retained even when emergency stop is triggered, so the robot can be restarted by canceling emergency stop without absolute reset or return-to-origin operation.

Step 1 Turn the emergency stop button clockwise to reset the emergency stop.

Step 2 Reset the alarm.

Press QUICK MENU on the programming box. The "QUICK MENU" screen will appear.
Use the cursor keys (▲/▼) to select (Alarm Reset), and then press ENTER. The confirmation screen will appear.
Use the cursor keys (▲/▼) to select (YES), and then press ENTER.
The alarm status is then reset.

NOTE
The serious alarm cannot be reset. In this case, it is necessary to turn off the controller power, and then turn it on again.

To turn on the motor power, follow the steps below.

Step 3 Display the "SERVO OPERATION (ALL)" screen.

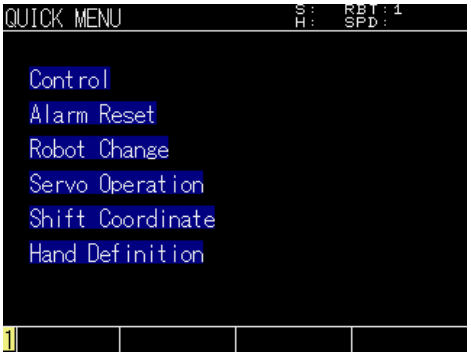
Press QUICK MENU on the programming box. The "QUICK MENU" screen will appear.
Use the cursor keys (▲/▼) to select (Servo Operation), and then press ENTER

Step 4 Turn on the motor power and servo.

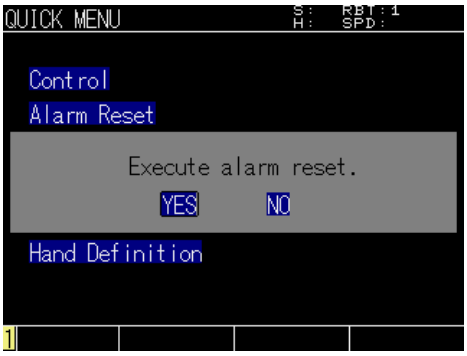
Use the cursor keys (◀/▶) to select (ON), and then press ENTER to turn on the servo.

Step 5 Press ESC to return to the initial screen.

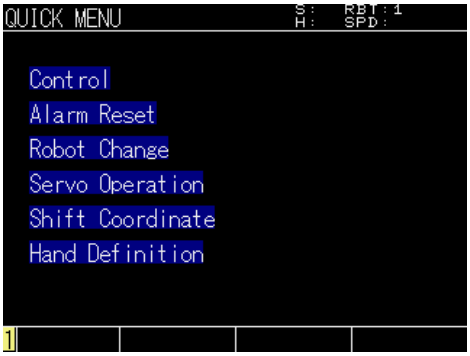
Step 2 "QUICK MENU" screen



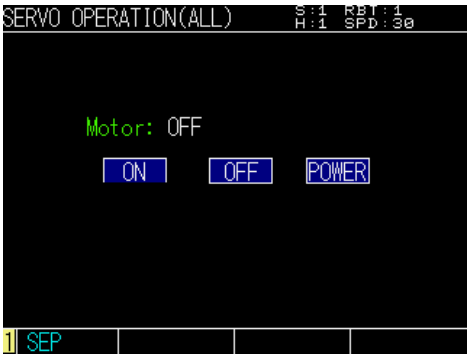
Step 2 Alarm reset confirmation screen



Step 3 "QUICK MENU" screen



Step 4 "SERVO OPERATION (ALL)" screen



3. Power-ON procedures

This section describes the procedures from turning on the controller power to performing return-to-origin of the robot.

CAUTION

To connect the programming box to the controller, always use the dedicated cable and connector that come supplied with the programming box. Do not modify the cable and do not connect a relay to the cable.

NOTE

- After turning off the robot controller, wait at least 5 seconds before turning the power back on again. If power is turned on again too quickly after the power was turned off, the controller might not start up correctly.
- Do not turn off the robot controller during program execution. If turned off, this causes errors in the internal system data and the program may not restart correctly when the power is again turned on. Always quit or stop the program before turning off the robot controller.
- When the "Servo on when power on" parameter is set to "INVALID", the controller always starts with the robot servo turned off when power is turned on, regardless of SAFE mode and serial I/O settings. Refer to "1.11.1 Servo ON from power ON of controller" in chapter 4 for details.

Step 1 *Check the setup and connections.*

Make sure that the necessary setup and connections are correctly completed according to the instructions in the user's manual.

Step 2 *Activate emergency stop.*

Press the emergency stop button on the programming box to activate emergency stop.

Step 3 *Turn on the power.*

The power is supplied to the power terminal on the front panel of the controller. The "PWR" LED and 7-segment LED are lit and the initial screen appears on the programming box. (It takes maximum 7 sec. to start the controller correctly after the "PWR" LED has been lit.)

Step 4 *Cancel emergency stop.*

Turn the emergency stop button on the programming box clockwise to reset emergency stop.

Step 5 *Turn on the servo.*

Refer to the RCX340 operator's manual for details on how to turn the servo ON.

Step 6 *Perform return-to-origin.*

Refer to the RCX340 operator's manual for details on return-to-origin.

NOTE

If the warning message "C50 : Memory backup battery low" appears when turning on the power, replace the lithium battery (service life is about 4 years) inside the controller.

4. Usage environments

Operating temperature

Operating temperature	0°C to 40°C

The ambient temperature should be maintained within a range of 0 to 40°C during operation.
This is the range in which continuous operation of the robot controller is guaranteed according to the initial specifications. If the robot controller is installed in a narrow space, then heat generated from the controller itself and from peripheral equipment may drive the temperature above the allowable operating temperature range.
This may result in thermal runaway or malfunctions and may lower component performance along with shortening their useful service life. So be sure to install the controller in locations with a vent having a natural air flow. If this proves insufficient, provide forced air-cooling.

Storage temperature

Storage temperature	-10°C to 65°C

The controller should be stored in a location at an ambient temperature between -10 and +65°C when not being used.
If the robot controller is stored in a location at high temperatures for extended periods, deterioration of the electronic components may occur and the memory backup time may decrease.

Operating humidity

Operating humidity	35% to 85% RH (no condensation)

The ambient humidity of the robot controller should be 35% to 85% RH (no condensation) in order to guarantee continuous operation within the initial specifications. Installing the robot controller inside an air-conditioned or cooling unit is recommended when the ambient humidity is higher than 85% or when condensation occurs.

Storage humidity

Storage humidity	Below 95% RH (no condensation)

The controller should be stored in a location at an ambient humidity below 95% RH (no condensation) when not being used. If the robot controller is stored in a location at high humidity for an extended period of time, rust may form on the electronic components.

Vibration and shock

Do not apply strong shocks to the controller. Do not install the controller in locations subject to large vibrations or shocks. The controller may malfunction or break down if subjected to large vibrations or shocks.

Environments

The controller is not designed to meet explosion-proof, dust-proof, and drip-proof specifications, and so do not use it in the following locations. If used in these locations, component corrosion, improper installation, or fire may result.

1) Environments containing combustible gases or dust particles, or flammable liquids, etc.
2) Environments where conductive substances such as metal cutting chips are present.
3) Environments where water, cutting water, oils, dust, metal particles, or organic solvents are present.
4) Environments containing corrosive gases or substances such as acid or alkali.
5) Environments containing mist such as cutting fluids or grinding fluids.
6) Environment containing silicon gas that leads to contact failure of the electrical contact point.

If using the controller in locations where dust particles of gases may generate, it is recommended to install the controller in a box with a cooling unit.

Installation location

Always install the robot controller indoors, at a height of less than 2000 meters above sea level.
Install the controller in a control panel with a structure that does not allow water, oil, carbon or dust particles to penetrate it.
Do not install the controller in the following locations:

1) Near devices which may be a source of electrical noise, such as large inverters, highoutput high-frequency generators, large contactors, and welding machines.
2) Locations where electrostatic noise is generated.
3) Locations subject to radio frequency interference.
4) Locations where there is a possibility of exposure to radioactivity.
5) Locations where dangerous items such as ignitable, flammable or explosive materials are present.
6) Near combustible materials.
7) Environments exposed to direct sunlight.
8) Narrow space where tasks (teaching, inspections, etc.) cannot be performed safely.

Chapter 2 System overview

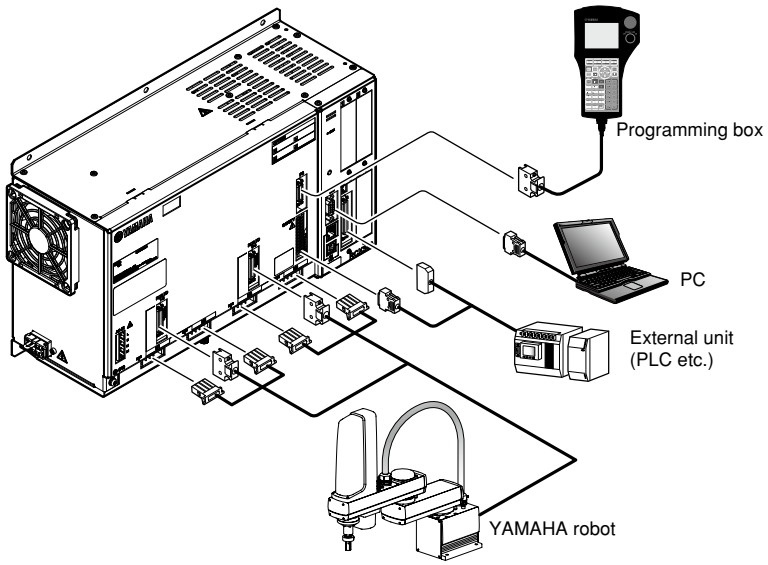
1. I/O interface overview

1.1 Main system configuration

■ Configuration 1 : System for controlling one robot

Example : YK500XG

All the axes on the robot controller are used as the main robot axes.

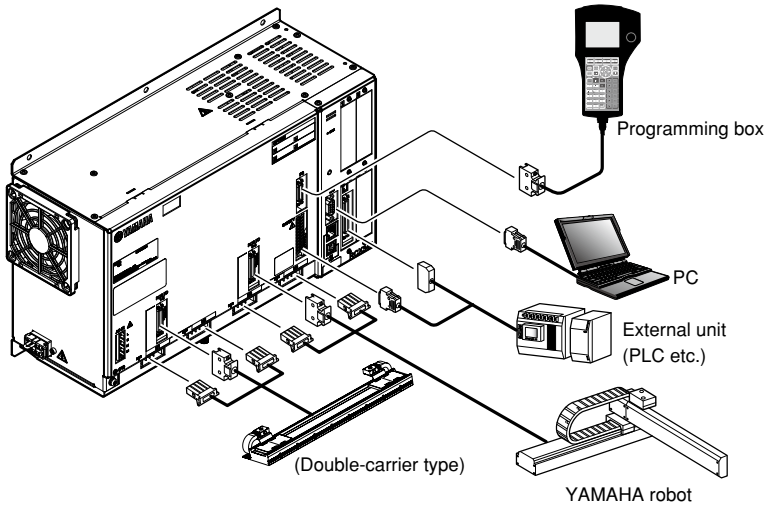


■ Configuration 2 : Multiple-robot setting

Example: Robot 1 : MXYx

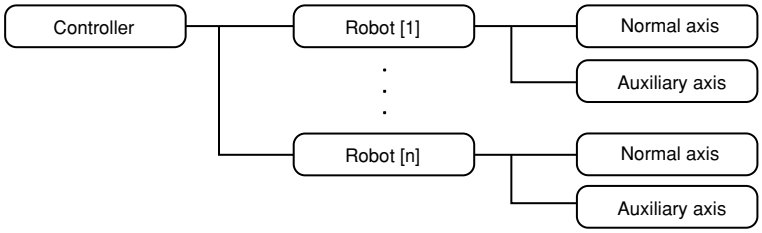
Robot 2 : MF30 double-carrier type

Axes 1 and 2 of the robot controller are used as axes of the robot 1 while axes 3 and 4 are used as axes of the robot 2.



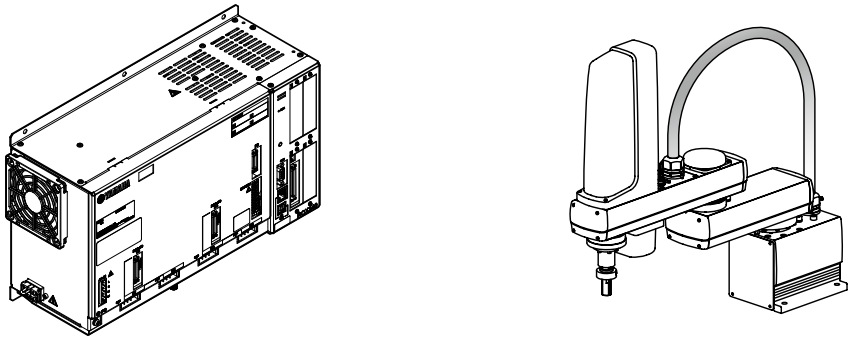
1.2 Axis configuration for the RCX340

The axis configuration for the YAMAHA RCX340 robot controller is shown below.



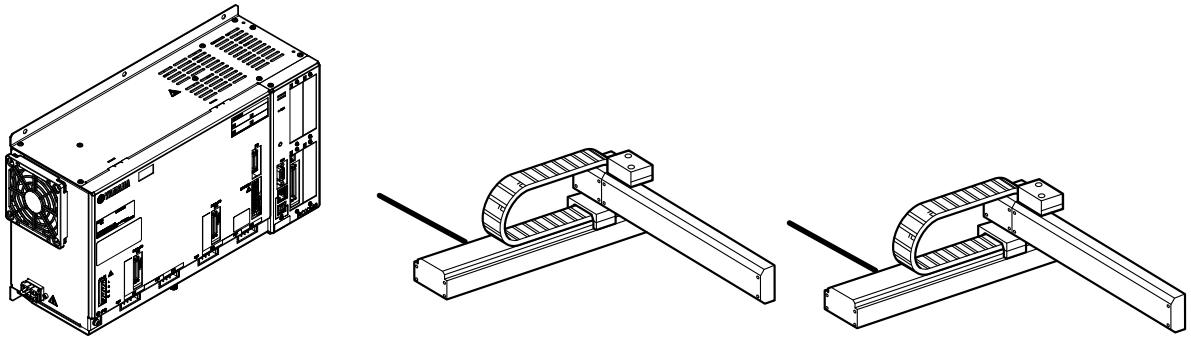
Robot [n] ("n" is a numeric value, 1 to 4.)	Aggregate of axes making up one robot. Up to four robots can be controlled.
Normal axis	Axis making up one robot. This axis is moved by the "MOVE" command of the robot language.
Auxiliary axis	This axis is not moved by the "MOVE" command of the robot language, but is moved by the "DRIVE" command.

Example 1 4-axis SCARA robot, 1 unit



Robot number	Robot type	M1	M2	M3	M4
1	SCARA robot	X	Y	Z	R

Example 2 XY-robot, 2 units

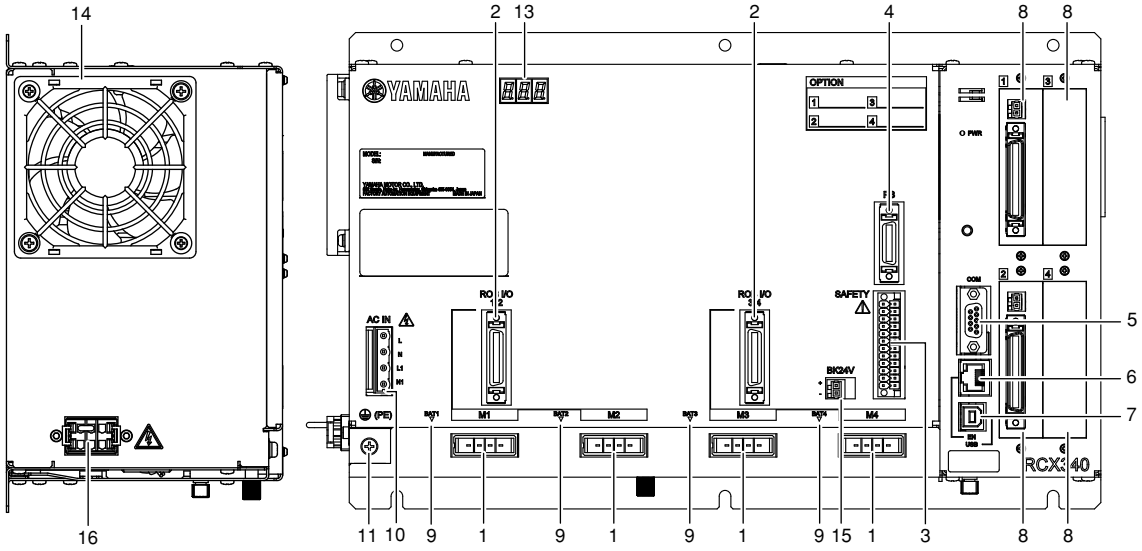


Robot number	Robot type	M1	M2	M3	M4
1	XY-robot 1	X	Y		
2	XY-robot 2			X	Y

2. Name of each part and control system

The RCX340 external view and the control system basic diagram are shown below.

2.1 RCX340 external view

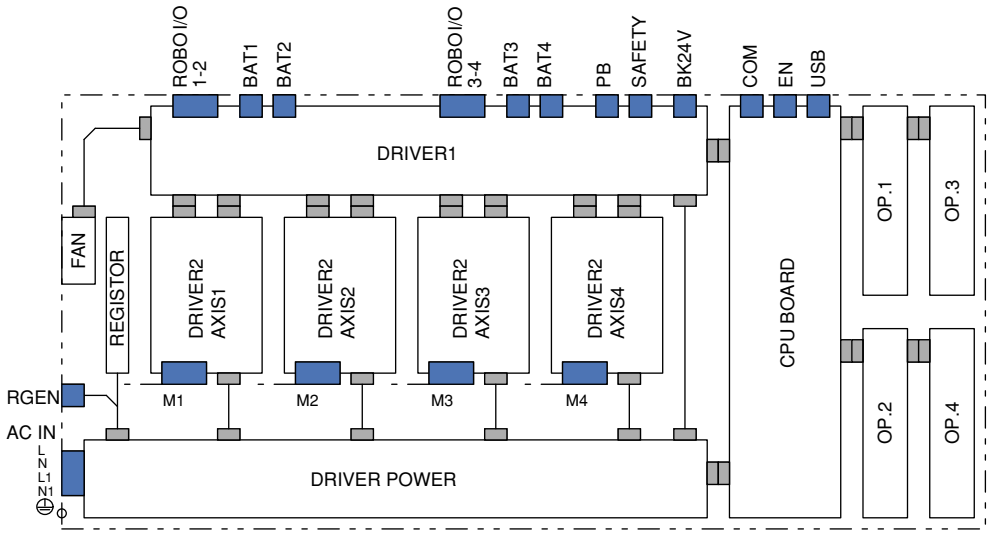


	Name	Function
1	M1/M2/M3/M4	These connectors are used to drive the servo motor.
2	ROB I/O[1-2/3-4]	These connectors are used for servo motor feedback and sensor signals.
3	SAFETY	This is a safety input/output connector for emergency stoppages, etc.
4	PB	This connector is used to connect the programming box.
5	COM	This is an RS-232C interface connector.
6	EN	This is an Ethernet connection connector.
7	USB	This is an USB connection connector.
8	(OP.)1/2/3/4	These are option ports. Up to four option boards can be installed.
9	BAT[1/2/3/4]	This connector is used to connect a battery for absolute backup battery.
10	AC IN[L/N/L1/N1]	This is the control power supply and main power supply (motor drive power supply).
11	⏚ (PE)	This is the ground terminal. D class grounding work is required.
12	“PWR”LED	Lights up when the power is turned ON.
13	7SEG LED	Indicates the controller or robot status.
14	FAN	Ensures that the temperature inside the controller is kept at a fixed level. When installing the controller, keep a space of 50mm or more from the left side panel so that the fan opening is not closed.
15	BK24V	This is an external 24V-input power connector for the brake.*
16	RGEN	This is a regenerative unit connector for the expansion. For the standard specifications, connect the thermal sensor shorting connector.

* When two or more axes use the brake.

2.2 Controller system

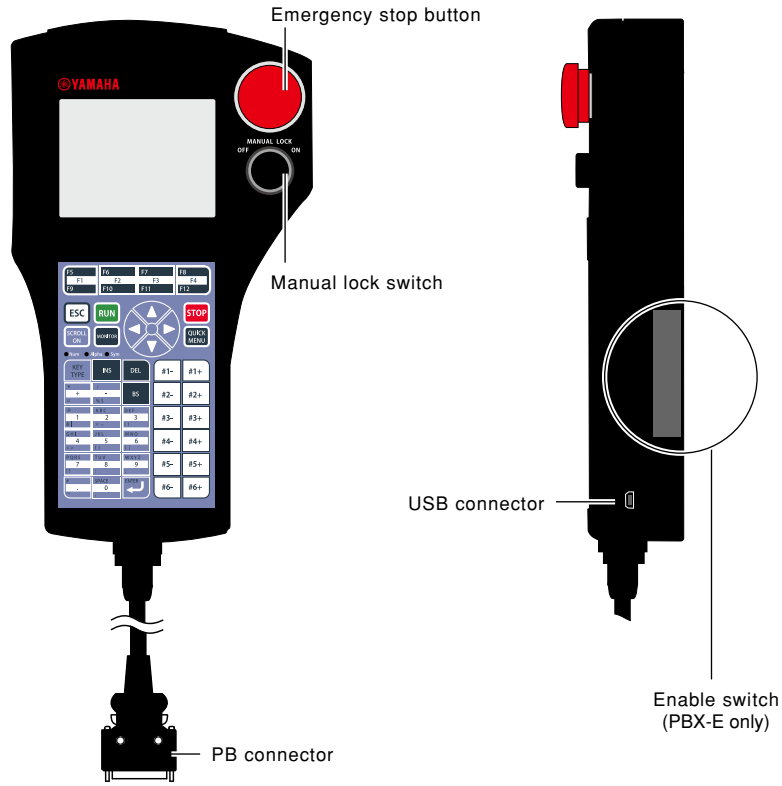
Basic block diagram



3. Optional devices

3.1 Programming box

Use of this programming box makes it possible to perform the robot manual operation, program input and editing, teaching, and parameter settings.



3.2 Basic key operation

Each key allows three kinds of entries.

Alpha: Alphabet entry
Num: Number entry
Sym: Symbol entry

When pressing the KEY TYPE key, the character type to be entered will change. Additionally, the LED indication showing the key status will also change.

■ LED indication (alphabet entry status)

Num Alpha Sym

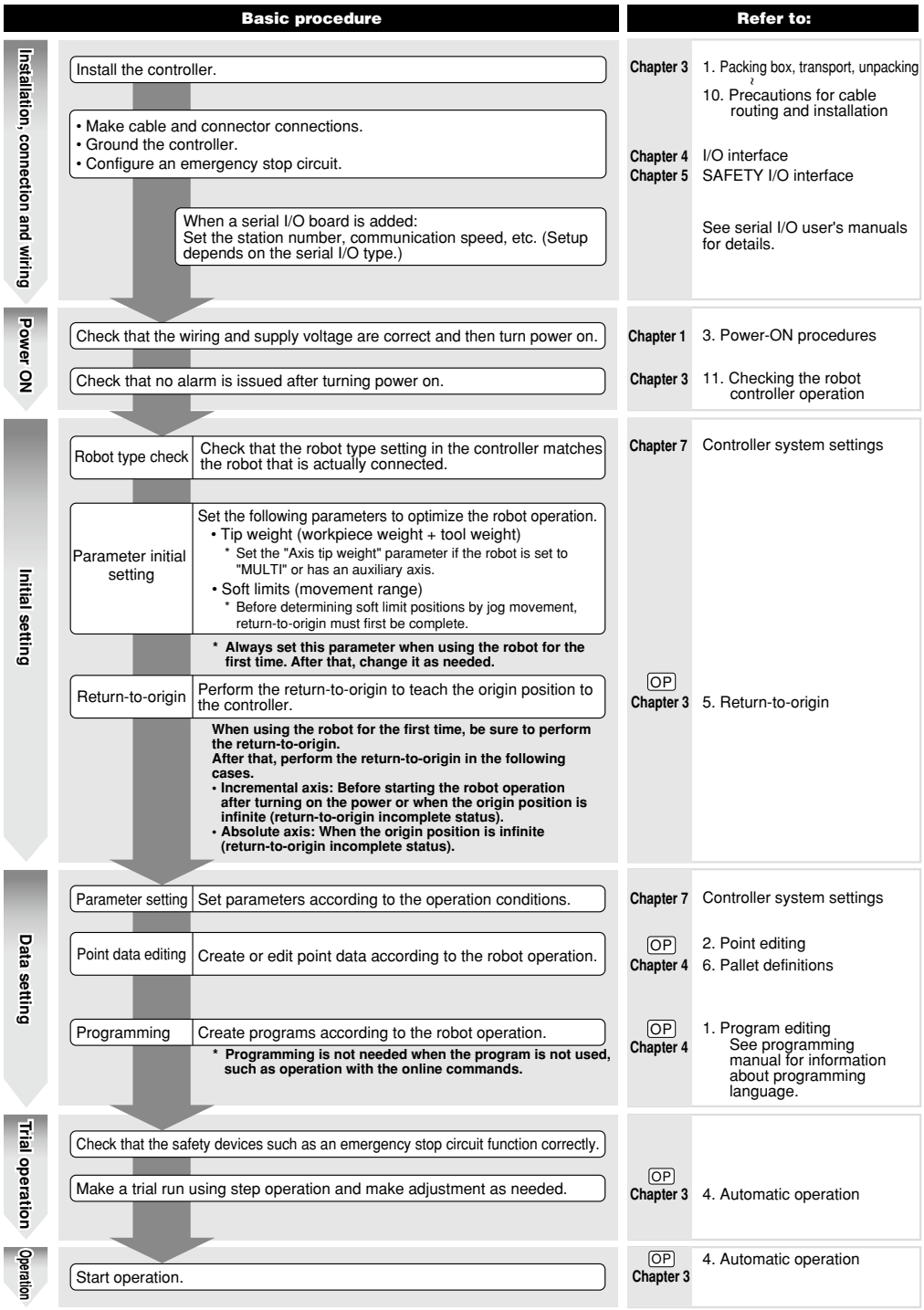
For details about key operation, see the operation manual.

3.3 Expansion I/O board

The expansion I/O board used in the robot controller has 24 general-purpose input points and 16 general-purpose output points.

4. Basic sequence from installation to operation

OP … Operator's manual



Chapter 3 Installation

Chapter 3 Installation

1. Packing box, transport, unpacking

1.1 Packing box

The robot controller is high precision equipment and is carefully packed in a cardboard box to avoid shocks and vibrations.
If the packing box is seriously damaged or dented, please notify your distributor before unpacking.

1.2 Transport

When transporting the robot controller, transport carefully with a trolley to prevent damage caused by dropping.

CAUTION

To prevent injury, or damage to the robot controller, do not drop or expose to vibrations during transport.

1.3 Unpacking

Take sufficient care not to apply shocks to the equipment when unpacking. After unpacking, check the accessories to make sure that nothing is missing.

CAUTION

The robot and controller are very heavy. Take sufficient care not to drop them during unpacking as this may damage the equipment or cause bodily injury.

	Accessories	
Standard	Power supply connector	1
	SAFETY connector	1
	PB terminator	1
	Connector guard for COM connector	1
	USB Connector guard	1
	CD-ROM manual	1
Option	Programming box	1
	Absolute battery	1 to 4
	I/O connector *1	1 set
	Communication cable	1
	External power connector brake	1
	Support software installation CD-ROM	1

*1 A dedicated connector for the selected I/O option is provided.
*2 Accessories other than those listed above may be provided depending on the selected options.

2. Installing the robot controller

2.1 Installation conditions

Take note of the following points when installing the robot controller.

■ Installation location

Use the screws to secure the controller to the installation plate inside the control panel so that it is in a horizontal position.
At this time, be sure to use the metallic installation plate.

■ Operating temperature and humidity

Always use the controller under the following temperature and humidity conditions.

- Ambient temperature: 0 – 40 °C
- Ambient humidity: 35 – 85% RH (there should be no condensation)

■ Operating environments to be avoided

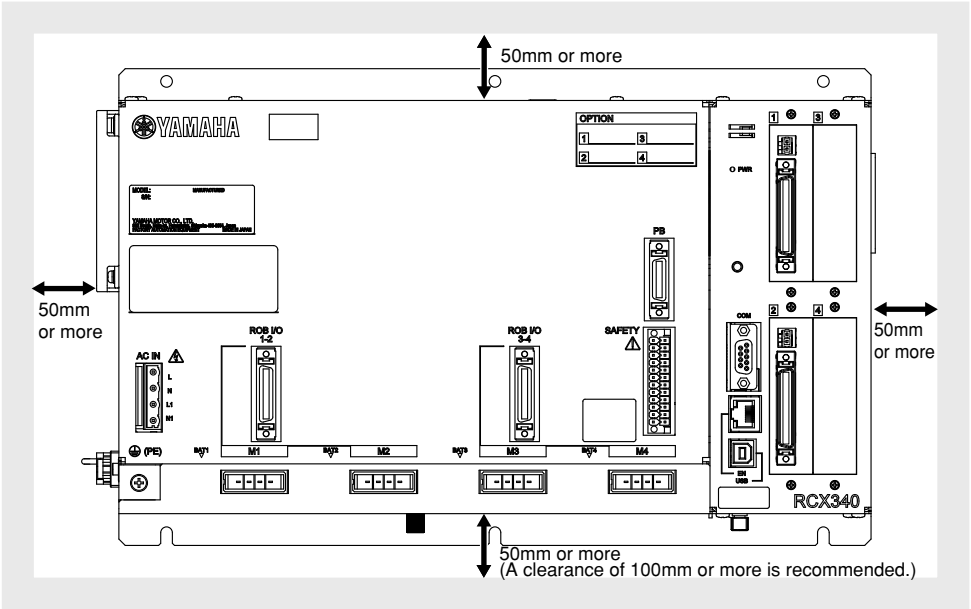
The controller should never be used in the following environments in order to ensure normal operation.

- Atmosphere with flammable gas, inflammable liquids, etc.
- Atmosphere with flying conductive material such as shavings generated during metal machining
- Atmosphere with corrosive acid or alkaline gases
- Mist atmosphere containing cutting fluid, grinding fluid
- Near electrical noise sources such as large inverters, high-output high-frequency transmitters, large contactors, welding machines
- Environments exposed to oil or water
  If the controller is to be used under such adverse conditions, place it in a watertight box equipped with a cooling unit.
- Locations subject to excessive vibrations
- Environment with controller installed on its side or end, or in an inverted position
- Environment in which controller connector cables are subject to impact or loads

■ Surrounding clearance

Install the controller in a well ventilated area, and ensure sufficient clearance on all sides. (See drawing below.)

■ Installation clearance

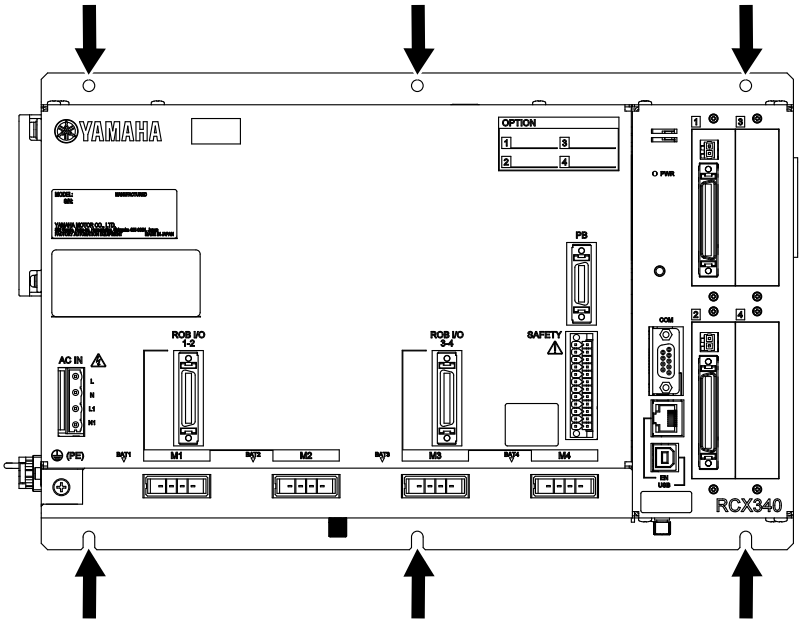


CAUTION

To prevent degradation or breakdowns, never use the controller in other than the specified installation conditions. For the bottom clearance, take the battery replacement workability into consideration. (A clearance of 100mm or more is recommended.)

2.2 Installation methods

Use the screws to secure the controller to the installation plate inside the control panel so that it is in a horizontal position. To secure the controller, use the M5 screws (6 pcs.). (See the figure below.) Additionally, be sure to use the metallic installation plate.

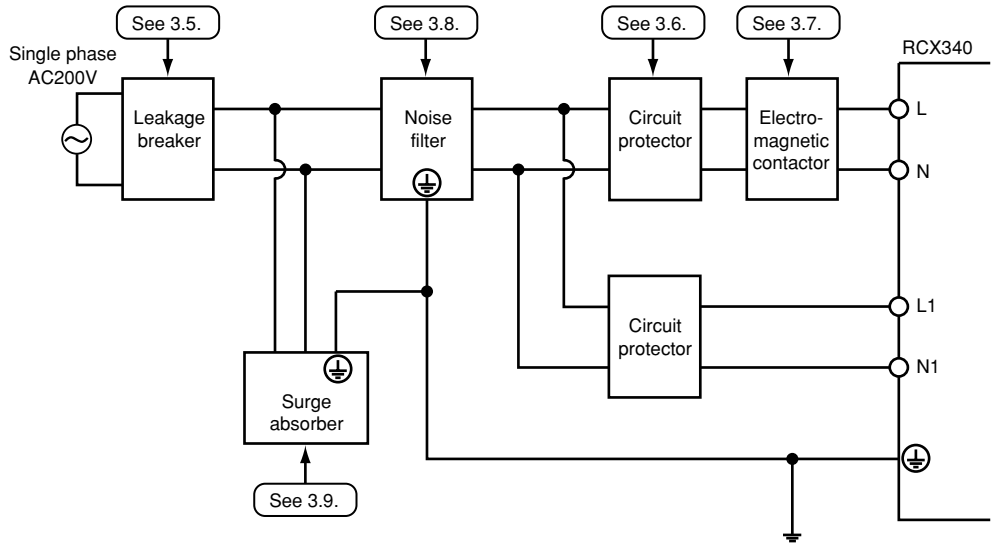


3. Connecting to the power

Attach the power connector to the power cable and insert it into the "AC IN" connector on the front panel of the controller as shown below.

3.1 Power supply connection example

■ Connection example



CAUTION

To prevent break downs, do not mistake the terminal connection locations.

3.2 Power supply and ground terminals

CAUTION

Before connecting the power cable, be sure to check that the power supply voltage matches the power specifications of your controller.

Symbol	Wiring	Remarks		
L	200 to 230V	Live	Main power supply (for motor power)	Wire cross-section 2.0sq* or more
N	200 to 230V	Neutral		
L1	200 to 230V	Live	Power for control	Wire cross-section 1.25sq* or more
N1	200 to 230V	Neutral		

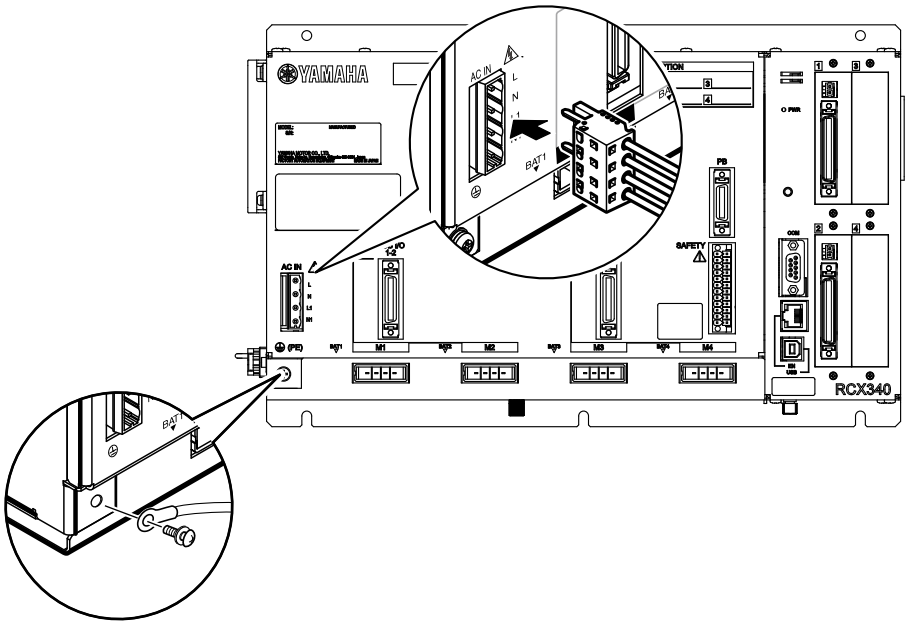
*sq (square) is a unit used to indicate the cross-sectional area of stranded wires, with 1sq indicating 1 square millimeter.

⏚ (PE)	Ground	Class D grounding (100 ohms or less)	Tightening torque	1.4Nm 2.0sq* or more

WARNING

- **TO PREVENT ELECTRICAL SHOCKS OR FAULTY OPERATION CAUSED BY NOISE, THE EARTH TERMINAL (PROTECTIVE CONDUCTOR) MUST BE GROUNDED PROPERLY.**
- **TO PREVENT ELECTRICAL SHOCKS, NEVER TOUCH THE AC IN TERMINALS WHEN POWER IS SUPPLIED TO THE ROBOT CONTROLLER.**

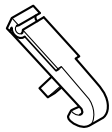
■ AC IN and ground terminals



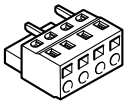
3.3 AC power connector wiring

Requirements

Prepare the following to wire power connectors.



Connection lever (provided)
or flat-blade screwdriver.



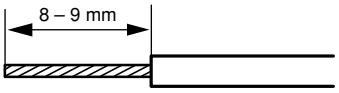
Connector (provided)

Wire

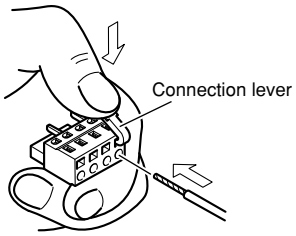
Wiring method

Strip the wire coating to expose 8 to 9mm of bare lead.
Use either of the methods shown below to insert the wire core into the opening in the power connector, and then ensure that the wire does not come out.

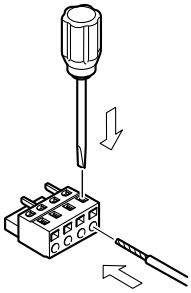
Strip 8 to 9 mm of coating.



If using connection lever provided.



If using flat-blade screwdriver.



The wire can be inserted while using the screwdriver to press down the spring from the opening on the top of the connector.

CAUTION

As a rule, only connect a single wire to each wire opening.

3.4 Considering power capacity and generated heat amount

The required power capacity and generated heat amount depend on the robot model and the number of axes to be controlled.

CAUTION

The power supply voltage for the robot controller must always be regulated within ±10%.
If the voltage drops, the controller detects the voltage drop error, causing the robot to trigger the emergency stop.
In contrast, operation at a voltage higher than specified may damage the robot controller or trigger emergency stop due to detecting an excessive motor power supply voltage.

Use the following tables as a guide to prepare a power supply and to determine the control panel size, controller installation method, and cooling means.

Controller: RCX340

1.When connected to SCARA robot

Robot model					Power capacity (VA)	Generated heat amount (W)
Standard type	Clean type	Dust-proof & drip-proof type	Orbit type	Wall-mount & inverse type		
YK120XG, YK150XG					300	58
YK180XG, YK180X, YK220X	YK180XC, YK220XC				500	63
YK250XG, YK350XG, YK400XG, YK500XGL, YK600XGL	YK250XCH, YK350XCH, YK400XCH, YK250XGC, YK350XGC, YK400XGC, YK500XGLC, YK600XGLC	YK250XGP, YK350XGP, YK400XGP, YK500XGLP, YK600XGLP		YK300XGS, YK400XGS	1000	75
	YK500XC, YK600XC				1500	88
YK500XG, YK600XG		YK500XGP, YK600XGP		YK500XGS, YK600XGS	1700	93
	YK700XC, YK800XC, YK1000XC				2000	100
YK600XGH, YK700XG, YK800XG, YK900XG, YK1000XG, YK1200X		YK600XGHP, YK700XGP, YK800XGP, YK900XGP, YK1000XGP	YK500TW	YK700XGS, YK800XGS, YK900XGS, YK1000XGS	2500	113

2.When connected to 2 axes (Cartesian robot or multi-axis robot)

Axis current sensor value		Power capacity (VA)	Generated heat amount (W)
X-axis	Y-axis		
05	05	600	65
10	05	800	70
20	05	1100	78
10	10	1000	75
20	10	1300	83
20	20	1700	93

3.When connected to 3 axes (Cartesian robot or multi-axis robot)

Axis current sensor value			Power capacity (VA)	Generated heat amount (W)
X-axis	Y-axis	Z-axis		
05	05	05	700	68
10	05	05	900	73
20	05	05	1200	80
10	10	05	1000	75
20	10	05	1300	83
20	20	05	1600	90
10	10	10	1200	80
20	10	10	1500	88
20	20	10	1800	95
20	20	20	2000	100

4.When connected to 4 axes (Cartesian robot or multi-axis robot)

Axis current sensor value				Power capacity (VA)	Generated heat amount (W)
X-axis	Y-axis	Z-axis	R-axis		
05	05	05	05	800	70
10	05	05	05	1000	75
20	05	05	05	1200	80
10	10	05	05	1100	78
20	10	05	05	1400	85
20	20	05	05	1600	90
10	10	10	05	1300	83
20	10	10	05	1500	88
20	20	10	05	1800	95
20	20	20	05	2100	103
10	10	10	10	1400	85
20	10	10	10	1700	93
20	20	10	10	2000	100
20	20	20	10	2200	105
20	20	20	20	2500	113

* Axis current sensor values can be substituted for each other.

3.5 Installing an external leakage breaker

In the interests of safety, always equip the robot controller power connection with an earth leakage current breaker.
Since the robot controller drives the motors by PWM control of IGBT, leakage current flows at high frequencies. This might cause the external leakage breaker to malfunction.
When installing an external leakage current breaker, it is important to choose the optimum sensitivity current rating (IΔn).
(Check the leakage breaker manufacturer's data sheets to select the optimum product compatible with inverters.)

CAUTION

1.Leak current was measured with a leak tester with a low-pass filter turned on (100Hz).
Leak tester: Hioki Electric 3283
2.When using two or more controllers, sum the leakage current of each controller.
3.Make sure that the controller is securely grounded.
4.Stray capacitance between the cable and FG may vary depending on the cable installation condition, causing the leakage current to fluctuate.

	Leakage current
RCX340 control power supply (L1, N1)	Total 2.7mA(MAX)
RCX340 main power supply (L, N)	

3.6 Installing a circuit protector

In the interests of safety, always equip the robot controller power connection with a circuit protector.
An inrush current, which might be from several to nearly 20 times higher than the rated current, flows at the instant that the controller is turned on or the robot motors start to operate. When installing an external circuit protector for the robot controller, select a circuit protector that provides optimum operating characteristics.
To ensure proper operation, we recommend using a medium to slow response circuit protector with an inertial delay function. (Refer to the circuit protector manufacturer's data sheets for making the selection.)

Example

	Rated current	Operating characteristics
RCX340 control power supply (L1, N1)	5A	Slow type with inertia delay
RCX340 main power supply (L, N)	15A	

3.7 Installing an electromagnetic contactor

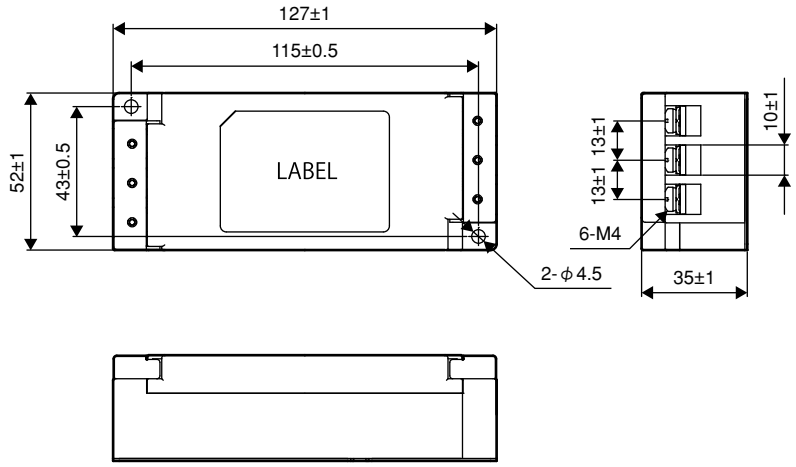
When controlling the power on/off operation of the robot controller using an external unit such as a PLC, an electromagnetic contactor should be installed on the AC power supply line for the controller. Select an electromagnetic contactor that falls under the required safety category and control the open/close operation using a circuit that meets the safety category.
In this case, separate the main power supply line from the control power supply line, and install the electromagnetic contactor on the main power supply side.
To control the operation using emergency stop, turn the main power on and off.

3.8 Installing a noise filter

Installation of a noise filter is recommended in order to suppress power line noise.

■ Dimensional outlines of recommended noise filter

Manufacturer : TDK-Lambda Corporation
Type No. : RSHN-2016



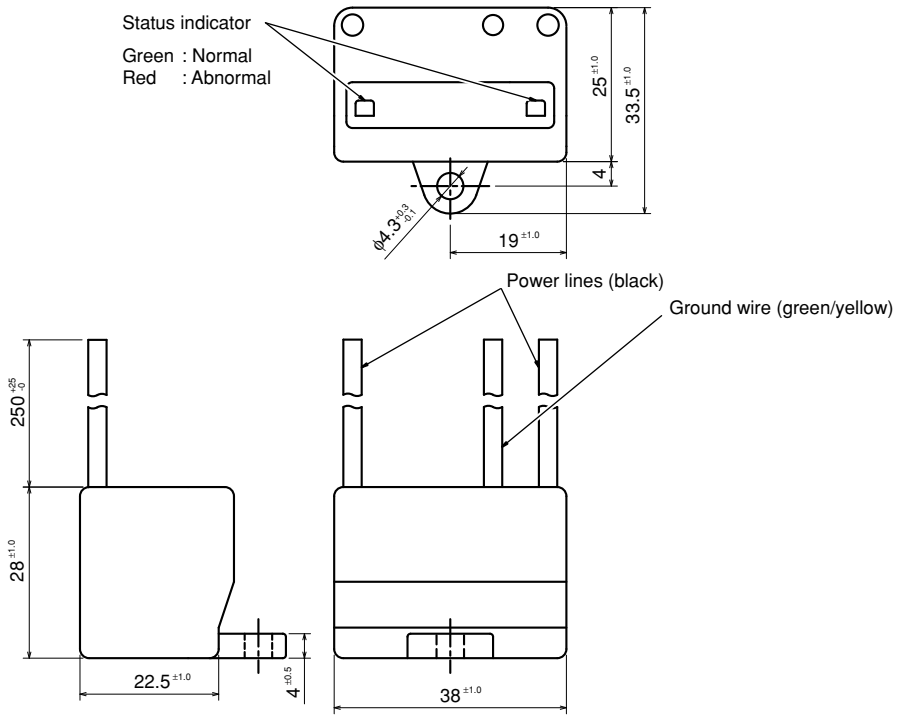
Product name	Recommended tightening torque
RSHN-2016	1.27N•m

3.9 Installing a surge absorber

It is recommended to install a surge absorber so as to increase the resistance against the surge noise generated by lightning.

■ Dimensional outlines of recommended surge absorber

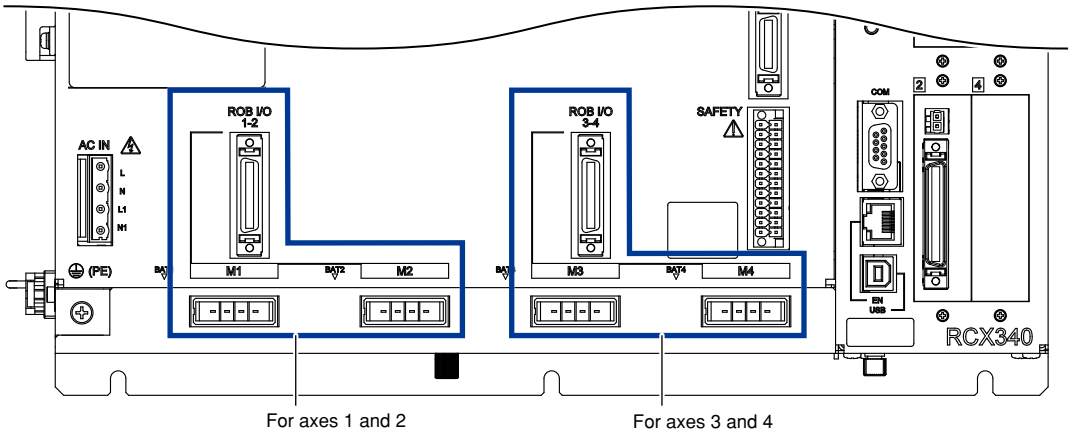
Manufacturer : SOSHIN ELECTRIC CO., LTD.
Type No. : LT-C12G801WS



4. Robot connections

4.1 Connecting the robot cables

Connect the robot connection cables to the "M1", "M2", "M3", "M4", "ROB I/O 1-2", and "ROB I/O 3-4" connectors on the front of the controller.
The "M1" and "M2" connectors and the "ROB I/O 1-2" connector are intended for axes 1 and 2. Additionally, the "M3" and "M4" connectors and the "ROB I/O 3-4" connector are intended for axes 3 and 4.



The robot connection cable specification may vary depending on the robot. For details, see the robot manual.

CAUTION

Always securely connect the robot cables. If they are not securely connected and fail to make good contact, the robot may malfunction. Before turning on the controller, make sure again that the cables are securely connected.
Additionally, ground the robot securely. For details about grounding, see the robot manual.

WARNING

THE POWER TO THE CONTROLLER MUST BE OFF WHEN CONNECTING THE ROBOT CABLES.
THE "M1", "M2", "M3", AND "M4" CONNECTORS AND THE ROB I/O CONNECTOR (1-2/3-4) HAVE THE SAME SHAPE. BE CAREFUL NOT TO MAKE INCORRECT CONNECTIONS.
IF CONNECTED INCORRECTLY, THIS MAY CAUSE THE ROBOT TO MALFUNCTION.
KEEP THE ROBOT CABLES SEPARATE FROM THE POWER CABLES AND OTHER EQUIPMENT POWER LINES. FAILURE TO FOLLOW THIS INSTRUCION MAY CAUSE MALFUNCTIONS.

NOTE

Make sure there are no bent or broken connector pins and no cable damage before connecting.

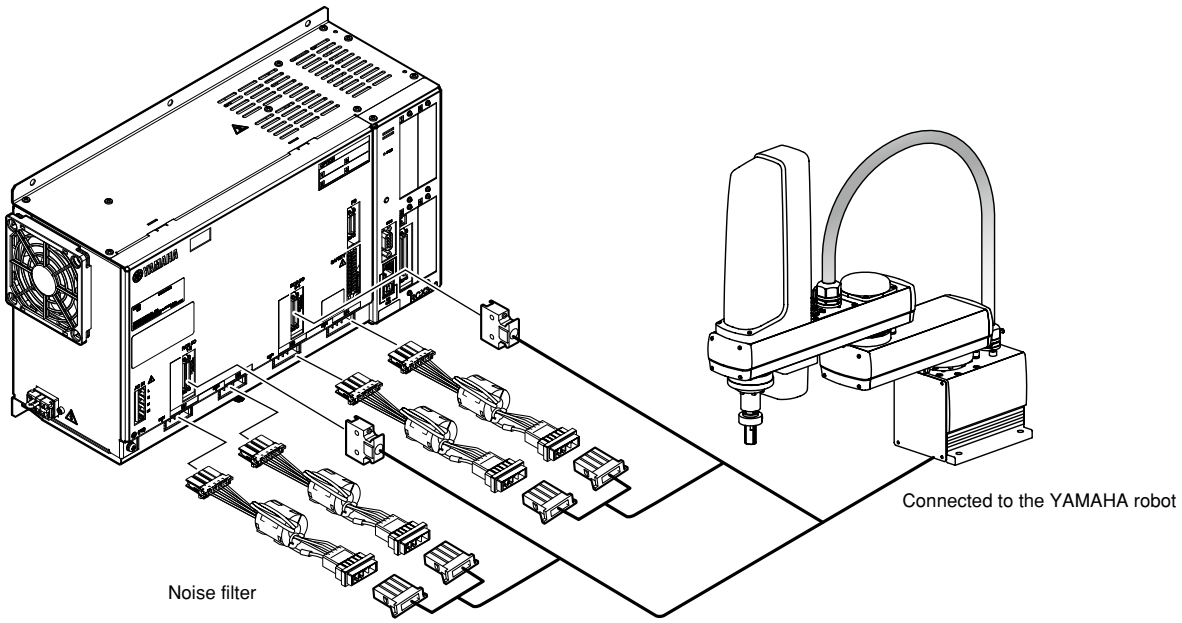
4.2 Noise countermeasures

Cables to be connected to the "M1", "M2", "M3", and "M4" connectors are motor cables for the motor drive. Since the motor cable produces switching noise by motor control, do not install the sensor, etc. close to the motor cable. Otherwise, the robot may malfunction. In this case, take noise preventive measures described below.

1. Install the sensor, etc., further away from the motor cable.
2. Use a shielded cable for the sensor, etc., and ground the shield.
3. Install a noise filter in the cable which connects the controller to the robot.

■ Noise filters:

Model KBG-M6563-00 (for M1, M3)
Model KBG-M6563-10 (for M2, M4)

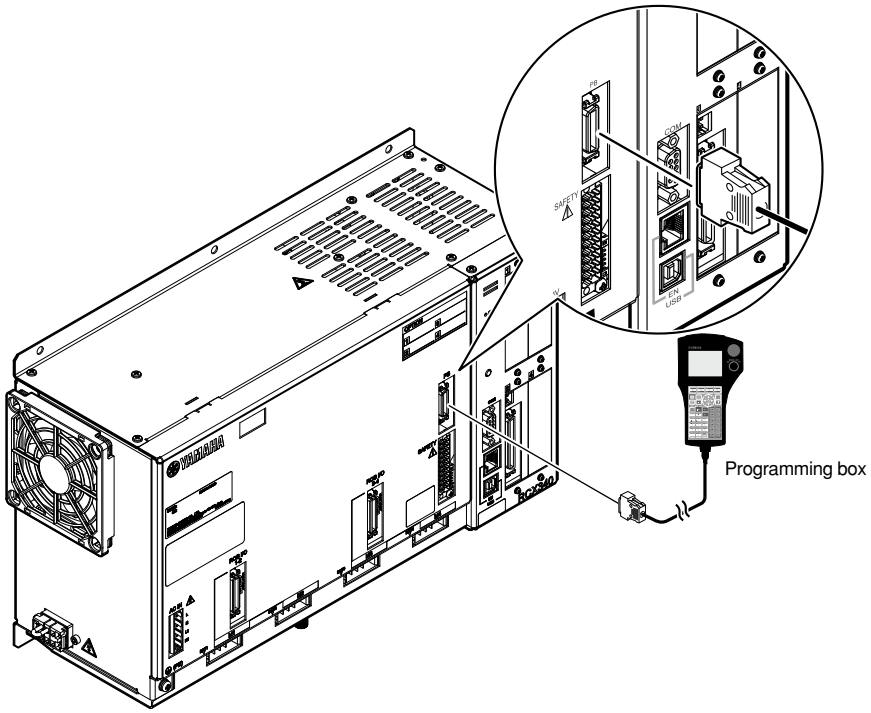


5. Connecting the programming box

Connect the programming box to the PB connector on the front of the robot controller.

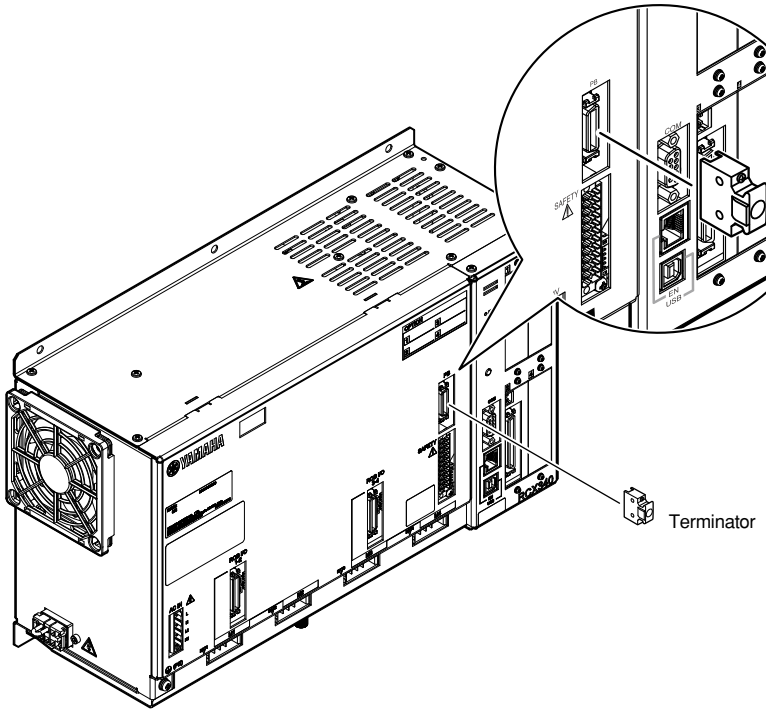
CAUTION

The PB connector must be connected in the right direction, and therefore caution is required. The programming box may break down if connected incorrectly.



■ Connecting a terminator

If not connecting the programming box, plug the terminator provided into the PB connector.



CAUTION

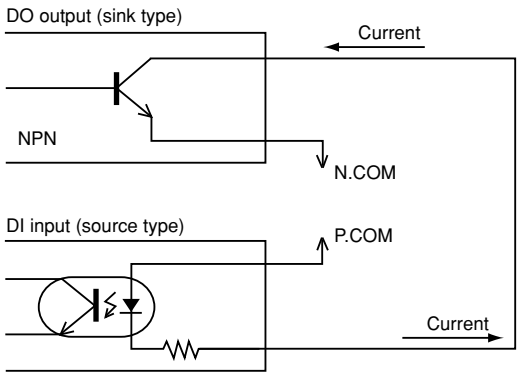
If not connecting the programming box, always plug the terminator provided into the PB connector.
The programming box is equipped with a B-contact (normally closed) type emergency stop button, and so the emergency stop function is triggered when the programming box is disconnected from the robot controller. Plug the terminator into the PB connector to avoid such emergency stop conditions.

6. I/O connections

The various input/output (I/O) signals from peripheral equipment can be connected to the robot controller. Each I/O is set with a number, and the I/O connector to be used depends on that number.
For more detailed information on inputs and outputs, refer to chapter "4. I/O interface" or chapter "5. SAFETY I/O interface".
The terms used in the manual are described as follows.

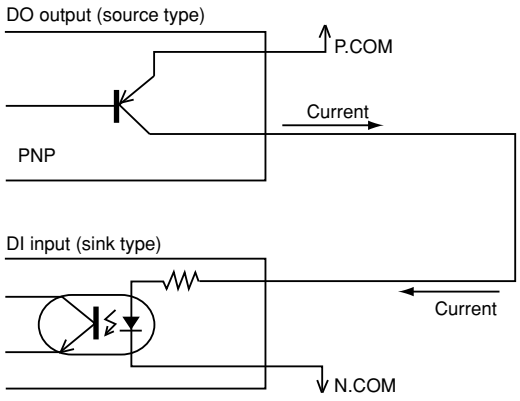
NPN specifications

NPN specifications indicate that a DO (digital output) type NPN open-collector transistor is used for the I/O port having a transistor and photocoupler, and a corresponding DI (digital input) is also used. NPN specifications therefore make use of a sink output and a source input (see drawing below).



PNP specifications

PNP specifications indicate that a DO (digital output) type PNP open-collector transistor is used for the I/O port having a transistor and photocoupler, and a corresponding DI (digital input) is also used. PNP specifications therefore make use of a source output and a sink input (see drawing below).



7. Connecting the absolute battery

The absolute battery connector has not been connected to the controller at shipment to prevent discharge. After the controller has been installed, be sure to connect the absolute battery connector before connecting the robot connection cables.
Connect the absolute battery to the BAT connector corresponding to the axis used as an absolute type axis.

■ Installing the absolute battery

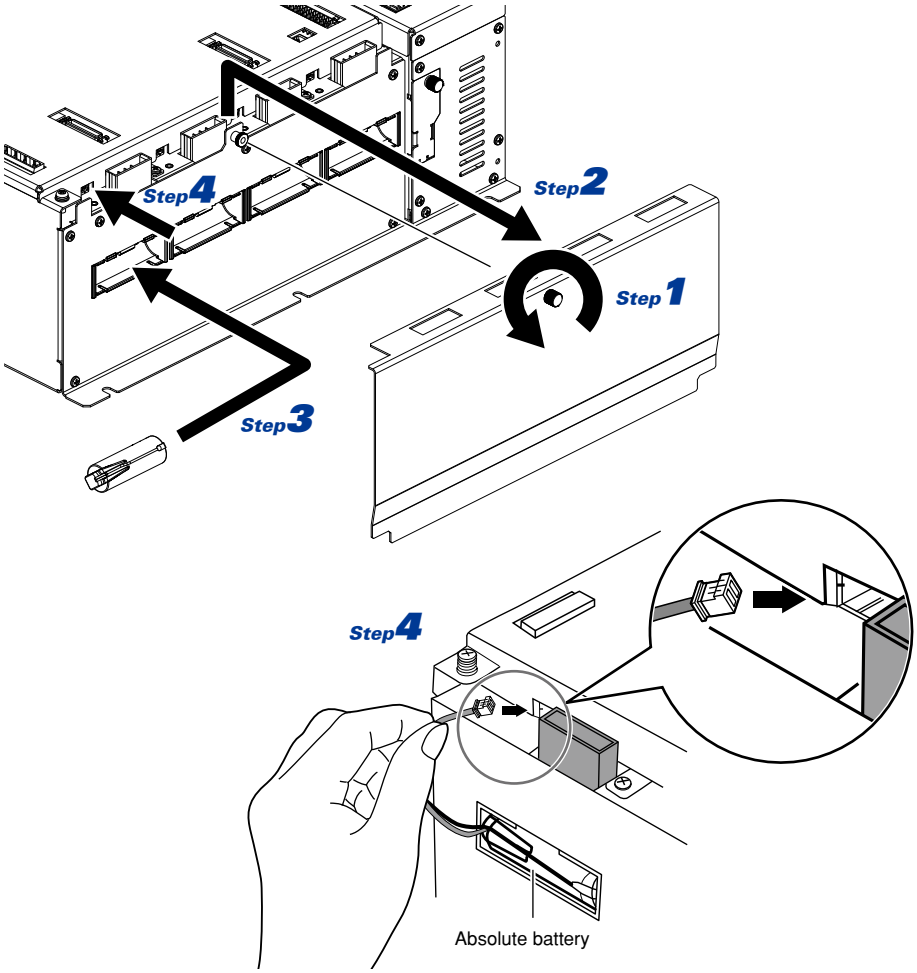
Step1 Loosen the knob on the bottom.

Step2 Remove the bottom cover.

Step3 Fit each absolute battery to the battery case on the bottom to install it.

Step4 Connect the connector of each absolute battery to the BAT connector.

* Replace the absolute battery in the same manner.



CAUTION

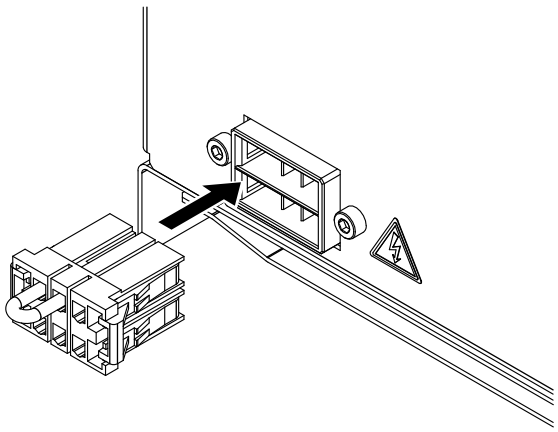
Do not process or extend the cable. Otherwise, abnormal operation or malfunction may occur.

NOTE

If the absolute battery is disconnected from the BAT connector with the power turned off, the robot enters the return-to-origin incomplete status.
Since the absolute battery connector has not been connected to the controller at shipment to prevent discharge, the alarm message showing the return-to-origin incomplete status is always displayed when turning on the power for the first time. This alarm message does not show the controller or robot failure.
When the controller power is turned off for a period of time exceeding the backup retention time, the battery needs to be replaced.
When storing the controller for an extended period of time, disconnect the absolute battery from the BAT connector to suppress the consumption of the absolute battery.
Install the absolute battery with the positive (+) pole faced leftward.

8. Connecting the regenerative shorting connector

A regenerative unit is incorporated.
To enable the temperature error monitor, short-circuit the sensor signal line with the shorting connector.



9. Connecting the brake power supply

When there are two or more brake axes, an external power supply is needed. Prepare a 24V10W-power supply for each axis.

NOTE
The power connector specifications and wiring are the same as the parallel I/O board.
For details, see "1.2 Power supply" and "1.3 Power connector wiring work" in Chapter 4.

10. Precautions for cable routing and installation

10.1 Wiring methods

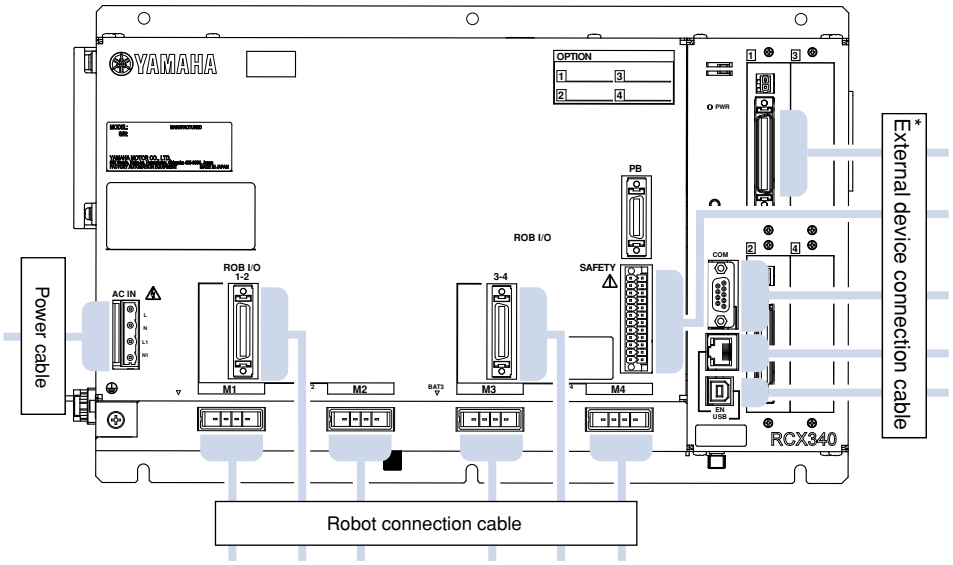
When performing the cable wiring to the controller, strictly observe the following cautions to prevent malfunction due to noise.

CAUTION

As a general guide keep the specified cables separated at least 100mm from each other.

1. **Keep the external device cable, robot cables and power cable separate from each other. Never bundle them together.**
2. **Keep the external device cable and robot cables away from other equipment power lines. Never bundle them together.**
3. **The wiring of electromagnetic contactors, induction motors, solenoid valves or brake solenoids should be separate from the external device cable and robot cable. Never pass them through the same conduit or bundle them together.**
4. **Do not extend the ground wire longer than necessary. The ground wire should be as short as possible.**

For each cable name, see the figure below.



*External devices: DIO, SAFFTY, COM, Ethernet, and USB, etc.

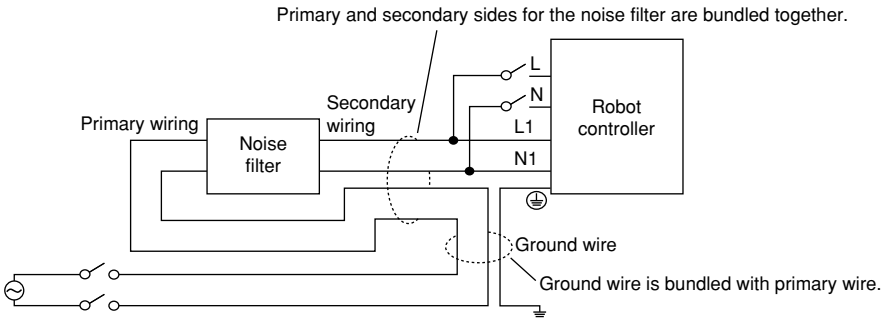
10.2 Methods of preventing malfunctions

To prevent malfunctions due to noise, take into account the following points.

1. Place a noise filter and ferrite core at a point near the robot controller.
   Do not bundle the primary wiring and secondary wiring of the noise filter together.

■ Noise filter installation

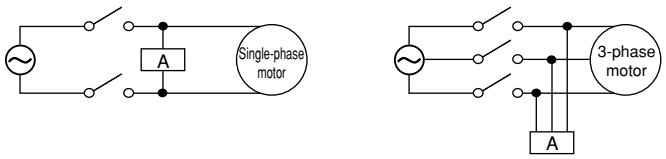
Bad examplev



2. Always attach a surge absorber to the coil of inductive loads (induction motor, solenoid valve, brake solenoid and relay) located near the robot controller.

■ Example of surge absorber circuit

For induction motor



A: Surge killer

■ Example of surge absorber circuit

For solenoid valve, solenoid

DC type
B: Diode, varistor, CR elements

AC type
C: Varistor, CR elements

11. Checking the robot controller operation

This section explains how to check the controller operation using a special connector that comes with the controller and an applicable robot.

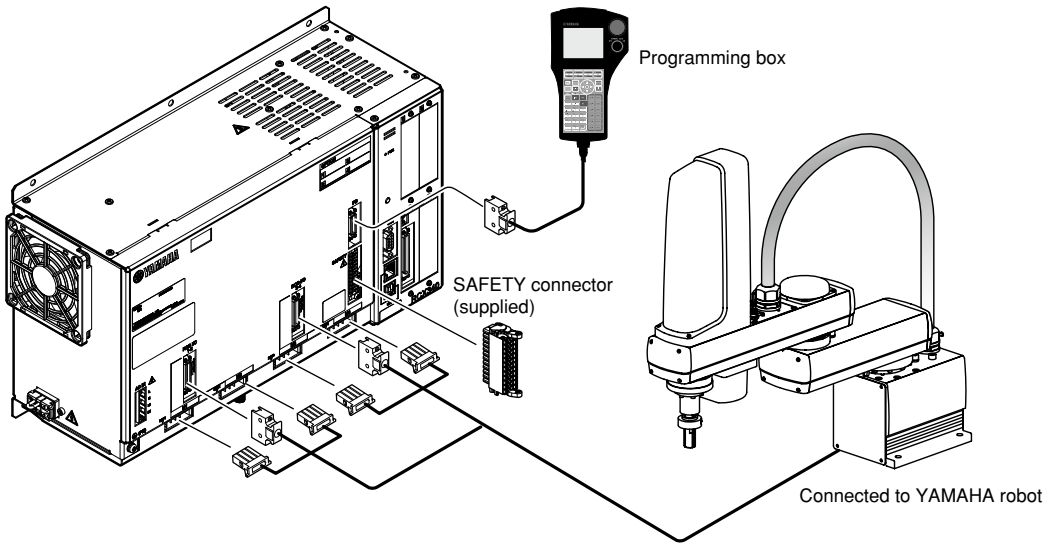
11.1 Controller wiring

Make the connections to the controller as described below.

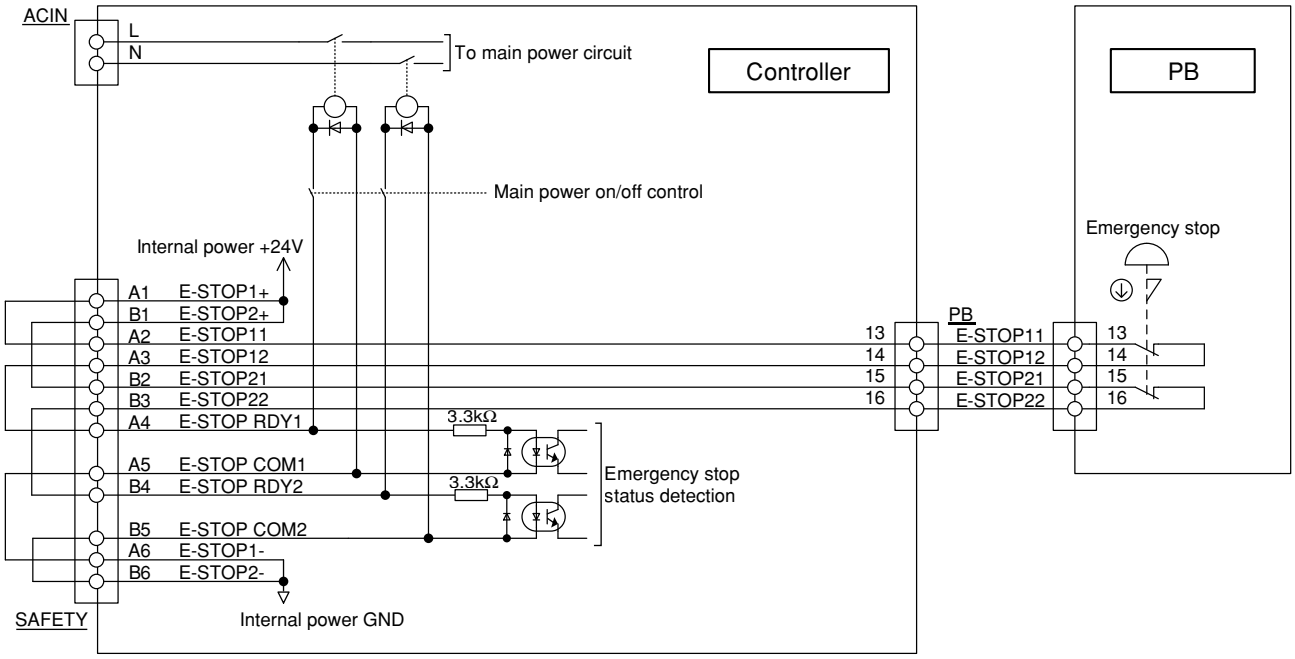
- Power supply (Do not supply power until you actually begin the operation check.)
- Robot cable
- Programming box
- Absolute battery (absolute type only)
- Regenerative unit (if needed)
- SAFETY connector (supplied)

  Short-circuit the following pins of the SAFETY connector supplied with the controller.

SAFETY connector
A1 – A2
A3 – A4
A5 – A6
B1 – B2
B3 – B4
B5 – B6



11.2 Wiring example of emergency stop circuit for operation check



The emergency stop button contacts of the programming box are output from the A2, A3, B2, and B3 pins of the SAFETY connector through the PB connector.

11.3 Operation check

Supply the power to the controller after connecting the controller, robot, and supplied connector.

NOTE

When the parallel I/O is installed, the robot enters the operation prohibition status by the stop function since the 24V-power is not supplied from the parallel I/O connector. This status can be reset from a viewpoint of software as the parallel I/O board setting is disabled.

Normal status

· The "PWR" LED on the front of the controller is lit and the 7-segment LED displays as follows.
(Servo off, return-to-origin incomplete, emergency stop reset)

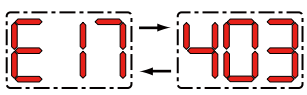
Abnormal status

· The "PWR" LED on the front of the controller is lit and the 7-segment LED displays the alarm code.

· Check the alarm message shown on the programming box and take corrective actions while referring to the troubleshooting.

(Example) Display if an alarm occurs.

"E + alarm group number" and "alarm classification number" are displayed alternately.



* For details about alarm contents shown by each alarm code, see "Troubleshooting".

Chapter 4 I/O interface

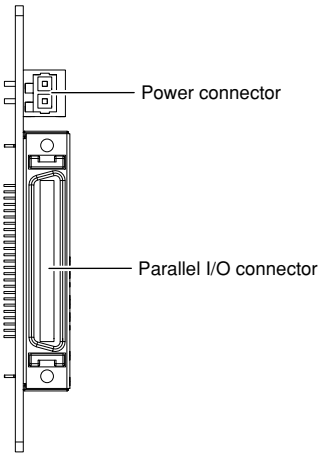
1. I/O interface overview

To make the robot applicable to the customer's system, the dedicated or general-purpose I/O interface is selected for the controller.
To use the I/O interface, add an optional parallel I/O board to the controller.
The parallel I/O board can select the standard specifications that include the dedicated input/output or the expanded specifications that have only the general-purpose input/output. Additionally, up to four boards can be installed.
The standard specifications/expanded specification and the PNP specifications/NPN specifications of the parallel I/O board are determined at shipment.
Additionally, when the serial I/O (CC-Link, DeviceNet, etc.) is selected, dedicated inputs other than DI06 (stop) of the parallel I/O board become disabled.
For details about the definitions of the NPN specifications and PNP specifications, see "6. I/O connections" in Chapter 3. In the following descriptions, the input signal and output signal are expressed as “DI” and “DO”, respectively.

NOTE
The dedicated inputs are limited to ensure the safety during manual operation of the robot.

Specifications			Connector name	Connector type No.	Wire thickness
Standard specifications	Input	Dedicated 8	STD.DIO	Shell: 10350-52A0-008 Plug: 10150-3000PE Manufacturer: SUMITOMO 3M	AWG30 to 24
		General-purpose 16			
	Output	Dedicated 9			
		General-purpose 8			
Expanded specifications	Input	24 points (Max. 96 points)	EXP.DIO		
	Output	16 points (Max. 64 points)			

■ Parallel I/O board



1.1 ID settings

Parallel I/O board IDs (1 to 4) are automatically allocated from the board connection position (in the option slot number order).
The option slot numbers are shown on the option slots of the controller main body in the order like "upper left → lower left → upper right → lower right".
Additionally, the parallel I/O board IDs can be set using the parameters. However, when the board has the standard specifications, the ID is always "1".

ID		General-purpose input/output	Dedicated input/output
1	Standard specifications	DI20-DI37 / DO20-DO27	Provided.*1
	Expanded specifications	DI10-DI37 / DO10-DO27	None
2		DI40-DI67 / DO30-DO47	None
3		DI70-DI117 / DO50-DO67	None
4		DI120-DI147 / DO70-DO107	None

*1 To enable the dedicated input, it is necessary to short-circuit CHK1 (pin number 4) and CHK2 (pin number 40) of the I/O.

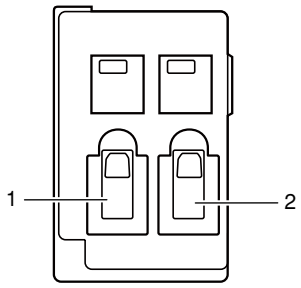
NOTE

- Standard specifications/expanded specifications are determined at shipment.
- Only one standard specification board can be used.
- When changing the ID, it is necessary to turn off the controller power, and then turn it on again.
- If the ID setting is mismatched, all parallel I/O board IDs are initialized.

1.2 Power supply

When using the I/O interface, it is necessary to connect an external 24V-power supply.
Perform the wiring of the power connector of the parallel I/O board, and then connect the 24V-power supply.

■ Power connector (Figure when viewed from the cable insertion side)



Connector model name 734-102 WAGO JAPAN

Terminal	Input	Electric wire to be used
1	DC24V	AWG22~18
2	GND	AWG22~18

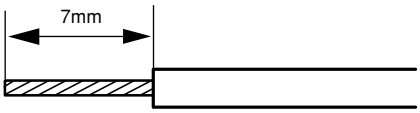
CAUTION

When the controller main body is turned off, do not supply an external DC24V-power to the parallel I/O interface continuously. If the external DC24V-power is supplied continuously, this may cause the controller to malfunction.

1.3 Power connector wiring work

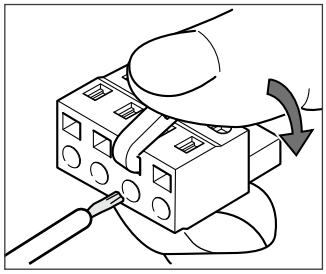
■ Stripping the electric wire

Strip the electric wire sheath 7mm.

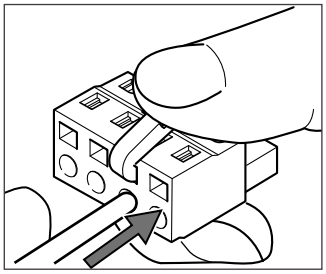


Perform the work while referring to the figures shown below.

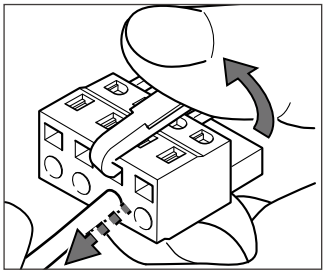
■ When using the finger operation lever



1. Push the finger operation lever installed on the top by finger to push down the spring.

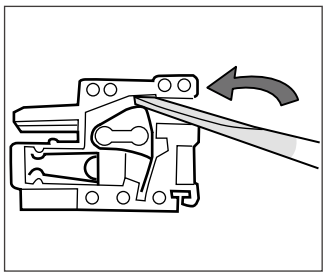


2. Insert the electric wire all the way from the insertion port while pushing the operation lever.

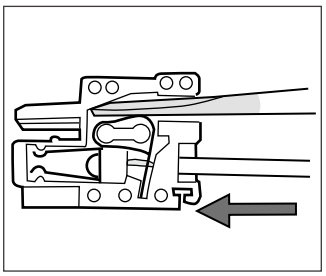


3. Releasing the operation lever will connect the wire. To check the connection, lightly pull the electric wire. (At this time, do not pull the electric wire strongly.)

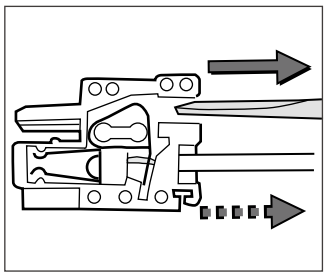
■ When using the screwdriver (front entry)



1. Insert the screwdriver into the operation slot (square hole). When the screwdriver is inserted correctly, it is then held.



2. Insert the electric wire that has been stripped correctly all the way to the wire hole (round hole).



3. To check the connection, lightly pull the electric wire. (At this time, do not pull the electric wire strongly.)

1.4 Connector I/O signals

1.4.1 Standard specification I/O connector signal list

NOTE

- "CHK1" and "CHK2" are connection check inputs of the standard specification I/O connector. When the ID is set at "1", be sure to short-circuit these inputs.
- When the serial I/O option is installed in the controller and the serial I/O is enabled, the dedicated inputs of the serial I/O are enabled and the dedicated inputs of the DIO options are disabled.

Pin	I/O No.	Signal name	Remarks
1	DI 01	Dedicated input Servo ON input	
2	DI 10	Dedicated input Sequence control	
3	DI 03	Spare	Do not use.
4	CHK 1	Check signal 1	Short-circuit with CHK2.
5	DI 05	Spare	Do not use.
6	DI 06	Dedicated input Stop	
7	DI 07	Spare	Do not use.
8	DI 20	General-purpose input 20	
9	DI 21	General-purpose input 21	
10	DI 22	General-purpose input 22	
11	DI 23	General-purpose input 23	
12	DI 24	General-purpose input 24	
13	DI 25	General-purpose input 25	
14	DI 26	General-purpose input 26	
15	DI 27	General-purpose input 27	
16	DO 00	Spare	Do not use.
17	DO 01	Dedicated output CPU OK	
18	DO 10	Dedicated output AUTO mode output	
19	DO 11	Dedicated output Return-to-origin complete	
20	DO 12	Dedicated output Sequence program-in-progress	
21	DO 13	Dedicated output Robot program-in-progress	
22	DO 14	Dedicated output Program reset status output	
23	DO 15	Dedicated output Warning output	
24	DO 16	Spare	Do not use.
25	DO 17	Spare	Do not use.
26	DI 12	Dedicated input Automatic operation start	
27	DI 13	Spare	Do not use.
28	DI 14	Dedicated input Return-to-origin (for INC axis)	
29	DI 15	Dedicated input Program reset input	
30	DI 16	Dedicated input Alarm reset input	
31	DI 17	Dedicated input Return-to-origin (for ABS axis)	
32	DI 30	General-purpose input 30	
33	DI 31	General-purpose input 31	
34	DI 32	General-purpose input 32	
35	DI 33	General-purpose input 33	
36	DI 34	General-purpose input 34	
37	DI 35	General-purpose input 35	
38	DI 36	General-purpose input 36	
39	DI 37	General-purpose input 37	
40	CHK 2	Check signal 2	Short-circuit with CHK1.
41	DO 02	Dedicated output Servo-on output	
42	DO 03	Dedicated output Alarm output	
43	DO 20	General-purpose output 20	
44	DO 21	General-purpose output 21	
45	DO 22	General-purpose output 22	
46	DO 23	General-purpose output 23	
47	DO 24	General-purpose output 24	
48	DO 25	General-purpose output 25	
49	DO 26	General-purpose output 26	
50	DO 27	General-purpose output 27	

1.4.2 Expanded specification I/O connector signal list

The IDs are set using the parameter.

Pin	I/O No. (ID=1)	I/O No. (ID=2)	I/O No. (ID=3)	I/O No. (ID=4)	Signal name
1	---	---	---	---	Reserved
2	DI 10	DI 40	DI 70	DI 120	General-purpose input 10,40,70,120
3	---	---	---	---	Reserved
4	DI 11	DI 41	DI 71	DI 121	General-purpose input 11,41,71,121
5	---	---	---	---	Reserved
6	---	---	---	---	Reserved
7	---	---	---	---	Reserved
8	DI 20	DI 50	DI 100	DI 130	General-purpose input 20,50,100,130
9	DI 21	DI 51	DI 101	DI 131	General-purpose input 21,51,101,131
10	DI 22	DI 52	DI 102	DI 132	General-purpose input 22,52,102,132
11	DI 23	DI 53	DI 103	DI 133	General-purpose input 23,53,103,133
12	DI 24	DI 54	DI 104	DI 134	General-purpose input 24,54,104,134
13	DI 25	DI 55	DI 105	DI 135	General-purpose input 25,55,105,135
14	DI 26	DI 56	DI 106	DI 136	General-purpose input 26,56,106,136
15	DI 27	DI 57	DI 107	DI 137	General-purpose input 27,57,107,137
16	---	---	---	---	Reserved
17	---	---	---	---	Reserved
18	DO 10	DO 30	DO 50	DO 70	General-purpose output 10,30,50,70
19	DO 11	DO 31	DO 51	DO 71	General-purpose output 11,31,51,71
20	DO 12	DO 32	DO 52	DO 72	General-purpose output 12,32,52,72
21	DO 13	DO 33	DO 53	DO 73	General-purpose output 13,33,53,73
22	DO 14	DO 34	DO 54	DO 74	General-purpose output 14,34,54,74
23	DO 15	DO 35	DO 55	DO 75	General-purpose output 15,35,55,75
24	DO 16	DO 36	DO 56	DO 76	General-purpose output 16,36,56,76
25	DO 17	DO 37	DO 57	DO 77	General-purpose output 17,37,57,77
26	DI 12	DI 42	DI 72	DI 122	General-purpose input 12,42,72,122
27	DI 13	DI 43	DI 73	DI 123	General-purpose input 13,43,73,123
28	DI 14	DI 44	DI 74	DI 124	General-purpose input 14,44,74,124
29	DI 15	DI 45	DI 75	DI 125	General-purpose input 15,45,75,125
30	DI 16	DI 46	DI 76	DI 126	General-purpose input 16,46,76,126
31	DI 17	DI 47	DI 77	DI 127	General-purpose input 17,47,77,127
32	DI 30	DI 60	DI 110	DI 140	General-purpose input 30,60,110,140
33	DI 31	DI 61	DI 111	DI 141	General-purpose input 31,61,111,141
34	DI 32	DI 62	DI 112	DI 142	General-purpose input 32,62,112,142
35	DI 33	DI 63	DI 113	DI 143	General-purpose input 33,63,113,143
36	DI 34	DI 64	DI 114	DI 144	General-purpose input 34,64,114,144
37	DI 35	DI 65	DI 115	DI 145	General-purpose input 35,65,115,145
38	DI 36	DI 66	DI 116	DI 146	General-purpose input 36,66,116,146
39	DI 37	DI 67	DI 117	DI 147	General-purpose input 37,67,117,147
40	---	---	---	---	Reserved
41	---	---	---	---	Reserved
42	---	---	---	---	Reserved
43	DO 20	DO 40	DO 60	DO 100	General-purpose output 20,40,60,100
44	DO 21	DO 41	DO 61	DO 101	General-purpose output 21,41,61,101
45	DO 22	DO 42	DO 62	DO 102	General-purpose output 22,42,62,102
46	DO 23	DO 43	DO 63	DO 103	General-purpose output 23,43,63,103
47	DO 24	DO 44	DO 64	DO 104	General-purpose output 24,44,64,104
48	DO 25	DO 45	DO 65	DO 105	General-purpose output 25,45,65,105
49	DO 26	DO 46	DO 66	DO 106	General-purpose output 26,46,66,106
50	DO 27	DO 47	DO 67	DO 107	General-purpose output 27,47,67,107

For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

1.5 Connector pin assignment lists

1.5.1 Standard specification I/O connector

2	DI10	SEQ enable	1	DI01	Servo ON	27	DI13	(Spare)	26	DI12	RUN
4	CHK1	Check input 1	3	DI03	(Spare)	29	DI15	RESET	28	DI14	ORIGIN (for INC axis)
6	DI06	STOP	5	DI05	(Spare)	31	DI17	ORIGIN (for ABS axis)	30	DI16	ALMRST
8	DI20	General-purpose input	7	DI07	(Spare)	33	DI31	General-purpose input	32	DI30	General-purpose input
10	DI22	General-purpose input	9	DI21	General-purpose input	35	DI33	General-purpose input	34	DI32	General-purpose input
12	DI24	General-purpose input	11	DI23	General-purpose input	37	DI35	General-purpose input	36	DI34	General-purpose input
14	DI26	General-purpose input	13	DI25	General-purpose input	39	DI37	General-purpose input	38	DI36	General-purpose input
16	DO00	(Spare)	15	DI27	General-purpose input	41	DO02	SERVO	40	CHK2	Check input 2
18	DO10	AUTO	17	DO01	CPUOK	43	DO20	General-purpose output	42	DO03	ALARM
20	DO12	SEQRUN	19	DO11	ORGOK	45	DO22	General-purpose output	44	DO21	General-purpose output
22	DO14	RESET	21	DO13	RUN	47	DO24	General-purpose output	46	DO23	General-purpose output
24	DO16	(Spare)	23	DO15	WARNING	49	DO26	General-purpose output	48	DO25	General-purpose output
			25	DO17	(Spare)				50	DO27	General-purpose output

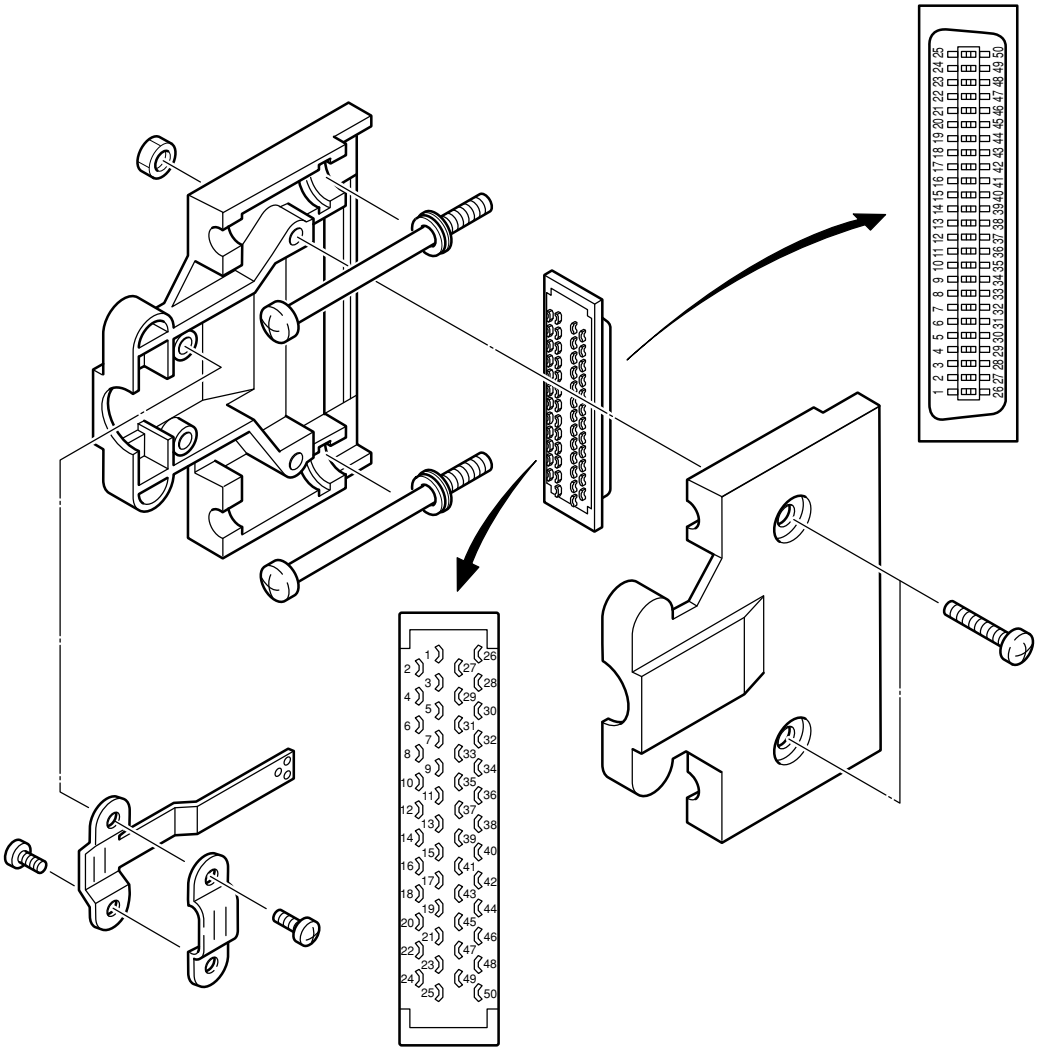
1.5.2 Expanded specification I/O connector

The following shows the expanded specification I/O connector pin assignment list when the ID is "2".
For details about pin assignments other than those with the ID set at "2", see the input/output signal list.

2	DI40	General-purpose input	1	–	Do not use.	27	DI43	General-purpose input	26	DI42	General-purpose input
4	DI41	General-purpose input	3	–	Do not use.	29	DI45	General-purpose input	28	DI44	General-purpose input
6	–	Do not use.	5	–	Do not use.	31	DI47	General-purpose input	30	DI46	General-purpose input
8	DI50	General-purpose input	7	–	Do not use.	33	DI61	General-purpose input	32	DI60	General-purpose input
10	DI52	General-purpose input	9	DI51	General-purpose input	35	DI63	General-purpose input	34	DI62	General-purpose input
12	DI54	General-purpose input	11	DI53	General-purpose input	37	DI65	General-purpose input	36	DI64	General-purpose input
14	DI56	General-purpose input	13	DI55	General-purpose input	39	DI67	General-purpose input	38	DI66	General-purpose input
16	–	Do not use.	15	DI57	General-purpose input	41	–	Do not use.	40	–	Do not use.
18	DO30	General-purpose output	17	–	Do not use.	43	DO40	General-purpose output	42	–	Do not use.
20	DO32	General-purpose output	19	DO31	General-purpose output	45	DO42	General-purpose output	44	DO41	General-purpose output
22	DO34	General-purpose output	21	DO33	General-purpose output	47	DO44	General-purpose output	46	DO43	General-purpose output
24	DO36	General-purpose output	23	DO35	General-purpose output	49	DO46	General-purpose output	48	DO45	General-purpose output
			25	DO37	General-purpose output				50	DO47	General-purpose output

1.6 Connector pin numbers

■ **Figure when viewed in the cable connector soldering direction**

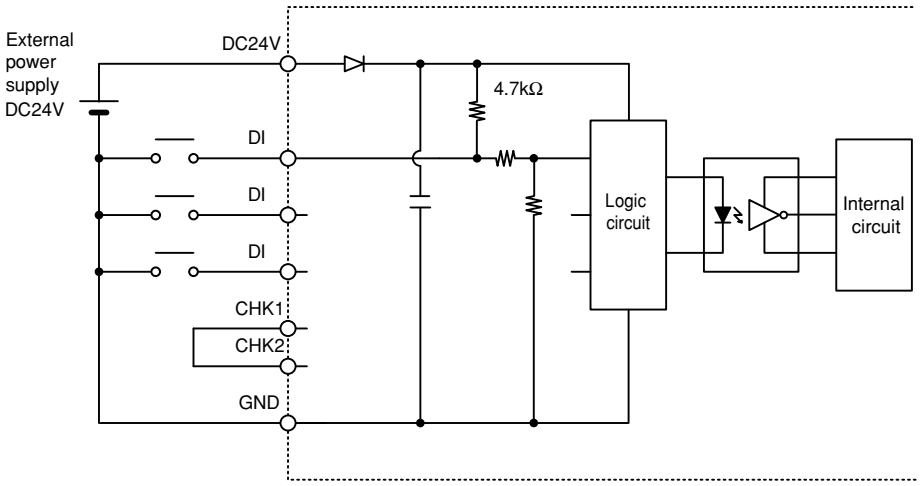


Connector shell model number	10350-52A0-008	SUMITOMO 3M
Connector plug model number	10150-3000PE	SUMITOMO 3M

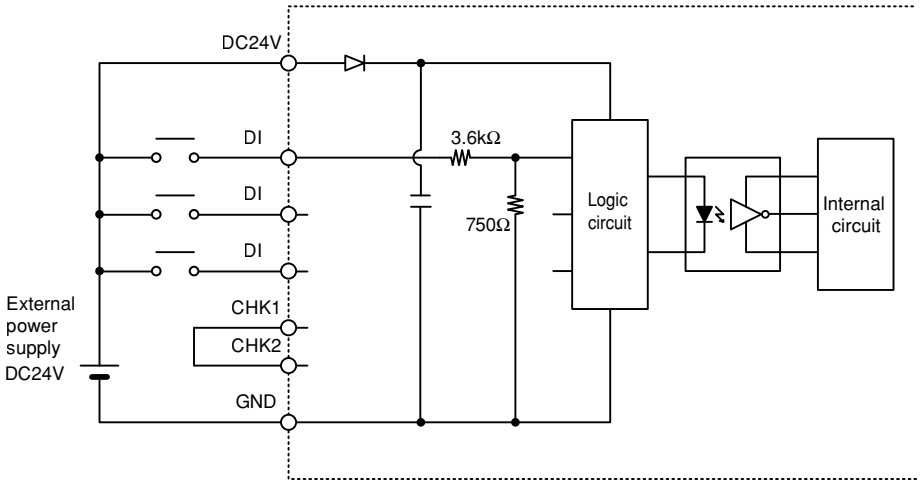
1.7 Typical input signal connection

For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

NPN specifications



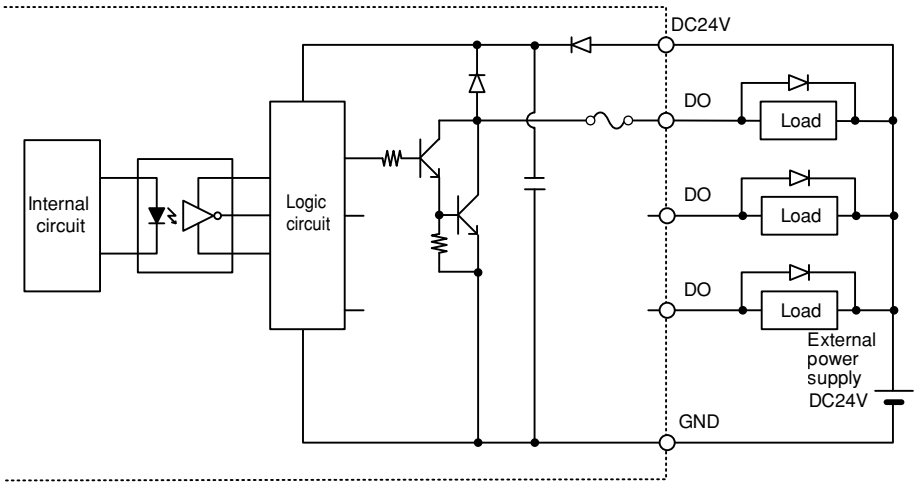
PNP specifications



1.8 Typical output signal connection

For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

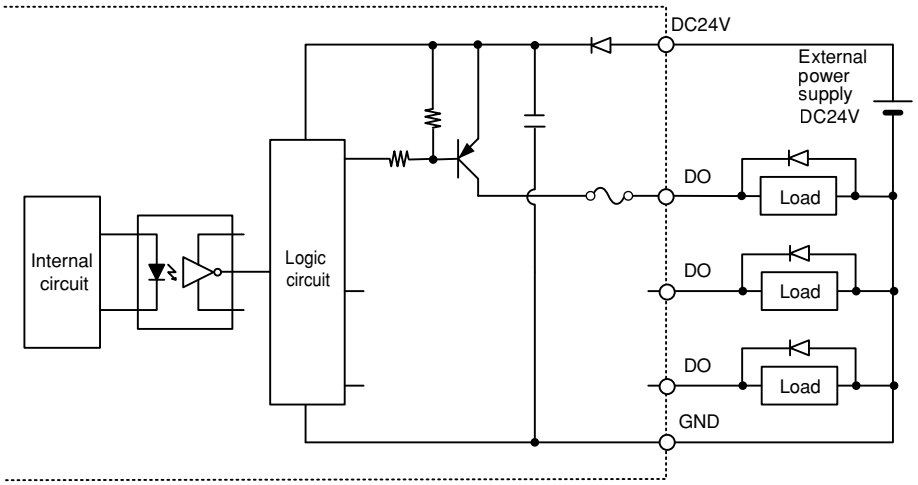
■ NPN specifications



CAUTION

- **When connecting an inductive load (solenoid, relay, etc.), connect a diode in parallel to the load as a surge killer.**
- **For the NPN specifications, do not short-circuit DO and DC24V. If they are short-circuited, this may cause the circuit to break.**

■ PNP specifications



CAUTION

For the PNP specifications, do not short-circuit DO and GND. If they are short-circuited, this may cause the circuit to break.

1.9 Dedicated input signal description

NOTE

- If two or more dedicated inputs are supplied simultaneously or the pulse width of input signals is too short, the input signals might not be recognized. Be sure to provide an interval of about 100ms between input pulses when two or more dedicated inputs are used.
- The dedicated inputs are valid when the controller is in the AUTO mode and the control authority is released.

1. DI01 Servo ON input

DI01 is used to reset the emergency stop status and turn on the servo.
When the DI01 contact is closed (ON), the servo turns on at the signal rise.

- Input signal pulse width: 100ms minimum

NOTE

- To use this function, it is necessary that no alarm occurs and the emergency stop input is also closed.
- In PHASER series robot operation, when the servo is first turned on after power-on, the robot emits a noise (sound) for 0.5 to 2 seconds during the servo ON process and then enters a servo ON state. This is normal operation necessary for obtaining control information by slightly moving the robot and is not an abnormal condition.

2. DI06 Stop

DI06 is used to pause the program or robot operation during program execution or manual robot movement operation.
When the DI06 contact is open (OFF), the program and robot operation stop. Additionally, the program execution and manual robot movement operation cannot be performed in the DI06 contact open status.

3. DI10 Sequence control

DI10 is used to execute a sequence program.
When the DI10 contact is closed (ON), a sequence program is executed.
DO12 (Sequence program-in-progress) is output while a sequence program is executed.

WARNING

THE STOP SIGNAL IS NOT A SAFETY INPUT. THEREFORE, DO NOT USE THIS SIGNAL FOR THE SAFETY PURPOSE. EVEN WHEN THE STOP SIGNAL IS TURNED ON, THE SERVO DOES NOT TURN OFF.

NOTE

When an external 24V-power is not supplied to the parallel I/O board, the robot always enters the stop status.
When the parallel I/O board setting is made invalid, the stop status is canceled.

4. DI12 Automatic operation start

This is used to start execution of the program.
When the DI12 contact is closed (ON) in AUTO mode, the robot program starts as the signal pulse is established. DO13 (Robot program-in-progress) is output when the robot program is executed.

- Input signal pulse width: 100ms minimum

CAUTION

When the program execution is stopped by a signal such as DI06 (Stop), the program re-executes the command that has stopped.

5. DI14 Return-to-origin (for INC axis)

DI14 is used to perform the return-to-origin of the incremental type axis and semi-absolute type axis. For the incremental type axis, when the return-to-origin is executed, the return-to-origin operation is performed. For the semi-absolute type axis, when the return-to-origin is executed, the absolute search operation is performed.
When the DI14 contact is closed (ON), the axes will start returning to their origin positions at the rising edge of the signal pulse, in the return-to-origin sequence specified by parameter.
When there are no incremental type axis and semi-absolute type axis, “6.309: INC. motor disconnected” alarm occurs.
This input signal is only for the axes whose return-to-origin method is set to "SENSOR" or "TORQUE" (stroke end).

- Input signal pulse width: 100ms minimum

6. DI15 Program reset input

DI15 is used to reset the program.
When the DI15 input turns on in the program execution stop status, the robot program is then reset.
At this point, all general-purpose outputs and variables are reset.
DO14 (Program reset status output) is output when the program is correctly reset.

- Input signal pulse width: 100ms minimum

7. DI16 Alarm reset input

DI16 is used to reset the alarm.
If an alarm occurs, remove the cause and execute this command to reset the alarm.

* Some alarms cannot be reset depending on their contents. In this case, shut down the control power and reset the alarm.

8. DI17 Return-to-origin (for ABS axis)

The operation may vary depending on the setting of the I/O parameter "DI17 mode".

1. When the "DI17 Mode" parameter is set to "ABS"

DI17 is dedicated to the return-to-origin of the absolute type axis.
DI17 is used to perform the return-to-origin of the absolute type axis. When the DI17 contact is closed (ON), the axes will start returning to their origin positions at the rising edge of the signal pulse, in the return-to-origin sequence specified by parameter.
When there is no absolute type axis, “6.310: ABS. motor disconnected” alarm occurs. DI17 is intended only for the axis with the return-to-origin method set at "SENSOR" or "TORQUE" (stroke end). Absolute reset cannot be performed when return-to-origin is incomplete on axes whose return-to-origin method is set to "MARK".

- Input signal pulse width: 100ms minimum

2. When the "DI17 Mode" parameter is set to "ABS/ORG"

DI17 is commonly used for the return-to-origin of the absolute type axis and incremental type axis.
DI17 is used to perform the return-to-origin of the absolute type axis and incremental type axis.

1. Absolute type axis
For details about operation, see “1. When the "DI17 Mode" parameter is set to "ABS"” shown above.

2. Incremental type axis
For details about operation, see DI14 (return-to-origin) shown above.
When the absolute type axis and incremental type axis are mixed, the return-to-origin of the incremental type axis is performed after the return-to-origin of the absolute type axis has been executed.

- Input signal pulse width: 100ms minimum

CAUTION

In most cases, do not use this setting. Only use this setting when the return-to-origin signal must be input to DI17. (For example, in cases where an RCX141 or RCX221 controller was replaced by the RCX240)

NOTE

The return-to-origin (for INC axis) and return-to-origin (for ABS axis) inputs do not execute the absolute reset for the axis with the mark return-to-origin method.

CAUTION

DI01, DI12, DI14, DI15, DI16 and DI17 inputs are disabled while the program is being executed. Input these signals only after the program is halted.

1.10 Dedicated output signal description

1. DO01 CPU_OK

This is always on during normal controller operation.
In the following cases this output turns off and CPU operation stops.

- Serious malfunction
- When the power supply voltage has dropped to lower than the specified value.

Normal operation cannot resume if this signal is turned off once, without turning the power supply on again.

2. DO02 Servo ON output

This output is on when the motor power supply inside the controller is on. However this signal turns off when a serious malfunction occurs or the emergency stop input contacts are open.
When DI01 (servo on input) of the "servo operation" or I/O interface is turned on after the emergency stop input contact has been closed, DO02 turns on in synchronization with it.
The servo will not turn on if a serious malfunction occurs or the emergency stop input contacts are open.

NOTE

In PHASER series robot operation, when the servo is first turned on after power-on, the robot emits a noise (sound) for 0.5 to 2 seconds during the servo ON process and after the robot moves slightly it then enters a servo ON state. This is normal operation for obtaining the necessary control information by slightly moving the robot and is not an abnormal condition.

3. DO03 Alarm

This output turns on in the following cases.

1) When the emergency stop input contact is open in the servo on status.

2) When a driver unit detects a serious malfunction such as an overload.

3) When the host CPU has stopped due to a major abnormality or other causes.

4) When the battery is not connected.

When the alarm is on, the alarm number is displayed on the 7-segment LED on the front of the controller at the same time.
Additionally, turn off the alarm as described below in the cases shown above.

In case of 1)
After closing the emergency stop input contact, turn on DI16 (alarm reset input) of the I/O interface.
The alarm can also be reset as the power is turned off, and then it is turned on again.

In case of 2)
Turn on DI16 (alarm reset input) of the I/O interface to turn off the alarm. Additionally, when the alarm is reset from the programming box, the alarm is turned off.

In case of 3)
Since the CPU has stopped, the alarm cannot be turned off and operation cannot be reset unless the power supply is turned on again.
If the alarm remains on even after the power has been turned off and then turned back on, the controller needs to be replaced.

In case of 4)
When a battery abnormality is detected, the alarm cannot turn off until the power supply is turned on again.
If the alarm is still on even after the power has been turned on again, then the battery connections must be checked or the battery replaced.

4. DO10 AUTO mode output

DO10 is always on when the controller is in the AUTO mode and the control authority is released.

5. DO11 Return-to-origin complete

DO11 is always on when return-to-origin on all axes is complete.
If this output is off, absolute reset or return-to-origin must be performed.

6. DO12 Sequence program-in-progress

DO12 is always on when the sequence program is being executed.

7. DO13 Robot program-in-progress

DO13 is always on when the robot program is being executed in AUTO mode, or when program instruction commands are executed individually.

8. DO14 Program reset status output

DO14 is always on when the robot program is in its reset status.
DO14 turns off when robot program execution is started.

9. DO15 Warning output

DO15 turns on if a warning occurs, for example, the controller detects the battery voltage drop.

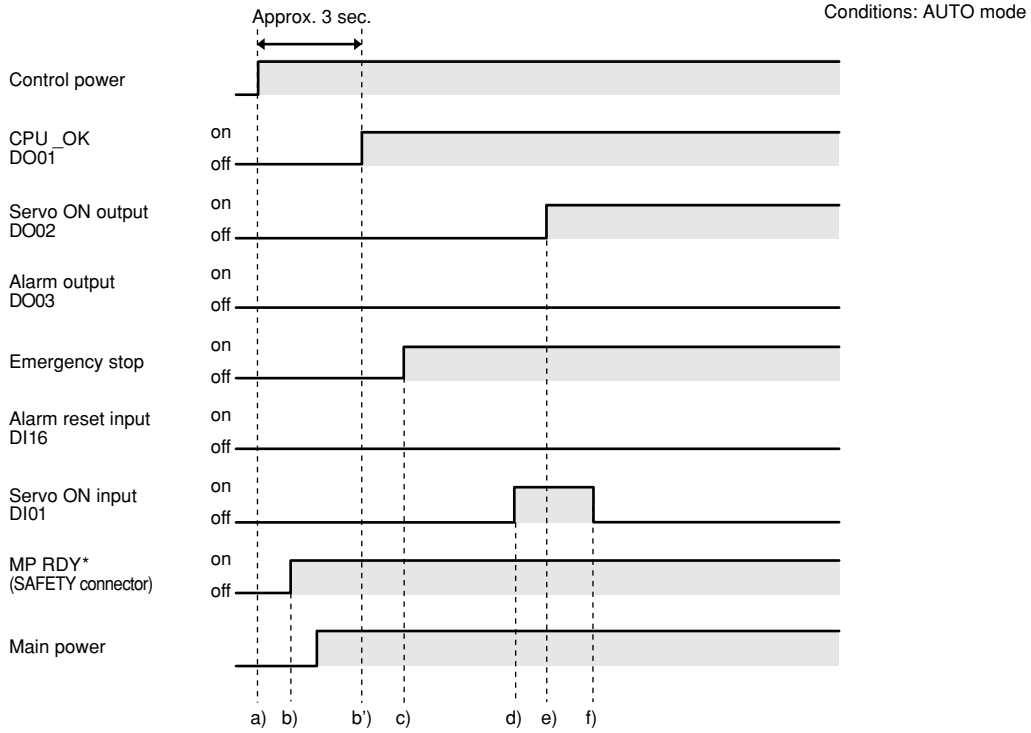
NOTE

The warning target is the system backup battery and absolute battery.

1.11 Dedicated I/O signal timing chart

1.11.1 Servo ON from power ON of controller

Servo ON from power ON of controller



*For details on MP RDY signal, refer to Chapter 5, "SAFETY I/O interface".

CAUTION

It will take about 3 seconds until the CPU_OK output status is confirmed after the power is turned on.

Initial servo ON processing when power is turned on.

a) Control power turns on.

b) MP RDY output turns on. (Main power supply turns on after MP RDY output turns on.)

b') CPU_OK output turns on.

c) Emergency stop input turns on.

d) Servo ON input turns on.

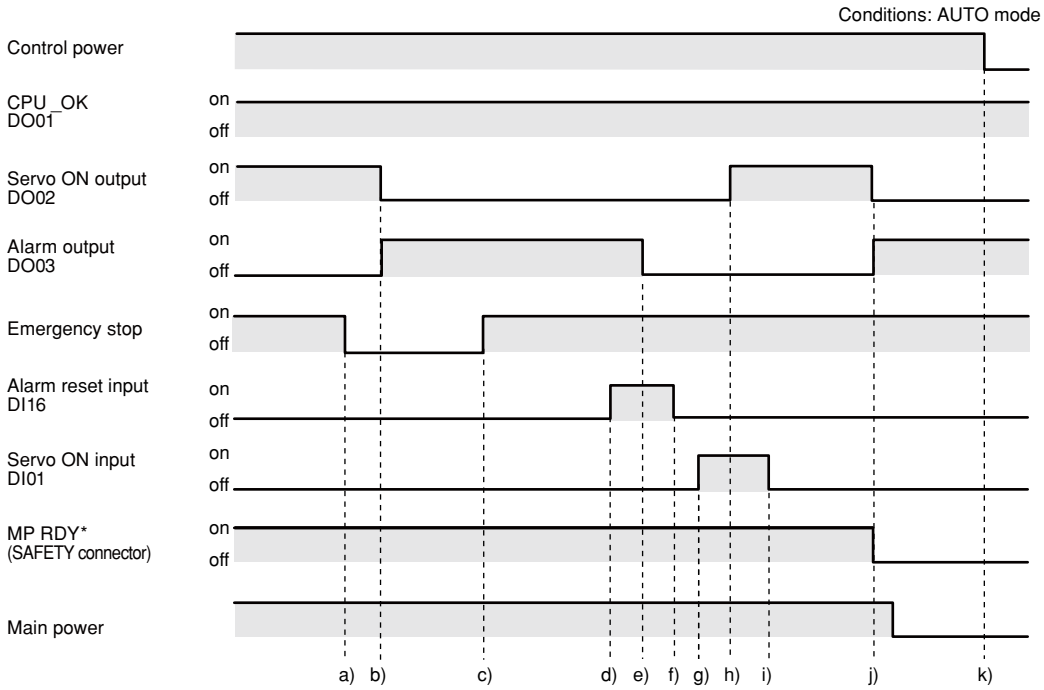
e) Servo ON output turns on.

f) Servo ON input turns off after checking for servo ON output.

* When processing with dedicated inputs, use I/O signals to perform handshake processing. If handshake processing is impossible, hold the input signal for a minimum of 100ms.
* Configure external circuitry so that when "MP RDY" is turned on mains power is supplied.

1.11.2 Controller emergency stop and servo on reset

Emergency stop and servo on reset from servo on status



Emergency stop

a) Emergency stop input turns off.

b) Alarm output turns on and servo ON output turns off.

Shifting from emergency stop to servo-on

c) Emergency stop input turns on.

d) Alarm reset input turns on.

e) Alarm output turns off.

f) Alarm reset input turns off after checking that the alarm reset output turns off.

g) Servo ON input turns on.

h) Servo ON output turns on.

i) Servo ON input turns off after checking for servo ON output.

* When processing with dedicated inputs, use I/O signals to perform handshake processing. If handshake processing is impossible, hold the input signal for a minimum of 100ms.

Serious alarm occurs.

j) Alarm output turns on, servo ON output turns on, and MP RDY OFF output turns on.

k) Control power turns off.

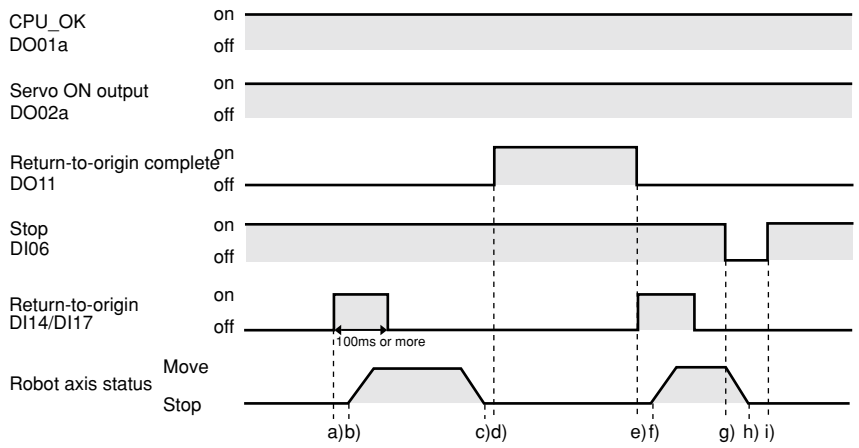
* If a serious alarm occurs (alarm classification number 900s), the alarm reset cannot be performed.

* An external circuit is constructed so that the main power is shut down as MR RDY turns off.

1.11.3 Return-to-origin

Return-to-origin

Conditions: Servo ON, AUTO mode



Return-to-origin

a) Return-to-origin input turns on. (pulse width: 100ms or more)

b) Robot axis starts moving to origin position.

c) Robot axis reaches origin position and stops moving.
On semi-absolute axes, the current position is determined and movement stops.

d) Return-to-origin complete output turns on.

Stop during return-to-origin

e) Return-to-origin input turns on (pulse width: 100ms or more) and return-to-origin complete output turns off.

f) Robot axis starts moving to origin position.

g) Stop input turns off.

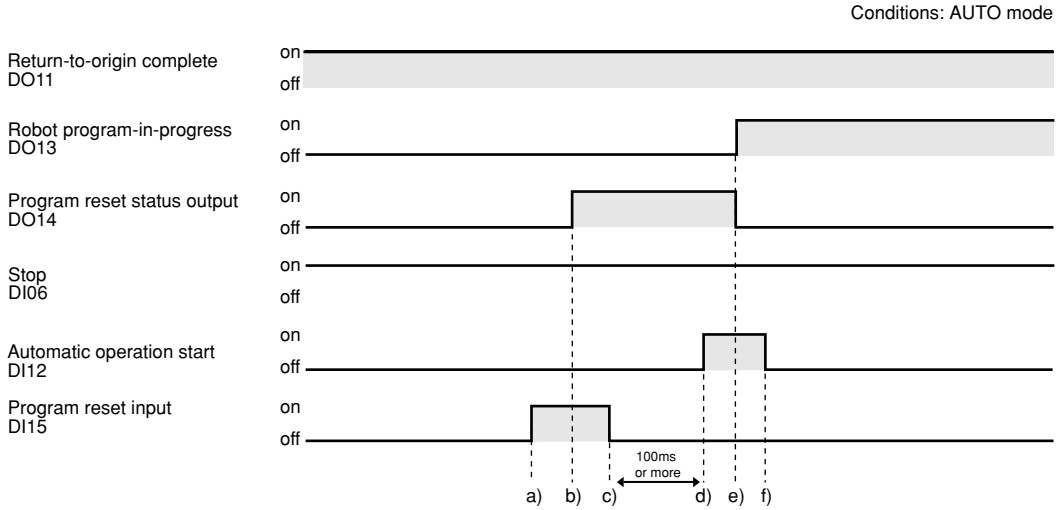
h) On-going robot axis movement stops.

i) Stop input turns on.

* When the return-to-origin complete output is on, return-to-origin does not have to be performed.
* Return-to-origin complete output is on until return-to-origin reset is required.
* The return-to-origin cannot be executed unless the robot is in the servo on status.
* When the return-to-origin input is on, the return-to-origin complete output is off.
* When turning on the controller with the incremental type axis, the robot enters the return-to-origin incomplete status. So, the return-to-origin complete output turns off.
* When the robot consists of only the absolute type axes, it starts up in the return-to-origin completion output on status if the position information alarm does not occur at the controller power on.
* When the "DI17 Mode" parameter is set to "ABS/ORG", return-to-origin can also be performed with DI17. For description of DI14 and DI17, refer to "1.9 Dedicated input signal description".

1.11.4 Program reset and program execution

■ Program reset and program execution



Program reset

a) Program reset input turns on.

b) Program reset status output turns on.

c) Program reset input turns off after checking program reset status output is turned on.

Program execution

d) Automatic operation start input turns on.

e) Program reset status input turns off, and robot program-in-progress output turns on.

f) Program start input turns off after checking robot program-in-progress output is turned on.

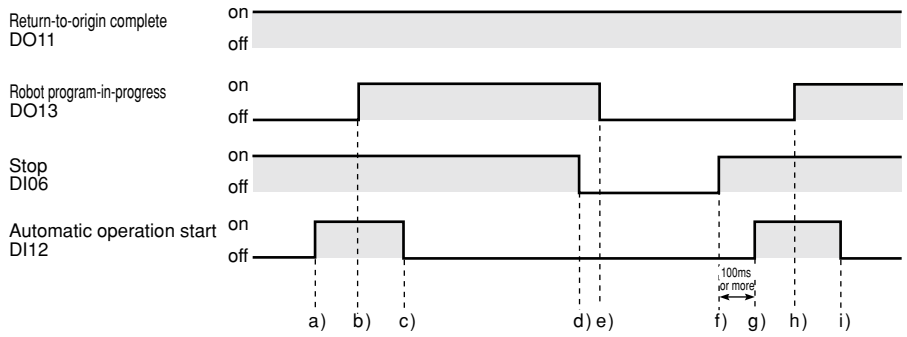
* Program cannot be executed when the emergency stop input and stop input are off.

* The AUTO mode input of the SAFETY connector is a function that is intended only for the controller with the CE specifications.

1.11.5 Stopping by program stop

Stopping by program stop

Conditions: AUTO mode



Program execution

a) Automatic operation start input turns on.

b) Robot program-in-progress output turns on.

c) Automatic operation start input turns off after checking that the robot program running output turns on.

Program stop process by stop input

d) Stop input turns off.

e) Robot program running output turns off.

Program execution process after program stop by stop input

f) Stop input turns on.

g) Automatic operation start input turns on.

h) Robot program-in-progress output turns on.

i) Automatic operation start input turns off after checking that the robot program running output turns on.

* Switching to emergency stop will cause the program to stop. An alarm is output at this time and the servo ON output turns off. The servo must be turned on to execute the program again.

WARNING

THE STOP SIGNAL IS NOT A SAFETY INPUT. THEREFORE, DO NOT USE THIS SIGNAL FOR THE SAFETY PURPOSE. EVEN WHEN THE STOP SIGNAL IS TURNED ON, THE SERVO DOES NOT TURN OFF.

CAUTION

If the program execution is stopped halfway by the stop input, it is executed again from the command that stops the program.
When the program execution is stopped during robot movement, the robot movement is started by executing the program again. So, take great care when executing the program again.

1.12 General-purpose I/O signals

1.12.1 General-purpose input signals

The standard specifications provide 16 points in total, DI20 to DI27 and DI30 to DI37 while the expanded specifications provide 24 points in total, DI10 to DI17, DI20 to DI27, and DI30 to DI37.
These general-purpose inputs are available to the user and can be used arbitrarily. They can be connected to components such as pushbutton switches and sensors. The input status of these can be read in the robot program or sequence program.

CAUTION

For input signals, input signals with 6ms or longer on/off time.

1.12.2 General-purpose output signals

The standard specifications provide 8 points in total, DO20 to DO27 while the expanded specifications provide 16 points in total, DO10 to DO17 and DO20 to DO27.
All signals are Darlington transistor open-collector outputs.
Maximum output current of each transistor is 100mA.
These general-purpose inputs are available to the user and can be used arbitrarily. The output status of these can be changed in the robot program or sequence program.

All output signals are initialized when the controller power is turned on.
Additionally, the area check outputs can be allocated to the general-purpose outputs.

CAUTION

If the port used for area check output is the same as that used by the user program, the output data might change. Do not use the same port.

NOTE

The number of general-purpose input/output points can be increased by expanding the optional parallel I/O boards.

1.12.3 General-purpose output signal reset (off)

All general-purpose output signals are reset (off) in the following cases.

- When “ALL RESET” is executed on the “AUTO OPE” screen.
- When the dedicated input signal DI15 (Program reset input) was turned on in AUTO mode while the program was stopped.
  (Refer to "1.9 Dedicated input signal description" in this chapter.)
- When any of the following initialization is performed on the “INITIALIZE” screen ([System] → [Initialize]).
  1. ALL: All data
  2. PGM: Program data
- When the online commands @RESET, @INIT PGM, @INIT MEM, or@INIT ALL were executed.
- When the HALTALL statement was executed in the program.

2. Ratings

For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

2.1 Input

■ NPN specifications

Method	DC input (positive common type) Photocoupler insulation method
Input power	24V DC ±10%, 5.1mA/point
Load	OFF voltage: 9.9Vmin (3.0mA)
	ON voltage: 4.0Vmax (4.2mA)
Response time	2ms or longer or 4ms *1 or longer

■ PNP specifications

Method	DC input (negative common type) Photocoupler insulation method
Input power	24V DC ±10%, 5.5mA/point
Load	ON voltage: 11.6Vmin (2.7mA)
	OFF voltage: 4.6Vmax (1.1mA)
Response time	2ms or longer or 4ms *1 or longer

2.2 Output

■ NPN specifications

Method	NPN open-collector (negative common type) Photocoupler insulation method
Load	24V DC ±10%, 50mA/point (resistance load)
Residual voltage	1.0V
Response time	2ms or longer or 4ms *1 or longer

■ PNP specifications

Method	PNP open-collector (positive common type) Photocoupler insulation method
Load	24V DC ±10%, 50mA/point (resistance load)
Residual voltage	1.0V
Response time	2ms or longer or 4ms *1 or longer

*1 This time applies when three or more optional I/O interface boards are installed.

3. Caution items

1. When using a dual-lead proximity sensor as an input signal, check whether or not the electrical specifications of the sensor output signal are within the input signal specifications of the controller. For example, if the residual voltage is large at turn on or off, this may cause malfunction.

2. Take noise preventive measures when using an inductive load such as a solenoid valve as an output load. For example, connect a diode (high-speed type) in parallel at both ends of a load, as a surge killer to protect against noise.

3. If a short occurs in the load or an excessive current flows, the over-current protective circuit shuts off the interface circuit.
   Once this circuit is activated, it may be required to replace parts in order to restore it to its previous state. Additionally, be sure to perform the operation within the rated load. Furthermore, heat generated inside may lead to burning damage if operated beyond the rated load.

4. As a noise prevention, keep the machine power cables separate and make sure wires are well shielded.

5. When the controller main body is turned off, do not supply the external DC24V-power to the I/O interface continuously. If the external DC24V-power is supplied continuously, this may cause the controller to malfunction.

Chapter 5 SAFETY I/O interface

1. SAFETY I/O interface overview

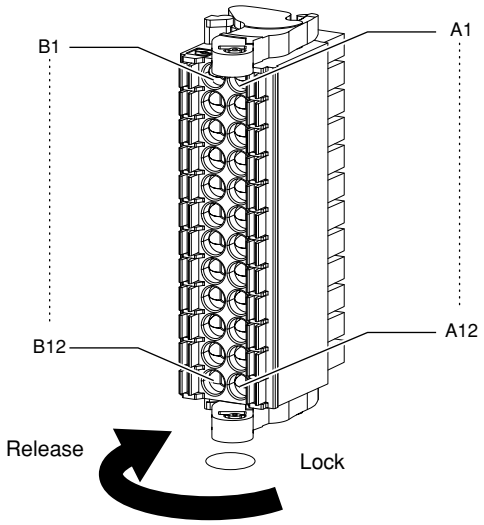
A SAFETY I/O interface is prepared to construct a robot safety circuit. Use the terminals to construct a safety circuit so that the system including the controller operates toward the safe side. Additionally, connect the input/output terminals correctly and effectively, and then start the operation after checking the operation of the safety circuit sufficiently.

Specifications	Connector name	Connector model No.	Wire thickness
SAFETY	SAFETY	DFMC 1,5/12-ST-3,5-LR BK 2BD PHOENIX	AWG24-16

1.1 Power

The emergency stop input uses either the controller's internal power for emergency stop, or external 24V-power. Additionally, the AUTO mode input (valid only for the CE specifications) uses the external 24V-power.

1.2 Connector I/O signals



PIN	I/O No.	PIN	I/O No.	Name	Remarks
B1	E-STOP2+	A1	E-STOP1+	Internal power (+) for emergency stop	
B2	E-STOP21	A2	E-STOP11	Emergency stop contact output	
B3	E-STOP22	A3	E-STOP12		
B4	E-STOP RDY2	A4	E-STOP RDY1	Emergency stop ready input	+24V/45mA
B5	E-STOP COM2	A5	E-STOP COM1		
B6	E-STOP2-	A6	E-STOP1-	Internal power (-) for emergency stop	
B7	ENABLE2+	A7	ENABLE1+	Enable switch contact output	1A/30Vmax Valid only when PBX-E is connected.
B8	ENABLE2-	A8	ENABLE1-		
B9	AUTO2+	A9	AUTO1+	AUTO mode input	7mA at24V Valid only for the CE specifications
B10	AUTO COM2	A10	AUTO COM1		
B11	MP RDY2+	A11	MP RDY1+	Motor power ready output	DC30V/300mAmax (MOS FET contact)
B12	MP RDY2-	A12	MP RDY1-		

The input/output signals have two systems, A line and B line of the connector.

CAUTION

- **Construct a physical emergency stop circuit so that the system including the controller operates toward the safe side.**
- **Do not connect any external power to "E-STOP+/-" of the internal power for the emergency stop. Additionally, do not use "E-STOP+/-" for a purpose other than the emergency stop.**

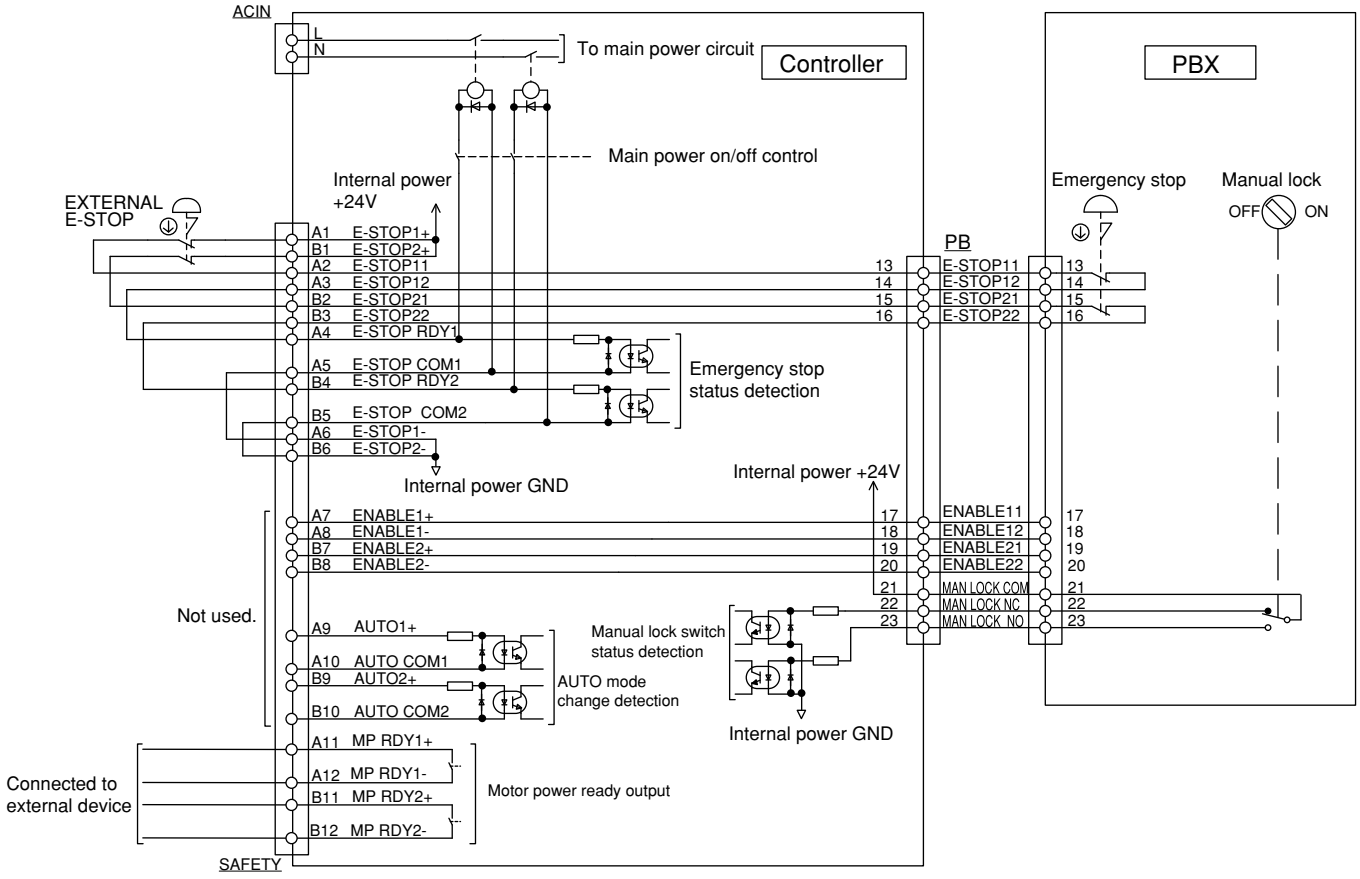
For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

1.3 Connection example combining the programming box with external emergency stop circuitry

CAUTION

- **Construct an external emergency stop circuit so that the emergency stop function of the overall system including the controller operates securely.**
- **"E-STOPRDY*" needs a relay or photocoupler drive current of 45mA or more.**

1.3.1 Connection example of controller with normal specifications and PBX

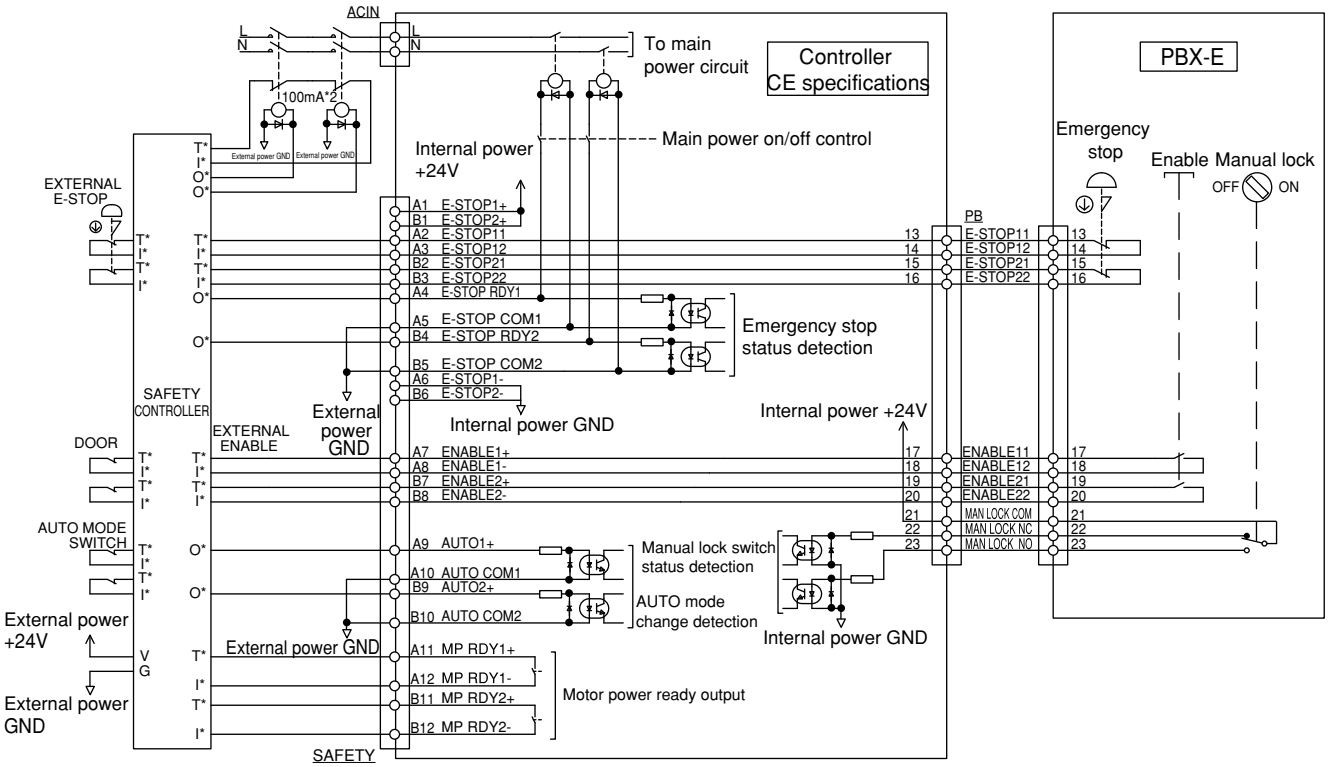


■ Operation description

- Use the internal power for the emergency stop. Short-circuit "E-STOP COM*" and "E-STOP*-".
- In the connection example, the emergency stop button on the programming box and external emergency stop button are connected in series.
  a. In the normal operation status, "E-STOP*+" is connected to "E-STOPRDY*" through each emergency stop button and SAFETY connector to turn on the motor power relay inside the controller.
  b. In the emergency stop status, the current does not flow to "E-STOP RDY*" of the SAFETY connector and the motor power turns off.
- When the programming box and SAFETY connector are removed, the robot enters the emergency stop status.
- The following PB connector pins of the PB terminator supplied with the controller are short-circuited and the automatic operation is ready to start.

PB connector
13 pin - 14 pin
15 pin - 16 pin
17 pin - 18 pin
19 pin - 20 pin
21 pin - 22 pin

1.3.2 Connection example of controller with CE specifications and PBX-E



Operation description

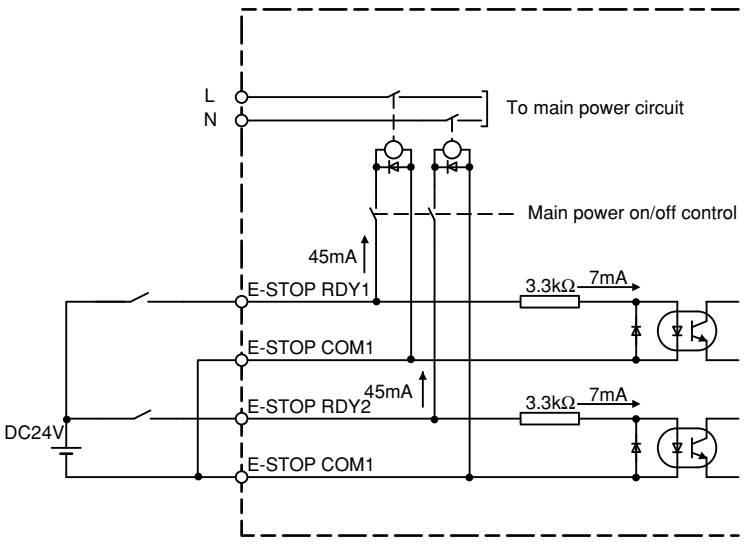
- This example does not use the internal power for the emergency stop. Use the external power and do not connect "E-STOP*+" and "E-STOP*-".
- The safety controller monitors the emergency stop and enable switch status of two systems. If any contact is open, the main power is shut down by the external contactor to put the robot in the emergency stop status.
- The safety controller operates the external main power according to the safety protection door open/close status, AUTO mode switch, and MP RDY* signal status of two systems. Additionally, the safety controller judges "E-STOP RDY*" and "AUTO*+" and outputs this judgment signal to the controller.
- To restart the external main power of the controller, it is necessary to input RESET to the safety controller.
- When the programming box and SAFETY connector are removed, the robot enters the emergency stop status.
- The following PB connector pins of the PB terminator supplied with the controller are short-circuited and the automatic operation is ready to start.

PB connector
13 pin - 14 pin
15 pin - 16 pin
17 pin - 18 pin
19 pin - 20 pin
21 pin - 22 pin

* For details about the CE specifications, see the Safety standards application guide.

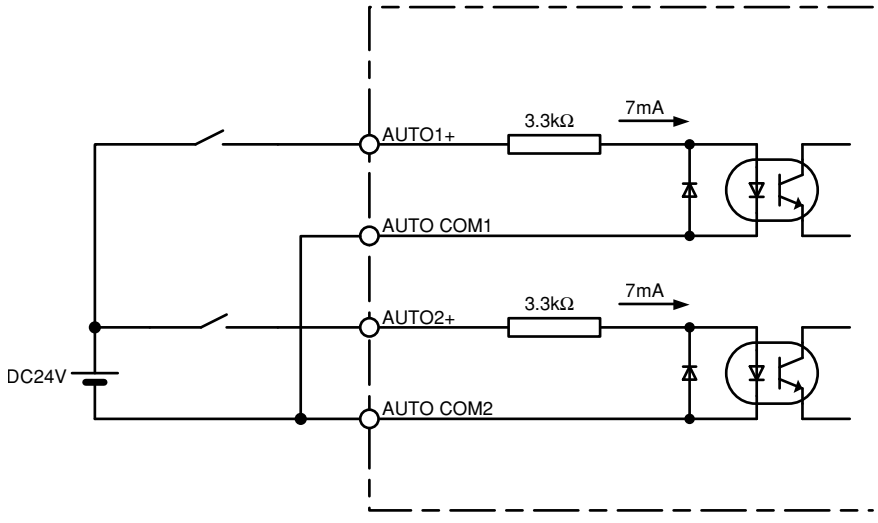
1.4 Dedicated input signal connections

1.4.1 Emergency stop inputs (E-STOP RDY*, E-STOP COM*)



The emergency stop inputs are used to construct a physical emergency stop circuit as a safety protection function of the overall system including the controller.
To operate the robot, the emergency stop input contact needs to be closed. For connection example, see "1.3.1 Connection example of controller with normal specifications and PBX".
When the emergency stop input contact is closed (ON), the servo power can be turned on. When any emergency stop input contact is open (OFF), the servo power cannot be turned on.
To drive the internal power relay that is connected in parallel, E-STOP RDY*/E-STOP COM* needs a current of 45mA.

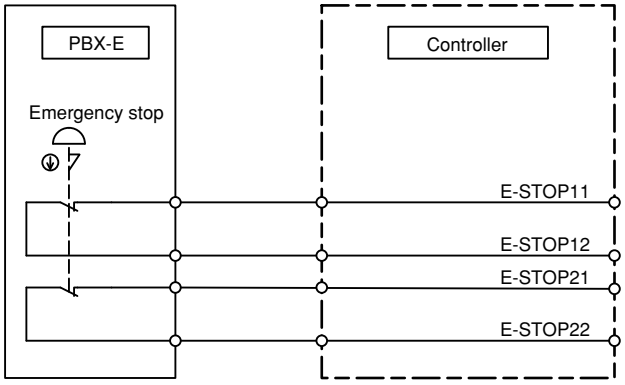
1.4.2 AUTO mode inputs (AUTO*+, AUTO COM*)



The AUTO mode inputs are valid only for the controller with the CE specifications. The AUTO mode inputs can change the external safety circuit of the controller to the AUTO mode and inform that the robot is in the automatic operation ready status. When either AUTO mode input turns off, the controller changes to the MANUAL mode. The AUTO mode inputs are valid only for the controller with the CE specifications. For the controller with the standard specifications, the operation mode can be changed only from the manual lock switch on the programming box.

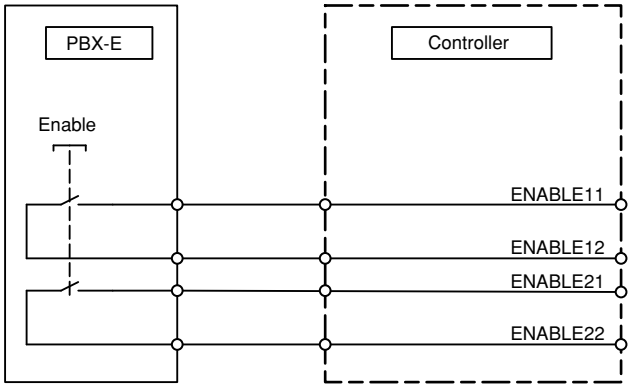
1.5 Dedicated output signal connections

1.5.1 Emergency stop contact outputs (E-STOP*1, E-STOP*2)



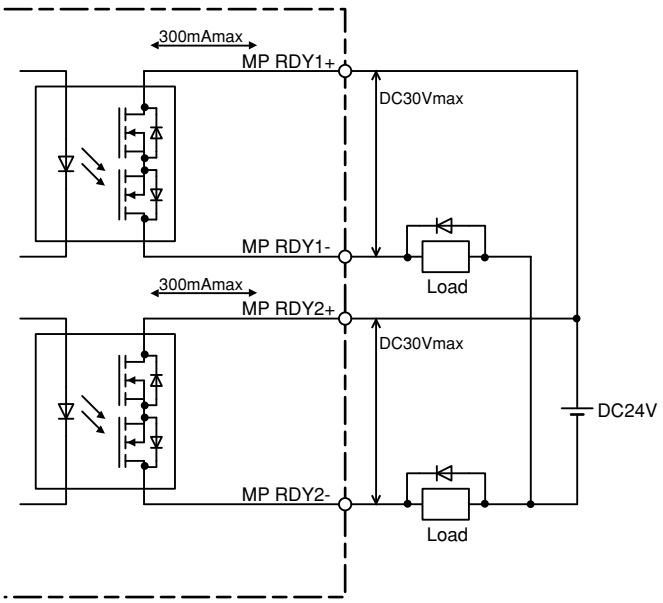
The emergency stop contact outputs are used to construct a physical emergency stop circuit as a safety protection function of the system including the controller. To operate the robot, the contact needs to be closed. For details about connections, see "1.3.1 Connection example of controller with normal specifications and PBX".
The emergency stop switch contacts are connected to the emergency stop switch contacts of the programming box.

1.5.2 Enable switch contact outputs (ENABLE*1, ENABLE*2)



The enable switch contact outputs are connected to the enable switch contacts of the programming box.
3-position enable switch status is informed to the external system as a safety protection function of the system including the controller.
Construct an external system so that it monitors the enable switch status (always on) in the MANUAL mode to permit the main power supply to the controller.

1.5.3 Motor power ready outputs (MP RDY*+, MP RDY*-)



This signal turns on when the controller can receive the external main power supply. When this signal turns on, this means that the servo on operation can be performed by supplying the main power and operating the servo on input signal.
If a serious alarm (alarm classification number 900s) that needs to turn off the power and turn it off again so as to reset the alarm, turn off the motor power ready output. This signal is connected to the PLC or external device and used to judge the main power supply on/off conditions.
The output current is up to 300mA.

Chapter 6 External communication interface

1. Overview

1.1 Communication overview

To perform the communication between the controller and external device, a communication port (RS-232C interface or Ethernet interface) is used to directly send the robot command communication command (SEND command) or send the command through the communication port.
As these communications are used individually or together, the robot is applicable to applications using an external communication.

1. Robot language command (SEND command) is used.

Example: SEND A TO CMU ... Sends the value of variable A to an external device through the RS-232C port.
SEND CMU TO P100 ... Receives the point data P100 through the RS-232C port.
SEND ETH TO ALL ... Receives the memory data of all systems through the Ethernet port.

The controller sends or receives the data corresponding to these commands.

* When using the RS-232C port and Ethernet port, specify “CMU” and “ETH”, respectively.

2. Various commands are directly sent from the external device through the communication port.

These commands are called "online commands".
When using this function, a part of the controller operation can be performed from an external device.

Example: @RUN ... Executes the program.
@READ PNT ... Reads out all of point data.
@MOVE P,P123,SPEED=30... Moves the robot 1 to point 123 at 30%-speed.

NOTE

All online commands can be used only when the controller is in the AUTO mode and the control authority is released externally.
When the controller is not in the AUTO mode, some commands, such as "@MOVE" cannot be executed.

1.2 Online and offline modes

The controller provides two communication modes, online mode and offline mode.

1. OFFLINE mode

In OFFLINE mode, the communication between the robot and external unit is executed with SEND commands in the program.
When using the RS-232C port and Ethernet port, specify “CMU” and “ETH”, respectively.

• SEND command (robot → external unit)

```
SEND <source file> TO CMU
SEND <source file> TO ETH
```

• SEND command (external unit → robot)

```
SEND CMU TO <destination file>
SEND ETH TO <destination file>
```

2. ONLINE mode

In ONLINE mode, commands can be directly sent to the robot from the external device.
Commands to be sent directly from the external device are called "online commands".
The SEND command in the robot program is valid even in the offline command.
To set ONLINE mode, select "ONLINE" as a communication parameter. The ONLINE statement in the program can also be used to set ONLINE mode.

• ONLINE command format

```
@ [_] <online command> [<_command option>] <termination code>
```

[ ] shows optional arguments.

@..... Start code (=40h)

_ ..... Blank

<online command>..... See the programming manual.

<command option> ..... See the programming manual.

<termination code> ..... CRLF(= 0Dh + 0Ah) code

- Robot control commands start with the start code “@"(=40h) and are executed by sending a statement that the termination code CRLF ((= 0Dh +0Ah) code) is put at its end. As exceptions, the control code "^C" or “^V" does not need the start code and termination code.
- One line consists of up to 80 characters except for the termination code ((CRLF(= 0Dh + 0Ah) code).
- The communication command consists of <online command> and <command option> parts. Some commands have no <command option> part or multiple <command option> parts.
- Character codes to be used are JIS8 unit system codes (KATAKANA characters are added to the ASCII codes). For details about the character code table, see "1.3 Character code" in this Chapter.
- One or more space must be put between the <online command> and <command option> parts.
- The <command option> part is specified by the user. Check the details of each communication command, and then input appropriate data.

NOTE

- In offline mode, online commands from external devices cannot be received.
- When using online commands be sure to switch to online mode.
- In the offline mode, the controller cannot be connected from the PC support software "RCX-Studio".Therefore, when connecting the controller using the support software, be sure to put the controller in the online mode.

1.3 Character code

HEX.	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0			SP	0	@	P		p				―	タ	ミ		
-1		XON	!	1	A	Q	a	q			。	ア	チ	ム		
-2			"	2	B	R	b	r			「	イ	ツ	メ		
-3	STOP	XOFF	#	3	C	S	c	s			」	ウ	テ	モ		
-4			$	4	D	T	d	t			、	エ	ト	ヤ		
-5			%	5	E	U	e	u			・	オ	ナ	ユ		
-6			&	6	F	V	f	v			ヲ	カ	ニ	ヨ		
-7			'	7	G	W	g	w			ァ	キ	ヌ	ラ		
-8	BS		(	8	H	X	h	x			ィ	ク	ネ	リ		
-9	TAB		)	9	I	Y	i	y			ゥ	ケ	ノ	ル		
-A	LF	EOF	*	:	J	Z	j	z			ェ	コ	ハ	レ		
-B			+	;	K	[	k	{			ォ	サ	ヒ	ロ		
-C			,	<	L		l	|			ャ	シ	フ	ワ		
-D	CR		-	=	M	]	m	}			ュ	ス	ヘ	ン		
-E			.	>	N	^	n	~			ョ	セ	ホ	"		
-F			/	?	O		o				ッ	ソ	マ	。		

Note 1: The above character codes are written in hexadecimal.

Note 2: SP indicates a blank space.

Note 3: Only capital letters can be used for robot language.
Small letters are used for program comments and so on.
However, these cannot be entered on the programming box.

Note 4: BS deletes the preceding character in the receive buffer.

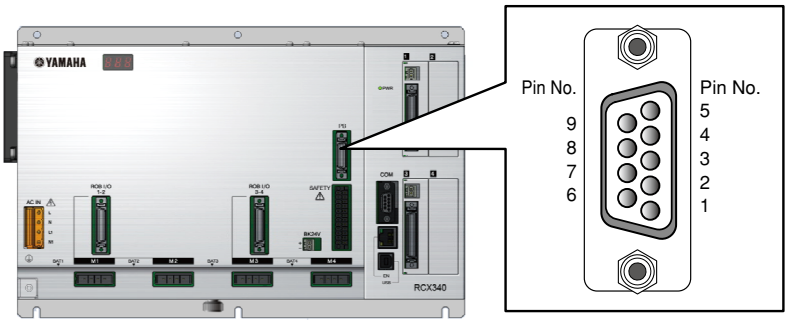
Note 5: TAB is replaced with one space.

2. RS-232C

2.1 Connectors and cables

The RS-232C interface connector is located on the front panel of the robot controller as shown below.

RS-232C interface

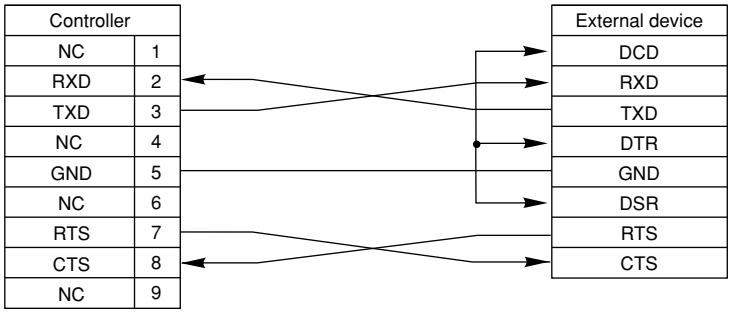


Pin No.	Name	Description	Input/ output
1	NC	Not used	
2	RXD	Receive data	Input
3	TXD	Send data	Output
4	NC	Not used	
5	GND	GND	
6	NC	Not used	
7	RTS	Request to send	Output
8	CTS	Permission to send	Input
9	NC	Not used	

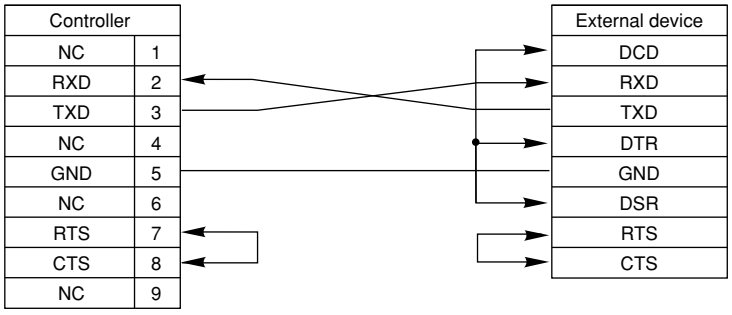
The controller connector is a 9-pin D-Sub female connector.

■ Cable wiring for connections

a. Cable capable of hardware busy control



b. Cable not using control wires



* When arranging signal wiring on an external device, be sure to refer to the manufacturers manual.

2.2 Communication specifications

Transmission mode	Full duplex
Synchronous system	Start-stop synchronization
Baud rate [bps]	4800, 9600, [19200], 38400, 57600, 115200
Character length [bit]	7, [8]
Stop bit [bit]	[1], 2
Parity	None, even, [odd]
RTS/CTS control	Yes, [No]
Termination code	CR, [CRLF]
XON/XOFF control	[Yes], No
Receive buffer	1024 bytes
Transmit buffer	1024 bytes

Numbers or items in square brackets [ ] indicate settings after initialization.

NOTE

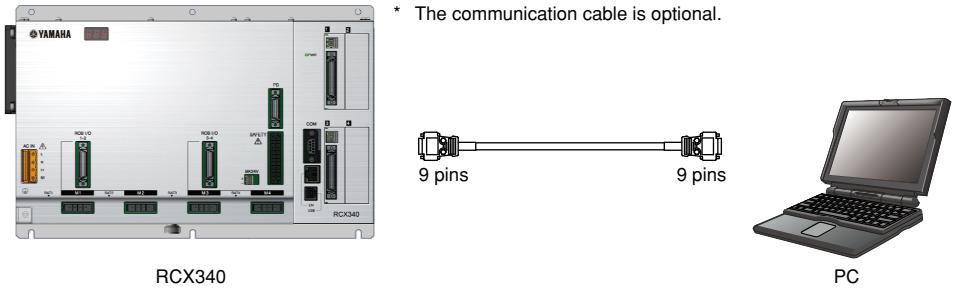
1) Termination code
   - **Robot transmit**
     When CRLF (carriage return + line feed) is selected:
     Transmits data with a CR code (0DH) and LF code (0AH) added at the end of a line.
     When CR (carriage return) is selected:
     Transmits data with a CR code (0DH) added at the end of a line.
   - **Robot receive**
     Receives data by treating entries made up to the CR code as 1 line and ignoring the LF code, regardless of which termination code is selected.
2) If the "Display language" parameter is set to "JAPANESE" in SYSTEM mode, then set the character length to 8 bits. Katakana letters (Japanese phonetic) cannot be output from the communication port if set to 7 bits.

2.3 Connections

The following are examples of connecting to a PC using the YAMAHA communication cable.

1. Using the PC's COM port

COM port

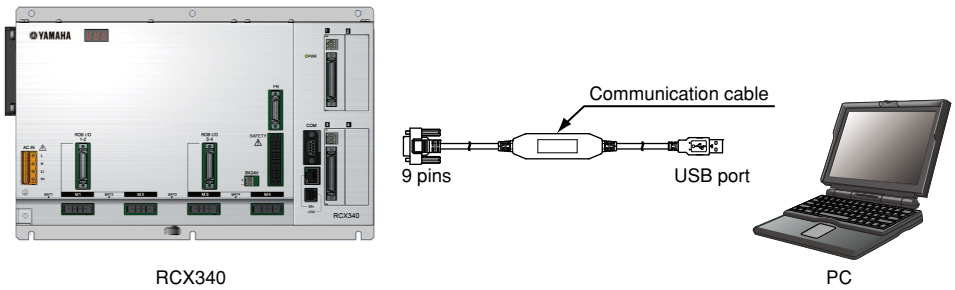


* The communication cable is optional.

Communication cable	Length	Cable type No.
9 pins ↔ 9 pins	5m	KAS-M538F-10

2. Using the PC's USB port

USB port



Communication cable	Length	Cable type No.
9 pins ↔ USB Port	5m	KBG-M538F-00

2.4 Communication parameter setting

Parameters and communication mode related to the communication that uses the RS-232C interface are set. There are six communication parameters.

Communication parameter set values

	Item name	Set value	Initial value	Remarks
1	LINE	ONLINE, OFFLINE	ONLINE	Sets the mode of the communication with the computer (online/offline). The online command can be executed only in the online mode.
2	Baud Rate	4800, 9600, 19200, 38400, 57600, 115200	19200	Sets the communication speed. When the communication speed is set at a high speed, the communication error occurs easily. If the communication error occurs frequently, set the communication speed to a low speed.
3	Length	7, 8	8	Sets the data bit length. When the data bit length is set at "7 bits", KATAKANA characters cannot be sent.
4	Stop Bits	1, 2	1	Sets the stop bit length. If the communication error occurs frequently, set the stop bit length to "2 bits".
5	Parity	0: None, 1: Odd, 2: Even	1	Sets the parity check. Use the parity check as much as possible.
6	Flow	0: None 1: Xon/Xoff 2: RTS/CTS	1	Sets whether or not the data flow control using the XON/XOFF code or RTS/CTS signal is performed. When the data flow control is not performed, data missing may occur. So, set the data flow control as much as possible.
7	Eof	0:CRLF 1:CR	0	Sets the line feed code.

■ Setting the communication mode and communication parameters

Step 1 ***Select [System] - [Communication Setting] from the initial screen.***

Step 2 ***Set the communication mode.***

Press the F2 (ONLINE) or F3 (OFFLINE) key on the "RS-232C" screen to change the setting to (ONLINE) or (OFFLINE).

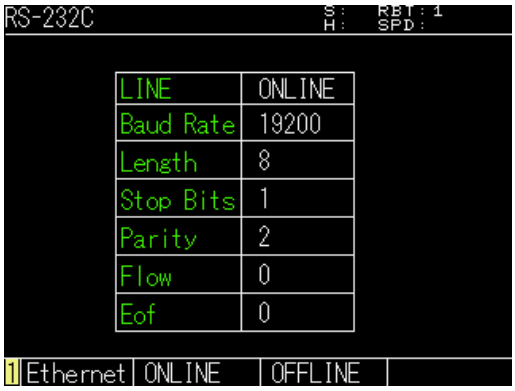
Step 3 ***Set the communication parameters.***

Use the cursor keys to select the set value you want to edit, input a numeric value, and then press the Enter key.
To set the data you have edited, press the Enter key until the cursor selects the numeric value in (BaudRate).

* When pressing the ESC key halfway, the contents you have edited are canceled.

Step 4 ***Press the ESC key to exit the data editing.***

▶ Step 1 **Setting the communication mode and communication parameters**



NOTE

- External offline commands are not accepted in the offline mode.
- When using offline commands, be sure to set the mode to the online mode.
- In the offline mode, the controller cannot be connected from the PC support software "RCX-Studio". Therefore, when connecting the controller using the support software, be sure to put the controller in the online mode.

2.5 Communication flow control

Software flow control (XON/XOFF) and hardware flow control (RTS/CTS) can be set.

2.5.1 Flow control during transmit

XON/XOFF and CTS indicate whether the other party can receive data.

Flow Control	Yes	No
XON/XOFF	Temporarily stops transmission when XOFF is sent from the other party. Resumes transmission when XON is sent.	XON (11H) and XOFF (13H) do not affect transmission even when they are received.
RTS/CTS	Stops transmission while CTS is OFF.	Stops transmission while CTS is OFF.

NOTE

1) Transmission stops when transmission is disabled in either of XON/XOFF or RTS/CTS flow control.
2) CTS must be on during transmission regardless of flow setting. When RTS/CTS is set to "No", the CTS should always be set on. However, if CTS is connected to RTS of the other party, CTS may not always be on causing the transmission to halt, depending on the other party specifications.

2.5.2 Flow control during receive

To prevent overflow when receiving data, XON/XOFF and RTS are used to notify the other party whether or not it is possible to receive data.

Flow Control	Yes	No
XON/XOFF	Transmits XOFF when available space in receive buffer falls below a certain capacity. Transmits XON when receive buffer is empty.	XON and XOFF are not transmitted. XON and XOFF are ignored if received.
RTS/CTS	Turns RTS off when available space in receive buffer falls below a certain capacity. Turns RTS on when receive buffer is empty.	RTS is always on.

NOTE

"XON/XOFF" and "RTS/CTS2 operate individually. For example, when all flow controls are set enabled, XOFF is sent and RTS is turned off if the free space of the receive buffer becomes insufficient. After that, when the free space of the receive buffer is recovered, XON is sent and RTS is turned on.

2.6 Other caution items

1) **The controller allows receiving data as long as the receive buffer has a free area.**
The receive buffer is cleared in the following cases.
   - When the power was turned off and turned back on.
   - When the program was reset.
   - When an ONLINE CMU statement or OFFLINE CMU statement was executed according to the robot language.
   - When the communication parameter was changed or when the initialization was executed.

2) **Turning on an external device might sent incorrect data to the robot controller which is readying to receive data when the power is turned on. That incorrect data might then be stored in the receive buffer if the controller is turned on prior to the external device and cause communication errors.**
In such a case, carry out the following steps:
   - Reset the program before program execution.
   - Clear the receive buffer by placing an ONLINE CMU statement or OFFLINE CMU statement at the top of the program.
   - Turn on the external device, and then turn on the controller.

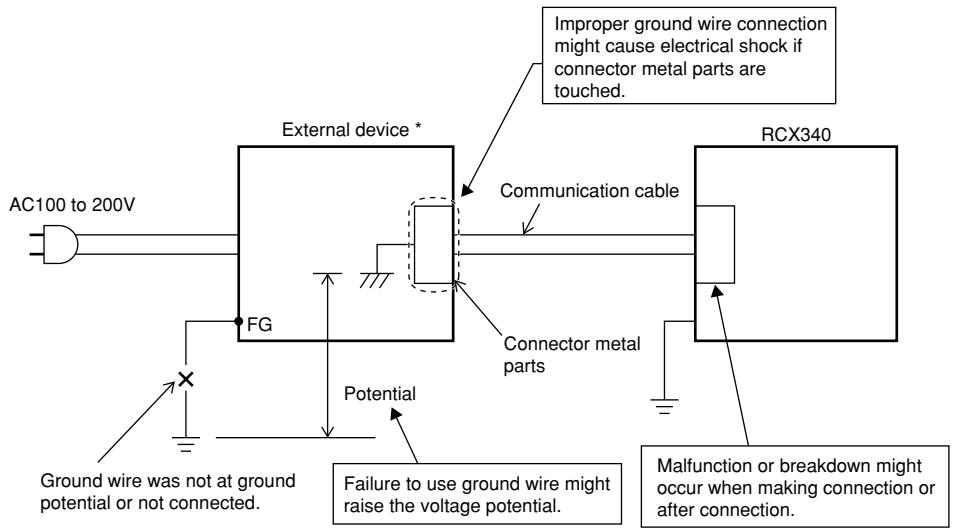
3) **When the external device does not support handshake protocols (BUSY control, XON/XOFF control), the data processing speed becomes slower than the communication speed, and this can generate a communication error. In this case, take countermeasures such as reducing the communication speed (baud rate).**

4) **When the communication speed is set at a high rate, communication errors may occur due to external noise. In this case, take countermeasures such as reducing the communication speed.**

5) **No response can be returned to the transmission from the external device during point trace execution. The response is returned after the execution has been completed.**

6) **Improper connection to an external device might cause electrical shocks, controller malfunctions or external device malfunctions or breakdowns, depending on the external device specifications and operating conditions.**
Always comply with the following points when connecting an external device.
   1. When the external device has a ground wire, be sure to ground it properly.
   2. If using an external device that does not have a ground wire, check whether or not its structure is designed to protect from electrical shock. Be sure to use an external device that is designed to protect from electrical shocks.

Problems caused by poor connections



* External device: Notebook PC using an AC adapter, etc.

3. Ethernet

Features of Ethernet

The RCX340 controller adopts the TCP/IP protocol. Therefore, the RCX340 controller can exchange the data with a TCP/IP protocol built-in device.

CAUTION

Connect the Ethernet port of the RCX340 only to the PC for development, or other controller or PC. Therefore, do not connect this port to the public telephone line.

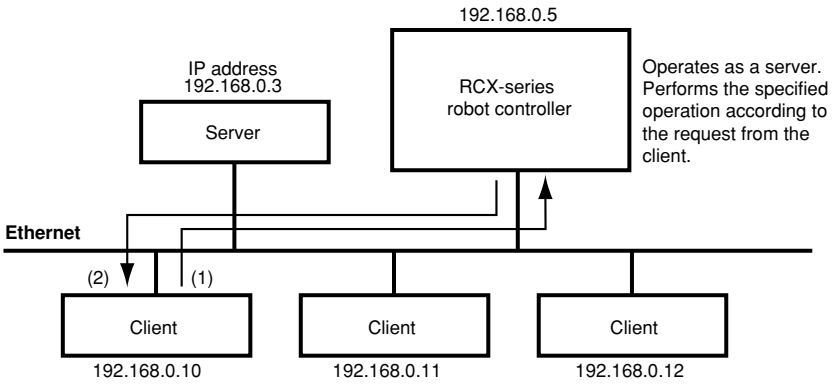
- As the 100BASE-TX specifications are adopted, cables to be used are UTP cables (shield-less twist pair cable) or STP cables (shielded twist pair cable). Therefore, the wiring work is very easy.
- Multiple controllers can be connected to the same network and all of the information can be controlled from the specific personal computer.
- Since the robot controller operates as a TELNET (socket) server, you can easily access the robot controller from the TELNET terminal, such as a personal computer. (For details about how to install TELNET of the personal computer, see the manual for relevant product.)

Additionally, for details about other device, such as network setting on the personal computer, see also the manual for relevant product. Furthermore, for details about robot programming, see the programming manual.

* Ethernet is a registered trademark of Xerox in the United States.

Communication mechanism

TCP/IP can identify each device uniquely by assigning the number unique to each device called "IP address" to each device connected to the network.
Therefore, the connection process is performed first by specifying the IP address of a robot controller to be communicated with. After exchanging the data, the connection is disconnected.
At this time, the controller operates as a server, monitors the connection request from the client (mating device, such as personal computer), and performs the specified operation according to the request from the client.
Therefore, the voluntary connection to other server from the robot controller is not performed.



Device, such as a personal computer becomes a client, and connects to the server to give the instruction so as to perform a specified operation.

(1) The connection process is performed by specifying the IP address of a robot controller to be communicated with. (Above example shows the client 192.168.0.10 has specified the robot controller 192.168.0.5 and made a connection.)

(2) After making the connection, the robot controller runs a specific series of actions according to instructions from the client.

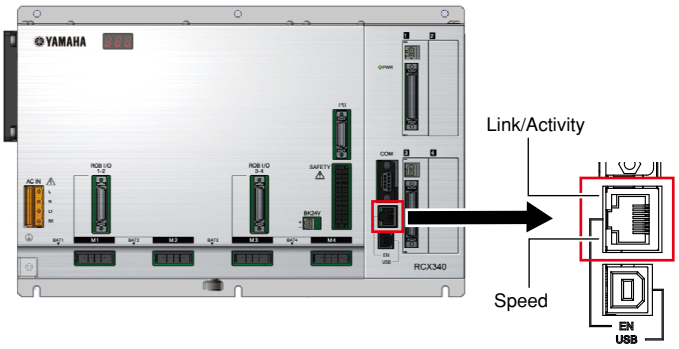
NOTE

During multitasking by the client, one client can connect to multiple robot controllers at the same time.
Only one client can make a simultaneous connection to one robot controller unit.
The IP address or subnet is set from the programming box.

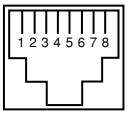
3.1 Connectors and cables

The Ethernet interface is located at the position shown in the figure below.

External interface



Modular connector



Pin number	Signal name
1	TD+
2	TD-
3	RD+
4	N.C
5	N.C
6	RD-
7	N.C
8	N.C

*Pin numbers 4, 5, 7, and 8 are not used.

The Ethernet cable is standardized in ANSI/TIA/EIA568A. To avoid miswiring or malfunction, be sure to use a cable that complies with this standard.
Additionally, 100BASE-TX needs transmission characteristics category 5 or higher.

Straight cable

This cable is used to connect the robot controller or mating device to the hub.

T-568A pin assignments

Signal name	Wiring color	Pin number
TD+	Green/white	1
TD-	Green	2
RD+	Orange/white	3
Not use	Blue	4
Not use	Blue/white	5
RD-	Orange	6
Not use	Brown/white	7
Not use	Brown	8

T-568A pin assignments

Pin number	Wiring color	Signal name
1	Green/white	TD+
2	Green	TD-
3	Orange/white	RD+
4	Blue	not use
5	Blue/white	not use
6	Orange	RD-
7	Brown/white	Not use
8	Brown	Not use

* 100BASE-TX does not use the wiring of 4, 5, 7, and 8 pins.
* There is a straight cable with T-568B pin assignments wired.

Cross cable

This cable is used to directly connect the robot controller and mating device. Additionally, when the hub does not have any cascade port, this cable is used for the cascade connection of the hub.
For devices applicable to Auto MDI/MDI-X, the straight cable can be used when the controller and mating device are connected directly.

T-568A pin assignments

Signal name	Wiring color	Pin number
TD+	Green/white	1
TD-	Green	2
RD+	Orange/white	3
Not use	Blue	4
Not use	Blue/white	5
RD-	Orange	6
Not use	Brown/white	7
Not use	Brown	8

T-568A pin assignments

Pin number	Wiring color	Signal name
1	Orange/white	TD+
2	Orange	TD-
3	Green/white	RD+
4	Blue	not use
5	Blue/white	not use
6	Green	RD-
7	Brown/white	Not use
8	Brown	Not use

* 100BASE-TX does not use the wiring of 4, 5, 7, and 8 pins.

3.2 Communication specifications

Specification item \ Type	Ethernet applicable unit
Network specifications	In conformity with Ethernet (IEEE802.3)
Communication speed	100Mbps (100BASE-TX)
Connector specifications	RJ-45 connector (8 modular connectors)
Cable specifications	UTP cable (shieldless twist pair cable) or STP cable (shielded twist pair cable) applicable to category 5 or higher
Maximum cable length	100m (between hub and controller)
Communication mode	Full duplex
Network protocol	Application layer : TELNET Transport layer : TCP Network layer : IP, ICMP, ARP Data link layer : CSMA/CD Physical layer : 100BASE-TX
Number of simultaneous log-in cycles	1
IP address setting	Setting is made from the programming box.
Monitor LED	Link/Activity, Speed
IP address initial value	192.168.0.2
Subnet mask initial value	255.255.255.0
Default gateway initial value	192.168.0.254

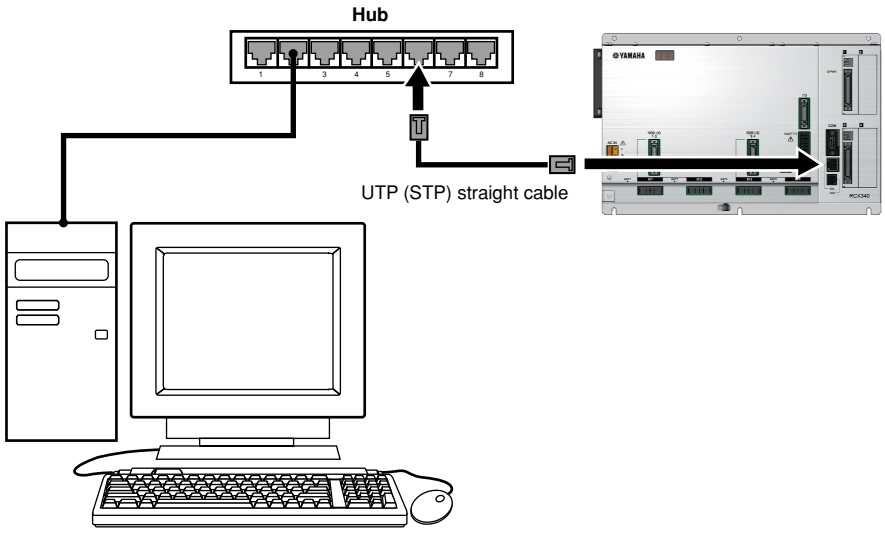
* The specifications and external views are subject to change without prior notice due to continual improvement.

CAUTION

YAMAHA uses FL HUB (PHOENIX CONTACT) for the operation check. When incorporating a system, it is recommended to use this hub. It is not assumed to use general consumer hubs at factory. Such hubs may have low noise immunity. Therefore, note that YAMAHA does not warrant the operation of a hub other than that specified above.
Be sure to connect a hub with high noise immunity to the controller.

3.3 Connections

The UTP cable (shieldless twist pair cable) or STP cable (shielded twist pair cable) applicable to category 5 or higher is used for the connections. The wiring type uses the straight type.
To make the connections, insert the modular jack of the cable into the modular connector of the controller until a click sounds. In the same manner, insert also the modular jack into the modular connector of the hub.



CAUTION

YAMAHA uses FL HUB (PHOENIX CONTACT) for the operation check. When incorporating a system, it is recommended to use this hub.
It is not assumed to use general consumer hubs at factory. Such hubs may have low noise immunity. Therefore, note that YAMAHA does not warrant the operation of a hub other than that specified above.
Be sure to connect a hub with high noise immunity to the controller.

CAUTION

The maximum cable length between the hub and controller is 100m.
When making the connections, be sure to refer to the manuals for mating device, such as personal computer or peripheral device, such as hub, etc.
When the communication mode of the hub can be set manually, set it to "100Mbps/Full duplex".

NOTE

To connect to the mating device, it is recommended to make connections using the straight cable through the hub. It is also possible to directly connect to the mating device using the cross cable without using the hub. In this case, the communication may not be performed depending on the LAN adapter of the mating device.

3.4 Parameter setting on controller (server)

It is necessary for the controller to set the IP address, subnet mask, and gateway port number. These settings are performed from the programming box.

Communication parameter set values on controller (server)

	Item name	Initial value	Remarks
1	LINE	ONLINE	Set value: ONLINE (online), OFFLINE (offline) Sets the mode of the communication with the computer (online/offline). The online command can be executed only in the online mode.
2	IP Address	192.168.0.2	Sets the IP address. This IP address is a number unique to each device that is assigned to identify multiple devices connected to the network. Therefore, it is necessary to set and control the IP address so that it is not duplicated with that of other device.
3	Subnet Mask	255.255.255.0	Selects the subnet mask. The subnet mask is used to finely separate the network.
4	Default Gateway	192.168.0.254	Sets the gateway. Actually, specify the IP address of the router. This router is a device that relays the information from a certain network to other network when there are multiple networks.
5	PORT ※	23 (TELNET port)	Sets the TCP port number of the controller. Specify the port number that is set here together with the IP address when the client connects to the robot controller.

*If a setting other than TELNET port (23) is made, the negotiation using the TELNET protocol is not attempted.
(The communication becomes the simple socket communication.)
*When changing the port, it is recommended to use a port number other than "Well-Known Port (0 to 1023)".

CAUTION

When connecting the robot controller to the existing network, be sure to check with the network administrator regarding the settings, such as IP address, subnet mask, and gateway.

NOTE

The IP address is separated into network address and host address sections. The network address section is extracted from the IP address by AND processing with the subnet mask. The remaining portion is the host address section. Devices belonging to the same network must all be set to have the same network address. The host address, however, should be different for every device and set so that no two devices have the same number. The first and the last host address numbers are reserved for the system so be sure not to set these as the IP address.
When the IP address for example is 192.168.0.10 and the subnet mask is 255.255.255.0, the network address section is found to be 192.168.0 and the host address section to be 10 by means of AND processing with the subnet mask. In this case, the network address section of all other devices belonging to that network must all be 192.168.0. The host address section of those other devices on the other hand, must be set to a number other than 10. The number 0 and 255 are reserved, so do not use them for setting the host address.
So when a device having an IP address of 192.168.0.10 and a subnet mask of 255.255.255.0 belongs to a particular network and you want to add another device to that network, then you would assign IP addresses from among 192.168.0.1 to 192.168.0.9 and 192.168.0.11 to 192.168.0.254.

NOTE

The RCX340 is not applicable to IP address auto acquisition functions such as DHCP and BOOTP. You must set the IP address manually.

■ Setting the communication mode and communication parameters

Step 1 *Display the "Ethernet" screen.*

Select (System) - (Communication Setting) from the initial screen. Next, press the F1 key (Ethernet) on the "RS-232C" screen.

Step 2 *Set the communication mode.*

Press the F2 (ONLINE) or F3 (OFFLINE) key on the "RS-232C" screen to change the setting to (ONLINE) or (OFFLINE).

Step 3 *Set the communication parameters.*

Use the cursor keys to select the set value you want to edit, input a numeric value, and then press the Enter key.

To set the data you have edited, press the Enter key until the cursor selects the numeric value in (IP Address).

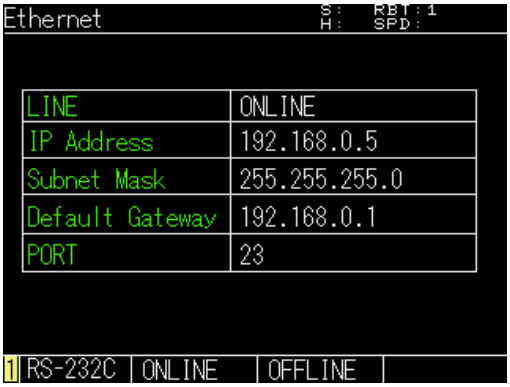
* *When pressing the ESC key halfway, the contents you have edited are canceled.*

Step 4 *Press the ESC key to exit the data editing.*

NOTE

- External offline commands are not accepted in the offline mode.
- When using online commands, be sure to put the controller in the online mode.
- In the offline mode, the controller cannot be connected from the PC support software "RCX-Studio".
  Therefore, when connecting the controller using the support software, be sure to put the controller in the online mode.

▶ Step 1 **Setting the communication mode and communication parameters**



3.5 System setting on personal computer (client)

The following describes the basic setting procedure by using Windows7 as an example. For details about other OS or device, see the relevant manual.
Additionally, for details about setting procedure, see the first step guide supplied with Windows7.
Additionally, the set values, such as IP address need to be changed appropriately according to the customer's network environment.

* Windows7 is a registered trade mark of Microsoft in the United States.

3.5.1 Setting the TCP/IP protocol

Step1 ***Open the "Control Panel" window.***

Step2 ***Click the [Network and Sharing Center] icon in the "Control Panel" window.***

Step3 ***Click [Change adapter settings] in the "Network and Sharing Center" window.***

Step4 ***Right-click the [Local Area Connection] icon to open the "Local Area Connection Properties" window.***

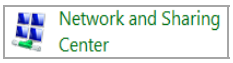
Step5 ***Check that [Client for Microsoft Networks] and [Internet Protocol Version 4 (TCP/IPv4)] are shown in the "Networking" tab window.***

Step6 ***Check on [Internet Protocol Version 4 (TCP/IPv4)] and click the [Properties] button.***

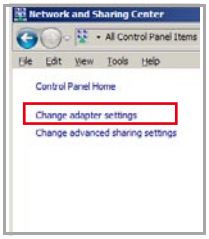
Step7 ***According to the operating conditions, enter the IP address, subnet mask, and gateway on the personal computer side in the "Internet Protocol Version 4 (TCP/IPv4) Properties" window.***
Set the DNS server according to the operating conditions.

Step8 ***Click the [OK] button to close the setting window.***

Step 2 **[Network and Sharing Center] icon**

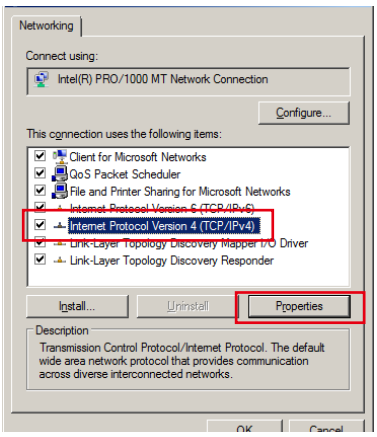


Step 3 **[Change adapter settings] icon**

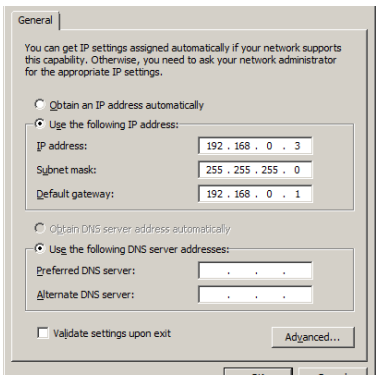


Step 4 **[Local Area Connection] icon**

Step 5 **"Local Area Connection Properties" window**



Step 7 **Entering the IP address, etc. on the personal computer side**



3.6 Connection check using "Ping"

After the network has been set, check using "ping" if the communication can be performed correctly. "ping" is a network diagnosis tool that is incorporated into OS as a standard accessory.
The following describes how to use "ping" that is incorporated into Windows7. For details about other OS or device, see the relevant manual.

Step 1 ***From the [Start] button, select [All Programs] -> [Accessories] -> [Command Prompt] to display the "Command Prompt" window.***

Step 2 ***Execute "ping".***

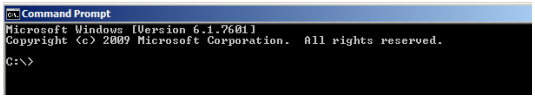
Enter "ping xxx.xxx.xxx.xxx" next to ">", and then press the Enter key. At this time, enter the IP address of the controller in the "xxx.xxx.xxx.xxx" portion.

Step 3 ***Check the "ping" results.***

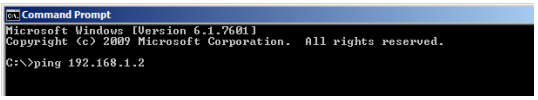
When communicated successfully, the display becomes as follows.
Reply from xxx.xxx.xxx.xxx: bytes=32 time<1ms TTL=64
(See also figure (1).)

If the communication fails, "Request timed out." is displayed. (See figure (2).)
In this case, review the network device, controller setting, and wiring to solve the problem.

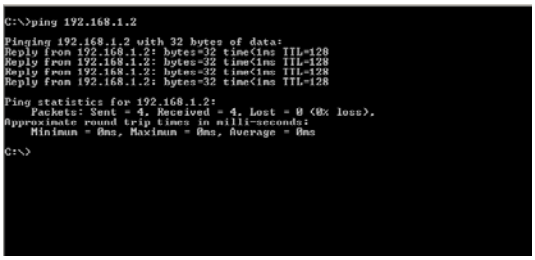
Step 1 **"Command Prompt" window**



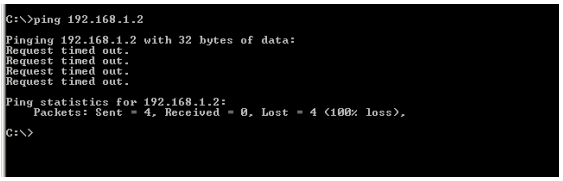
Step 2 **Executing "ping"**



Step 3 **(1) Communicated successfully.**



(2) Communication fails.



3.7 Communication example using "TELNET.EXE"

The following describes how to make the connections using "TELNET.EXE". For details about how to install TELNET in the personal computer, see the manual for relevant product. It is preconditioned that the IP address of the robot is set at "92.168.0.2" and the port number is set at "23.

Step 1 ***From the [Start] button, select [Accessories] -> [Run] to display the "Run" window.***

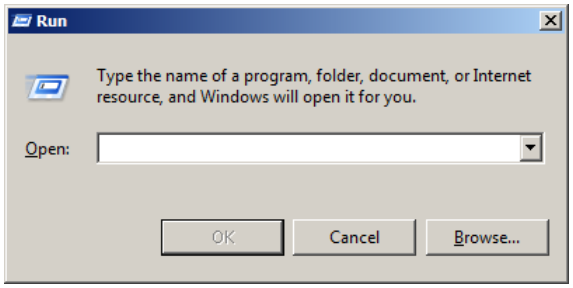
Step 2 ***After you have input "telnet" in the "Open" field, and then click the [OK] button.***

Step 3 ***Input "open xxx.xxx.xxx.xxx" next to ">", and then press the Enter key.***

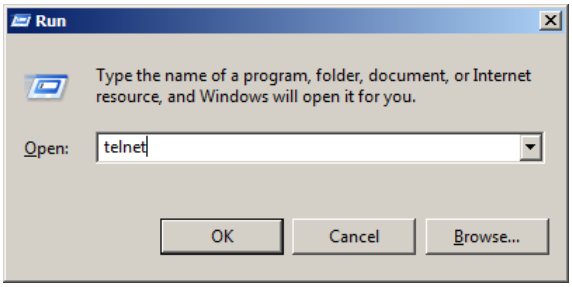
At this time, enter the IP address of the controller in the "xxx.xxx.xxx.xxx" portion. The controller is then connected and the message "Welcome to RCX340" will appear.

Step 4 ***To cancel the connection with the controller, input "LOGOUT" or "BYE", and then press the Enter key.***

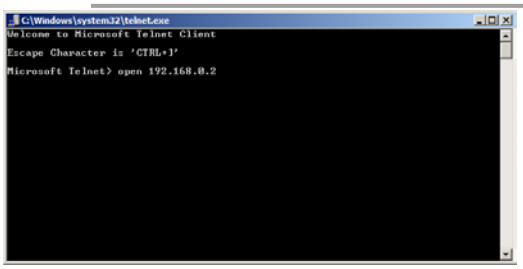
Step 1 "Run" window (1)

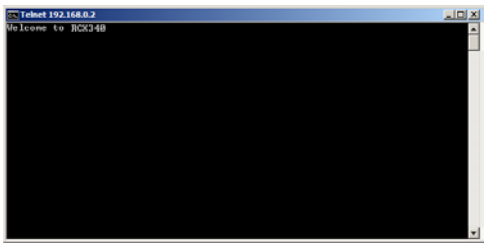


Step 2 "Run" window (2)



Step 3 "telnet" window (1)





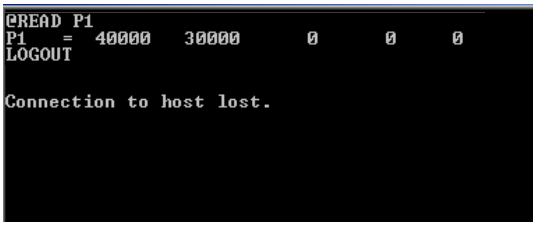
Step 4 "telnet" window (2)

Step5 ***The message appears and the connection is then canceled.***
Press any key to return to Step 3.

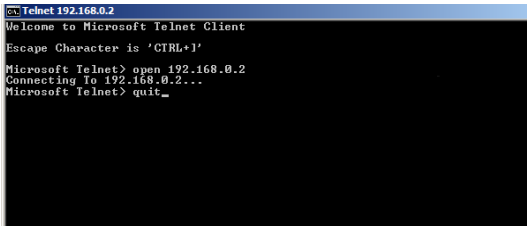
Step6 ***To exit "telnet", input "quit" next to ">", and then press the Enter key.***

NOTE
To control multiple robot controllers at the same time, run multiple TELNET.EXE.

Step 5 "telnet" window (3)



Step 6 "telnet" window (4)



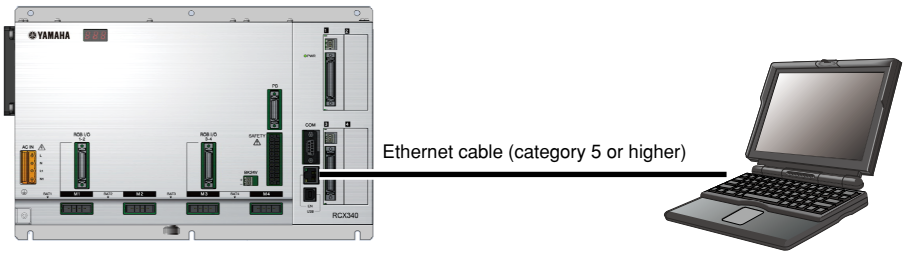
3.8 Appendix

3.8.1 Example of network system configuration

CAUTION
The network system configuration may vary depending on the user's network scale.
For details, be sure to consult the system administrator.

■ Configuration example 1

One controller is controlled by one personal computer.



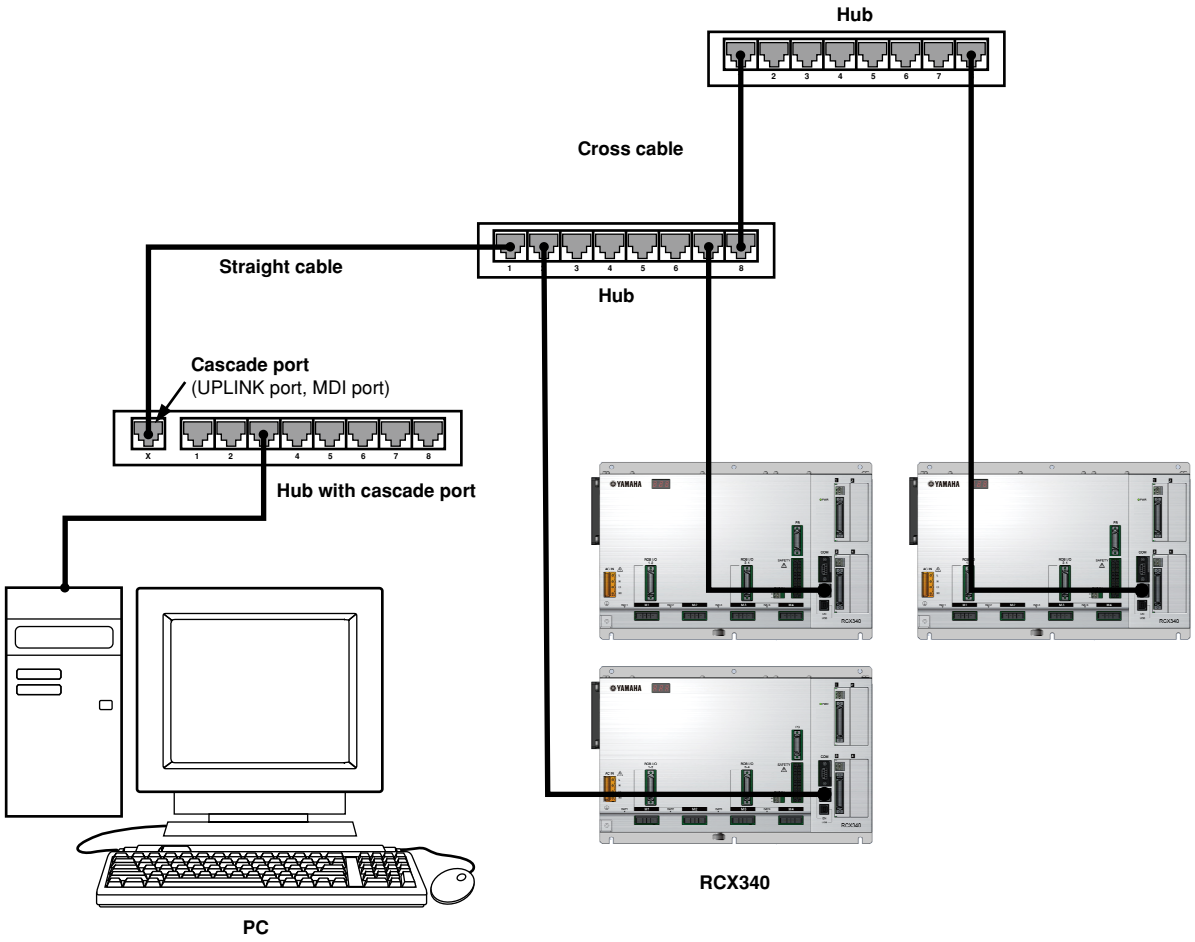
RCX340 PC

System setting example

	IP address	Subnet mask	Gateway
Personal computer	192.168.0.2	255.255.255.0	192.168.0.1
Controller 1	192.168.0.3	255.255.255.0	192.168.0.1

Configuration example 2

Many controllers are controlled by performing the cascade connection of the hubs.

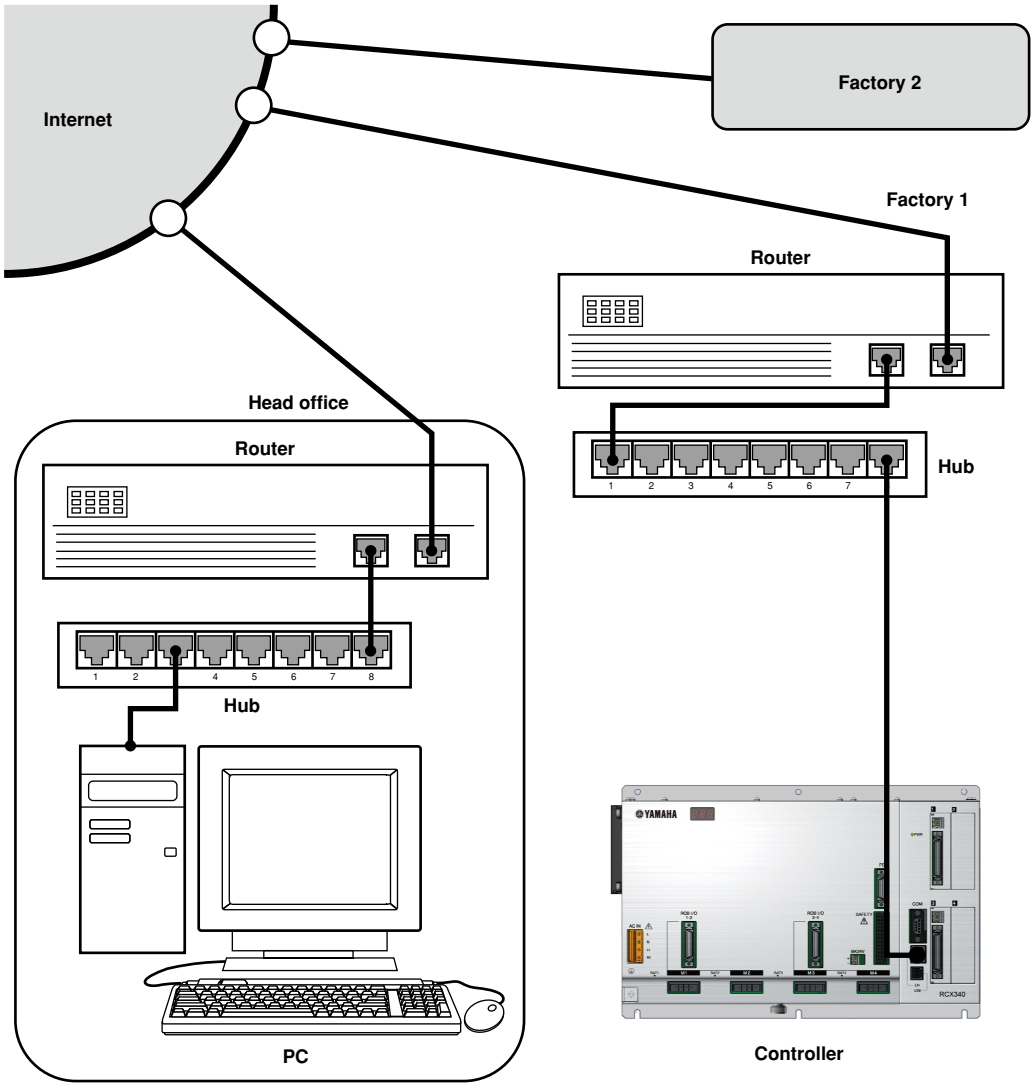


* Similar network can be configured by performing the stack connection of the stackable hubs. In this case, multiple hubs that are connected through the stack connection are recognized as a single large hub from the network. So, unlike the cascade connection, the number of connection hubs is not limited.
* Be sure to use the Ethernet cable with category 5 or higher.

System setting example

	IP address	Subnet mask	Gateway
Personal computer	192.168.0.2	255.255.255.0	192.168.0.1
Controller 1	192.168.0.3	255.255.255.0	192.168.0.1
Controller 2	192.168.0.4	255.255.255.0	192.168.0.1
:	:	:	:
Controller 9	192.168.0.11	255.255.255.0	192.168.0.1
Controller 10	192.168.0.12	255.255.255.0	192.168.0.1

■ Configuration example 3



To secure the security, it is recommended to construct a firewall (illegal access prevention mechanism).

System setting example

	IP address	Subnet mask	Gateway
Router in head office	133.215.0.2	255.255.255.0	
Personal computer	133.215.0.3	255.255.255.0	133.215.0.1
Router at factory 1	133.215.1.1	255.255.255.0	
Controller 1	133.215.1.2	255.255.255.0	133.215.1.1
Router at factory 2	133.215.2.1	255.255.255.0	
Controller 1	133.215.2.2	255.255.255.0	133.215.2.1

* The routers need to be set appropriately.
* To connect to the Internet, the global address needs to be set for the IP address.
* Since duplicated addresses are not permitted, the customer cannot use the addresses shown in the setting examples above. Be sure to use the customer's unique addresses. Note that the address allocation and control are performed by NIC (JPNIC in Japan).

3.8.2 Glossary

TCP/IP

TCP/IP is a general term for a group of standard protocols for carrying out communications over the Internet centering around TCP and IP protocols. Computers and PCs capable of accessing the Internet all use TCP/IP protocols.
The RCX340 incorporates the TCP, IP, ICMP, ARP, and TELNET protocols of the TCP/IP protocols.

Ethernet

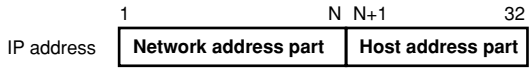
One of the network related hardware standards.
This Ethernet is a network that was developed by Xerox in the United States at the beginning of 1970s. Presently, the Ethernet is standardized internationally as IEE802.3. According to the transmission cable type, the Ethernet is classified into 100BASE-T2, 100BASE-T5, and 100BASE-TX, etc. The maximum cable length or the maximum number of connections may vary depending on the classification.
The RCX340 adopts the 100BASE-TX specifications.
Protocols that are generally used on the Ethernet are NetBEUI and IPX/SPX in addition to the TCP/IP protocols.
The CSMA/CD data transmission method is also the features of the Ethernet.

CSMA/CD (Carrier Sense Multiple Access with Collision Detection)

CSMA/CD is a method of sending signals, developed by combining a CSMA data transmission method with a transmission error handling method called CD.
CSMA refers to joint use of one transmission cable by many devices connected over a network. CSMA is therefore a method for checking network status beforehand and then transmitting the data after verifying that transmission is possible.
CD is a method for handling data collisions that occur on the network. In this method, when a data collision (conflict) occurs, that data is re-transmitted after a randomly selected time period has elapsed.
Many devices can be connected to the Ethernet by using these CSMA/CD methods. However, performance cannot be guaranteed in real-time because of transmission standby (time awaiting transmission) and retransmissions.

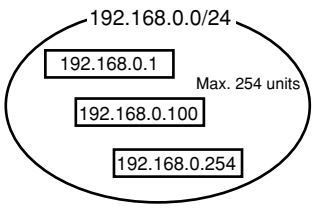
IP address

This IP address is a number unique to each device that is assigned to each device so that the numbers are not duplicated with each other so as to identify the device on the network. (More precisely, the IP address is assigned to each network interface since multiple network interfaces may be installed into one personal computer.) In the TCP/IP protocols, the data transmission source or communication destination is specified by this IP address. The IP address is a 32bit-(4byte)-numeric value. Normally, the IP address is separated 1-byte by 1-byte by a dot (".") and expressed in decimal notation. For example, an IP address of "0xC0A80002" is expressed as "192.168.0.2".
The IP address consists of two address parts. One is a network address part that shows the address of the network's own address.
The other is a host address part that shows the address to identify each device.
N bits from the beginning of the IP address are used as a network address. Bits from the "N+1"th bit to 32th bit are used as a host address. (The value of "N" is determined by the subnet mask.)



For example, when the IP address is "192.168.0.2" and the value of "N" (network length) is 24 bits, the network address part becomes "192.168.0" and the host address part becomes "2". Generally, to express the network address, set "0" for the host address part and describe "/" and the network length next to the address. In the example shown above, the network address is expressed as "192.168.0.0/24".

One network can be connected with as many devices as there are addresses to identify them. However, host address bits having all zeroes (0), or all ones (1) are reserved and so cannot be used. Therefore, in the example shown above, the host address can identify 256 units. However, since "0" and "256" cannot be used, the maximum number of units that can be connected becomes 254.



The host address can be set freely by each company (organization). However, when connecting to the Internet, it is necessary to make an application to the NIC (JPNIC in Japan) for a network address to get the acquisition. Note that the network address can also be set freely by each company (organization) in the environment where the network is not connected to the Internet in the same manner as the host address.

In the environment where the network is not connected to the Internet, it is permitted to freely use the addresses shown below.
These addresses are called "private address".

10.0.0.0 to 10.255.255.255	(1 unit of class A)
172.16.0.0 to 172.31.255.255	(16 units of class B)
192.168.0.0 to 192.168.255.255	(256 units of class C)

An address acquired by making application to NIC on the other hand is referred to as a global address.

Subnet mask

This subnet mask is used to separate the IP address into a network address part and host address part. The network address bits are set to "1" and the host address bits are set to "0".
In the same manner as the IP address, the subnet mask is a 32bit-(4byte)-numeric value. The subnet mask is separated 1-byte by 1-byte by a dot (".") and expressed in decimal notation.
Therefore, when the subnet mask is "255.255.255.0", the network address part becomes 24 bits.

Generally, when making an application to the NIC for an IP address, only one network address is allocated to each company (organization). Any of class A to class C is allocated depending on the scale of each company (organization). For example, since the network length is 16 bits in class B, one network address that can connect up to 65533 units is allocated. However, when using this network address as it is, the efficiency of the management or process becomes poor. So, normally, the subnet mask is set appropriately to separate the network into multiple networks.
For example, when a subnet mask of 255.255.255.0 is set for the class B network, 256 networks, each of which can control up to 254 units, can be set.

MAC address (Media Access Control Address)

This MAC address is also called "Ethernet address" and shows a hardware identification number (6-byte numeric value) set for each network interface. Since the MAC address is set for each unit in the manufacture phase, the user does not need to set it.
The Ethernet system identifies the connected unit from this MAC address. That is, even when the communication is performed using the TCP/IP protocols, the communication is performed while the IP address is automatically converted into the MAC address.

HUB

A device used to connect the personal computer and each unit. This hub is equipped with multiple ports to connect the modular jacks. A unit is connected to this port using the twist pair cable with the modular jack.

Router

A device used to connect multiple networks with each other. This router sends the external data transmitted from the internal network to the external network or sends the data transmitted from the external network to the internal network. Additionally, specific data is disposed of through the filtering process to ensure the network safety.

The IP address of the router is set for each network unit as a gateway address. As this setting is made, each unit can correctly receive or send the data among the networks.

Chapter 7 Controller system settings

Chapter 7 Controller system settings

1. Overview

To operate the robot, various settings corresponding to the customer's operation are needed.
This Chapter describes how to make the various controller settings and display the information.
Additionally, system settings other than the robot operation settings are also described.

	Item	Description
2	Information	Displays the information controlled by the controller.
3	History	Displays the alarm history data.
4	Initialize	Initializes various data.
5	Generation	Makes the settings corresponding to specifications of the axis and the robot to be connected.
6	Access Level	Sets the operation level (operable range).
7	USB Memory Operation	Saves or restores various data using the USB memory.
8	Check	Checks if an alarm occurs in the controller.
9	Communication Setting	Sets the external communication interfaces.
10	Safety Setting	Sets the safety parameters.
11	Parameter	Sets the parameters.

1.1 Conditions for system setting

1.1.1 System generation

The system generation of the controller has been set at shipment corresponding to the specifications of robot to be connected and axis. So, the system generation setting by the customer is not needed.
If the system generation related memory is corrupted by serious trouble or if the robot or axis to be connected to the controller is changed, the system generation setting is needed.
For details about how to operate the system generation, contact your distributor.

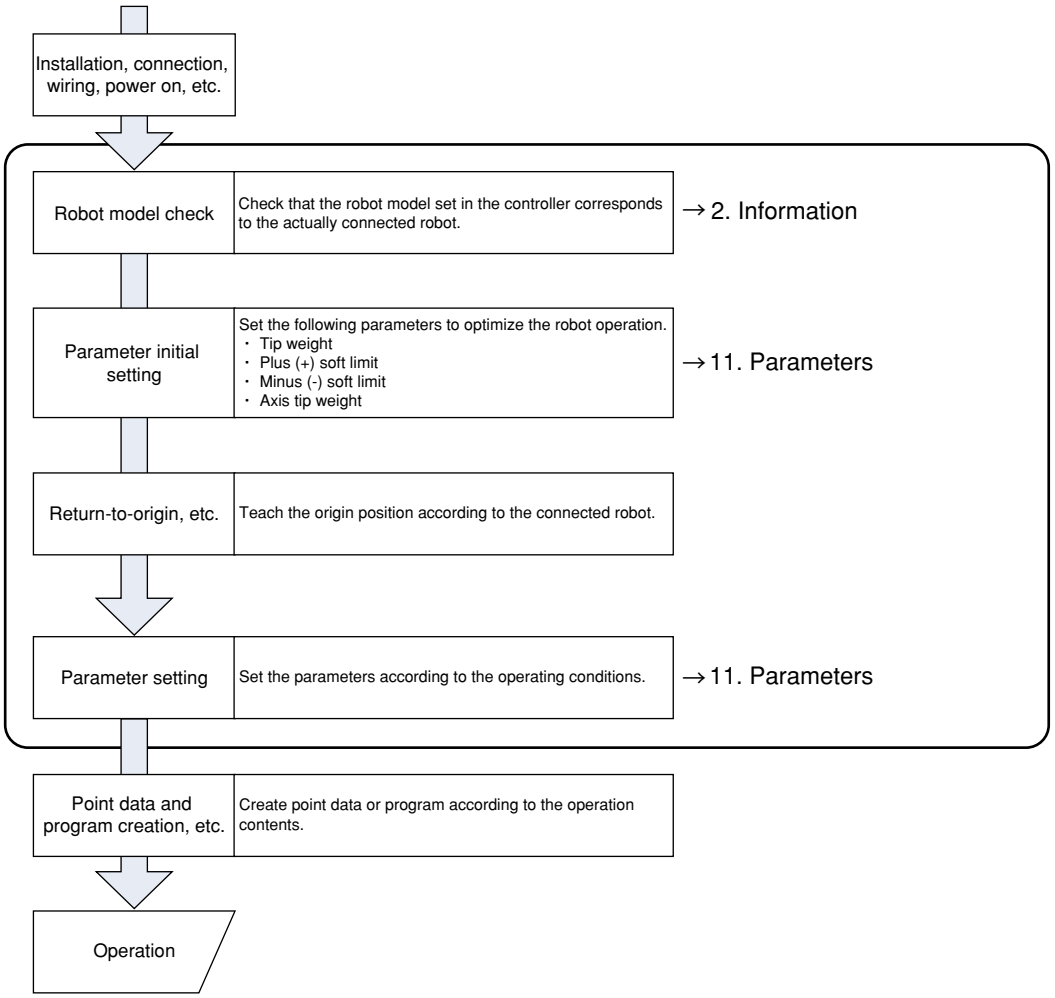
1.1.2 Parameter setting

Perform the parameter setting in the following cases.
- The system generation is performed.
- The robot in the factory shipment status is installed and operated.
- The robot or axis movement range is changed.
- The robot or axis transfer conditions are changed.

For details about parameter settings, see "11 Parameters" in this Chapter.

1.2 System setting procedure

The basic controller system setting procedure is shown below.



CAUTION

Be sure to set the following parameters before performing the return-to-origin.

- **Tip weight**
- **Axis tip weight (for optimization of the acceleration/deceleration of the robot/axis during return-to-origin)**

2. Information

When selecting [System] - [Information] from the initial screen, the "INFORMATION" screen will appear.

The "INFORMATION" screen displays the robot information, option information, clock, and version.
Valid keys and submenu descriptions on the “INFORMATION” screen are shown below.

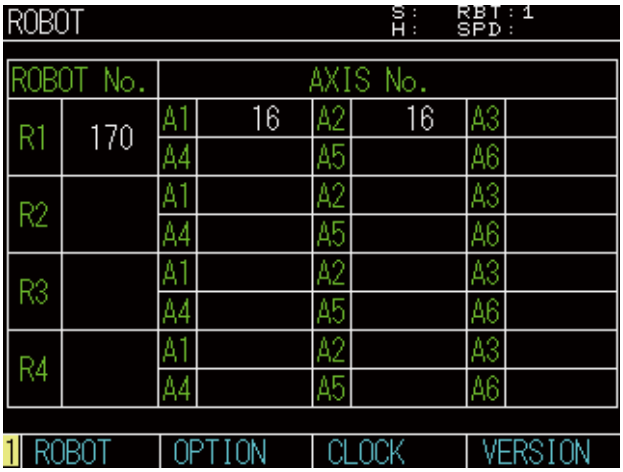
Valid keys	Menu	Function
F1	ROBOT	Displays the robot information set in the controller.
F2	OPTION	Displays the type of the board connected to the option slot.
F3	CLOCK	Displays the clock.
F4	VERSION	Displays various versions.

Press (ESC) to return to the initial screen.

2.1 Robot information

The robot type number and axis type number connected to the controller are displayed.
To display the “ROBOT” screen, select [Menu] → [System] → [Information] or press the F1 key (ROBOT) on other information screen.

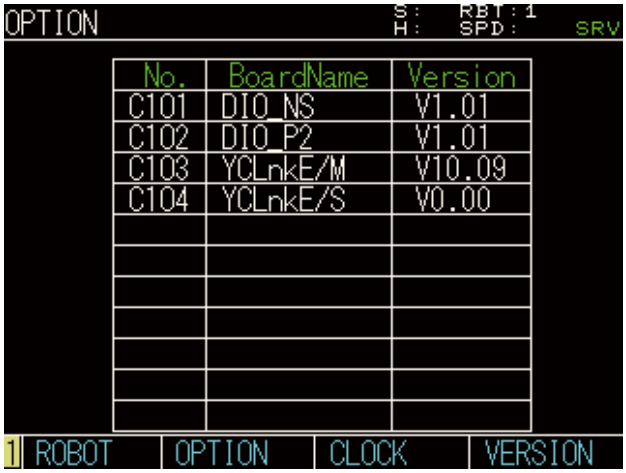
■ “ROBOT” screen



2.2 Option information

When pressing the F2 key (OPTION), the "OPTION" screen will appear.
The “OPTION” screen displays the type and version of the option board connected to the option slot of the controller.

■ “OPTION” screen



Display	Meaning
DIO_Nm	Displays that the option DIO with the NPN specifications is installed. "m" shows the specifications. (S :Standard DIO, 2 : Expanded DIO2)
DIO_Pm	Displays that the option DIO with the PNP specifications is installed. "m" shows the specifications. (S :Standard DIO, 2 : Expanded DIO2)
CCLNK	Displays that the CC-Link unit is installed.
D_Net	Displays that the DeviceNet unit is installed.
ENet_IP	Displays that the EtherNet/IP unit is installed.
YCLnkE/M	Displays that the YC-Link/E master unit is installed.
YCLnkE/S	Displays that the YC-Link/E slave unit is installed.
iVY	Displays that the iVY (VISION) unit is installed.
iVY_LC	Displays that the iVY (VISION with light) unit is installed.
Gripper1	Displays that the electric gripper (first unit) is installed.
Gripper2	Displays that the electric gripper (second unit) is installed.

- For details about the definitions of the NPN specifications and PNP specifications, see "6. I/O connections" in Chapter 3.
- For details about the serial I/O units, such as CC-Link, EtherNet/IP, YC-Link, and iVY system, see the manual for relevant unit.

NOTE

When two electric grippers are installed, “Gripper1” and “Gripper2” are displayed.

2.3 Clock

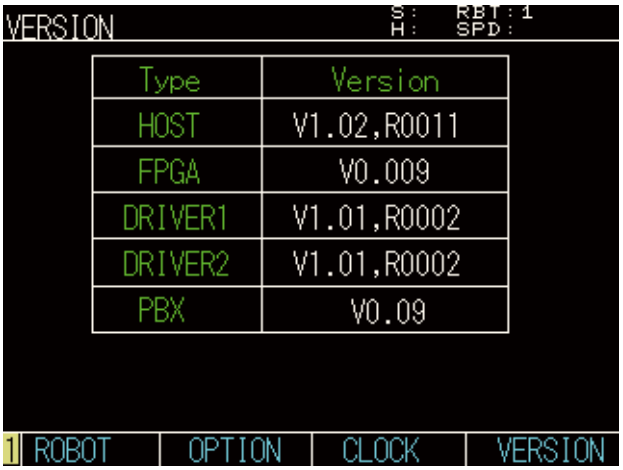
When pressing the F3 key (CLOCK), the controller built-in clock will appear.

■ **"CLOCK" screen**

2.4 Version

When pressing the F4 key (VERSION), various versions inside the controller and the version of the programming box are displayed.

■ **"VERSION" screen**



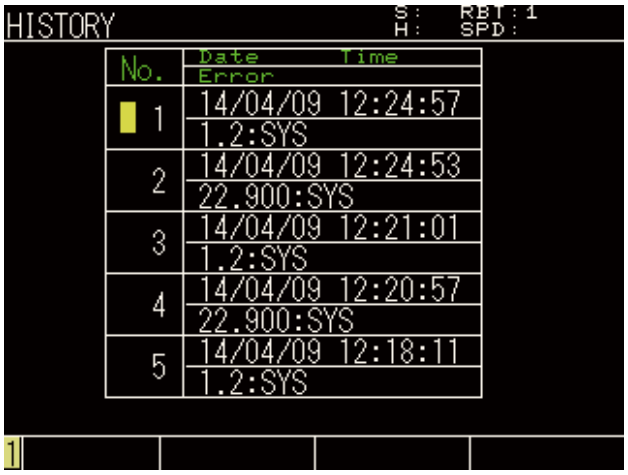
3. History

When selecting [System] - [History] from the initial screen, the "HISTORY" screen will appear.
The “HISTORY” screen displays five past alarm history records from the newest history record. Up to 500 alarm history records are saved.

The alarm display format is shown below.

Number	Alarm occurrence date and time
	Alarm number: Alarm occurrence location

■ “HISTORY” screen



The display is scrolled one line with the cursor keys. When the scroll function is set at ON, the display is scrolled one screen with the cursor keys.

CAUTION

The alarm history data is very important information when taking the robot troubleshooting measures. Therefore, do not initialize the alarm history data carelessly.

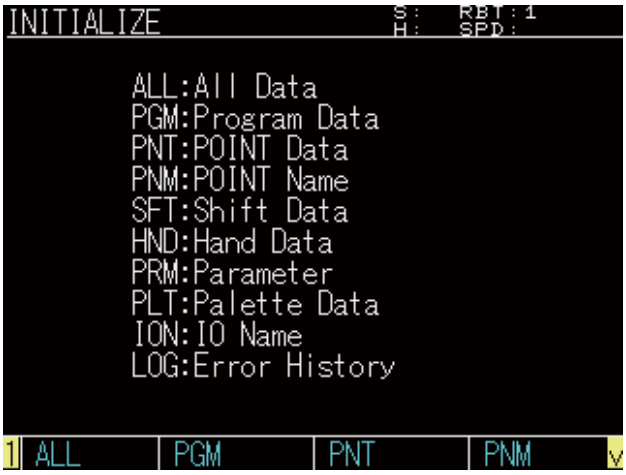
NOTE

- When the number of alarm history records exceeds 500, the oldest history record is deleted.
- When the same alarm as the previous alarm occurs, this alarm is not recorded.
- When the alarm classification is " 0 ", such alarm is not recorded.

4. Initialize

When selecting [System] - [Initialize] from the initial screen, the "Initialize" screen will appear.
On this screen, you can initialize the data managed by the controller. Use the F1 key (ALL DATA) to F11 (CLOCK) to select the item you want to initialize.

■ "INITIALIZE" screen



Valid keys and submenu descriptions on the "INITIALIZE" screen are shown below.

Valid keys	Menu	Function
F1	ALL	Initializes all data.
F2	PGM	Deletes the program data.
F3	PNT	Deletes the point data.
F4	PNM	Deletes the point name data.
F5	SFT	Deletes the shift coordinate data.
F6	HND	Deletes the hand definition data.
F7	PRM	Initializes the parameter data.
F8	PLT	Deletes the pallet definition data.
F9	ION	Deletes the input/output name data.
F10	LOG	Deletes the alarm history data.
F11	CLOCK	Sets the clock.

4.1 Initializing the data

Programs, point data, point names, shift coordinates, hand definitions, parameters, pallet definitions, IO names, and alarm history data are initialized or deleted.
Before executing the initialization process, carefully check that the currently input data is unnecessary.

NOTE
- Once the memory is initialized, the external data needs to be input to restore the data.
- If the memory is corrupted for some reason, the memory needs to be initialized.

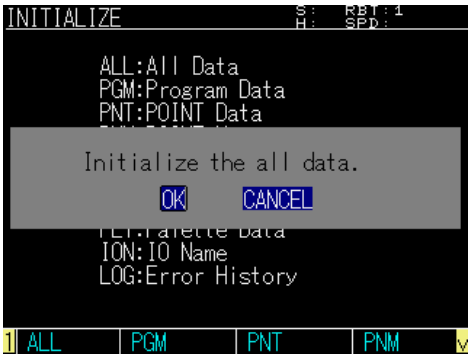
Valid keys and submenu descriptions on the "INITIALIZE" screen are shown below.

Valid keys	Menu	Function
F1	ALL	Initializes all data.
F2	PGM	Deletes the program data.
F3	PNT	Deletes the point data.
F4	PNM	Deletes the point name data.
F5	SFT	Deletes the shift coordinate data.
F6	HND	Deletes the hand definition data.
F7	PRM	Initializes the parameter data.
F8	PLT	Deletes the pallet definition data.
F9	ION	Deletes the input/output name data.
F10	LOG	Deletes the alarm history data.

Step 1 ***Use the function keys to select the item you want to initialize.***
Use the F1 key (ALL DATA) to F10 key (LOG) to select the item.
The initialization execution confirmation screen will appear.

Step 2 ***Execute the initialization process.***
Select the (OK) button, and then press the Enter key to execute the initialization process.
Select the (CANCEL) button, and then press the Enter key to cancel the initialization process.

▶ **Step 1** **Confirming the initialization execution**



4.2 Setting the clock

The controller is equipped with the clock function, allowing you to set the date and time.

CAUTION

The clock used inside the controller has an error when compared to the actual time.
If an error occurs, make the setting again.

Step 1 *Press the F11 key (CLOCK) on the "INITIALIZE" screen.*

The current date and time will appear.

Step 2 *Enter the date.*

Use the cursor keys to select the date (year/month/day), use 0 to 9 keys to input a value, and then press the Enter key.
Subsequently, use the cursor keys to select (SET), and then press the Enter key. The date is then set in the controller.

Step 3 *Enter the time.*

Use the cursor keys to select time (hour: minute: second). Use the 0 to 9 keys to input a value, and then press the Enter key.

Subsequently, use the cursor keys to select (SET), and then press the Enter key. The time is then set in the controller.

5. Generation

The system generation of the controller has been set at shipment corresponding to the specification of robot to be connected and axis. So, the system generation setting by the customer is not needed.
If the system generation related memory is corrupted by serious trouble or if the robot or axis to be connected to the controller is changed, the system generation setting is needed.
For details about how to operate the system generation, contact your distributor.

CAUTION

- **If the system generation is changed by mistake, this may adversely affect the robot operation or cause serious hazard to the operator. When the system generation needs to be changed, contact your distributor.**
- **If the system generation is changed without consulting your distributor, YAMAHA shall not be held responsible for any trouble arising from this change.**

6. Access level

Changing a program or point data incorrectly may cause the robot and/or controller to break down or malfunction.
To prevent such problems, the controller can be set to operating levels that permit or prohibit changing programs and point data.
The operation level can be set to any of the following levels.

Level	Description
Maintenance level (Level 0)	All operations can be performed. To move to this level, a password is required.
Operator level (Level 1)	Only the manual operation and automatic operation can be performed. Programs with Hidden (hide) attribute cannot be loaded.

NOTE

When any of the following conditions arises, the access level is forcibly set to "level 0".
1. All of the data are initialized. (See "4. Initialize" in this Chapter.)
2. The memory is corrupted. ("9.723: Controller status data destroyed" appears.)

6.1 Changing the access level

To change the access level, follow the procedure below.

NOTE

The correct password must be entered to change the access level.

Step 1 ***Display the "ACCESS LEVEL" screen.***

Use the cursor keys to select (System) on the initial screen, and then press the Enter key. Next, select (Access Level), and then press the Enter key.
The "ACCESS LEVEL" screen will appear.

Step 2 ***Enter the access level you want to set.***

Input the access level, and then press the Enter key. Select (SET), and then press the Enter key.

0	Maintenance level
1	Operator level

To set "1 (operator level)", press the Enter key again. Determine the setting you have entered.
To set "0 (maintenance level)", perform the operation stated in Step 3.

Step 3 ***Enter the password.***

Enter the password in the password entry field, and then press the Enter key.

* If an incorrect password is entered, "6.35: Password mismatch" alarm occurs.

Press the ESC key to exit the access level setting.

▶ **Step 2** ACCESS LEVEL

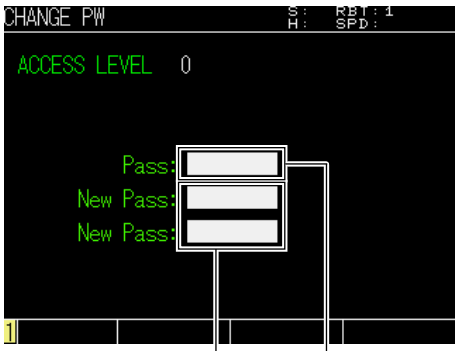
Step 1 ***Press the F1 key (CHANGE PW) on the "ACCESS LEVEL" screen.***

The "CHANGE PW" screen will appear.

Step 2 ***Set a new password.***

Enter the current password in (Pass), and then press the Enter key.
Next, enter a new password in (New Pass) at two locations, and then press the Enter key.
Press the ESC key to exit the password change.

Step 2 Changing the password



Enter the current password.
Enter a new password (two locations).

7. USB memory operation

Various data in the memory inside the controller can be saved into the USB memory. Additionally, various data saved in the USB memory can be restored to the controller.

NOTE

If the internal memory is corrupted for some reason, the internal memory of the controller can be restored using the data saved in the USB memory.
Before operating the robot controller as a system, it is recommended to save the internal data.

When selecting [System] - [USB Memory Operation] from the initial screen, the "USB MEMORY" screen will appear.

■ "USB MEMORY" screen

CAUTION

- If a trouble (data corruption or error, etc.) occurs in the USB memory or saved data, the data cannot be restored. Be sure to save the data into an external storage device, such as personal computer.
- If an abnormal process, such as power shutdown occurs while the data is being saved, the saved data is not guaranteed.

Press [ESC] to return to the initial screen.

7.1 Saving the data

The data in the internal memory of the controller is saved into the USB memory.
The data is saved into the "YAMAHA" folder immediately beneath the USB memory.

NOTE

If the internal memory is corrupted for some reason, the internal memory of the controller can be restored using the data saved in the USB memory.
Before operating the robot controller as a system, it is recommended to save the internal data.

Step 1 *Press the F1 key (SAVE).*

The type of the data to be saved appears.

Type	Contents
ALL	Saves all data.
PGM	Saves the program data.
PNT	Saves the point data.
SFT	Saves the shift coordinate data.
HND	Saves the hand definition data.
PRM	Saves the parameter data.
PLT	Saves the pallet definition data.
ION	Saves the input/output name data.
LOG	Saves the error history data.

Step 2 *Select the type of the data you want to save.*

Use the cursor keys to select the type of the data you want to save, and then press the F1 key (CHOOSE).
The save file list will appear.

Step 3 *Select the file you want to save.*

To save the file newly, press the F1 key (CHOOSE). Input the file name in the next step.
To save the file in the overwrite mode, use the cursor keys to select the file you want to save, and then press the F1 key (CHOOSE) or Enter key.

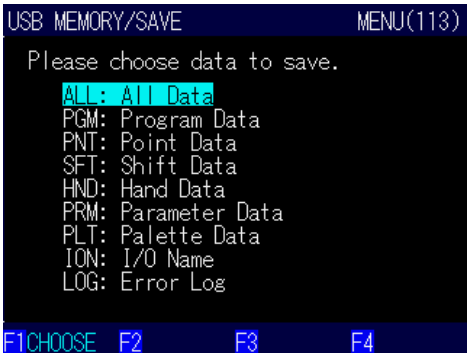
When many files are saved, press the F2 key (NEXT) to scroll the file list.

Step 4 *Save the file.*

Input the file name of the file you want to save.
To save into a new file, input a new file name.
To save into an existing file in the overwrite mode, input an existing file name.
Press the Enter key to save the file into the USB memory.

Press the ESC key to cancel the data saving.
The message, "Now Saving", will appear during data saving.

Step 2 Selecting the save data file.



CAUTION

- **If a trouble (data corruption or error, etc.) occurs in the USB memory or saved data, the data cannot be restored. Be sure to save the data into an external storage device, such as personal computer.**
- **If an abnormal process, such as power shutdown occurs while the data is being saved, the saved data is not guaranteed.**
- **The "Skip undefined parameter" item of other parameters is not saved.**

7.2 Loading the data

The data saved in the USB memory is restored to the internal memory of the controller.
The data is saved into the "YAMAHA" folder immediately beneath the USB memory.

NOTE

If the internal memory is corrupted for some reason, the internal memory of the controller can be restored using the data saved in the USB memory.
Before operating the robot controller as a system, it is recommended to save the internal data.

Step 1 *Press the F2 key (LOAD).*

The data type appears.

Type	Contents
ALL	Loads all data.
PGM	Loads the program data.
PNT	Loads the point data.
SFT	Loads the shift coordinate data.
HND	Loads the hand definition data.
PRM	Loads the parameter data.
PLT	Loads the pallet definition data.
ION	Loads the input/output name data.
LOG	Loads the error history data.

Step 2 *Select the type of the data you want to load.*

Use the cursor keys to select the type of the data you want to load, and then press the F1 key (CHOOSE).
The files that can be loaded will appear.

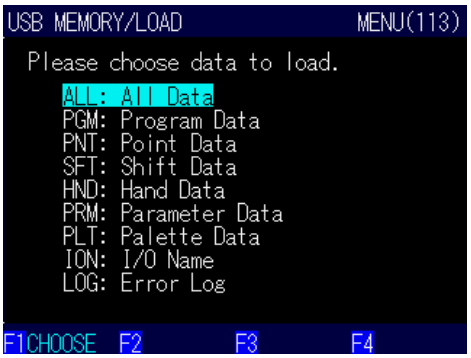
Step 3 *Select the file you want to load.*

Use the cursor keys to select the type of the data you want to load, and then press the F1 key (CHOOSE).
The confirmation message will appear.
When many files are saved, press the F2 key (NEXT) to scroll the file list.

Step 4 *Load the data.*

Press the Enter key to load the data from the file.
Press the ESC key to cancel the data loading.
The message, "Now Loading", will appear during data loading.

Step 2 Selecting the loading data type



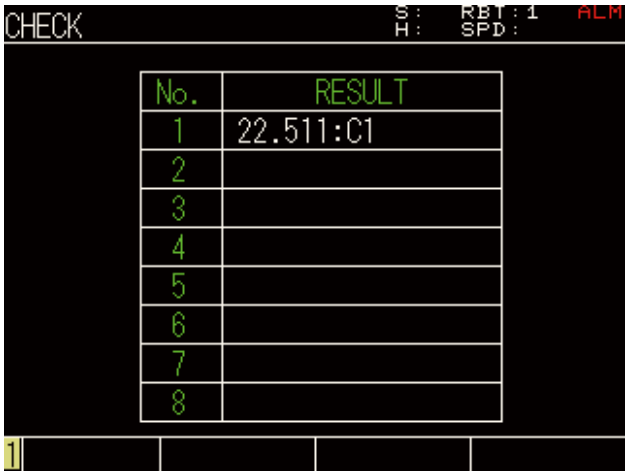
CAUTION

- **When loading the data as ALL file or parameter file, the controller must be put in the servo off status. Additionally, after the data has been loaded, the robot is put in the origin return incomplete status.**
- **If a trouble (data corruption or error, etc.) occurs in the USB memory or saved data, the data cannot be restored. Be sure to save the data into an external storage device, such as personal computer.**
- **If an abnormal process, such as power shutdown occurs while the data is being loaded, the restored data is not guaranteed.**

8. Check

When selecting [System] - [Check] from the initial screen, the "CHECK" screen will appear.The controller is diagnosed. If an error is detected, relevant message will appear.

■ "CHECK" screen



NOTE

Additionally, even when the DC24V power is not supplied to the option DIO, the alarm occurs.

Press [ESC] to return to the initial screen.

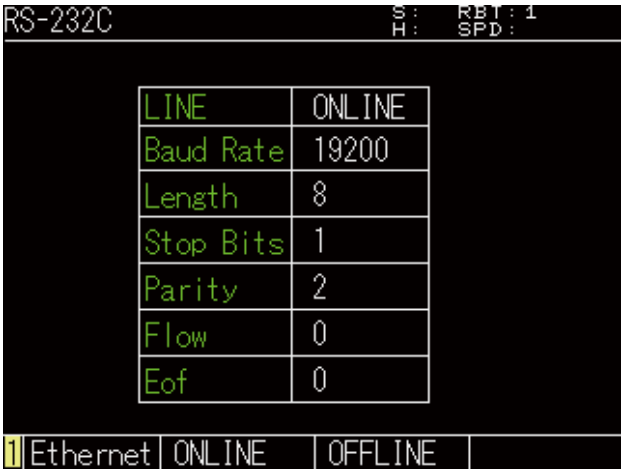
9. Communication setting

The communication mode and communication parameters of the external communication interface are set.

9.1 RS-232C

When selecting [System] - [Communication Setting] from the initial screen, the "RS-232C" screen will appear. On the “RS-232C” screen, you can set the commutation parameters and communication mode of the RS-232C interface.

■ RS-232C communication setting

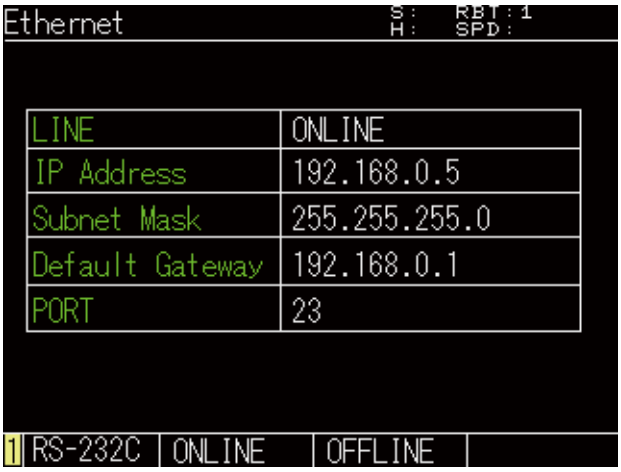


For details about how to set the RS-232C, see "2. RS-232C" in Chapter 6.

9.2 Ethernet

When selecting [System] - [Communication Setting] from the initial screen, the "RS-232C" screen will appear. Next, when pressing the F1 key (Ethernet) on the “RS-232C” screen, the “Ethernet” screen will appear.
On the “Ethernet” screen, you can set the commutation parameters and communication mode of the Ethernet interface.

■ Ethernet communication setting



For details about how to set the Ethernet, see "3. Ethernet" in Chapter 6.

10. Safety setting

The safety parameters are set to safely perform the work with the programming box within the safety enclosure of the system using the robot.

When selecting [System] - [Safety Setting] from the initial screen, the "SAFETY SETTING" screen will appear.

On the “SAFETY SETTING" screen, you can set five items described below.

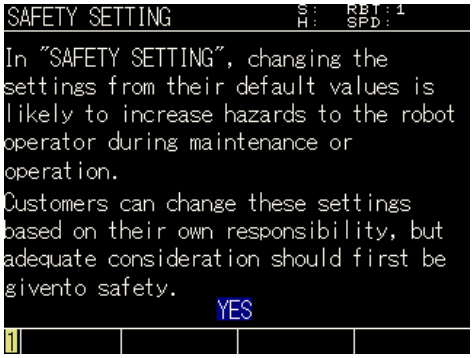
	Item name	Setting	Remarks
1	Hold to Run For Aut	Valid/Invalid	When set valid, the robot operation (including the program execution) is executed while holding down the key on the programming box.
2	Deceleration Control	Valid/Invalid	When set valid, the maximum robot movement speed is limited to its 3%.
3	Exclusive IO	Valid/Invalid	Sets the dedicated input of the I/O interface valid or invalid. To use the dedicated input, set "Valid". * Even when set invalid, the general-purpose inputs and outputs can be used.
4	RS-232C	Valid/Invalid	Sets the RS-232C interface valid or invalid. To use the RS-232C interface, set "Valid".
5	Ethernet	Valid/Invalid	Sets the Ethernet interface valid or invalid. To use the Ethernet interface, set "Valid".

■ Setting procedure

Step 1 ***Select [System] - [Safety Setting] from the initial screen.***

The warning screen appears. Agree to the contents, and then press the Enter key.

Warning screen

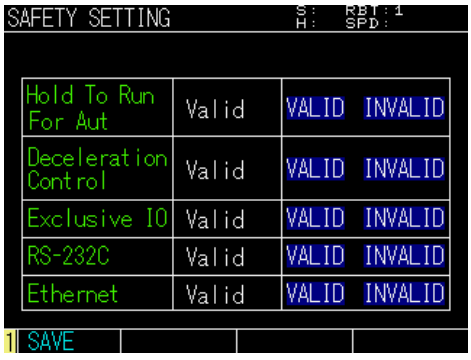


Step 2 ***Set [VALID] or [INVALID].***

Use the cursor keys to select (VALID) or (INVALID) of the item you want to set, and then press the Enter key.

To set the setting valid even after the power shut-down, perform the operation stated in Step 3.

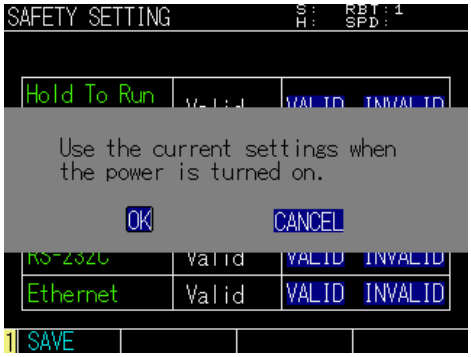
Setting the safety parameters



Step3 *Save the settings.*

When pressing the F1 key (SAVE) on the "SFETY SETTING" screen, the setting save confirmation screen will appear.
Select (OK), and then press the Enter key to save the settings.
When selecting (Cancel), the settings are not saved.

Saving the safety parameters



Step4 *Press the ESC key to exit the data editing.*

WARNING

IN "SAFETY SETTING", CHANGING THE SETTINGS FROM THEIR DEFAULT VALUES IS LIKELY TO INCREASE HAZARDS TO THE ROBOT OPERATOR DURING MAINTENANCE OR OPERATION.
CUSTOMERS CAN CHANGE THESE SETTINGS BASED ON THEIR OWN RESPONSIBILITY, BUT ADEQUATE CONSIDERATION SHOULD FIRST BE GIVEN TO SAFETY.

11. Parameters

There are six kinds of parameters available, controller setting related parameters, robot operation related parameters, axis related parameters, control related parameters, I/O related parameters, and option board related parameters.

CAUTION

- **The parameters are important data to match the robot specifications to the controller specifications. If the parameters are set incorrectly, this may cause alarm or malfunction. So, be sure to set the parameters correctly.**
- **Save the data files (program, point, point comment, parameter, shift, hand, and pallet, etc.) saved inside the RCX340 to an external storage device, such as personal computer before and after setting the parameters.**
- **If incorrect parameter setting is changed, this may adversely affect the robot operation or cause serious hazard to the operator. Before changing the parameters, contact your distributor.**
- **The absolute reset or return-to-origin may be required as the parameters are changed.**

When selecting [Edit] - [Parameter] from the initial screen, the "PARAMETER" screen will appear.

11.1 Setting the parameters

The robot operation and controller setting related parameters are set.

Step 1 ***Press the F1 key (CONTROLLER) to F6 key (OPTION) to select the parameter category.***

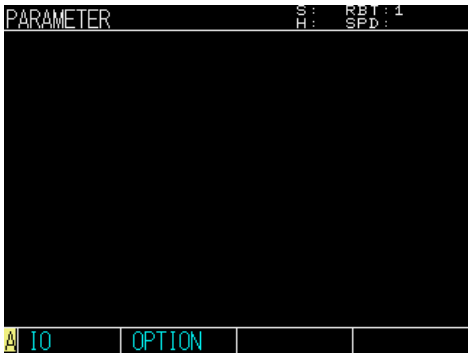
The "PARAMETER" screen for the selected category will appear.

Step 2 ***Select the parameter.***

Use the cursor keys to select the parameter.
Or, enter the parameter number on the pop-up screen that is displayed by pressing the F2 key (JUMP) to select the parameter.
Press the F1 key (EDIT).
Enter the parameter with the numeric keys.
For details about each parameter, see "11.3 Controller parameters" and subsequent sections in this Chapter.

Step 3 ***Press the ESC key to exit the parameter editing.***

Step 1 "PARAMETER" screen



Valid keys and submenu descriptions on the parameter category selection screen are shown below.

Valid keys	Menu	Function
F1	CONT	Sets the controller setting related parameters.
F2	ROBOT	Sets the robot operation related parameters.
F3	AXIS	Sets the axis related parameters.
F4	CONTROL	Sets the control related parameters.
F5	IO	Sets the I/O related parameters.
F6	OPTION	Sets the option board related parameters.

11.2 Parameter list

Controller parameters

For details about parameters, see "11.3 Controller parameters" in this Chapter.

Name	Identifier	Setting range	Initial value	Unit
Skip undefined parameters	PRMSKP	0: Disable, 1: Enable	0: Disable	–
Incremental mode control	INCMOD	0: Disable, 1: Enable	0: Disable	–
MOVE1/DRIVE1 start position	MOVIMD	0: Keep, 1: Reset	0: Keep	–
Servo on when power on	SRVOON	0: Disable, 1: Enable	0: Disable	–
Current program number	CRNTPG	0 to 100	0	–
Main program number	MAINPG	0 to 100	0	–

NOTE

This manual describes the control parameters shown above.
Other control parameters are normally write-protected. When such parameters need to be changed, contact your distributor.

Robot parameters

For details about parameters, see "11.4 Robot parameters" in this Chapter.

Name	Identifier	Setting range	Initial value	Unit
Tip weight *2	WEIGHT	0 to 500	This value depends on the model.	kg
Return-to-origin order	ORGORD	0 to 654321	312456	–
R-axis orientation hold *1	RORIEN	0: Hold, 1: Not hold	0: Hold	–
Arm type at reset *1	ARMTYP	0: None, 1: Right-handed system, 2: Left-handed system	0: None	–
SCARA R-axis moment of inertia *1	SCRINR	0 ~ 32767	0	10-4kgm^2

*1 This parameter is valid only for SCARA robots.

NOTE

This manual describes the control parameters shown above.
Other control parameters are normally write-protected. When such parameters need to be changed, contact your distributor.

Axis parameters

For details about parameters, see "11.5 Axis parameters" in this Chapter.

Name	Identifier	Setting range	Initial value	Unit
Axis tip weight *2	AXSTIP	0 to value depending on the model		kg
Pulse (+) soft limit	PLMT+	-6144000 to +6144000	This value depends on the model.	pulse
Minus (-) soft limit	PLMT-	-6144000 to +6144000	This value depends on the model.	pulse
Arm length	ARMLEN	0 to 9999999	0	0.001mm,0.001deg
Offset pulse	OFFSET	-6144000 to +6144000	0	pulse
Acceleration coefficient	ACCEL	1 to 100	100	%
Deceleration rate	DECRAT	1 to 100	This value depends on the model.	%
Manual acceleration	MANACC	1 to 100	100	%
OUT valid position	OUTPOS	1 to 9999999	This value depends on the model.	pulse
Arch pulse 1	ARCHP1	0 to 9999999	This value depends on the model.	pulse
Arch pulse 2	ARCHP2	0 to 9999999	This value depends on the model.	pulse
Return-to-origin method	ORGMTD	0: Mark, 1: Sensor, 2: Stroke end, 3: R stroke end	This value depends on the model.	–
Return-to-origin direction	ORGDIR	0: Minus, 1: Pulse	This value depends on the model.	–
Return-to-origin speed 1	ORGVEL1	1 to value depending on the model	20	pulse/ms
Origin shift	ORGSFT	-6144000 to +6144000	0	pulse
Tolerance	TOLE	1 to value depending on the model	80	pulse
Motor axis polarity	MOTDIR	0:CW 1:CCW	This value depends on the model.	–

*2 Payload setting
As the workpiece weight to be transferred by the robot is set, the controller optimizes the acceleration during robot operation.

For multi type robot or auxiliary axis:

- The tip weight parameter needs to be set for each axis. (Set the tip weight for each axis, such as tip weight of axis 1, tip weight of axis 2, and so on.)
- Set the axis tip weight parameter of the axis parameters.
- Even when the tip weight of the robot parameters is changed, the acceleration does not change.

For robots other than multi type robot:

- Set the workpiece weight held at the robot tip for the tip weight of the robot parameters.
- The value of the arm length parameter may affect the acceleration. The effective stroke value of each axis needs to be entered for the arm length.

* In this manual, the multi type robot means a robot that is not orthogonalized.

NOTE

This manual describes the axis parameters shown above.
Other axis parameters are normally write-protected. When such parameters need to be changed, contact your distributor.
When the payload needs to be changed due to special robot configuration, contact your distributor.

Control parameters

NOTE

Control parameters are normally write-protected. When the parameters need to be changed, contact your distributor.

I/O parameters

For details about parameters, see "11.6 I/O parameters" in this Chapter.

Name	Identifier	Setting range	Initial value	Unit
DO output at emergency stop	EMGCDO	0: Reset, 1: Hold	1: Hold	–
DIO noise cancel count	DIOCAN	0 to 7	1	–
DO output at program reset	RESCDO	0: Reset, 1: Hold	0: Reset	–
DI17 mode	DI17MD	0: ABS, 1: ABS/ORG	0: ABS	–

NOTE

This manual describes the I/O parameters shown above.
Other I/O parameters are normally write-protected. When such parameters need to be changed, contact your distributor.

Option parameters

For details about parameters, see "11.7 Option board related parameters" in this Chapter.

Name	Identifier	Setting range	Initial value	Unit
Option board enable	OPTENBL	0: Disable, 1: Enable	1: Enable	–
CC-Link station number	CCLADD	1 to 61	1	–
CC-Link baud rate	CCLCOM	0:156k, 1:625k, 2:2.5M, 3:5M, 4:10M	0:156k	–
CC-Link version	CCLVER	0:Ver.1.10 1:Ver.2.00	0:Ver.1.10	–
DeviceNet station number	DEVADD	0 to 63	0	–
DeviceNet baud rate	DEVCOM	0:125k, 1:250k, 500k, 4:Auto	0:125k	–
DeviceNet I/O size	DEVTYP	0: Normal, 1: Compact	0: Normal	–
EtherNet/IP IP address	EIPADD	0.0.0.0 ~ 255.255.255.255	0.0.0.0	–
EtherNet/IP subnet mask	EIPSUB	0.0.0.0 to 255.255.255.255	0.0.0.0	–
EtherNet/IP default gateway	EIPDEF	0.0.0.0 to 255.255.255.255	0.0.0.0	–
EtherNet/IP DHCP	EIPDHCP	0: Disable, 1: Enable	0: Disable	–

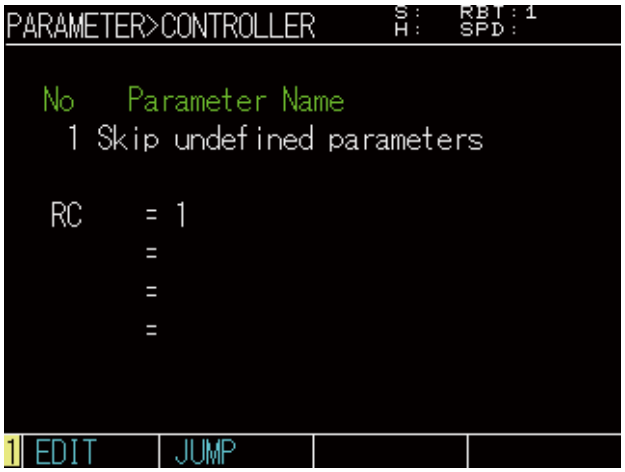
NOTE

This manual describes the option parameters shown above.
Other option parameters are normally write-protected. When such parameters need to be changed, contact your distributor.

11.3 Controller parameters

Controller related parameters are edited

■ "PARAMETER>CONTROLLER" screen



NOTE

Controller parameters not described in this manual are normally write-protected. When such parameters need to be changed, contact your distributor.

Valid keys and submenu descriptions on the "PARAMETER>CONTROLLER" screen are shown below.

Valid keys	Menu	Function
/		Moves up or down the cursor.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the specified number.

■ Setting by entering numeric values

The following shows how to set the parameter by using the current program number as an example.

Step 1 Select [Current program no.] and press the F1 key (EDIT).

Step 2 Enter the current program number.

The settable value range will appear on the screen.

Enter a numeric value 0 to 9 and press the Enter key.

Step 3 Press the ESC key to exit the "EDIT" screen.

▶ **Step 2** Setting the current program number

■ Setting by entering selections

The following shows how to set the parameter by using the servo on when power on as an example.

Step 1 *Select [Servo on when power on] and press the F1 key (EDIT).*

Step 2 *Set the servo on when power on.*

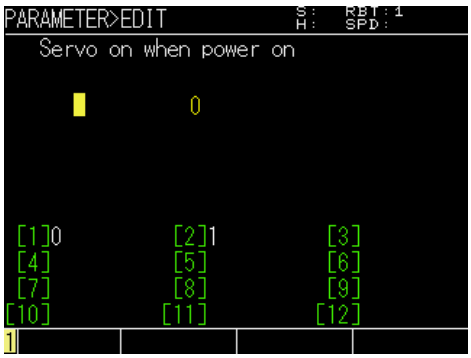
The selectable value lists (1) to (12) will appear.

Use 0 to 9 keys to select the value, and then press the Enter key.

NOTE

At this time, enter the value you want to actually set for the controller. Be careful not to select (1) to (12).
For example, when you want to set "0" for the controller in the figure on the right, press the "0" key on the programming box.
Do not press the "1" key.

▶ **Step 2** Setting the servo on when power on



Step 3 *Press the ESC key to exit the "EDIT" screen.*

■ Skip undefined parameters

This parameter sets whether or not the undefined data (parameters not supported by the controller) of the parameter file to be loaded to the controller is skipped.
When this parameter is enabled, the parameter file is loaded by skipping the undefined data in the file. This parameter is automatically disabled when starting up the controller.

Setting	Meaning
1: Enable	Undefined parameters are not loaded.
0: Disable	Undefined parameters are loaded.

CAUTION

• When this parameter is enabled, spelling errors in the parameter file cannot be detected. Do not set this parameter enabled except for the case that new version parameters need to be loaded into the old version controller.

NOTE

As the controller software is upgraded, new parameters may be added. When new version parameters including added parameters are loaded to the old version controller, "10.14: Undefined parameter found" error occurs.

■ Incremental mode control / INCMOD

This parameter sets whether or not the robot is always put in the return-to-origin incomplete status when starting up this controller.
When the parameter is initialized, "0: Disable" is set.

Setting	Meaning
0: Disable	Holds the origin position information on absolute type axes even when the power is shut down.
1: Enable	Puts all axes in the return-to-origin incomplete status when turning on the power.

NOTE

- When this parameter is enabled, all axes are always put in the return-to-origin incomplete status when turning on the controller.
- When using the absolute type axes without installing the absolute battery, set this parameter enabled.

CAUTION

When there is an axis with the mark return-to-origin method selected, set this parameter disabled.

■ MOVEI/DRIVEI start position / MOVIMD

This parameter sets the operation when executing the relative motion command again after it has been stopped by the interlock or emergency stop. When the parameter is initialized, "0: Keep" is set.

NOTE

This parameter is set at "Keep" at shipment.

Setting	Meaning
0: Keep	When executing the relative motion again after it has been stopped, the previous motion continues. The target position before executing again does not change. When executing the return-to-origin or absolute reset, the target position after the relative motion stop is reset.
1: Reset	When executing the relative motion again after it has been stopped, the relative motion is newly performed from the current position. The target position before executing again will change.

■ Servo on when power on/SRVOON

This parameter sets whether the controller starts in the servo on status or servo off status when starting up the controller. When the parameter is initialized, "0: Disable" is set.

Setting	Meaning
1: Enable	The controller starts in the servo on status. However, when the control authority is not released or the serial I/O setting is enabled, the controller starts in the servo on status. (RCX141/142 and RCX221/222 controller compatible mode)
0: Disable	The controller always starts in the servo on status. (RCX143/144 controller compatible mode)

■ Current program number / CRNTPG

This parameter sets the current program number. When the parameter is initialized, "0" is set.

NOTE

The current program is a program that is executed last in the task 1.
Additionally, when the main program number is "0", the current program is a program that is registered as task 1 when resetting the program.

■ Main program number / MAINPG

This parameter sets the main program number. When the parameter is initialized, "0" is set.

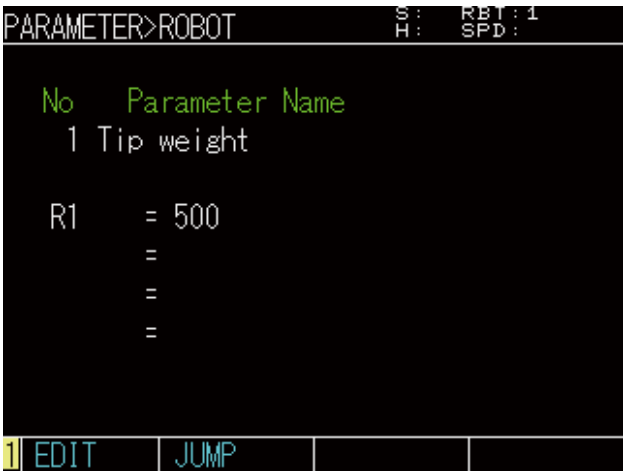
NOTE

The main program is a program that is registered as task 1 with the top priority when resetting the program.

11.4 Robot parameters

Robot related parameters are edited

■ "PARAMETER>ROBOT" screen



NOTE

Controller parameters not described in this manual are normally write-protected. When such parameters need to be changed, contact your distributor.

Valid keys and submenu descriptions on the "PARAMETER>ROBOT" screen are shown below.

Valid keys	Menu	Function
/		Changes the selected parameter.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the specified number.

■ Setting by entering numeric values

The following shows how to set the parameter by using the tip weight as an example.

Step 1 Select [Tip weight] and press the F1 key (EDIT).

Step 2 Enter the tip weight.

The settable value range will appear on the screen.

Use 0 to 9 keys to enter a value, and then press the Enter key.

Step 3 Press the ESC key to exit the "EDIT" screen.

▶ **Step 2** Setting the tip weight

■ Setting by entering selections

The following shows how to set the parameter by using the tip weight as an example.

Step 1 ***Select [R axis orientation] and press the F1 key (EDIT).***

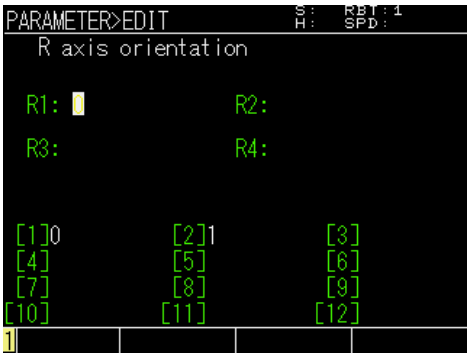
Step 2 ***Set the R-axis orientation.***

The selectable value lists (1) to (12) will appear.
Use 0 to 9 keys to select the value, and then press the Enter key.

NOTE

At this time, enter the value you want to actually set for the controller. Be careful not to select (1) to (12).
For example, when you want to set "0" for the controller in the figure on the right, press the "0" key on the programming box.
Do not press the "1" key.

▶ **Step 2** Setting the R-axis orientation



Step 3 ***Press the ESC key to exit the "EDIT" screen.***

■ Tip weight / WEIGHT

The tip weight (workpiece weight + tool weight) of the robot is set in "kg" units.
However, when the robot for which the tip weight is set is YK120XG, YK150XG, YK180XG, or YK220X, the tip weight is set in "0.1kg" units.
The maximum value is determined by the robot model that has been set.
When the parameter is initialized, the maximum value is set.

NOTE

- For multi type robots, this parameter cannot be entered.
- For the tip weight setting for the axis with the auxiliary axis setting, the tip weight is set with the axis tip weight of the axis parameters.
- When using the electric gripper YRG series, the weight of the gripper main body is added to the tool weight. For details, see the user's manual for electric gripper YRG series.)

CAUTION

The acceleration value, etc. is set to the optimal valve according to the value of this parameter.
Therefore, when a value lower than the actual tip weight is set, this may adversely affect the robot main body.
So, be sure to enter a correct value.

* In this manual, the multi type robot means a robot that is not orthogonalized.

■ Return-to-origin order / ORGORD

This parameter sets the order of the return-to-origin operation to set the motor position by the robot using the numeric value. When the parameter is initialized, "312456" is set.
1, 2, 3, 4, 5, and 6 correspond to relevant axis numbers. Axis corresponding to the numeric value performs the return-to-origin operation in order from the left end. Axes that are not set finally perform the return-to-origin operation at the same time.

NOTE

- Perform the return-to-origin operation from an axis that may interfere with a peripheral device.
- This order includes the robot axis and axillary axis.

CAUTION

When performing the return-to-origin of three or more axes with the return-to-origin method set at the stroke end method, the emergency stop may be activated.
At this time, change the stroke end return-to-origin method to simultaneous two axes or return-to-origin of each axis.

When different position detection methods (absolute specifications or incremental specifications) are mixed in one robot, the order of the return-to-origin operations may vary depending on the return-to-origin method.

Example:
Robot axis configuration: Axis 1, axis 2, axis 3, axis 4
Return-to-origin order setting: 312456
Position detection method of each axis: Axis 1, axis 2 ⇒ Incremental specifications
Axis 3, axis 4 ⇒ Absolute specifications

1. The return-to-origin operations of only the absolute type axes are performed.
The return-to-origin operations of only the absolute type axes are performed from the left end of the return-to-origin order setting in order.

3	→	1	→	2	→	4	→	5	→	6
Axis 3 operation		Axis 1 cancel		Axis 2 cancel		4 operation		Axis 5 cancel		Axis 6 cancel

2. The return-to-origin operations of only the incremental type axes are performed.
The return-to-origin operations of only the incremental type axes are performed from the left end of the return-to-origin order setting in order.

3	→	1	→	2	→	4	→	5	→	6
Axis 3 cancel		Axis 1 operation		Axis 2 operation		Axis 4 cancel		Axis 5 cancel		Axis 6 cancel

3. The return-to-origin operations of both the absolute type and incremental type axes are performed.
First, the return-to-origin operations of the absolute type axes are performed from the left end of the return-to-origin order setting in order.
Subsequently, the return-to-origin operations of the incremental type axes are performed in the same manner.

3	→	1	→	2	→	4	→	5	→	6
Axis 3 operation		Axis 1 cancel		Axis 2 cancel		Axis 4 operation		Axis 5 cancel		Axis 6 cancel

3	→	1	→	2	→	4	→	5	→	6
Axis 3 cancel		Axis 1 operation		Axis 2 operation		Axis 4 cance		Axis 5 cancel		Axis 6 cancel

NOTE
The semi-absolute specifications of the PHASER series are included in the incremental specifications.

The actual example of the return-to-origin operation is shown below.

	Programming box operation	PGM execution	IO operation	
	Key operation	Command *1	Input port	DI17 mode *2
Absolute specifications only	Impossible (axis-by-axis is possible.)	ORIGIN 0,2	DI17	ABS
Incremental specifications only	Impossible (axis-by-axis is possible.)	ORIGIN 0,1	DI14	ABS
Both specifications at the same time	“ALL”	ORIGIN 0,0	DI17	ABS/ORG

*1 For details about ORIGIN command, see the programming manual.
*2 This is the DI17 mode setting of the control parameters.

■ R-axis orientation / RORIEN

This parameter sets whether or not the R-axis orientation (posture) is held when performing the manual operation on the XY coordinates in the SCARA robot.
When the parameter is initialized, "0: Hold" is set.
When the orientation set at "Hold", the R-axis automatically rotates so that the R-axis holds the current orientation if the arm tip moves in the X-coordinate axis direction or Y-coordinate axis direction.
This parameter is invalid in robots other than the SCARA robot.

Setting	Meaning
0: Hold	Holds the R-axis orientation (posture).
1: Not hold	Does not hold the R-axis orientation (posture).

NOTE
This parameter is invalid when the R-axis does not exist or the R-axis has the auxiliary axis setting.

■ Arm type at reset / ARMTYP

This parameter sets the hand system that is selected at program reset.
When the parameter is initialized, "no designation" is set.
When moving on the XY coordinates in the SCARA robot or when performing the coordinate conversion (joint coordinates ⇔ Cartesian coordinates), the hand system setting becomes important.
This parameter is invalid in robots other than the SCARA robot.

Setting	Meaning
0: No designation	Does not specify the hand system at program reset.
1: Right-handed system	Sets the hand system at program reset to the right-handed system.
2: Left-handed system	Sets the hand system at program reset to the left-handed system.

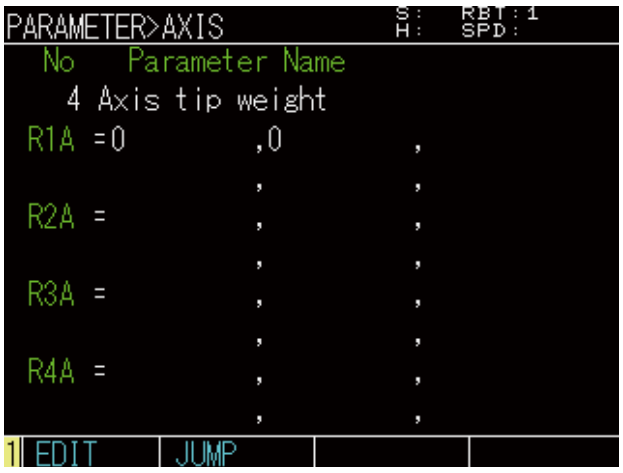
■ SCARA R-axis moment of inertia / SCRINR

This parameter sets the moment of inertia for the R-axis of the SCARA robot.
The unit is "kgm2 × 10-4".
This parameter is invalid in robots other than the SCARA robot.

11.5 Axis parameters

Axis related parameters are edited.

■ "PARAMETER>AXIS" screen



NOTE
Controller parameters not described in this manual are normally write-protected. When such parameters need to be changed, contact your distributor.

Valid keys and submenu descriptions on the "PARAMETER>AXIS" screen are shown below.

Valid keys	Menu	Function
▲ / ▼		Changes the selected parameter.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the specified number.

■ Setting by entering numeric values

The following shows how to set the parameter by using the axis tip weight as an example.

Step 1 ***Select [Axis tip weight] and press the F1 key (EDIT).***

Step 2 ***Select the robot.***

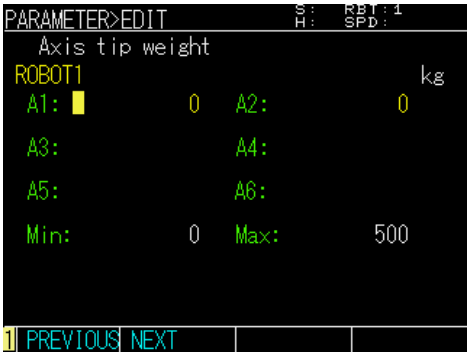
Use the F1 key (PREVIOUS) and F2 key (NEXT) to select the robot.

Step 3 ***Enter the axis tip weight.***

The settable value range will appear on the screen.
Use the cursor keys to select the axis you want to set.
Use 0 to 9 keys to enter a value, and then press the Enter key.

Step 4 ***Press the ESC key to exit the edit screen.***

▶ **Step 2** Setting the axis tip weight



■ Setting by entering selections

The following shows how to set the parameter by using the return-to-origin method as an example.

Step 1 ***Select [Origin method] and press the F1 key (EDIT).***

Step 2 ***Select the robot.***

Use the F1 key (PREVIOUS) and F2 key (NEXT) to select the robot.

Step 3 ***Select the return-to-origin method.***

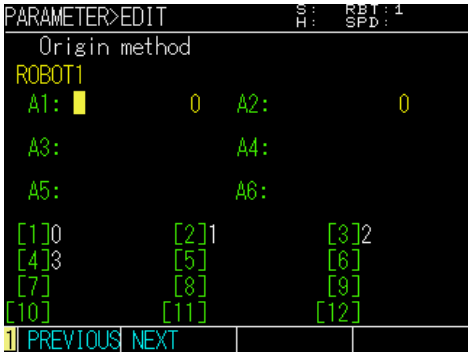
The selectable value lists (1) to (12) will appear.
Use 0 to 9 keys to select the value, and then press the Enter key.

NOTE

At this time, enter the value you want to actually set for the controller. Be careful not to select (1) to (12). For example, when you want to set "0" for the controller in the figure on the right, press the "0" key on the programming box. Do not press the "1" key.

Step 4 ***Press the ESC key to exit the edit screen.***

▶ **Step 2** Setting the return-to-origin method



■ Axis tip weight / AXSTIP

This parameter sets the tip weight (workpiece weight + tool weight) in "kg" units when the robot setting is the multi type robot and axillary axis setting.
When the parameter is initialized, the maximum value is set. The maximum value is automatically set by the model.

* In this manual, the multi type robot means a robot that is not orthogonalized.

NOTE

• For robots other than the multi type robot and auxiliary axis, this parameter cannot be entered. At this time, set the tip weight of the robot parameters.

CAUTION

An optimal value is automatically set for the acceleration, etc. according to the value of this parameter. Therefore, when a value lower than the actual axis tip weight is set, this may adversely affect the robot main body. So, enter a correct value.

■ Pulse (+) soft limit / PLMT+
Minus (-) soft limit / PLMT-

This parameter sets the axis movement range using the upper limit value (pulse (+) soft limit) and lower limit value (minus (-) soft limit).
When the parameter is initialized, the value unique to the model is set.
When performing the point teaching or automatic operation, check that the specified point data is within the soft limit range.

NOTE

Enter the soft limit value with 0 to 9 keys, "." key, and "-" key.
When the value that is entered with the keys is a real number (numeric value including a period), the unit is automatically converted into the pulse value.

WARNING

BE SURE TO SET THE SOFT LIMIT INSIDE THE MECHANICAL MOVEMENT RANGE (MECHANICAL STOPPER) OF THE AXIS. IF THE SOFT LIMIT IS SET OUTSIDE THE MECHANICAL MOVEMENT RANGE, THE AXIS COLLIDES WITH THE MECHANICAL STOPPER AT A HIGH SPEED, CAUSING OBJECT CLAMPED BY THE END EFFECTOR TO SCATTER OR THE ROBOT TO MALFUNCTION.

CAUTION

- **Since this parameter is important to determine the operating range, be sure to set the correct value.**
- **For the X-axis and Y-axis of the SCARA robot, make the setting so that the total of the pulse (+) and minus (-) soft limit absolute values does not exceed 360 degrees. If the setting that exceeds 360 degrees is made, an error may occur in the coordinate conversion results.**
- **When the return-to-origin is incomplete, the functions by the soft limit become invalid. So, take great care when performing the jog movement.**

■ Arm length / ARMLEN

For the SCARA robot, this parameter sets the X- and Y-arm lengths.
When the parameter is initialized, the value unique to the model is set.
Additionally, this parameter is set automatically when setting the standard coordinates.
For the Cartesian robot, this parameter sets the effective stroke length of each axis. According the arm length setting, the axis weight of each axis is set automatically.

When the parameter is initialized, "0" is set.

NOTE

Enter the arm length with 0 to 9 keys, "." key, and "-" key.

CAUTION

For the SCARA robot, the coordinate conversion to the Cartesian coordinates is performed using the arm length and offset pulse. So, be sure to set the correct arm length value.

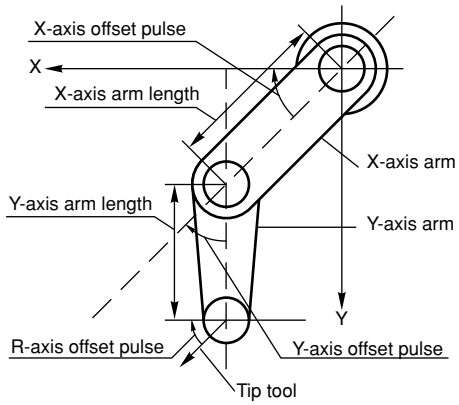
■ Offset pulse / OFFSET

This parameter sets the angle to the arm posture or standard coordinate axis in the status that the X-, Y-, and R-axis motor positions of the SCARA robots are located at their "0"-pulse positions.
When the parameter is initialized, "0" is set.

- X-axis offset pulse ... Angle formed by the pulse (+) X-axis direction of the standard coordinates and the X-axis arm. (Unit: pulse)
- Y-axis offset pulse ... Angle formed by the X-axis arm and Y-axis arm. (Unit: pulse)
- R-axis offset pulse ... Angle formed by the pulse (+) X-axis direction of the standard coordinates and the R-axis tip tool. (Unit: pulse)

Additionally, this parameter is set automatically when setting the standard coordinates.

"Offset pulse" setting



CAUTION

- **For the SCARA robot, the coordinate conversion to the Cartesian coordinates is performed using the arm length and offset pulse. So, be sure to set the correct offset pulse.**
- **When the data is entered using this parameter (press in the input cursor display status), the standard coordinates are set.**

■ Acceleration coefficient / ACCEL

This parameter sets the acceleration during robot movement by the movement command in a range of 1 to 100%.
When the parameter is initialized, "100" is set.
This coefficient acquires the optimal performance when "100%" is set to the tip weight setting.

NOTE

When the tip swings during robot movement acceleration, decrease this value to suppress the swing.

CAUTION

When decreasing the acceleration coefficient, a period of stop time in response to the stop command by the STOP key or stop signal may become long. Take great care when using the robot with the acceleration coefficient decreased extremely.

■ Deceleration rate / DECRAT

This parameter sets the deceleration rate during robot movement by the movement command in a range of 1 to 100%.
This parameter shows the rate on the speed reduction side to the acceleration side.
When the parameter is initialized, the value unique to the model is set.

NOTE

When the tip swings during robot movement stop, decrease this value to suppress the swing.

CAUTION

When decreasing the deceleration rate, a period of stop time in response to the stop command by the STOP key or stop signal may become long. Take great care when using the robot with the deceleration rate decreased extremely.

■ Manual acceleration / MANACC

This parameter sets the acceleration coefficient during robot movement with the manual operation in a range of 1 to 100%.
When the parameter is initialized, "100" is set.
This coefficient acquires the optimal performance when "100%" is set to the tip weight setting.

NOTE

When the tip swings during acceleration of the manual movement, decrease this value to suppress the swing.

CAUTION

When decreasing the acceleration coefficient, a period of stop time in response to the stop command by the STOP key or stop signal may become long. Take great care when using the robot with the acceleration coefficient decreased extremely.

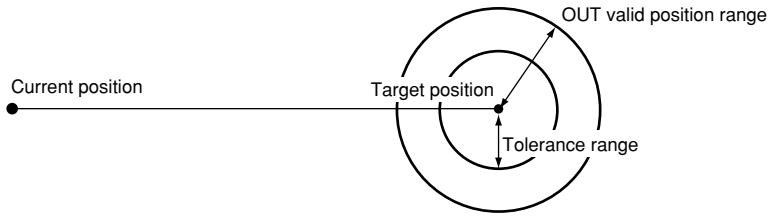
■ OUT valid position / OUTPOS

This parameter sets the execution completion range to the target position when the movement command is executed in the program. However, this parameter applies to only the PTP motion.
When the parameter is initialized, the value unique to the model is set.
When the current position of the robot enters the specified range, this is judged to the movement command execution completion. However, the movement to the target position continues. The smaller the value, the shorter the time until the next command is executed.
When performing the movement command continuously, the next movement command cannot be executed until the positioning is completed even when the previous movement command line has been completed.

NOTE

Enter the OUT valid position with 0 to 9 keys, "." key, and "-" key. When the value entered with the keys is a real number (numeric value including a period), the unit is converted into the pulse value.

OUT valid position range



CAUTION

If the tolerance value is larger than the OUT valid position value, both the command execution and positioning are completed when it enters the OUT valid position range.

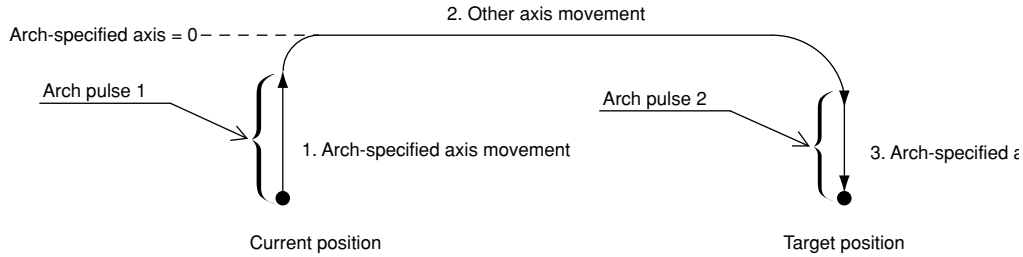
■ Arch pulse 1 / ARCHP1
Arch pulse 2 / ARCHP2

This parameter sets the overlap area of the arch-specified axis and other axis movement when executing the arch motion that is an option of the PTP motion. When the parameter is initialized, "9999999" is set.
The smaller the value, the larger the overlap area during axis movement. As a result, the movement execution time can be reduced.
The value that the unit conversion of the set value of the selected is performed is displayed.

NOTE

Enter the arch pulse 1 and arch pulse 2 with 0 to 9 keys, "." key, and "-" key. When the value entered with the keys is a real number (numeric value including a period), the unit is converted into the pulse value.

Arch pulse



1. The arch-specified axis starts moving to the position specified by the option. ("1" shown in the figure above)
2. When the arch-specified axis moves arch pulse 1 or more, other axes move to their target positions. ("2" shown in the figure above)
3. The arch-specified axis moves to the target position so that the remaining distance becomes arch pulse 2 when the movement of other axes is completed. ("3" shown in the figure above)
4. When all axes enter the OUT valid position range, the command is completed.

CAUTION

• The tracking of the arch motion may vary depending on the movement speed. Perform the interference check at actual robot operation speed.

■ Return-to-origin method / ORGMTD

This parameter sets the return-to-origin method of the robot.
When the parameter is initialized, the stroke end method is set.

0: Mark method ..... Method to set the origin position, such as match mark by the user.
1: Sensor method ..... Origin position detection method by sensor input
2: Stroke end method ... Origin position detection method by mechanical stroke end
3: ZR-stroke end method ... Origin position detection method by mechanical stroke end dedicated to the ZR-axis
The origin position is detected by combining the Z-axis and R-axis return-to-origin methods.
* It is necessary to set this parameter for both axes with the coordinate attribute set at ZR-axis.

CAUTION

• According to the robot specifications, this parameter is set at shipment.
• If the setting is changed without consulting your distributor, your distributor shall not be held responsible for any trouble arising from this setting change.
• When this parameter is changed, the robot is put in the origin return incomplete status.

■ Return-to-origin direction / ORGMTD

This parameter sets the movement direction when the robot performs the return-to-origin. When the parameter is initialized, the value unique to the model is set.

0: Minus ... The minus (-) direction of the motor position is the return-to-origin direction.
1: Plus ... The plus (+) direction of the motor position is the return-to-origin direction.

CAUTION

• When any of the conditions shown below is satisfied, do not change the setting that has been preset at factory prior to shipping.

Conditions	Problem at setting change
The model is the F14H lead 5mm.	When performing the stroke end return-to-origin on the non-motor side, the origin position becomes unstable.
The iVY system is used.	The camera calibration is not executed correctly.

When the setting needs to be changed, contact your distributor.
• If the setting is changed without consulting your distributor, your distributor shall not be held responsible for any trouble arising from this setting change.
• When this parameter is changed, the robot is put in the origin return incomplete status.

■ Return-to-origin speed / ORGVEL1

This parameter sets the movement speed when performing the return-to-origin.
When the parameter is initialized, the value unique to the model is set for the incremental type axis and absolute type axis. For the semi-absolute type axis, "20 pulses/ms (= 20mm/s)" is set.

CAUTION

For the incremental type axis and absolute type axis, the maximum value of the return-to-origin speed is determined by the motor.
For the semi-absolute type axis, the maximum value is "20 pulses/ms (= 20mm/s)".

■ Origin shift / ORGSFT

This parameter is used to correct the deviation amount of each axis if the work position deviates after the motor has been replaced and an impact has been applied. When the parameter is initialized, "0" is set.
Set the electrical deviation origin position amount to the mechanical origin position of the robot. The value of this parameter becomes the current motor position immediately after the return-to-origin.
Example:
When the current position after moved to the work position before positional deviation is expressed by “A” pulse and the current position after moved to the work position after positional deviation is expressed by “B” pulse, enter the value (A - B).

CAUTION

- **This parameter is important to determine the robot position. Set the correct value. Additionally, change the parameter setting only when required.**
- **When this parameter is changed, the robot is put in the origin return incomplete status.**
- **This parameter is valid after the absolute reset or return-to-origin.**

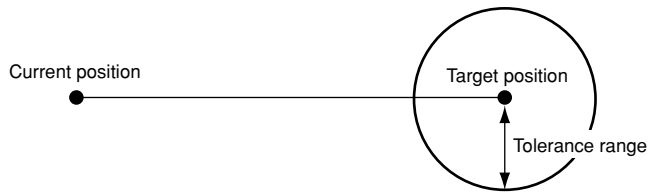
■ Tolerance / TOLE

This parameter sets the positioning completion range to the target position when the robot moves.
When the parameter is initialized, the value unique to the model is set.
When the current position of the robot enters the specified range, this is judged to the positioning completion. The larger the parameter value, the shorter the time until positioning completion.

NOTE

Enter the tolerance value with 0 to 9 keys, “.” key, and “-” key.
When the value that is entered with the keys is a real number (numeric value including a period), the unit is automatically converted into the pulse value.

Tolerance range



CAUTION

- **This parameter is important to determine the robot behavior around the target position. So, set the correct value.**
- **When the tolerance value is made small extremely, a variation in robot positioning time may occur.**
- **The maximum value of the tolerance is determined by the motor type.**

■ Motor axis polarity / MOTDIR

This parameter sets the direction, in which the robot moves.
When the parameter is initialized, the value unique to the model is set.

0: CW ... The motor CW direction is the minus (-) direction of the axis.
1: CCW ... The motor CCW direction is the minus (-) direction of the axis.

This parameter cannot be changed in the servo on status. To change the parameter, put the robot in the servo off status.
For details about the robot operation direction to the minus (-) direction of the motor, see "Robot operation direction list" in this Chapter.

CAUTION

• When any of the conditions shown below is satisfied, do not change the setting that has been preset at factory prior to shipping.

Conditions	Problem at setting change
The model is the F14H lead 5mm.	When performing the stroke end return-to-origin on the non-motor side, the origin position becomes unstable.
The iVY system is used.	The camera calibration is not executed correctly.

When the setting needs to be changed, contact your distributor.

• If the setting is changed without consulting your distributor, your distributor shall not be held responsible for any trouble arising from this setting change.

• When this parameter is changed, the robot is put in the origin return incomplete status.

Robot operation direction list

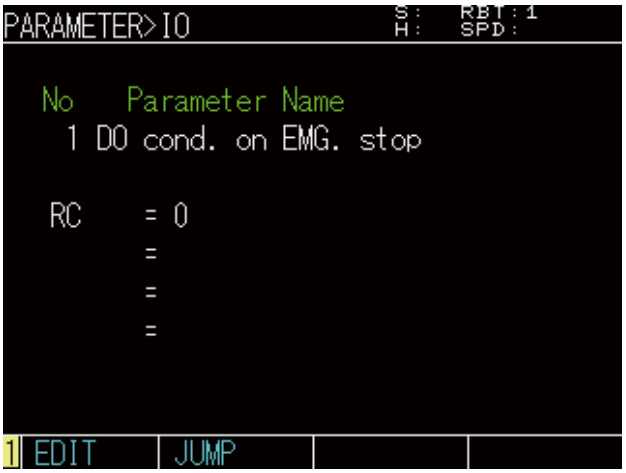
Series name	Classification	Model name	Motor minus (-) direction
FLIPX FLIPX-C	Compact T type Compact clean type	T4H,T5H,T6 C4H,C5H,C6	Direction to move to the motor side
	Compact F type Compact clean type	F8,F8L,F8LH C8,C8L,C8LH	Direction to move to the non-motor side
	Medium T type Medium, large F type Medium, large clean type	T9,T9H F10,F14,F14H,F17,F17L,F20 C10,C14,C14H,C17,C17L,C20	Direction to move to the motor side
	Nut rotation	F20N	Direction to move to the side opposite to the motor installation
	Nut rotation (hollow motor)	N15,N18	Direction to move left when viewed from the flexible cable guide.
	Belt drive	B10,B14,B14H	
		Motor installation R direction	Direction to move to the motor side
		Motor installation L direction	Direction to move to the non-motor side
	Rotation axis	R5,R10,R20	Counterclockwise direction when viewed from the side opposite to the shaft
PHASER	MR type MR type (semi-absolute specifications) MF type MF type (semi-absolute specifications)	MR12 MR12A MF7,MF15,MF20,MF30,MF50,MF75 MF7A,MF15A,MF20A,MF30A,MF50A,MF75A	Direction to move left when viewed from the flexible cable guide.
XY-X	XY-axis	PXYX	
		Axis 1	Direction to move to the motor side
		FXYX	
		Axis 1	Direction to move to the motor side
		Axis 2	Direction to move to the motor side
		FXYBX	
		Axis 1	
		Arm variations Ⓐ1 , Ⓐ2	Move to the non-motor side
		Arm variations Ⓐ3 , Ⓐ4	Move to the motor side
		Axis 2	
		Arm variations Ⓐ1 , Ⓐ4	Move to the motor side
		Arm variations Ⓐ2 , Ⓐ3	Move to the non-motor side
	ZR-axis	ZRS	
		Axis 3	Shaft protrusion direction
		Axis 4	Counterclockwise direction when viewed from the side opposite to the shaft
YP-X	2-axis	YP220BX	
		Axis 1	Shaft protrusion direction
		Axis 3	Up direction
		YP320X	
		Axis X	Shaft retraction direction
		Axis Z	Up direction
	3-axis	YP220BXR	
		Axis 1	Shaft protrusion direction
		Axis 3	Up direction
		Axis 4	Counterclockwise direction when viewed from the side opposite to the shaft
		YP330X	
		Axis 1	Shaft retraction direction
		Axis 2	Left side when viewed from the robot front
		Axis 3	Up direction
	4-axis	YP340X	
		Axis 1	Shaft retraction direction
		Axis 2	Left side when viewed from the robot front
		Axis 3	Up direction
		Axis 4	Counterclockwise direction when viewed from the side opposite to the shaft

* For details about arm variations, see "YAMAHA robot catalog".

11.6 I/O parameters

I/O parameters are edited.

■ "PARAMETER>IO" screen



Valid keys and submenu descriptions on the "PARAMETER>IO" screen are shown below.

Valid keys	Menu	Function
/		Changes the selected parameter.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the specified number.

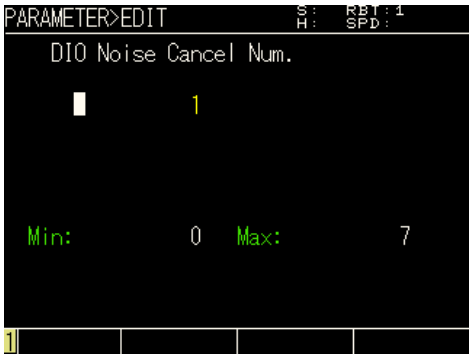
The following shows how to set the parameter by using the DIO noise cancel count as an example.

Step 1 Select "DIO Noise Cancel Num." and press the F1 key (EDIT).

Step 2 Enter the DIO noise cancel count.
The settable value range will appear on the screen.
Use 0 to 9 keys to enter a value, and then press the Enter key.

Step 3 Press the ESC key to exit the "EDIT" screen.

▶ **Step 2** Setting the DIO noise cancel count



■ DO at emergency stop / EMGCDO

This parameter sets whether or not the DO/MO/LO/TO/SO port outputs are held when the emergency stop is input to the controller.
When the parameter is initialized, "1: Hold" is set.

Setting	Meaning
0: Reset	Resets the DO/MO/LO/TO/SO port outputs when the emergency stop is input to the controller.
1: Hold	Holds the DO/MO/LO/TO/SO port outputs when the emergency stop is input to the controller.

■ DIO noise cancel count / DIOCAN

Short pulse shape external input signals (dedicated input signals and general-purpose input signals) are canceled. Unintended input signals, such as noise are prevented.Signals with length that does not satisfy the conditions (specified cycle x 0.25msec.) are determined to noise and they are canceled.

* For input signals, input signals with 6ms or longer on or off time.

■ DO output at program reset / RESCDO

This parameter sets whether or not the DO/MO/LO/TO/SO port outputs are reset when all programs are reset or the HALT ALL statement is executed. When the parameter is initialized, "0: Reset" is set.

Setting	Meaning
0: Reset	The DO/MO/LO/TO/SO port outputs are reset when executing any of the following operations. • All reset (RESETALL) is performed during automatic operation. • Dedicated input signal DI15 or SI15 (program reset) is turned on during program stop. (For details, see "1.9 Dedicated input signal description" in chapter 4.) • Any of the following data is initialized by selecting [System] → [Initialize]. ALL: All data PGM: Program data • Online command @RESET, @INIT PGM, @INIT ALL, @INIT MEM, or @SWI is executed. • HALTALL is executed in the program.
1: Hold	Even when any of the operations shown above is executed, the DO/MO/LO/TO/SO port outputs are not reset.

■ DI17 mode / DI17MD

This parameter sets the operation of the dedicated input DI17/SI17.
When the parameter is initialized, "0: ABS" is set.

Setting	Meaning
0:ABS	DI17/SI17 is made dedicated to the return-to-origin of the absolute type axis. When the signal is input, the return-to-origin of the absolute type motor axis is performed according to the return-to-origin order. For the incremental specifications, the return-to-origin is performed by the DI14/SI14 input.
1:ABS/ORG	Determines the DI17/SI17 input to the return-to-origin of the absolute and incremental type axes. When the signal is input, the return-to-origin of the absolute and incremental type axes is performed. When there is the absolute type axis, the return-to-origin of the absolute type axis is performed first. After that, when there is the incremental type axis, the return-to-origin of the incremental type axis is performed.

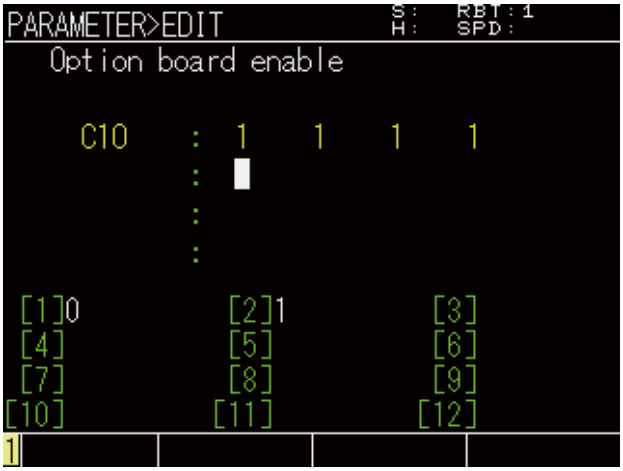
11.7 Option board related parameters

Option related parameters are edited.

NOTE

- For details about the serial I/O unit, such as CC-Link, EtherNet/IP, YC-Link, and iVY system, see the manual for relevant unit.
- For YC-Link, there are no parameter settings.

■ "PARAMETER>EDIT" screen



Valid keys and submenu descriptions on the "PARAMETER>EDIT" screen for the option board related parameters are shown below.

Valid keys	Menu	Function
/		Changes the selected parameter.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the specified number.

■ Option board enable / OPTENBL

This parameter sets the option DIO (PNP specifications and NPN specifications) enabled or disabled.
When the parameter is initialized, "1: Enable" is set.

Setting	Meaning
0	Disables the option DIO.
1	Enables the option DIO.

■ CC-Link station number / CCLADD

This parameter sets the CC-Link station number.
When the parameter is initialized, "1" is set.

CC-Link baud rate / CCLCOM

This parameter sets the CC-Link baud rate station.
When the parameter is initialized, "0: 156kbps" is set.

Setting	Meaning
0	156kbps
1	625kbps
2	2.5Mbps
3	5Mbps
4	10Mbps

CC-Link version / CCLVER

This parameter sets the CC-Link version.
When the parameter is initialized, "0: Ver.1.100" is set.

Setting	Meaning
0	Ver.1.10
1	Ver.2.00

DeviceNet station number / DEVADD

This parameter sets the DeviceNet station number.
When the parameter is initialized, "0" is set.

DeviceNet baud rate / DEVCOM

This parameter sets the CC-Link baud rate.
When the parameter is initialized, "0: 125kbps" is set.

Setting	Meaning
0	125kbps
1	250kbps
2	500kbps
3	Auto

DeviceNet I/O size / DEVTYP

This parameter selects the number of channels shared by the DeviceNet applicable unit from "Normal" or "Compact".
When "Normal" is selected, each of the input and output shares 24CH.
When "Compact" is selected, each of the input and output shares 2CH.
When the parameter is initialized, "0: Normal" is set.

Setting	Meaning
0	Normal
1	Compact

EtherNet/IP IP address / EIPADD

This parameter sets the IP address.
When the parameter is initialized, "0.0.0.0" is set.

EtherNet/IP subnet mask / EIPSUB

This parameter sets the subnet mask.
When the parameter is initialized, "0.0.0.0" is set.

EtherNet/IP default gateway / EIPDEF

This parameter sets the gateway.
When the parameter is initialized, "0.0.0.0" is set.

EtherNet/IP DHCP setting / EIPDHCP

This parameter sets the DHCP function enabled or disabled.
Set this parameter enabled when assigning the IP address, etc. from the host unit.
When the parameter is initialized, "0: Disable" is set.

Setting	Meaning
0	Disable
1	Enabled

* After the parameter setting has been changed, the power need to be turned on again.
* When the DHCP function is enabled, the IP address, subnet mask, and gateway set values become "0.0.0.0".

Chapter 8 Periodic inspecition

1. Before carrying out work

In order to operate the robot system safely and more efficiently, carry out the periodic inspection and maintenance. This section describes how to carry out periodic inspections on the controller. Before carrying out the inspection, carefully read and follow the instructions in this chapter and in Chapter 1 "Using the robot safely".

2. Periodic inspections

2.1 Daily inspections

The following inspections must be performed on a daily basis before and after robot operation.

1. Inspections carried out with the power turned off

WARNING
- **TURN OFF THE PRIMARY POWER SOURCE OR THE POWER ON THE CONTROLLER INSIDE THE CONTROL PANEL.**
- **DISPLAY AN "IN USE" SIGN TO WARN OTHER USERS NOT TO TURN ON THE CONTROLLER POWER.**

Inspect the below items.

Inspection item	Inspection details
Ground terminal	Verify that the terminal is not loose. Tighten where necessary.
Power connector	Check that the power connector is not loose. Tighten and connect securely where necessary.
Power cable	Check that the power cable is securely connected to the power connector. Connect securely where necessary.
Robot cable	Check that the robot cable is securely connected to the controller. Connect securely where necessary.
Other cables	Check for damage to cables, excessive bending and loose connectors.

2. Inspections carried out with the power turned on

WARNING
- **CHECK THAT NO ONE IS INSIDE THE SAFETY ENCLOSURE BEFORE TURNING THE CONTROLLER POWER ON.**
- **DISPLAY AN "IN USE" SIGN TO WARN OTHER USERS NOT TO USE THE CONTROLLER, PROGRAMMING BOX OR CONTROL PANEL.**
- **CARRY OUT INSPECTIONS FROM OUTSIDE THE SAFETY ENCLOSURE.**

Inspect the below items from outside the safety enclosure.

Inspection area	Inspection details
Safety enclosure	Check if it is in the correct position. Is an emergency stop executed when the door is opened?
Emergency stop device	Check if an emergency stop is executed when the device is operated.
Mode switching device	Check if the mode switches correctly when the device is operated.
Robot motion	Check for unusual motion, vibrations or sounds.

2.2 Three-monthly inspections

The following inspections must be performed every three months.

WARNING

- **TURN OFF THE PRIMARY POWER SOURCE OR THE POWER ON THE CONTROLLER INSIDE THE CONTROL PANEL.**
- **DISPLAY AN "IN USE" SIGN TO WARN OTHER USERS NOT TO TURN ON THE CONTROLLER POWER.**

Inspect the below items.

Inspection item	Inspection details
Power connector	Check that the power connector is not loose.
Power cable	Check that the power cable is securely connected to the power connector.
Robot cable	Check that the robot cable is securely connected to the controller.
Other cables	Check for damage to cables, excessive bending and loose connectors.
Fan filter	Check the fan filter for dirt and damage. For details concerning how to inspect the fan filter, see the next section "3. Replacing the fan filter".

3. Replacing the fan filter

Check the fan filter on the back of the controller for dirt and damage.

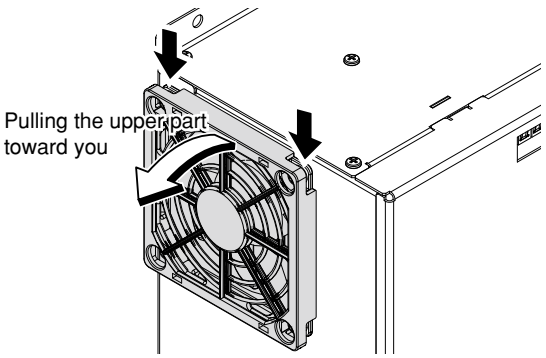
WARNING
TURN OFF THE PRIMARY POWER SOURCE OR THE POWER ON THE CONTROLLER INSIDE THE CONTROL PANEL.

Step 1 ***Remove the filter cover.***
The filter cover is fixed to the controller with nails in four places.
Insert fingers into the 2 gaps located in the upper corners of the filter and pull towards you.

Step 2 ***Check the fan filter for dirt and damage.***
Replace the filter if it is dirty or is damaged.

Step 3 ***Attach the filter cover.***
After attaching the filter cover, check that the all four of the fixing nails are fastened securely.

Step 1 Removing the filter cover



CAUTION
Do not loosen the screws that secure the fan cover. Otherwise, malfunction may occur.

4. Replacing the absolute battery

The absolute battery is a consumable part. If a trouble occurs in the backup data retention, this is determined as expiration of the battery service life, and replace the absolute battery.
The reference for battery replacement may vary depending on the operating conditions. However, this reference is that the total power off time after the battery has been connected to the controller reaches about 8,000 hours (about one year).

Battery specifications	3.6V 2750mAh
Battery part number	KAS-M53G0-11

NOTE
For details about how to replace the absolute battery, see "7. Connecting the absolute battery" in Chapter 3.

5. Replacing the memory battery

The memory battery is a consumable part. If a trouble occurs in the backup data retention, this is determined as expiration of the battery service life, and replace the memory battery.
The reference for battery replacement may vary depending on the operating conditions. However, this reference is that the total power off time reaches about 4 years.

CAUTION

- **If the memory battery is removed, the data files (program, point, point comment, parameter, shift, hand, and pallet, etc.) saved inside the controller will be lost. Therefore, be sure to perform the replacement work after the data has been saved into an external storage device.**
- **After the battery replacement work has been completed, load the data that has been saved into the external storage device into the controller.**
- **As the memory battery replacement work is performed, the robot is put in the return-to-origin incomplete status. Be sure to perform the return-to-origin after the battery replacement work has been completed.**

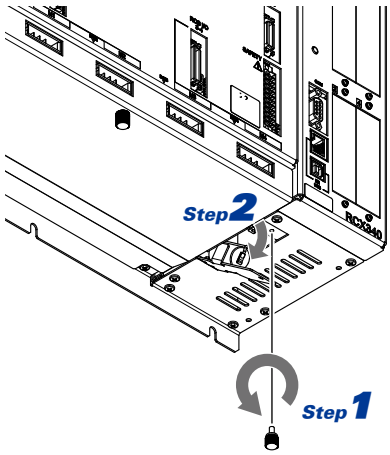
■ Replacing the memory battery

Step1 ***Loosen the knob on the bottom.***

Step2 ***Remove the bottom cover, to which the memory battery is secured.***

Step3 ***Disconnect the memory battery connector from the controller main body.***

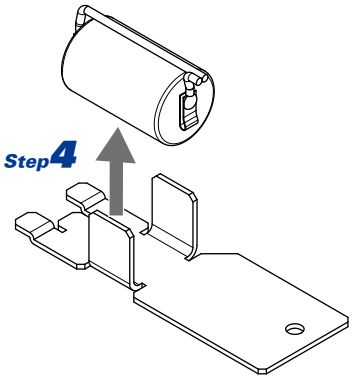
▶ **Step 1**



Step4 ***Remove the memory battery from the bottom cover and replace it with a new one.***

Step5 ***Install the new battery in the reverse order of removal.***

▶ **Step 4**



6. Maintenance parts

■ Consumable parts

Part name	Part No.	Remarks
Absolute battery	KCA-M53G0-01	3.6V 2750mAh
Fan filter	KCX-M427G-00	5 / bag
Memory battery	KAS-M53G0-01	3.0V 850mAh

■ Replacing the memory battery

The memory battery is a consumable part. If a trouble occurs in the backup data retention, this is determined as expiration of the battery service life, and replace the memory battery.
The reference for replacement may vary depending on the operating conditions. However, this reference is that the total power off time reaches about 4 years.

Chapter 9 Specifications

1. Controller

1.1 Basic specifications

Basic specifications	Applicable robots		Single-axis robot FLIP-X, Linear single-axis robot PHASER, Cartesian robot XY-X, SCARA robot YK-XG & YK-X (except YK120X and YK150X), Pick & Place robot YP-X
	Connected motor capacity		1600W or less (in total for 4 axes)
	Power capacity		2500VA
	Dimensions		W355 × H195 × D130 (main unit)
	Weight		6.2kg (main unit)
	Power supply voltage		Single phase 200 to 230V AC ±10%, 50/60Hz
Axis control	Number of controllable axes		4 axes maximum (simultaneous control: 6 axes) Up to 16 axes (4 robots) can be expanded through the controller link.
	Drive method		AC full digital servo
	Position detection method		Resolver, Magnetic linear scale
	Control method		PTP motion (Point to Point), ARCH motion, linear interpolation, circular interpolation
	Coordinate systems		Joint coordinates, Cartesian coordinates
	Position display units		Pulses, millimeters (1/1000 increments), degrees (1/1000 increments)
	Speed setting		1-100%, 1% increments (setting possible with the commands execution)
	Acceleration/deceleration setting		Automatic acceleration setting based on robot model and tip weight parameter Setting with accel coefficient and decel. rate parameters (1% steps) *Can be changed by programming. Zone control (Optimum acceleration setting matching SCARA robot arm position)
Programming	Program language		YAMAHA BASIC II (conforming to JIS B8439 (SLIM language))
	Multitask		16 tasks maximum
	Sequence program		1 program
	Memory size		2.1MB (Total of program and point data) (Available size for program when the maximum of point is used: 300KB)
	Program		100 programs (maximum number of programs) 9999 lines (maximum lines per program)
	Point		30000 points (maximum number of points)
	Point teaching		MDI (coordinate value input), direct teaching, teaching playback, offline teaching (data input from external unit)
	System backup (Internal memory backup)		Lithium battery (service life about 4 years at 0 to 40°C)
	Internal flash memory		512KB ("ALL" data only)
External I/O	SAFETY	Input	Emergency stop ready input, 2 systems AUTO mode input, 2 systems (valid only for the CE specifications)
		Output	Emergency stop contact output, 2 systems Enable contact output, 2 systems (valid only when using the PBX-E) Motor power ready output, 2 systems
	Break output		Transistor output (PNP open-collector)
	Origin sensor input		Connectable to 24V DC NC contact (normally closed) sensor
	External communications		RS-232C : 1 channel (D-SUB 9-pin female connector) Ethernet : 1CH (IEEE802.3u/IEEE802.3 compliance) 100Mbps/10Mbps (100BASE-TX/10BASE-T) Applicable to Auto Negotiation USB : 1CH (B type) RS-422 : 1CH (dedicated to the pendant)

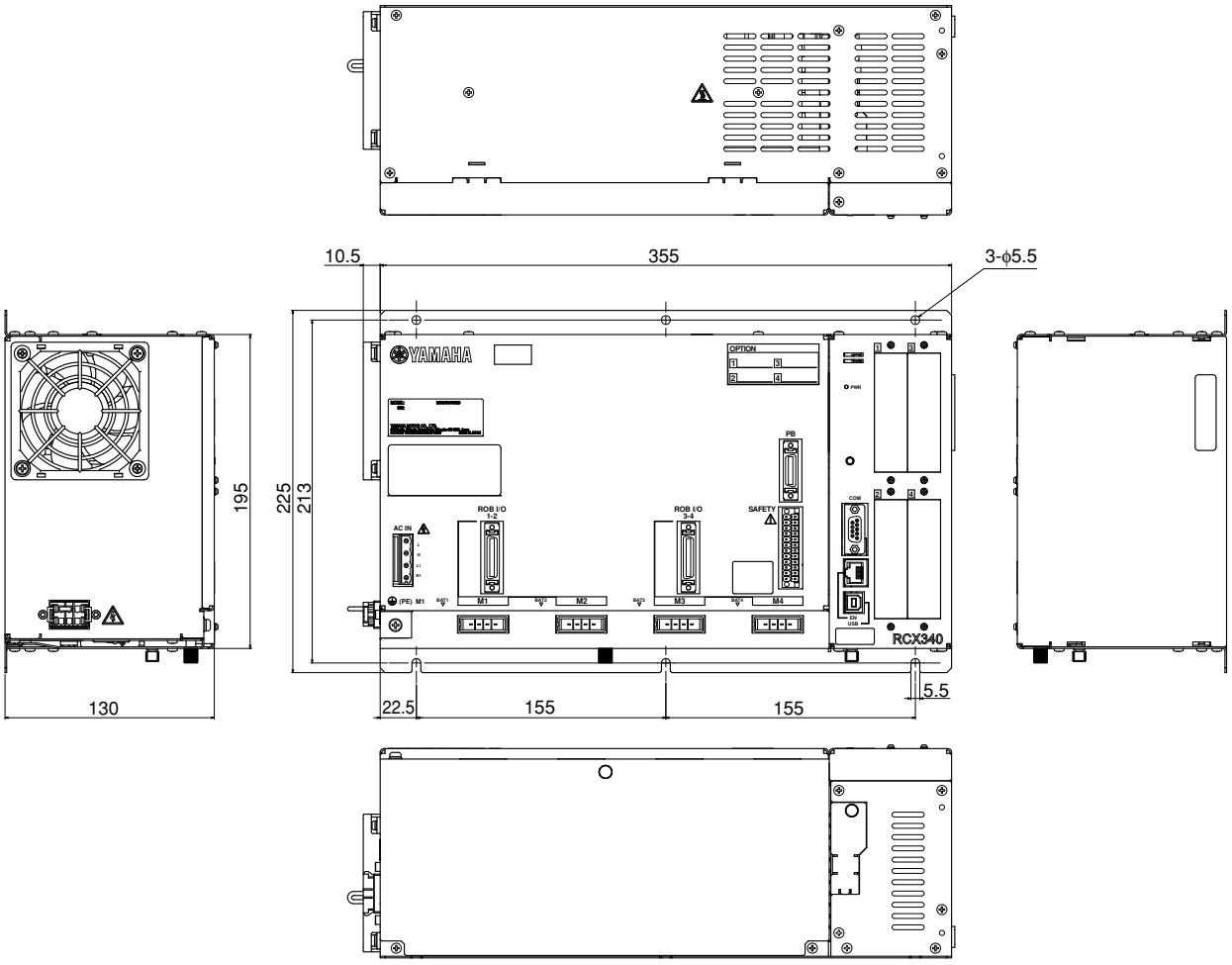
General specifications	Operating temperature			0 to 40°C
	Storage temperature			-10 to 65°C
	Operating humidity			35 to 85% RH (no condensation)
	Noise immunity			Conforms to IEC61000-4-4 Level 3
	Protective structure			IP20
	Protection class			I
Options	Options board	Option slot		4 slots
		Parallel I/O board	Standard specifications	Dedicated input 8 points, dedicated output 9 points General-purpose input 16 points, general-purpose output 8 points (1 boards maximum, NPN/PNP specifications)
			Expanded specifications	General-purpose input 24 points, general-purpose output 16 points (4 boards maximum, NPN/PNP specifications)
		CC-Link board 4 stations occupied. Ver2.0		Dedicated input 16 points, dedicated output 16 points DeviceNet board General-purpose input 96 points, general-purpose output 96 points
		DeviceNet board Compact and normal		
		EtherNet I/P board		
	Programming box			PBX, PBX-E
	Absolute battery			3.6V, 2750mAH/axis Backup retention time: about 1 year
	PC software			RCX-Studio

1.2 Basic functions

Function	Description
Operation modes	AUTO mode (Major functions: program creation, program execution, step execution, etc.) MANUAL mode (Major functions: jog movement, point data teaching, parameter editing, etc.)
Commands	Array declaration commands (DIM statement) Assignment commands (Numeric assignment statement, character string assignment statement, point definition, etc.) Movement commands (MOVE, DRIVE, PMOVE statements, etc.) Conditional branching commands (IF, FOR, WHILE statements, etc.) External output commands (DO, MO, LO, TO, SO statements) Parameter commands (ACCEL, OUTPOS, TOLE statements, etc.) Condition wait command (WAIT statement) Task related commands (START, SUSPEND, CUT statements, etc.) etc.
Functions	Arithmetic functions (SIN, COS, TAN functions, etc.) Character string functions (STR$, LEFT$, MID$, RIGHT$ functions, etc.) Point functions (WHERE, JTOXY, XYTOJ functions, etc.) Parameter functions (ACCEL, OUTPOS, TOLE statements, etc.) etc.
Variables	Simple variables (integer variables, real variables, character variables) Array variables (integer variables, real variables, character variables) Point variables Shift variables Input/output variables etc.
Arithmetic operation	Arithmetic operators (+, -, *, /, MOD) Logic operators (AND, OR, XOR) Relational operators (=, <, >, <>, <=, >=)
Monitor	Input/output status monitor (200ms intervals)
Online commands	Program operation commands (RUN, STOP, RESET, STEP, etc.) Utility commands (COPY, ERA, INIT, etc.) Data handling commands (READ, WRITE, etc.) Robot language commands (independent-executable commands)
Data files	Program, point, parameter, shift, hand, all, error history etc.
Internal timer	Timer count variable (TCOUNTER), 1ms interval
Program break points	32 points maximum

1.3 External view

RCX340 external view



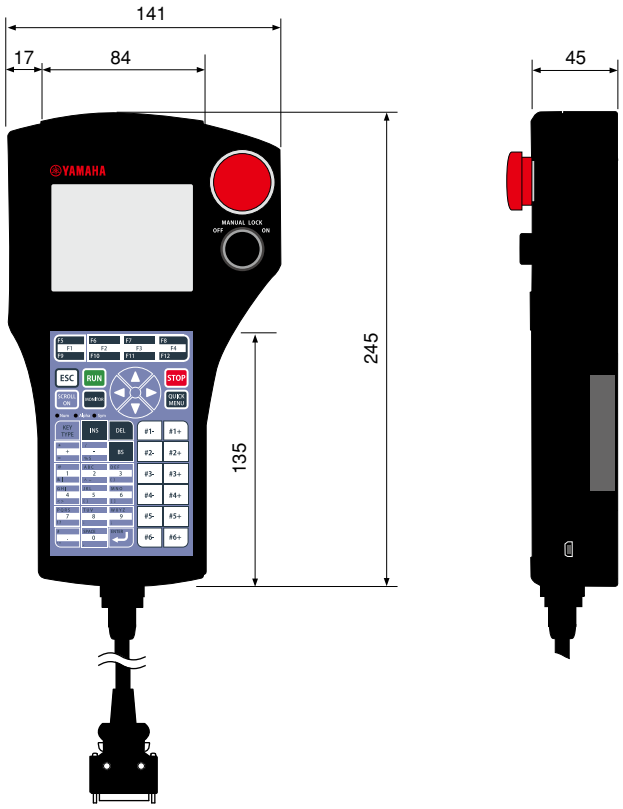
2. Programming box

2.1 Basic specifications

■ Programming box basic specifications

Item	PBX	PBX-E
Display screen	Color LCD (320 × 240dot)	
Emergency stop button	Normally-closed contract (with lock function)	
Enable switch	Not provided	3-position type
Manual lock selector switch	90°, 2-notch	
Power	+12V DC	
Operating environment	Ambient temperature : 0 to 40°C, Storage temperature : -10 to 60°C Humidity : 35 to 80% (no condensation)	
Dimensions (mm)	W141 × H245 × D45 (excluding projecting parts)	
Cable length	5m (Standard), 12m（Option）	
Weight	440g (excluding cable)	460g (excluding cable)

2.2 External view



Troubleshooting

1. Alarm messages

1.1 Controller related alarm messages

If an alarm occurs, relevant alarm message appears on the screen of the programming box. For details about contents of each alarm message, see the list.
The alarm code consists of two elements, "group" and "classification". Each code is classified as follows.

XX . YYY
- Classification number ・・・Classified by the axis operation or resetting procedure if an alarm occurs.
- Group number ・・・Classified into groups [0] to [30] according to the alarm contents.

[Error message display format]

Group number
Classification number } Alarm code
Alarm message

12.600 : Emergency stop on
Code : ＊＊＊＊ — The group number and classification number of the alarm are expressed in hexadecimal notation.

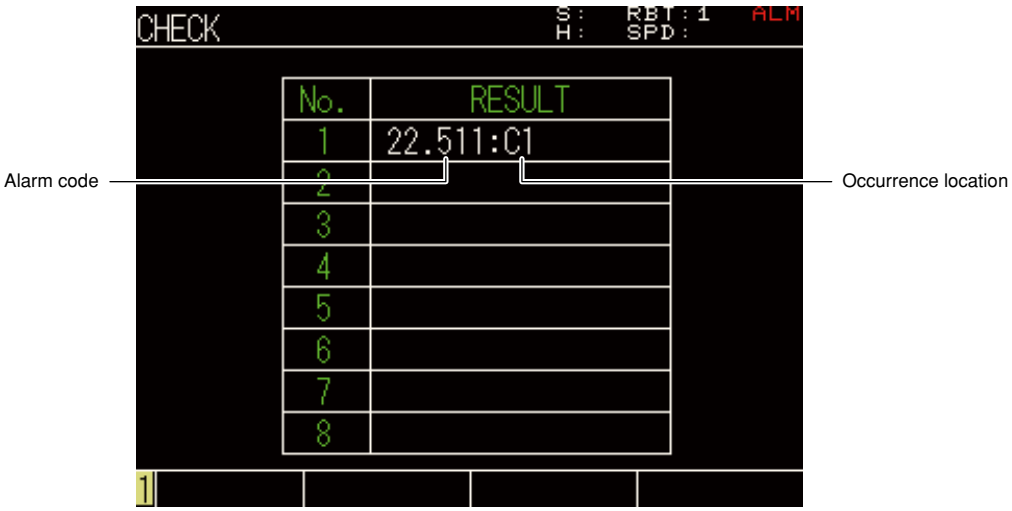
Meaning/Cause	＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊
Action	＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊

Shows the measures to reset or avoid the alarm.
Shows the alarm meaning and the cause of the alarm occurrence.

NOTE
If the alarm cannot be solved even after taking the corrective action, contact your distributor.

* The alarm occurrence status and alarm history can be checked from the programming box.
Information on the alarm occurrence location (axis or option unit, etc.) may be added next to the alarm code.

■ Checking the alarm occurrence status



Alarm occurrence location list

T*	Task *... Task number
SYS	Startup, memory check, generation
ONL	Online command
RMT	Remote command
SEQ	Sequence program
SIN	Standard input
C*	Controller *... Controller number
C*O*	Option board *... Controller number, option slot number
R*/R*A*	Robot, axis *... Robot number, axis number
M*/C*M*	Physical motor *... Controller number, motor number

For example, when “17.403:M1” is displayed, this shows that the position reset position error occurs in motor 1. In the same manner, when “14.400:T02” is displayed, this shows that the communication shutdown error occurs in task 2.

1.1.1 Alarm group number list

The alarm message is classified into groups [0] to [30] according to the alarm contents.
The contents of each group are shown below.

Group number	Contents
[0]	Operation messages
[1]	System events
[2]	Alarm related to the robot movement range
[3]	Alarm related to the program file operation
[4]	Alarm related to the data input
[5]	Operation alarm related to the syntax of the robot language (compile)
[6]	Alarm related to the robot language execution
[7]	(Not used.)
[8]	(Not used.)
[9]	Alarm related to the memory
[10]	Alarm related to the environment and general hardware
[11]	(Not used.)
[12]	Alarm related to the option board
[13]	(Not used.)
[14]	Alarm related to the communication
[15]	(Not used.)
[16]	(Not used.)
[17]	Alarm related to the motor control
[18]	(Not used.)
[19]	(Not used.)
[20]	(Not used.)
[21]	Serious software alarm
[22]	Serious hardware alarm
[23]	(Not used.)
[24]	(Not used.)
[25]	(Not used.)
[26]	(Not used.)
[27]	(Not used.)
[28]	Alarm related to the driver I/F
[29]	(Not used.)
[30]	(Not used.)

1.1.2 Alarm classification number list

Error code	Type	Level	Axis operation in case of error	History	LED display	Reset method	Example
0	Correct	-	-	-	×	-	-
1 to 199	Message	-	-	-	×	Operation restart	HALT, HOLD, break point
200 to 299		-	-	Save	×		CPU start
300 to 399	Operation error	-	Individual operation stop		×	Corresponding operation restart	No point
400 to 499		-	Operation stop		Display		Stop
500 to 599	External error	Level 3	Operation stop			Reset command	PIO24V off, SIO link error
600 to 699		Level 2	Servo brake				Emergency stop, main power off
700 to 799	Internal error	Level 3	Operation stop				Fan error
800 to 899		Level 2	Servo brake				Overload
900 to 999		Level 1	Immediate servo off			System restart	Over-current, driver communication failure

1.1.3 Warning number list

Warning number	Type	Level	Axis operation in case of error	History	LED display	Reset method	Example
c1 to c99	General warning	-	-	-	Warning ⇔ Status	Warning cause is removed.	Overload warning

[0] Operation messages

0.0 : OK

Code : &H0000 &H0000

Meaning/Cause	Correct status. No alarm occurs.
Action	—

0.2 : Running

Code : &H0000 &H0002

Meaning/Cause	Program or command is running.
Action	—

0.5 : Busy

Code : &H0000 &H0005

Meaning/Cause	Data is being saved.
Action	—

0.7 : Turn on power again

Code : &H0000 &H0007

Meaning/Cause	a. System generation was performed due to a robot change, etc. b. Parameter was changed by data transfer. c. System generation data was destroyed. d. Error occurred when servo was turned ON.
Action	Turn the power off and then on again.

0.8 : Try again

Code : &H0000 &H0008

Meaning/Cause	Operation failed.
Action	Try again.

0.16 : Can't edit while DIO DC24V on

Code : &H0000 &H0010

Meaning/Cause	Setting to disable the DC24V monitor function of the DIO was attempted even when DC24V is supplied to the DIO connector. (The monitor function cannot be disabled when DC24V is supplied to DIO.)
Action	To disable the monitor function, stop the DC24V supply, and then change the parameter.

0.19 : Can't edit

Code : &H0000 &H0013

Meaning/Cause	
Action	

0.20 : Illegal command in this mode

Code : &H0000 &H0014

Meaning/Cause	Cannot execute the specified online command in the current mode.
Action	1. Stop the online command. 2. Change the mode.

0.21 : No control authority

Code : &H0000 &H0015

Meaning/Cause	Operation cannot be executed since there is no control authority.
Action	Release the control authority with the programming box.

[1] System events

1.1 : Program terminated by "CUT"

Code : &H0001 &H0001

Meaning/Cause	Program execution was terminated by the "CUT" command.
Action	—

1.2 : Program terminated by "EXIT TASK"

Code : &H0001 &H0002

Meaning/Cause	Program execution was terminated by the "EXIT TASK" command.
Action	—

1.3 : Program terminated by "HALTALL"

Code : &H0001 &0003

Meaning/Cause	Program execution was terminated by the "HALTALL" command.
Action	—

1.4 : Program ended by "HALTALL"

Code : &H0001 &H0004

Meaning/Cause	Program execution was terminated by the "HALTALL" command.
Action	—

1.5 : Program ended by "HALT"

Code : &H0001 &H0005

Meaning/Cause	Program execution was terminated by the "HALT" command.
Action	—

1.6 : Program stopped by "HOLDALL"

Code : &H0001 &H0006

Meaning/Cause	Program execution was stopped by the "HOLDALL" command.
Action	Stop is canceled by pressing the RUN key to restart the program execution from the next command.

1.7 : Program stopped by "HOLD"

Code : &H0001 &H0007

Meaning/Cause	Program execution was stopped by the "HOLD" command.
Action	Stop is canceled by pressing the RUN key to restart the program execution from the next command.

1.8 : Stop executed

Code : &H0001 &H0008

Meaning/Cause	External stop command is input during command execution to stop the operation.
Action	—

1.9 : Arrived at breakpoint

Code : &H0001 &H0009

Meaning/Cause	Break point was reached during program execution.
Action	—

1.10 : Changed control authority

Code : &H0001 &H000A

Meaning/Cause	Operation stopped since the control authority was lost.
Action	Release the control authority with the programming box.

1.11 : Stop other task alarm

Code : &H0001 &H000B

Meaning/Cause	Program execution was stopped since an alarm occurred in other task.
Action	Reset the alarm to restart the program operation.

1.12 : Program stopped by key release

Code : &H0001 &H000C

Meaning/Cause	Run key was released in the “Hold To Run” enable status.
Action	To restart the operation, press the Run key continuously.

1.200 : CPU normal start

Code : &H0001 &H00C8

Meaning/Cause	Start-up checks and initialization ended and controller operation started.
Action	—

[2] Alarm related to the robot movement range

2.300 : Std. coord. doesn't exist

Code : &H0002 &H012C

Meaning/Cause	a. Preset calculation for setting standard coordinates is not functioning. b. Operating position exceeded the operating area range.
Action	1. Set the standard coordinates correctly. 2. Change operating position to within operating area.

2.301 : Coordinate cal. failed

Code : &H0002 &H012D

Meaning/Cause	a. Preset calculation for setting standard coordinates is not functioning. b. Operating position exceeded the operating area range.
Action	1. Set the standard coordinates correctly. 2. Change operating position to within operating area.

2.303 : Shift cal. failed

Code : &H0002 &H012F

Meaning/Cause	Calculating for setting shift coordinates failed.
Action	Set shift coordinates correctly.

2.304 : Hand cal. failed

Code : &H0002 &H0130

Meaning/Cause	a. Design calculation could not be performed during hand definition setting. b. Multiple axes with the same coordinate attribute were operated when specifying the hand R.
Action	1. Set the hand definitions correctly. 2. Set the specified axis of the movement command correctly when specifying the hand R.

2.305 : Illegal Pallet parameter

Code : &H0002 &H0131

Meaning/Cause	Calculation for setting pallet definition failed.
Action	Set pallet definition correctly.

2.306 : Movable range cal. failed

Code : &H0002 &H0132

Meaning/Cause	a. Calculation of movement path failed. b. Current position is not within movement range.
Action	1. Change to a correct movement point. 2. Change current position to within movement range.

2.307 : Overlap soft limit

Code : &H0002 &H0133

Meaning/Cause	In the SCARA robot, the total of the absolute values of the axis 1 or axis 2 plus soft limit and minus soft limit becomes the value to move the arm one or more rotation.
Action	1. Set the soft limit values correctly. 2. Set the soft limit values so that the arm movement range becomes one rotation or less.

2.308 : X exceeded shift coord. range

Code : &H0002 &H0134

Meaning/Cause	X-axis exceeded the shift coordinate range.
Action	1. Change the operation position to the inside of the shift coordinate range. 2. Change the shift coordinate range.

2.309 : Y exceeded shift coord. range

Code : &H0002 &H0135

Meaning/Cause	Y-axis exceeded the shift coordinate range.
Action	1. Change the operation position to the inside of the shift coordinate range. 2. Change the shift coordinate range.

2.310 : Z exceeded shift coord. range

Code : &H0002 &H0136

Meaning/Cause	Z-axis exceeded the shift coordinate range.
Action	1. Change the operation position to the inside of the shift coordinate range. 2. Change the shift coordinate range.

2.311 : R exceeded shift coord. range

Code : &H0002 &H0137

Meaning/Cause	R-axis exceeded the shift coordinate range.
Action	1. Change the operation position to the inside of the shift coordinate range. 2. Change the shift coordinate range.

2.314 : Arch condition bad

Code : &H0002 &H013A

Meaning/Cause	When the arch position and the arch distance of the arch option are set in "mm" units in the SCARA robot, the arch motion cannot be performed for the X/Y-axis.
Action	Change to correct arch motion command.

2.318 : Arm length is 0

Code : &H0002 &H013E

Meaning/Cause	When arm length setting is 0 on SCARA type robots, movement on Cartesian coordinates was attempted.
Action	1. Set standard coordinates. 2. Set the arm length parameter.

2.319 : Cannot move(RIGHTY to LEFTY)

Code : &H0002 &H013F

Meaning/Cause	Interpolation movement shifting from the left-handed system to the right-handed system was executed with a SCARA robot.
Action	Check the current hand system and point data hand system flag.

2.320 : Cannot move (LEFTY to RIGHTY)

Code : &H0002 &H0140

Meaning/Cause	Interpolation movement shifting from the left-handed system to the right-handed system was executed with a SCARA robot.
Action	Check the current hand system and point data hand system flag.

2.321 : Cannot use TOOL coord.

Code : &H0002 &H0141

Meaning/Cause	Failed to select tool coordinates could because no hand data has been entered.
Action	Set the hand data.

CAUTION

An R-axis unit must be installed to a SCARA or Cartesian robot. Set the hand data while a hand or gripper is attached to the tip of the R-axis.

2.326 : Exeeded velocity

Code : &H0002 &H0146

Meaning/Cause	Interpolation operation speed exceeded the specified level.
Action	Change the specified speed.

2.327 : Circular arc cal. failed

Code : &H0002 &H0147

Meaning/Cause	Circular interpolation operation could not be calculated.
Action	1. Specify the circular arc plane option of the circular interpolation correctly. 2. Set the specified axis of the circular interpolation operation correctly.

2.328 : Circular arc restart failed

Code : &H0002 &H0148

Meaning/Cause	Stop position of the “MOVE C” command was different from the restart position.
Action	Match the stop position to the restart position.

2.329 : Same point exists

Code : &H0002 &H0149

Meaning/Cause	a. Same points exist for 1 of 3 points of an MOVE C command. b. Same points are consecutively on the path of PATH motion.
Action	1. Change the MOVE C command to 3 different points. 2. Make changes so that the same points are not consecutively on the path of PATH motion.

2.330 : 3 points on line

Code : &H0002 &H014A

Meaning/Cause	3 points of an MOVE C command were placed on a straight line.
Action	Change the 3 different points of the MOVE C command so they are not on the same straight line.

2.331 : Circular arc radius too small

Code : &H0002 &H014B

Meaning/Cause	MOVE C command radius is less than 0.1mm.
Action	Change MOVE C command to 0.1mm or more for circular arc radius.

2.332 : Circular arc radius too large

Code : &H0002 &H014C

Meaning/Cause	MOVE C command radius exceeded 5000mm (5 meters).
Action	Change MOVE C command to within 5000mm (5 meters) for circular arc radius.

2.333 : Too low speed

Code : &H0002 &H014D

Meaning/Cause	Specified speed was too low so movement time exceeded 60 minutes. Maximum movement time is 60 minutes.
Action	Increase the specified speed.

2.334 : Over soft limit

Code : &H0002 &H014E

Meaning/Cause	Soft limit value preset in the parameter for operation position was exceeded.
Action	1. Change the operating position to within the soft limits. 2. Change the soft limit value.

2.335 : Over movable rang

Code : &H0002 &H014F

Meaning/Cause	Area is outside the movable range of movement path.
Action	1. Set movement points correctly. 2. Specify movement path to be within the movable range.

2.336 : ZR Torque origin failed

Code : &H0002 &H0150

Meaning/Cause	Stroke end return-to-origin of the ZR-axis was failed.
Action	Change the dog length of the R-axis.

2.337 : Illegal DRIVE XY axes

Code : &H0002 &H0151

Meaning/Cause	X-axis or Y-axis point was not specified when using the XY designation option of the DRIVE command.
Action	Specify the X-axis or Y-axis point when using the XY designation option of the DRIVE command.

[3] Alarm related to the program file operation

3.1 : Too many programs

Code : &H0003 &H0001

Meaning/Cause	Making of a new program was attempted after number of programs exceeded 100.
Action	Make a new program after deleting an unnecessary program. (Make a backup if necessary.)

3.2 : Program already exists

Code : &H0003 &H0002

Meaning/Cause	It was attempted to newly create, copy, or send (register with the “SEND” command) the same name as the registered program name.
Action	Create, copy, or send (register with the “SEND” command) an unregistered program name.

3.3 : Program doesn't exist

Code : &H0003 &H0003

Meaning/Cause	A registered program of the specified name does not exist.
Action	Correctly enter a registered program name.

3.4 : Writing prohibited

Code : &H0003 &H0004

Meaning/Cause	The specified program is write protected.
Action	Use a program that is not write protected.

3.6 : Too many breakpoints

Code : &H0003 &H0006

Meaning/Cause	Setting of break point exceeding 32 points was attempted.
Action	After deleting unnecessary break points, set the new break point. (Up to 32 break points can be set in one program.)

3.7 : Breakpoint doesn't exist

Code : &H0003 &H0007

Meaning/Cause	Break point was not found during search.
Action	Set a break point if needed.

3.18 : Duplicated Breakpoint

Code : &H0003 &H0012

Meaning/Cause	Setting of breakpoint was attempted on line already set with breakpoints.
Action	To set the breakpoint, specify a line where breakpoints have not yet been set.

3.19 : Illegal program no

Code : &H0003 &H0013

Meaning/Cause	Program number beyond program 1 to 100 was specified.
Action	Specify a program number ranging from 1 to 100.

3.20 : Program step doesn't exist

Code : &H0003 &H0014

Meaning/Cause	It was attempted to perform the operation by specifying the number of lines exceeding that registered in the program.
Action	Operate the lines registered in the program.

3.21 : Reading prohibited

Code : &H0003 &H0015

Meaning/Cause	It was attempted to browse the program with the hidden attribute.
Action	Make the relevant program readable.

3.37 : Program already loaded

Code : &H0003 &H0025

Meaning/Cause	It was attempted to load the program that is already in the executable status.
Action	—

3.38 : Program is running

Code : &H0003 &H0026

Meaning/Cause	It was attempted to start the program that is already running.
Action	—

3.39 : Sequence program is running

Code : &H0003 &H0027

Meaning/Cause	It was attempted to revise or delete the sequence program that is running.
Action	Stop the sequence program.

3.40 : Can't found sequence object

Code : &H0003 &H0028

Meaning/Cause	It was attempted to execute the sequence program that has not been compiled.
Action	Compile the sequence program.

[4] Alarm related to the data input

4.1 : Point number error

Code : &H0004 &H0001

Meaning/Cause	A point number was entered exceeding P29999.
Action	Input a correct point number.

4.2 : Input format error

Code : &H0004 &H0002

Meaning/Cause	Wrong format was used to enter the data.
Action	Use the correct data format.

4.4 : Undefined robot number

Code : &H0004 &H0004

Meaning/Cause	Specified robot number does not exist.
Action	Enter a correct robot number.

4.5 : Undefined axis number

Code : &H0004 &H0005

Meaning/Cause	Specified axis number does not exist.
Action	Enter a correct axis number.

4.6 : Invalid input number

Code : &H0004 &H0006

Meaning/Cause	Invalid data was entered. a. Invalid data was entered in the area check output port number.
Action	1. Enter a port number that can be used

4.8 : Parameter range error

Code : &H0004 &H0008

Meaning/Cause	It was attempted to set a parameter exceeding the range that can be input.
Action	Set the parameter within the range that can be input.

4.9 : Point name doesn't exist

Code : &H0004 &H0009

Meaning/Cause	
Action	

4.10 : Illegal point name

Code : &H0004 &H000A

Meaning/Cause	
Action	

4.11 : Illegal I/O port

Code : &H0004 &H000B

Meaning/Cause	
Action	

4.12 : Data not enough

Code : &H0004 &H000C

Meaning/Cause	
Action	

[5] Operation alarm related to the syntax of the robot language (compile)

5.1 : Syntax error

Code : &H0005 &H0001

Meaning/Cause	Syntax error found in program.
Action	Change to the correct syntax.

5.2 : Data error

Code : &H0005 &H0002

Meaning/Cause	Data entered in wrong format.
Action	Input the data in the correct format.

5.3 : Number error

Code : &H0005 &H0003

Meaning/Cause	a. Mistake in the number entry. b. Expression value is wrong.
Action	1. Change to the correct number. 2. Change to the correct value.

5.4 : Bit number error

Code : &H0005 &H0004

Meaning/Cause	Specified bit number is not within 0 to 7.
Action	Change to the correct bit number.

5.6 : Digit number error

Code : &H0005 &H0006

Meaning/Cause	a. Binary number has exceeded 8 digits (places). b. Octal number has exceeded 6 digits (places). c. Decimal number has exceeded the specified range. d. Hexadecimal number has exceeded 8 digits (places). e. Cartesian coordinate point data has more than 3 decimal places.
Action	1. Change to the correct number of digits (places). 2. Specify the Cartesian coordinate point data of up to 2 decimal places.

5.7 : Illegal axis name

Code : &H0005 &H0007

Meaning/Cause	Robot axis name is wrong.
Action	Change to the correct axis name.

5.8 : Illegal order

Code : &H0005 &H0008

Meaning/Cause	Wrong bit specified for input/output port.
Action	Change to ascending order starting from right.

5.9 : Too many parameters

Code : &H0005 &H0009

Meaning/Cause	
Action	

5.11 : Overflow

Code : &H0005 &H000B

Meaning/Cause	
Action	

5.12 : Stack overflow

Code : &H0005 &H000C

Meaning/Cause	a. Parenthesis was used 6 times or continuously in an expression. b. Overflow in stack area for compiling/execution.
Action	1. Reduce parentheses in the expression to 5 times or less. 2. Reduce program size. 3. Reduce nesting of GOSUB statement, CALL statement and FOR to NEXT statement. 4. Reduce argument of CALL statement. (especially character variables)

5.13 : Illegal variable

Code : &H0005 &H000D

Meaning/Cause	A variable other than a global variable was used in SEND/@READ/@WRITE commands.
Action	Change to a global variable.

5.14 : Type mismatch

Code : &H0005 &H000E

Meaning/Cause	a. Expression does not match on both sides. b. Prohibited type constant/variable/expression was used.
Action	1. Change so that both sides of expression match. 2. Use a correct type of constant/variable/expression.

5.15 : FOR variable error

Code : &H0005 &H000F

Meaning/Cause	Variable names for NEXT statement and corresponding FOR statement do not match.
Action	Change so that FOR statement variable names match with NEXT statement variable names.

5.16 : WEND without WHILE

Code : &H0005 &H0010

Meaning/Cause	There is no WHILE statement corresponding to the WEND statement.
Action	1. Delete the WEND statement. 2. Add a WHILE statement corresponding to the WEND statement.

5.17 : WHILE without WEND

Code : &H0005 &H0011

Meaning/Cause	There is no WEND statement corresponding to WHILE statement.
Action	1. Delete the WHILE statement. 2. Add a WEND statement corresponding to the WHILE statement.

5.18 : NEXT without FOR

Code : &H0005 &H0012

Meaning/Cause	a. There is no FOR statement corresponding to NEXT statement. b. NEXT command was executed without executing FOR command.
Action	1. Delete the NEXT statement. 2. Add a FOR statement corresponding to the NEXT statement. 3. Confirm execution of FOR command.

5.19 : FOR without NEXT

Code : &H0005 &H0013

Meaning/Cause	There is no NEXT statement corresponding to FOR statement.
Action	1. Delete the FOR statement. 2. Add a NEXT statement corresponding to the FOR statement.

5.20 : ENDIF without IF

Code : &H0005 &H0014

Meaning/Cause	There is no IF statement corresponding to ENDIF statement.
Action	1. Delete the ENDIF statement. 2. Add an IF statement corresponding to the ENDIF statement.

5.21 : ELSE without IF

Code : &H0005 &H0015

Meaning/Cause	There is no IF statement corresponding to ELSE statement.
Action	1. Delete the ELSE statement. 2. Add an IF statement corresponding to the ELSE statement.

5.22 : IF without ENDIF

Code : &H0005 &H0016

Meaning/Cause	There is no ENDIF statement corresponding to IF statement.
Action	1. Delete the IF statement. 2. Add an ENDIF statement corresponding to the IF statement.

5.23 : ELSE without ENDIF

Code : &H0005 &H0017

Meaning/Cause	There is no ENDIF statement corresponding to ELSE statement.
Action	1. Delete the ELSE statement. 2. Add an ENDIF statement corresponding to the ELSE statement.

5.24 : END SUB without SUB

Code : &H0005 &H0018

Meaning/Cause	a. There is no SUB statement corresponding to END SUB statement. b. END SUB command was executed without SUB command.
Action	1. Delete the END SUB statement. 2. Add a SUB statement corresponding to the END SUB statement. 3. Confirm execution of SUB command.

5.25 : SUB without END SUB

Code : &H0005 &H0019

Meaning/Cause	There is no END SUB statement corresponding to SUB statement.
Action	1. Delete the SUB statement. 2. Add an END SUB statement corresponding to the SUB statement.

5.26 : Duplicated variable

Code : &H0005 &H001A

Meaning/Cause	Two or more array variables were defined for the same name.
Action	Delete a definition statement for the array variables with the same name.

5.27 : Duplicated identifier

Code : &H0005 &H001B

Meaning/Cause	Two or more identifiers were defined for the same name.
Action	Define another identifier.

5.28 : Duplicated label

Code : &H0005 &H001C

Meaning/Cause	Two or more of the same labels were defined.
Action	Define another label.

5.29 : Undefined array

Code : &H0005 &H001D

Meaning/Cause	Assignment/reference was made for undefined array.
Action	Define the undefined array.

5.30 : Undefined identifier

Code : &H0005 &H001E

Meaning/Cause	An undefined identifier was used.
Action	Define an identifier for undefined identifier.

5.31 : Undefined label

Code : &H0005 &H001F

Meaning/Cause	Reference made to undefined label.
Action	Set definition for undefined label.

5.32 : Undefined user function

Code : &H0005 &H0020

Meaning/Cause	Undefined function was called.
Action	Set definition for undefined function.

5.33 : Undefined HAND

Code : &H0005 &H0021

Meaning/Cause	
Action	

5.34 : Too many dimensions

Code : &H0005 &H0022

Meaning/Cause	An array exceeding 3 dimensions was defined.
Action	Change array to within 3 dimensions.

5.35 : Dimension mismatch

Code : &H0005 &H0023

Meaning/Cause	The number of array dimensions does not match that defined by the DIM statement.
Action	1. Make the number of array dimensions match that defined by the DIM statement. 2. Make the number of array dimensions match the DIM statement.

5.36 : Argument mismatch

Code : &H0005 &H0024

Meaning/Cause	The number of SUB statement arguments does not correspond to the CALL statement.
Action	Make the number of SUB statements correspond to the CALL statement.

5.38 : Illegal option

Code : &H0005 &H0026

Meaning/Cause	Error is present in command option.
Action	Define another identifier.

5.39 : Illegal identifier

Code : &H0005 &H0027

Meaning/Cause	Reserved word was used as an identifier.
Action	Change to an identifier not used as a reserved word. Refer to the programming manual.

5.40 : Illegal command in procedure

Code : &H0005 &H0028

Meaning/Cause	Cannot execute command within procedure (from SUB to END SUB statements).
Action	Delete command that cannot be executed within procedure.

5.41 : Illegal command outside procedure

Code : &H0005 &H0029

Meaning/Cause	Command cannot be executed outside of procedure (between SUB to END SUB statements).
Action	Delete command that cannot be executed outside of procedure.

5.42 : Illegal command inside IF

Code : &H0005 &H002A

Meaning/Cause	Cannot execute command between IF to ENDIF statements. (Command can be executed for one IF statement line.)
Action	Delete command that cannot be executed between IF to ENDIF statements.

5.43 : Illegal direct

Code : &H0005 &H002B

Meaning/Cause	Independent execution of command is impossible.
Action	1. Change execution according to program. 2. Change it to a command that can be executed independently.

5.44 : Cannot use external label

Code : &H0005 &H002C

Meaning/Cause	Command cannot use an external label.
Action	1. Change to an internal label. 2. Change execution command.

5.45 : Illegal program name

Code : &H0005 &H002D

Meaning/Cause	a. When transmitting a program file by SEND command, the NAME statement was not defined on beginning line of the program data. b. Characters other than alphanumeric and underscore (_) were used in the program name. c. Program name has exceeded 32 characters.
Action	1. Define NAME statement on beginning line of program data. 2. Use only alphanumeric and underscore (_) characters in the program name. 3. Use 32 characters or less in the program name.

5.46 : Too many identifiers

Code : &H0005 &H002E

Meaning/Cause	Number of identifiers exceeded 500.
Action	Ensure the number of identifiers is within 500 items.

5.47 : CASE without SELECT

Code : &H0005 &H002F

Meaning/Cause	There is no SELECT statement corresponding to CASE statement.
Action	1. Delete the CASE statement. 2. Add a SELECT statement corresponding to the CASE statement.

5.48 : END SELECT without SELECT

Code : &H0005 &H0030

Meaning/Cause	There is no SELECT statement corresponding to END SELECT statement.
Action	1. Delete the END SELECT statement. 2. Add a SELECT statement corresponding to the END SELECT statement.

5.49 : SELECT without END SELECT

Code : &H0005 &H0031

Meaning/Cause	There is no END SELECT statement corresponding to SELECT statement.
Action	1. Delete the SELECT statement. 2. Add an END SELECT statement corresponding to the SELECT statement.

5.50 : CASE without END SELECT

Code : &H0005 &H0032

Meaning/Cause	There is no END SELECT statement corresponding to CASE statement.
Action	1. Delete the CASE statement. 2. Add an END SELECT statement corresponding to the CASE statement.

5.51 : Illegal command line

Code : &H0005 &H0033

Meaning/Cause	Cannot execute command statement between SELECT and CASE statements.
Action	Delete the command statement between SELECT and CASE statements.

5.52 : Command doesn't exist

Code : &H0005 &H0034

Meaning/Cause	Line does not have a command statement.
Action	1. Add a command statement. 2. Delete the line that does not have a command statement.

5.53 : Compile failure

Code : &H0005 &H0035

Meaning/Cause	Error occurred in software.
Action	Contact your distributor with details of the problem.

5.54 : ELSEIF without IF

Code : &H0005 &H0036

Meaning/Cause	There is no IF statement corresponding to ELSEIF statement.
Action	1. Delete the ELSEIF statement. 2. Add an IF statement corresponding to the ELSEIF statement.

5.55 : ELSEIF without ENDIF

Code : &H0005 &H0037

Meaning/Cause	There is no ENDIF statement corresponding to ELSEIF statement.
Action	1. Delete the ELSEIF statement. 2. Add an ENDIF statement corresponding to the ELSEIF statement.

5.100 : Identifier already exists

Code : &H0005 &H0064

Meaning/Cause	
Action	

5.101 : EXIT FOR without FOR

Code : &H0005 &H0065

Meaning/Cause	There is no FOR statement corresponding to EXIT FOR statement.
Action	1. Delete the EXIT FOR statement. 2. Add a FOR statement corresponding to the EXIT FOR statement

5.102 : EXIT SUB without SUB

Code : &H0005 &H0066

Meaning/Cause	There is no SUB statement corresponding to the EXIT SUB statement.
Action	1. Delete the EXIT SUB statement. 2. Add a SUB statement corresponding to the EXIT SUB statement

5.103 : Can't open communicate file

Code : &H0005 &H0067

Meaning/Cause	
Action	

[6] Alarm related to the robot language execution

6.1 : Illegal command

Code : &H0006 &H0001

Meaning/Cause	Execution of a non-supported or non-executable command was attempted.
Action	Change to a command that can be executed.

6.2 : Illegal function call

Code : &H0006 &H0002

Meaning/Cause	The expression "ON <expression> GOTO" or "ON <expression> GOSUB" command was a negative value.
Action	Change <expression> to a positive value.

6.3 : Division by 0

Code : &H0006 &H0003

Meaning/Cause	A command to divide by 0 (÷ 0) was attempted.
Action	Change from the divide by 0 command.

6.4 : Point doesn't exist

Code : &H0006 &H0004

Meaning/Cause	Assignment, movement or reference to an undefined point was attempted.
Action	Define the point.

6.5 : Coordinate type error

Code : &H0006 &H0005

Meaning/Cause	a. Arithmetic operations of joint coordinate point data and Cartesian coordinate point data were attempted. b. Joint coordinate system and Cartesian coordinate system were mixed together within the MOVE C, command point data. c. Point data in PMOVE command was not specified in Cartesian coordinates.
Action	1. Change to same coordinate system. 2. Change to Cartesian coordinate system.

6.6 : Subscript out of range

Code : &H0006 &H0006

Meaning/Cause	A subscript of an array variable has exceeded the range defined in DIM statement.
Action	Change the subscript of array variable to within the defined range.

6.7 : RETURN without GOSUB

Code : &H0006 &H0007

Meaning/Cause	RETURN command was executed without executing the GOSUB command.
Action	Confirm execution of GOSUB command.

6.8 : END SUB without CALL

Code : &H0006 &H0008

Meaning/Cause	END SUB command was executed without executing CALL command.
Action	Confirm execution of SUB command.

6.9 : EXIT SUB without CALL

Code : &H0006 &H0009

Meaning/Cause	EXIT SUB command was executed without executing CALL command.
Action	Confirm execution of SUB command.

6.10 : SUSPEND without START

Code : &H0006 &H000A

Meaning/Cause	SUSPEND command was executed for a task not executed by START command.
Action	Confirm execution of START command.

6.11 : CUT without START

Code : &H0006 &H000B

Meaning/Cause	CUT command was executed for a task not executed by START command.
Action	Confirm execution of START command.

6.12 : RESTART without START

Code : &H0006 &H000C

Meaning/Cause	RESTART command was executed for a task not executed by START command.
Action	Confirm execution of START command.

6.13 : RESTART without SUSPEND

Code : &H0006 &H000D

Meaning/Cause	RESTART command was executed for a task not executed by SUSPEND command.
Action	Confirm execution of SUSPEND command.

6.14 : Task number error

Code : &H0006 &H000E

Meaning/Cause	a. Task number is outside the range 1 to 16. b. START, CUT, SUSPEND or RESTART command was executed for task 1 (main task). c. START, CUT, SUSPEND or RESTART command was executed for its own task.
Action	1. Change to a correct task number. 2. Delete task command for task 1. 3. Delete command for its own task.

6.15 : Task running

Code : &H0006 &H000F

Meaning/Cause	START command was executed for a task currently in operation.
Action	Delete START command.

6.16 : Task suspending

Code : &H0006 &H0010

Meaning/Cause	START or SUSPEND command was executed for a task in pause (suspend) condition.
Action	Delete START or SUSPEND command.

6.17 : Illegal command in error routine

Code : &H0006 &H0011

Meaning/Cause	Command which could not be executed was attempted within an error processing routine.
Action	Delete the command which could not be executed.

6.18 : EXIT FOR without FOR

Code : &H0006 &H00012

Meaning/Cause	EXIT FOR command was executed without executing FOR command.
Action	Confirm execution of FOR command.

6.19 : SUB without CALL

Code : &H0006 &H0013

Meaning/Cause	SUB command was executed without executing CALL command.
Action	Confirm execution of CALL command.

6.20 : Not execute CALL

Code : &H0006 &H0014

Meaning/Cause	CALL command was not executed.
Action	Confirm execution of CALL command.

6.25 : No sufficient memory for OUT

Code : &H0006 &H0019

Meaning/Cause	Failed to run an OUT command due to insufficient memory caused by multiple OUT commands that were run in succession.
Action	Check the number of OUT commands. The maximum number of OUT commands that can be run in parallel is 16.

6.26 : PATH without SET

Code : &H0006 &H001A

Meaning/Cause	Any of PATH L, PATH C and PATH END was executed without executing PATH SET.
Action	First execute PATH SET when setting a path.

6.27 : PATH without END

Code : &H0006 &H001B

Meaning/Cause	PATH START was executed without executing PATH END.
Action	Execute PATH END to end the path setting and then execute PATH START.

6.28 : No PATH data

Code : &H0006 &H001C

Meaning/Cause	No path is set for PATH motion.
Action	Set a path with PATH L and PATH C. The previously set path will be lost in the following cases: • When PATH SET is executed. • When program is changed. • When program is reset. • When controller power is turned off.

6.29 : Too many PATH data

Code : &H0006 &H001D

Meaning/Cause	The number of PATH motion paths has exceeded 300.
Action	Reduce the number of PATH motion paths to 300 or less in total of straight lines and circular arcs.

6.30 : Not PATH start position

Code : &H0006 &H001E

Meaning/Cause	Robot's current position is not the start position of PATH motion.
Action	Move the robot to the start position specified with PATH SET and then execute PATH START.

6.31 : PATH execute error

Code : &H0006 &H001F

Meaning/Cause	Cannot execute PATH motion. a. Acceleration zone distance is too short. b. Speed is too high in the position where the direction changes.
Action	1. Reduce the speed setting. 2. Lengthen the straight line or circular arc distance containing acceleration/deceleration. 3. Make setting so that the direction at the connection point of straight lines does not change greatly.

6.32 : ABS of MARK incomplete

Code : &H0006 &H0020

Meaning/Cause	Absolute reset was attempted with an ORIGIN statement or dedicated input while absolute reset on an axis whose return-to-origin method is set to "Mark" is incomplete.
Action	Perform the absolute reset of the axis with the "mark" method first.

6.33 : MARK method is not allowed

Code : &H0006 &H0021

Meaning/Cause	Return-to-origin was attempted with an ORIGIN statement or dedicated input while the return-to-origin method for an incremental type axis or semi-absolute type axis is set to "Mark".
Action	Return-to-origin on the incremental type axis or semi-absolute type axis cannot be performed by the mark method. Change the return-to-origin method.

6.34 : Port number error

Code : &H0006 &H0022

Meaning/Cause	a. Port numbers specified for the DO, DI, MO, SI, and SO ports were not 0 to 7, 10 to 17, and 20 to 27. b. Port numbers specified for the LO and TO ports were not 0. c. Output to port 0 or port 1 was specified for the DO, MO, and SO ports.
Action	1. Change to the correct port numbers. 2. Make the change so that the output to a port other than port 0 and port 1 is specified for the DO, MO, and SO ports.

6.35 : Password mismatch

Code : &H0006 &H0023

Meaning/Cause	Password was not correct.
Action	Enter a correct password.

6.36 : Undefined pallet

Code : &H0006 &H0024

Meaning/Cause	Specified pallet definitions were not found.
Action	1. Change the specified pallet. 2. Define the pallet.

6.37 : Specification mismatch

Code : &H0006 &H0025

Meaning/Cause	Command is non-executable in the current robot specifications.
Action	Change the execution command.

6.101 : Stack underflow

Code : &H0006 &H0065

Meaning/Cause	
Action	

6.102 : Data out of range

Code : &H0006 &H0066

Meaning/Cause	
Action	

6.103 : Illegal point no

Code : &H0006 &H0067

Meaning/Cause	
Action	

6.104 : Illegal shift no

Code : &H0006 &H0068

Meaning/Cause	
Action	

6.105 : Illegal hand no

Code : &H0006 &H0069

Meaning/Cause	
Action	

6.106 : Illegal pallet no

Code : &H0006 &H006A

Meaning/Cause	
Action	

6.107 : Illegal axis no

Code : &H0006 &H006B

Meaning/Cause	
Action	

6.108 : Illegal robot no

Code : &H0006 &H006C

Meaning/Cause	
Action	

6.109 : Illegal task no

Code : &H0006 &H006D

Meaning/Cause	
Action	

6.110 : Too many characters

Code : &H0006 &H006E

Meaning/Cause	a. Character string constant exceeding 75 characters was defined. b. Character string exceeding 75 characters was added.
Action	1. Change to a character string constant with 75 characters or less. 2. Change to a character string addition with 75 characters or less.

6.111 : Task stopped

Code : &H0006 &H006F

Meaning/Cause	
Action	

6.112 : Task doesn't exist

Code : &H0006 &H0070

Meaning/Cause	
Action	

6.113 : Too many Tasks

Code : &H0006 &H0071

Meaning/Cause	
Action	

6.114 : Type mismatch

Code : &H0006 &H0072

Meaning/Cause	
Action	

6.115 : Timeout

Code : &H0006 &H0073

Meaning/Cause	
Action	

6.116 : All axes complated

Code : &H0006 &H0074

Meaning/Cause	
Action	

6.117 : Access level error

Code : &H0006 &H0075

Meaning/Cause	
Action	

6.300 : Motor power off

Code : &H0006 &H012C

Meaning/Cause	
Action	

6.301 : Servo off

Code : &H0006 &H012D

Meaning/Cause	Movement command was executed in the servo off status.
Action	Put the robot in the servo on status.

6.302 : Origin incomplete

Code : &H0006 &H012E

Meaning/Cause	a. Operations shown below were performed in the origin incomplete status. • Program or command execution • Point teaching • Cartesian coordinate movement Return-to-origin operation was not performed. b. Absolute battery was removed from the controller. Or, retained position became unstable by absolute battery voltage drop. c. ROB I/O cable was disconnected. d. Return-to-origin operation was stopped halfway. e. System generation was changed or parameters were initialized. Or, parameters to determine the origin return direction, axis polarity, or origin position were changed. (Writing ALL and PRM files into the controller is also included.)
Action	Perform the absolute reset or return-to-origin operation to put the robot in the return-to-origin complete status.

6.309 : INC.motor disconnected

Code : &H0006 &H0135

Meaning/Cause	Return-to-origin command of the incremental type axis was executed in the system setting without incremental type axis.
Action	Check the system generation data.

6.310 : ABS.motor disconnected

Code : &H0006 &H0136

Meaning/Cause	Return-to-origin command of the absolute type axis was executed in the system setting without absolute type axis.
Action	Check the system generation data.

6.312 : ABS.reset position incomplete

Code : &H0006 &H0138

Meaning/Cause	
Action	

6.313 : MRK.motor disconnected

Code : &H0006 &H0139

Meaning/Cause	
Action	

6.314 : Can't execute while servo on

Code : &H0006 &H013A

Meaning/Cause	It was attempted to write the ALL and PRM files in the servo on status. ALL and PRM files could not be written in the servo on status.
Action	Write the file in the servo off status.

6.315 : ZR torque origin incorrect setting

Code : &H0006 &H013B

Meaning/Cause	a. Return-to-origin was executed at the same time when setting the ZR stroke end method. b. R-axis stack was not set for the Z-axis. c. Z-axis or R-axis return-to-origin method was not set to the ZR stroke end method. d. Multiple Z-axis (or R-axis) return-to-origin methods were set to the ZR stroke end method.
Action	1. Set the return-to-origin order correctly. (Simultaneous return-to-origin is impossible.) 2. Set the R-axis stack correctly. 3. Set the Z-axis and R-axis return-to-origin methods to the ZR stroke end method. 4. Set one Z-axis or R-axis for the ZR stroke end method.

6.316 : Can't execute while servo on

Code : &H0006 &H013C

Meaning/Cause	
Action	

6.317 : Illegal origin method

Code : &H0006 &H013D

Meaning/Cause	
Action	

6.319 : Can't change hand data

Code : &H0006 &H013F

Meaning/Cause	
Action	

6.399 : Can't execute while alarm

Code : &H0006 &H018F

Meaning/Cause	
Action	

6.999 : Interpreter runtime system error

Code : &H0006 &H03E7

Meaning/Cause	
Action	

[9] Alarm related to the memory

9.300 : Memory full

Code : &H0009 &H012C

Meaning/Cause	No available space in the program or point data area.
Action	Delete unnecessary programs or points.

9.301 : Program too big

Code : &H0009 &H012D

Meaning/Cause	Source program size exceeded the permissible size.
Action	Compress the source program size.

9.701 : Program destroyed

Code : &H0009 &H02BD

Meaning/Cause	a. Part or all of the program data has been destroyed. b. This error message is sometimes issued due to a major error or the power being turned off during rewrite of program data.
Action	1. Delete that program during selection. 2. Initialize the program data.

9.702 : Point data destroyed

Code : &H0009 &H02BE

Meaning/Cause	a. Part or all of the point data has been destroyed. b. This error message is sometimes issued due to a major error or the power being turned off during rewrite of point data.
Action	Initialize the point data.

9.704 : Parameter destroyed

Code : &H0009 &H02C0

Meaning/Cause	Part or all of the parameter data has been destroyed.
Action	Initialize the parameter data.

9.706 : Shift data destroyed

Code : &H0009 &H02C2

Meaning/Cause	Part or all of the shift data has been destroyed.
Action	Initialize the shift data.

9.707 : Hand data destroyed

Code : &H0009 &H02C3

Meaning/Cause	Part or all of the hand data has been destroyed.
Action	Initialize the hand data.

9.709 : Pallet data destroyed

Code : &H0009 &H02C5

Meaning/Cause	Part or all of the pallet definition data was destroyed.
Action	Initialize the pallet definition data.

9.710 : Break point data destroyed

Code : &H0009 &H02C6

Meaning/Cause	
Action	

9.711 : IO name data destroyed

Code : &H0009 &H02C7

Meaning/Cause	
Action	

9.712 : Area checkout data destroyed

Code : &H0009 &H02C8

Meaning/Cause	
Action	

9.713 : Calibration data destroyed

Code : &H0009 &H02C9

Meaning/Cause	
Action	

9.714 : Convair data destroyed

Code : &H0009 &H02CA

Meaning/Cause	
Action	

9.715 : Alarm log destroyed

Code : &H0009 &H02CB

Meaning/Cause	
Action	

9.716 : Variable data destroyed

Code : &H0009 &H02CC

Meaning/Cause	
Action	

9.717 : Program register data destroyed

Code : &H0009 &H02CD

Meaning/Cause	
Action	

9.718 : Communicate setting destroyed

Code : &H0009 &H02CE

Meaning/Cause	
Action	

9.722 : GEP parameter destroyed

Code : &H0009 &H02D2

Meaning/Cause	
Action	

9.723 : Controller status data destroyed

Code : &H0009 &H02D3

Meaning/Cause	
Action	

9.724 : Robot status data destroyed

Code : &H0009 &H02D4

Meaning/Cause	
Action	

9.725 : Axis status data destroyed

Code : &H0009 &H02D5

Meaning/Cause	
Action	

9.726 : Motor status data destroyed

Code : &H0009 &H02D6

Meaning/Cause	
Action	

9.727 : Out status data destroyed

Code : &H0009 &H02D7

Meaning/Cause	
Action	

9.729 : Sequence object destroyed

Code : &H0009 &H02D9

Meaning/Cause	Part or all of the sequence object program has been destroyed.
Action	Make the sequence object program again.

9.900 : Sys.generation destroyed

Code : &H0009 &H0384

Meaning/Cause	A part or all of the system generation data has been destroyed.
Action	Re-perform the system generation data.

9.901 : Sys.generation mismatch

Code : &H0009 &H0385

Meaning/Cause	Robot type or axis number designation in the system generation data was incorrect.
Action	Re-perform the system generation data.

[10] Alarm related to the environment and general hardware

10.1 : Robot disconnected

Code : &H000A &H0001

Meaning/Cause	Axis control was attempted with "no axis" specified for all axes of system generation.
Action	Re-perform the system generation.

10.4 : D.unit disconnected

Code : &H000A &H0004

Meaning/Cause	Manual movement was attempted on the axis that is not specified.
Action	Do not perform any axis-related operation.

10.5 : Illegal robot type

Code : &H000A &H0005

Meaning/Cause	
Action	

10.6 : DRIVER.unit version mismatch

Code : &H000A &H0006

Meaning/Cause	Driver unit version does not match the CPU unit.
Action	Make sure the CPU unit and driver unit versions match each other.

10.7 : CPU.unit version mismatch

Code : &H000A &H0007

Meaning/Cause	CPU unit version does not match the CPU.
Action	Make sure the CPU unit and driver unit versions match each other.

10.8 : Cannot set auxiliary axis

Code : &H000A &H0008

Meaning/Cause	Setting of axis that cannot be set as an auxiliary axis was attempted. The following axes cannot be set as an auxiliary axis. • SCARA type robot axes • X and Y axes except on MULTI type robots
Action	1. Do not set an auxiliary axis. 2. Change the axis setting.

10.9 : Cannot set no axis

Code : &H000A &H0009

Meaning/Cause	A no-axis setting was attempted on an axis which cannot accept it. The following axes cannot be set to no-axis. • X and Y axes except on MULTI type robots
Action	1. Do not make a no-axis setting. 2. Change the axis setting.

10.10 : Cannot change axis

Code : &H000A &H000A

Meaning/Cause	Changing of an axis whose setting cannot be changed was attempted. The following axes cannot be changed. • X and Y axes on SCARA type robots
Action	1. Do not change that axis. 2. Change a different axis.

10.11 : FDD isn't installed

Code : &H000A &H000B

Meaning/Cause	
Action	

10.12 : EEPROM isn't installed

Code : &H000A &H000C

Meaning/Cause	
Action	

10.13 : Cannot set Dualdrive

Code : &H000A &H000D

Meaning/Cause	A dual drive setting was attempted on an axis that cannot be set to dual drive.
Action	1. Do not set to dual drive. 2. Change the axis setting.

10.14 : Undefined parameter found

Code : &H000A &H000E

Meaning/Cause	a. Undefined, wrong parameter data was written because controller data from different controller version was used b. Parameter name is wrong.
Action	1. Write the correct parameter data. 2. Enter the parameter name correctly. 3. Set the "Skip undefined parameters" parameter to "VALID".

10.15 : D.unit type mismatch

Code : &H000A &H000F

Meaning/Cause	
Action	

10.16 : Cannot set YC-Link

Code : &H000A &H0010

Meaning/Cause	An attempt was made to set a YC-Link for an axis that is set to dual drive.
Action	1. Do not set the YC-Link. 2. Change the axis setting.

10.17 : Cannot set Gripper

Code : &H000A &H0011

Meaning/Cause	a. It was attempted to set the gripper for the YC-Link set axis. b. It was attempted to set the gripper for the dual drive set axis. c. It was attempted to set the gripper for an axis number exceeding the number of boards installed.
Action	1. Do not set the gripper for such axis. 2. Change the setting axis.

10.18 : Cannot change auxiliary axis

Code : &H000A &H0012

Meaning/Cause	It was attempted to reset the auxiliary axis setting of the gripper set axis.
Action	Do not reset the auxiliary axis setting.

10.19 : Illegal axis type

Code : &H000A &H0013

Meaning/Cause	
Action	

10.21 : Sys. backup battery low voltage

Code : &H000A &H0015

Meaning/Cause	a. System backup battery voltage is low. b. System backup battery is disconnected from CPU board.
Action	1. Replace system backup battery. 2. Connect system backup battery securely to CPU board.

10.23 : Axis disconnected

Code : &H000A &H0017

Meaning/Cause	
Action	

10.25 : Controller disconnected

Code : &H000A &H0019

Meaning/Cause	
Action	

10.26 : Motor disconnected

Code : &H000A &H001A

Meaning/Cause	
Action	

10.100: Real time clock data faild

Code : &H000A &H0064

Meaning/Cause	
Action	

10.101: Driver overlap assign

Code : &H000A &H0065

Meaning/Cause	
Action	

10.700: Illegal safe mode

Code : &H000A &H02BC

Meaning/Cause	
Action	

10.900: Turn on power again

Code : &H000A &H0384

Meaning/Cause	a. System generation was performed since the robot, etc. was changed. b. Parameters were changed through the communication. c. System generation data was destroyed. d. Error occurred when attempting to turn on the servo.
Action	Turn the power off and then on again.

[12] Alarm related to the option board

12.21 : PROFIBUS link error

Code : &H000C &H0015

Meaning/Cause	a. Error in cable for PROFIBUS system. b. The PROFIBUS system's station address setting is incorrect. c. The master unit power is turned off, or the PLC has stopped operating or is not operating correctly, or is broken. d. Breakdown in PROFIBUS compatible unit.
Action	1. Check for a break, misconnection or wiring error in PROFIBUS cable, and check the specifications (cable length, etc.). 2. Check the station address settings. 3. Check whether the master unit is operating correctly. 4. Check the hardware configuration settings. 5. Replace the PROFIBUS compatible unit.

12.22 : PROFIBUS hardware error

Code : &H000C &H0016

Meaning/Cause	Breakdown in PROFIBUS compatible unit.
Action	Replace the PROFIBUS compatible unit.

12.31 : DI DC24V disconnected

Code : &H000C &H001F

Meaning/Cause	a. 24V DC not being supplied to DI section of OPT.DIO unit. b. Drop in 24V DC supply voltage to DI section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24V DC to DI section of OPT.DIO. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if a sufficient 24V DC is supplied to DI section of OPT.DIO unit.

12.32 : DO1 DC24V disconnected

Code : &H000C &H0020

Meaning/Cause	a. 24V DC not being supplied to DO1 section of OPT.DIO unit. b. Drop in 24V DC supply voltage to DO1 section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24V DC to DO1section of OPT.DIO unit. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if load connected to DO1 section of OPT.DIO unit is too large for the 24V DC supply to handle.

12.33 : DO2 DC24V disconnected

Code : &H000C &H0021

Meaning/Cause	a. 24V DC not being supplied to DO2 section of OPT.DIO unit. b. Drop in 24V DC supply voltage to DO2 section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24V DC to DO2 section of OPT.DIO unit. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if load connected to DO2 section of OPT.DIO unit is too large for the 24V DC supply to handle.

12.34 : POS.OUT Point not exist

Code : &H000C &H0022

Meaning/Cause	Comparison point data does not exist.
Action	Set comparison point data correctly.

12.35 : POS.OUT Point unit error

Code : &H000C &H0023

Meaning/Cause	Comparison points 1 and 2 do not use the same unit system.
Action	Change them to the same unit system.

12.36 : PIO DC24V option setting error

Code : &H000C &H0024

Meaning/Cause	
Action	

12.41 : EtherNet link error

Code : &H000C &H0029

Meaning/Cause	TELNET is disconnected. a. The cable is broken or disconnected. b. Communicating with a client was off for more than the time specified by the "timeout [min]" parameter for EtherNet. c. Logout was attempted while the "logout" parameter for EtherNet is set to "STOP". d. No response for a keep-alive packet from the client.
Action	1. Connect the cable or connector securely. 2. Communicate with a client at least once within the time specified by the "timeout [min]" parameter, or set the parameter to "0" to disable the timeout function. 3. Set the "logout" parameter to "CONT." to avoid errors during logout. 4. Check whether the client is responding to the keep-alive packet, or set the "keep-alive [sec]" parameter to "0" to stop the keep-alive packet from being sent out.

12.42 : EtherNet hardware error

Code : &H000C &H002A

Meaning/Cause	Breakdown in EtherNet compatible unit.
Action	Replace the EtherNet compatible unit.

12.75 : Illegal remote command

Code : &H000C &H004B

Meaning/Cause	The remote command or command data is incorrect.
Action	Check the remote command or command data.

12.80 : Incorrect Indiv. Origin setting

Code : &H000C &H0050

Meaning/Cause	a. 2 or more axes were specified for the "Axes selection port (DI & SI)" parameter. b. No axis was specified for the "Axes selection port (DI & SI)" parameter. c. Axis which is not present was specified for the "Axes selection port (DI & SI)" parameter.
Action	1. Specify only 1 axis. 2. Specify an appropriate axis. 3. Specify an axis which is present.

12.85 : Bad Gripper status setting

Code : &H000C &H0055

Meaning/Cause	The same port number was set for the other parameters "G1 status output (DO & SO)" and "G2 status output (DO & SO)".
Action	Set different port numbers for the other parameters "G1 status output (DO & SO)" and "G2 status output (DO & SO)".

12.200: EtherNet/IP DHCP enabled

Code : &H000C &H00C8

Meaning/Cause	
Action	

12.400: Standard in stop on

Code : &H000C &H0190

Meaning/Cause	a. Program execution or axis movement was attempted in the stop status. b. Robot was put in the stop status during program execution or axis movement. c. 24V-power for I/O was not supplied to the DIO connector. d. DIO connector was not connected.
Action	1. Cancel the stop, and then execute the program or move the axis. 2. Supply the 24V-power for I/O. 3. Connect the DIO connector. 4. Make the board status invalid when DIO is not used.

12.401: Arm locked

Code : &H000C &H0191

Meaning/Cause	Movement of an arm was attempted while the arm lock variable LO was ON.
Action	Clear the arm lock variable LO.

12.500: Changed operation mode input

Code : &H000C &H01F4

Meaning/Cause	Changed operation mode
Action	

12.520: PIO STD DC24V low voltage

Code : &H000C &H0208

Meaning/Cause	
Action	

12.521: PIO DC24V over voltage

Code : &H000C &H0209

Meaning/Cause	
Action	

12.522: PIO STD DC24V low voltage

Code : &H000C &H020A

Meaning/Cause	
Action	

12.531: CC-Link communication error

Code : &H000C &H0213

Meaning/Cause	a. Error in cable for CC-Link system. b. Communication setting of the CC-Link system is incorrect. c. Master station PLC power is turned off, has stopped operating or is damaged. d. Breakdown in CC-Link compatible unit.
Action	1. Check for a break, misconnection or wiring error in CC-Link cable, and check the specifications (cable length, etc.). 2. Check the station No. and communication baud rate settings. 3. Check that the master station PLC operates correctly. 4. Replace the CC-Link compatible unit.

12.532: CC-Link overtime error

Code : &H000C &H0214

Meaning/Cause	a. Communication error occurred by noise, etc. in the CC-Link system. b. Master station PLC power is turned off or has stopped operating.
Action	1. Take the noise preventive actions for the cable and controller of the CC-Link system. 2. Check that the master station PLC operates correctly. 3. Check the CC-Link cable connection.

12.533: CC-Link initialize error

Code : &H000C &H0215

Meaning/Cause	It was failed to initialize the CC-Link option board.
Action	Contact your distributor with details on this problem.

12.541: DeviceNet link error

Code : &H000C &H021D

Meaning/Cause	a. Error in cable for DeviceNet system. b. The DeviceNet system's MacID or communication speed setting is incorrect. c. No power supplied for communication. d. The master unit power is turned off, has stopped operating, is not operating correctly or is damaged. e. Breakdown in DeviceNet compatible unit.
Action	1. Check for a break, misconnection or wiring error in DeviceNet cable, and check the specifications (cable length, etc.). 2. Check the MacID and communication speed settings. 3. Check that the communication power is supplied. 4. Check that the master unit operates correctly. 5. Replace the DeviceNet compatible unit.

12.542: DeviceNet overtime error

Code : &H000C &H021E

Meaning/Cause	a. Communication error occurred by noise, etc. in the DeviceNet system. b. Master unit power is turned off or has stopped operating.
Action	1. Take the noise preventive actions for the cable and controller of the DeviceNet system. 2. Check that the master unit operates correctly. 3. Check the DeviceNet cable connection.

12.543: DeviceNet initialize error

Code : &H000C &H021F

Meaning/Cause	It was failed to initialize the DeviceNet option board.
Action	Contact your distributor with details on this problem.

12.551: EtherNet/IP link error

Code : &H000C &H0227

Meaning/Cause	a. Error in cable for EtherNet/IP system. b. Communication setting of the EtherNet/IP system is incorrect. c. Master unit power is turned off, has stopped operating or is damaged. d. Breakdown in EtherNet/IP compatible unit.
Action	1. Check for a break, misconnection or wiring error in EtherNet/IP cable, and check the specifications (cable length, etc.). 2. Check the communication setting. 3. Check that the master unit operates correctly. 4. Replace the EtherNet/IP compatible unit.

12.552: EtherNet/IP overtime error

Code : &H000C &H0228

Meaning/Cause	a. Communication error occurred by noise, etc. in the EtherNet/IP system. b. Master unit power is turned off or has stopped operating.
Action	1. Take the noise preventive actions for the cable and controller of the EtherNet/IP system. 2. Check that the master unit operates correctly. 3. Check the EtherNet/IP cable connection.

12.553: EtherNet/IP initialize error

Code : &H000C &H0229

Meaning/Cause	It was failed to initialize the EtherNet/IP option board.
Action	Contact your distributor with details on this problem.

12.554: EtherNet/IP parameter mismatch

Code : &H000C &H022A

Meaning/Cause	Parameters set inside the controller did not match to those set in the option board.
Action	Initialize the EtherNet/IP option parameters.

12.561: Profibus link error

Code : &H000C &H0231

Meaning/Cause	a. Error in cable for Profibus system. b. Communication setting of the Profibus system was incorrect. c. Master unit power is turned off, has stopped operating or is damaged. d. Breakdown in Profibus compatible unit.
Action	1. Check for a break, misconnection or wiring error in Profibus cable, and check the specifications (cable length, etc.). 2. Check the communication setting. 3. Check that the master unit operates correctly. 4. Replace the Profibus compatible unit.

12.562: Profibus overtime error

Code : &H000C &H0232

Meaning/Cause	a. Communication error occurred by noise, etc. in the Profibus system. b. Master unit power is turned off or has stopped operating.
Action	1. Take the noise preventive actions for the cable and controller of the Profibus system. 2. Check that the master unit operates correctly. 3. Check the Profibus cable connection.

12.563: Profibus initialize error

Code : &H000C &H0233

Meaning/Cause	It was failed to initialize the Profibus option board.
Action	Contact your distributor with details on this problem.

12.600: Emergency stop on

Code : &H000C &H0258

Meaning/Cause	a. Programming box emergency stop button was pressed. b. Emergency stop terminals on SAFETY connector are open (emergency stop status). c. Programming box or terminator are not connected to PB connector. d. SAFETY connector is not connected.
Action	1. Release the emergency stop button on the programming box. 2. Close the emergency stop terminals on SAFETY connector. 3. Connect programming box or terminator to PB connector. 4. Attach the SAFETY connector.

12.601: Illegal operation mode input

Code : &H000C &H0259

Meaning/Cause	
Action	

12.700: Option board changed

Code : &H000C &H02BC

Meaning/Cause	Option board configuration was changed.
Action	Initialize the option board setting.

12.705: Parallel I/O board assign changed

Code : &H000C &H02C1

Meaning/Cause	
Action	

12.706: PIO DC24V I/O stop

Code : &H000C &H02C2

Meaning/Cause	
Action	

12.709: SIO option board initialize error

Code : &H000C &H02C5

Meaning/Cause	It was failed to initialize the SIO option board.
Action	Contact your distributor with details on this problem.

12.900: Incorrect option setting

Code : &H000C &H0384

Meaning/Cause	a. Error in ID setting on option unit. b. Option units that cannot be mixed were installed. c. Cannot identify the installed option unit.
Action	1. Check the ID setting of the option unit. 2. Install the correct option unit. 3. Replace the option unit. 4. Replace the controller.

12.901: PIO DC24V internal error

Code : &H000C &H0385

Meaning/Cause	
Action	

12.902: PIO DC24V CPU error

Code : &H000C &H0386

Meaning/Cause	
Action	

[14] Alarm related to the communication

14.1 : Communication error

Code : &H000E &H0001

Meaning/Cause	a. Error occurred in the external communication. b. Overrun error or framing error occurred. c. External device was turned on or off with the communication cable connected to the external device.
Action	1. Do not put noise generation source close to the robot so as to improve the communication environment. 2. Replace the communication cable. 3. Check the communication parameter setting.

14.2 : Parity error

Code : &H000E &H0002

Meaning/Cause	During external communication via the RS-232C, an error occurred.
Action	Check the communication parameter settings.

14.11 : Receive buffer overflow

Code : &H000E &H000B

Meaning/Cause	Communication receive buffer exceeded permissible capacity.
Action	1. Delay the communication parameter speed (baud rate). 2. Change communication parameter so that flow control is enabled.

14.12 : CMU is not ready

Code : &H000E &H000C

Meaning/Cause	Could not sent data from controller because receive prohibit status of other party continued for more than 10 seconds.
Action	1. Replace the communications cable. 2. Check that flow control is normal in software processing for other party.

14.20 : Too many Command characters

Code : &H000E &H0014

Meaning/Cause	a. Online command character string in 1 line exceeded 80 letters. b. Command statement created with a remote command exceeded 80 letters.
Action	1. Limit number of characters in 1 line for an online command to 80 letters or less. 2. Check the command data of the remote command.

14.21 : No return code(C/R)

Code : &H000E &H0015

Meaning/Cause	a. Character string in 1 line exceeded 75 letters. b. C/R code (0Dh) was not added at end of line.
Action	1. Limit number of characters in 1 line to 75 letters. 2. Add a C/R code at the end of a single line.

14.22 : No start code(@)

Code : &H000E &H0016

Meaning/Cause	Starting code "@" was not added at beginning of single line in an online command.
Action	Add starting code "@" at the beginning of online command.

14.23 : Illegal command Operating

Code : &H000E &H0017

Meaning/Cause	During data editing, an online command was executed.
Action	After completing data edit, execute an online command.

14.24 : Illegal command Running

Code : &H000E &H0018

Meaning/Cause	During program run, a non-executable online command was attempted.
Action	After stopping the program, execute the online system command which could not previously be executed.

14.27 : Illegal command in this mode

Code : &H000E &H001B

Meaning/Cause	
Action	

14.28 : Illegal port type

Code : &H000E &H001C

Meaning/Cause	Communication port not specified.
Action	Contact your distributor with details on this problem.

14.29 : Command stop timeout

Code : &H000E &H001D

Meaning/Cause	
Action	

14.30 : Port is already open

Code : &H000E &H001E

Meaning/Cause	
Action	

14.31 : Port open failed

Code : &H000E &H001F

Meaning/Cause	
Action	

14.32 : Data receive error

Code : &H000E &H0020

Meaning/Cause	
Action	

14.33 : Parameter error

Code : &H000E &H0021

Meaning/Cause	
Action	

14.400: Communicate disconnected

Code : &H000E &H0190

Meaning/Cause	
Action	

14.700: can not be initialized

Code : &H000E &H02BC

Meaning/Cause	
Action	

[17] Alarm related to the motor control

17.400: PZ failure

Code : &H0011 &H0190

Meaning/Cause	a. Motor is defective. b. Resolver signal wire is broken.
Action	1. Replace the motor. 2. Replace the ROB I/O cable.

17.401: Pole search error

Code : &H0011 &H0191

Meaning/Cause	Failed to detect the motor magnetic pole when the servo was turned on. a. Servo wire is broken or misconnected. b. Position sensor cable is miswired. c. Axis parameter setting related to motor control is wrong.
Action	1. Correct the motor wiring. 2. Check the position sensor cable wiring. 3. Correct the parameter setting.

17.402: ABS. data error

Code : &H0011 &H0192

Meaning/Cause	a. Linear scale length setting was incorrect. b. Z-phase was detected incorrectly.
Action	1. Set the correct value for the linear scale length. 2. Replace the ROB/IO cable. 3. Replace the robot.

17.403: Position reset malposition

Code : &H0011 &H0193

Meaning/Cause	a. ABSINIT statement was executed at a position where the current position cannot be reset. b. Absolute reset was executed at a position where the absolute reset cannot be executed.
Action	1. Move to a position where the current position can be reset, and then execute the ABSINIT statement. 2. Move the axis to a position (machine reference is 44 to 56%) where the absolute reset can be executed.

17.404: Moving distance error

Code : &H0011 &H0194

Meaning/Cause	Movement distance exceeded the specified value during return-to-origin.
Action	Re-perform the system generation.

17.410: ABS. battery error

Code : &H0011 &H019A

Meaning/Cause	a. Absolute battery cable is broken. b. Absolute battery cable is not connected. c. Drop in absolute battery voltage.
Action	1. Replace the absolute battery. 2. Connect the absolute battery. 3. Enable the "Incremental mode control" parameter for use in incremental mode.

17.411: ABS. encoder error

Code : &H0011 &H019B

Meaning/Cause	a. Resolver signal line was disconnected or broken while power to the controller was cut off. (Same as when ROB I/O connector is removed.) b. The controller was restarted, after resolver signal line was disconnected while the power was on. (Same as when ROB I/O connector is removed.) (Even after turning off the power, the controller still knows that resolver signal line was disconnected while the power was on. This is displayed as an error when the controller is restarted.)
Action	Perform absolute reset.

17.412: ABS. count error

Code : &H0011 &H019C

Meaning/Cause	Movement speed is too high during power-off of the controller.
Action	Perform absolute reset.

17.413: ABS. overflow error

Code : &H0011 &H019D

Meaning/Cause	Position information lost when motor speed (rotation) exceeded 4096 when controller power was cut off.
Action	1. Do not rotate motor more than necessary when the controller power is being cut off. 2. Perform absolute reset.

17.414: ABS. mixing error 1

Code : &H0011 &H019E

Meaning/Cause	Mismatch occurred in the position data count while the controller power is off.
Action	Execute the absolute reset operation.

17.500: Bad origin sensor

Code : &H0011 &H01F4

Meaning/Cause	a. Origin sensor is defective. b. Origin sensor wiring is broken.
Action	1. Replace the origin sensor. 2. Replace the ROB I/O cable.

17.800: Motor overload

Code : &H0011 &H0320

Meaning/Cause	a. Robot drive section mechanically locked. b. Motor current exceeded its rated value due to a motor overload. c. Motor acceleration is excessive. d. System generation setting is wrong. e. Motor cable wiring is broken or wiring is incorrect. f. Electromagnetic brake for holding vertical axis is defective. g. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis. h. SAFETY connector is not used correctly.
Action	1. Perform robot service and maintenance. 2. Decrease load on motor. 3. Lower the motor acceleration. 4. Redo the system generation. 5. Wire the motor cable correctly. 6. Replace the motor cable. 7. Replace the magnetic brake for holding the vertical axis. 8. Replace the ROB I/O cable. 9. Do not use 24V DC from SAFETY connector as power source for external loads.

17.801: Driver overload

Code : &H0011 &H0321

Meaning/Cause	a. Robot drive section mechanically locked. b. Motor current exceeded its rated value due to a motor overload. c. Motor acceleration is excessive. d. System generation setting is wrong. e. Motor cable wiring is broken or wiring is incorrect. f. Electromagnetic brake for holding vertical axis is defective. g. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis. h. SAFETY connector is not used correctly.
Action	1. Perform robot service and maintenance. 2. Decrease load on motor. 3. Lower the motor acceleration. 4. Redo the system generation. 5. Wire the motor cable correctly. 6. Replace the motor cable. 7. Replace the magnetic brake for holding the vertical axis. 8. Replace the ROB I/O cable. 9. Do not use 24V DC from SAFETY connector as power source for external loads.

17.802: Current limit error

Code : &H0011 &H0322

Meaning/Cause	a. Robot drive section mechanically locked. b. System generation setting is wrong. c. Motor cable wiring is broken or wiring is incorrect. d. Electromagnetic brake for holding vertical axis is defective. e. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis. f. SAFETY connector is not used correctly.
Action	1. Perform robot service and maintenance. 2. Redo the system generation. 3. Wire the motor cable correctly. 4. Replace the motor cable. 5. Replace the magnetic brake for holding the vertical axis. 6. Replace the ROB I/O cable. 7. Do not use 24V DC from SAFETY connector as power source for external loads.

17.900: AC power down

Code : &H0011 &H0384

Meaning/Cause	a. AC supply voltage of control power supply dropped below 85% of rated voltage. b. Power source has insufficient capacity.
Action	1. Check the AC supply voltage. 2. Check if supply voltage drops during robot operation. 3. Lower the robot duty cycle.

17.901: Over voltage

Code : &H0011 &H0385

Meaning/Cause	a. Output voltage for motor power supply exceeded 420 volts. b. Regenerative unit safety device triggered due to temperature rise (120°C or more) in regeneration damping resistor. c. Regenerative unit is defective. d. Safety connector is used incorrectly.
Action	1. Check the power supply voltage. 2. Lower the robot operating duty. 3. Do not supply 24V DC to SAFETY connector from external source.

17.902: IPM error

Code : &H0011 &H0386

Meaning/Cause	a. Power module overheated. b. Power module or motor drew excessive current.
Action	Lighten the load on the robot.

17.905: Resolver wire breakage

Code : &H0011 &H0389

Meaning/Cause	a. Resolver signal wire is broken. b. Motor malfunction occurred. c. Controller malfunction occurred.
Action	1. Replace the ROB I/O cable. 2. Replace the motor. 3. Replace the controller.

17.906: ABS. mixing error 2

Code : &H0011 &H038A

Meaning/Cause	Mismatch occurred in the position data count while the controller power is on.
Action	1. Replace the ROB/IO cable. 2. Replace the controller.

17.910: Position deviation error

Code : &H0011 &H038E

Meaning/Cause	a. Robot drive section mechanically locked. b. Motor acceleration is excessive. c. System generation setting is wrong. d. Motor cable wiring is broken or wiring is incorrect. e. Electromagnetic brake for holding vertical axis is defective. f. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis. g. SAFETY connector is not used correctly.
Action	1. Perform robot service and maintenance. 2. Lower the motor acceleration. 3. Redo the system generation. 4. Wire the motor cable correctly. 5. Replace the motor cable. 6. Replace the magnetic brake for holding the vertical axis. 7. Replace the ROB I/O cable. 8. Do not use 24V DC from SAFETY connector as power source for external loads.

17.911: Velocity deviation error

Code : &H0011 &H038F

Meaning/Cause	a. Robot drive section mechanically locked. b. Motor acceleration is excessive. c. System generation setting is wrong. d. Motor cable wiring is broken or wiring is incorrect. e. Electromagnetic brake for holding vertical axis is defective. f. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis.
Action	1. Perform robot service and maintenance. 2. Lower the motor acceleration. 3. Redo the system generation. 4. Wire the motor cable correctly. 5. Replace the motor cable. 6. Replace the magnetic brake for holding the vertical axis. 7. Replace the ROB I/O cable.

17.912: Current deviation error

Code : &H0011 &H0390

Meaning/Cause	a. Motor cable wiring was broken. b. Controller was faulty.
Action	1. Replace the motor cable. 2. Replace the controller.

17.913: Dual position deviation error

Code : &H0011 &H0391

Meaning/Cause	On a dual-axis drive, the position differential between the main axis and sub axis is too large. a. Friction in the robot drive section is too large. b. Motor brake wiring is broken.
Action	1. Check the drive sections for assembled condition and lubrication to ensure smooth movement. 2. Check that the motor brake works properly.

17.914: Overspeed

Code : &H0011 &H0392

Meaning/Cause	a. Robot drive unit was pushed by external force and its speed exceeded the specified speed. b. System generation setting was incorrect.
Action	1. Remove the external force. 2. Re-perform the system generation.

17.915: Motor over current

Code : &H0011 &H0393

Meaning/Cause	a. Robot drive section mechanically locked. b. Motor current exceeded its rated value due to a motor overload. c. Motor acceleration is excessive. d. System generation setting is wrong. e. Motor cable wiring is broken or wiring is incorrect. f. Electromagnetic brake for holding vertical axis is defective. g. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis. h. SAFETY connector is not used correctly.
Action	1. Perform robot service and maintenance. 2. Decrease load on motor. 3. Lower the motor acceleration. 4. Redo the system generation. 5. Wire the motor cable correctly. 6. Replace the motor cable. 7. Replace the magnetic brake for holding the vertical axis. 8. Replace the ROB I/O cable. 9. Do not use 24V DC from SAFETY connector as power source for external loads.

17.916: Feedback error1

Code : &H0011 &H0394

Meaning/Cause	Wiring of motor cable or ROB I/O cable is incorrect.
Action	1. Rewire the motor cable or ROB I/O cable correctly. 2. Replace the motor cable or ROB I/O cable.

17.920: EMG. stop Input error

Code : &H0011 &H0398

Meaning/Cause	a. Driver unit malfunctioned by external noise. b. Controller was defective.
Action	1. Turn the power off and then on again. 2. Contact your distributor with details on this problem.

17.921: Reference velocity error

Code : &H0011 &H0399

Meaning/Cause	a. Driver unit malfunctioned by external noise. b. Controller was defective.
Action	1. Turn the power off and then on again. 2. Contact your distributor with details on this problem.

17.922: Command error

Code : &H0011 &H039A

Meaning/Cause	a. Driver unit malfunctioned by external noise. b. Controller was defective.
Action	1. Turn the power off and then on again. 2. Contact your distributor with details on this problem.

17.923: Parameter data error

Code : &H0011 &H039B

Meaning/Cause	a. Driver unit malfunctioned by external noise. b. Controller was defective.
Action	1. Turn the power off and then on again. 2. Contact your distributor with details on this problem.

17.990: Watchdog error 1

Code : &H0011 &H03DE

Meaning/Cause	a. Driver unit malfunctioned by external noise. b. Controller is defective.
Action	1. Turn the power off and then on again. 2. Replace the controller.

17.991: Watchdog error 2

Code : &H0011 &H03DF

Meaning/Cause	a. Driver unit malfunctioned by external noise. b. Controller is defective.
Action	1. Turn the power off and then on again. 2. Replace the controller.

17.992: System error 1

Code : &H0011 &H03E0

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.993: System error 2

Code : &H0011 &H03E1

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.994: System error 3

Code : &H0011 &H03E2

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.995: System error 4

Code : &H0011 &H03E3

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.996: Mode error 1

Code : &H0011 &H03E4

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.997: Mode error 2

Code : &H0011 &H03E5

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.999: Undefine

Code : &H0011 &H03E7

Meaning/Cause	Undefined system error.
Action	Contact your distributor with details of the problem.

[21] Serious software alarm

21.700: System error (EXCEPTION)

Code : &H0015 &H02BC

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.701: System error (Motion Robot Type)

Code : &H0015 &H02BD

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.702: System error (Motion Robot)

Code : &H0015 &H02BE

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.703: System error (Motion Axis)

Code : &H0015 &H02BF

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.704: System error (Motion Arm Type)

Code : &H0015 &H02C0

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.705: System error (Motion Option)

Code : &H0015 &H02C1

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.901: System error (JOG)

Code : &H0015 &H0385

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.902: System error (srvmod)

Code : &H0015 &H0386

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.903: System error (TaskID)

Code : &H0015 &H0387

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.904: System error (drcom)

Code : &H0015 &H0388

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.905: System error (drmod))

Code : &H0015 &H0389

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.906: System error (Gen.Data)

Code : &H0015 &H038A

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.907: System error 70

Code : &H0015 &H038B

Meaning/Cause	
Action	

21.908: System error 80

Code : &H0015 &H038C

Meaning/Cause	
Action	

21.909: System error 90

Code : &H0015 &H038D

Meaning/Cause	
Action	

21.910: Watchdog error (CPU)

Code : &H0015 &H038E

Meaning/Cause	a. CPU malfunctioned due to external noise. b. Controller is defective.
Action	1. Turn the power off and then on again. 2. Replace the controller.

21.911: System error (EmgHalt)

Code : &H0015 &H038F

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.912: System error (RTOS)

Code : &H0015 &H0390

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.913: System error (CRFPOS)

Code : &H0015 &H0391

Meaning/Cause	Current position of driver does not match the instructed position.
Action	1. Replace the driver. 2. Replace the controller.

21.914: DPRAM error (PTP data)

Code : &H0015 &H0392

Meaning/Cause	PTP command data could not be written to the driver.
Action	1. Replace the driver. 2. Replace the controller.

21.915: System error (Gripper)

Code : &H0015 &H0393

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.916: System error (EtherNet/IP)

Code : &H0015 &H0394

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.999: System error (UNDEFINED)

Code : &H0015 &H03E7

Meaning/Cause	
Action	

[22] Serious hardware alarm

22.504: Abnormal drop in voltage

Code : &H0016 &H01F8

Meaning/Cause	a. Output voltage for motor power supply dropped below 140V. b. Power supply has insufficient capacity. c. Vertical axis electromagnetic brake is defective. d. SAFETY connector is used incorrectly.
Action	1. Check the power supply voltage. 2. Check if supply voltage drops during robot operation. 3. Lower the robot duty cycle. 4. Replace the vertical axis electromagnetic brake. 5. Do not supply 24V DC to SAFETY connector from external source. 6. Do not use 24V DC from SAFETY connector as power source for driving external loads.

22.507: Driver over heat

Code : &H0016 &H01FB

Meaning/Cause	Driver unit temperature increased to approximately 60°C or more.
Action	1. Improve the installation environment. 2. Check that the cooling fan operates correctly. 3. Replace or clean the cooling fan filter. 4. Decrease the robot operating duty to reduce the amount of heat generated. 5. Replace the controller.

22.508: Regen. over heat

Code : &H0016 &H01FC

Meaning/Cause	Regenerative unit heated up abnormally.
Action	1. Improve the installation environment. 2. Check that the cooling fan operates correctly. 3. Replace or clean the cooling fan filter. 4. Decrease the robot operating duty to reduce the amount of heat generated. 5. Replace the controller.

22.509: Internal 24V power abnormal

Code : &H0016 &H01FD

Meaning/Cause	Internal 24V-power voltage dropped. a. SAFETY connector wiring was incorrect. b. Brake cable was short-circuited. c. Controller malfunctioned.
Action	1. Perform the wiring of the SAFETY connector correctly. 2. Replace the robot cable. 3. Replace the controller.

22.511: Fan stop error

Code : &H0016 &H01FF

Meaning/Cause	Power was not supplied to the controller cooling fan. a. Controller cooling fan cable wiring was broken. b. ROB I/O cable was short-circuited. c. Controller malfunctioned. d. Error occurred in the controller cooling fan. e. Controller cooling fan malfunctioned. f. Controller malfunctioned.
Action	1. Replace the controller cooling fan cable. 2. Replace the ROB/IO cable. 3. Replace the controller. 4. Replace the controller cooling fan. 5. Replace the controller.

22.516: Controller over heat

Code : &H0016 &H0204

Meaning/Cause	Environmental temperature inside the controller increased to approximately 60°C or more.
Action	1. Improve the installation environment. 2. Check that the cooling fan operates correctly. 3. Replace the controller.

22.600: Motor power off

Code : &H0016 &H0258

Meaning/Cause	Main power voltage dropped in the servo on or servo off status.
Action	Check that the main power is input.

22.800: Control power off

Code : &H0016 &H0320

Meaning/Cause	a. AC supply voltage of control power supply dropped below 85% of rated voltage. b. Power source has insufficient capacity.
Action	1. Check the AC supply voltage. 2. Check if supply voltage drops during robot operation. 3. Lower the robot duty cycle.

CAUTION

This error always occurs when the power is cut off.

22.901: CT type mismatch

Code : &H0016 &H0385

Meaning/Cause	Correct current sensor controller was not used for the set robot.
Action	Replace the current sensor controller with a correct one.

22.902: Position sensor type mismatch

Code : &H0016 &H0386

Meaning/Cause	Correct position sensor was not set for the set robot correctly.
Action	Contact your distributor with details on this problem.

22.903: Driver unit disconnected

Code : &H0016 &H0387

Meaning/Cause	CPU unit did not recognize the driver unit.
Action	Replace the controller.

22.904: Driver2 board disconnected

Code : &H0016 &H0388

Meaning/Cause	CPU unit did not recognize the driver 2 board.
Action	Replace the controller.

22.905: Abnormal over voltage

Code : &H0016 &H0389

Meaning/Cause	a. Output voltage for motor power supply exceeded 420 V. b. Regenerative unit safety device triggered due to temperature rise in regeneration damping resistor. c. Regenerative unit is defective. d. Safety connector is used incorrectly.
Action	1. Check the power supply voltage. 2. Lower the robot operating duty. 3. Do not supply 24V DC to SAFETY connector from external source.

22.906: Break 24V power abnormal

Code : &H0016 &H038A

Meaning/Cause	Brake power voltage dropped. a. Power was not supplied to BK24V. b. Brake cable was short-circuited. c. Controller malfunctioned.
Action	1. Supply the brake power. 2. Replace the robot cable. 3. Replace the controller.

[28] Alarm related to the driver I/F

28.900: Driver version mismatch

Code : &H001C &H0384

Meaning/Cause	Software version of the driver unit was not appropriate.
Action	Update the software version of the driver unit.

28.902: DMA transfer timeout

Code : &H001C &H0386

Meaning/Cause	Time-out occurred in the communication process between the CPU unit and driver unit.
Action	Contact your distributor with details on this problem.

28.903: Driver interrupt timeout

Code : &H001C &H0387

Meaning/Cause	Time-out occurred in the communication process between the CPU unit and driver unit.
Action	Contact your distributor with details on this problem.

28.904: RTOS fail

Code : &H001C &H0388

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

28.905: Send checksum fail

Code : &H001C &H0389

Meaning/Cause	Driver unit received abnormal data.
Action	Contact your distributor with details of this problem.

28.906: Receive checksum fail

Code : &H001C &H038A

Meaning/Cause	CPU unit received abnormal data.
Action	Contact your distributor with details on this problem.

[C] Warning

C50 : Memory backup battery low

Meaning/Cause	Memory storage battery voltage dropped.
Action	Replace the memory storage battery.

C70 : Motor overload

Meaning/Cause	Motor was overloaded. Alarm might occur.
Action	Reduce the load to the motor.

C71 : Driver overload

Meaning/Cause	Driver was overloaded. Alarm might occur.
Action	Reduce the load to the driver.

C72 : Motor over current

Meaning/Cause	Motor drew excessive current. Alarm might occur.
Action	Reduce the load to the motor.

C73 : Absolute battery low voltage

Meaning/Cause	ABS battery voltage was 3.1V or less.
Action	Replace the ABS battery.

1.2 Programming box related alarm messages

If a hardware or software error occurs in the programming box, relevant message appears on the screen.

NO PANEL DATA

Meaning/Cause : Screen data could not be downloaded during upgrading.
Action : Perform the upgrading again.

Receiving Error.

Meaning/Cause : Error occurred during data receiving.
Specified communication was not performed within the specified period of time.
Action : Check the communication cable for abnormality.
Check that the connector is inserted correctly.

Sending Error.

Meaning/Cause : Error occurred during data sending.
CTS signal did not turn on for 5 sec. during data sending.
Action : Check the communication cable for abnormality.
Check that the connector is inserted correctly.

Receiving timeout.

Meaning/Cause : Error occurred during data receiving.
Specified communication was not performed within the specified period of time.
Action : Check the communication cable for abnormality.
Check that the connector is inserted correctly.

NG=xx.xxx

Meaning/Cause : Alarm occurred in the controller.
Action : Check the alarm contents and perform the alarm reset.

No breakpoint set.

Meaning/Cause : Break point was not set in the program debug.
Action : Set a break point.

USB IO ERROR

Meaning/Cause : USB memory device was not supported.
Action : Replace the USB memory device with a correct one.

USB Not Connect

Meaning/Cause : USB memory device was not connected. Or, a device other than the USB memory device was connected.
Action : Connect the USB memory device correctly.

Bad Format

Meaning/Cause : Format of the USB memory device was illegal.
Action : Change the format of the USB memory device to FAT16 or FAT32.

Not FAT16 Format

Meaning/Cause : Format of the USB memory device was NTFS.
Action : Change the format of the USB memory device to FAT16 or FAT32.

2. Troubleshooting

2.1 When trouble occurs

Please contact your distributor with details of the problem that occurs. Report the following items in as much detail as possible.

Item	Description
What happened	• Controller model name and serial No. example:RCX340 • Robot model name and serial No. example:YK400XR • Controller version No. example:V1.05 R0018
When	• Date of purchase example:June 2014 • How long used example: Since delivery, about 1 year
Under what conditions	• Usage conditions example:when power is turned on when creating program during manual movement when robot is moved to particular location during program operation.
Current status is	• Status on programming box screen example:Nothing is displayed on screen Error message appears on screen • Robot servo status example:Servo won't turn on Abnormal sound when robot is moved Sets to origin incomplete. • Programming box operating status example:Keys won't function Response after pressing key is slow Only the emergency stop button functions etc.
How often it happens	• How often above problem occurs example:Always occurs when power is turned on. Occurs at particular line during program operation. Only occurs once, then does not occur again.

NOTE

When the programming box is connected, the error message appearing on the screen is a valuable source of information for troubleshooting.

2.2 Acquiring the alarm information

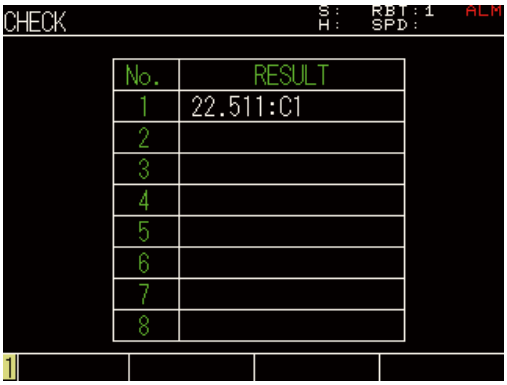
The controller stores the alarm information in its inside. You can check the current controller error status and past alarm history data.

2.2.1 Checking the alarm occurrence status

■ Checking the alarm with the programming box

Select [System] - [Check] from the initial screen.
If an alarm occurs, relevant alarm code will appear.

Checking the alarm occurrence status



■ Checking the alarm from the RS-232C or Ethernet

Step 1 ***Connect the controller and personal computer.***

Connect the controller and personal computer with the RS-232C cable or Ethernet cable (category 5 or higher) and set the communication conditions so that the online command can be set.

Step 2 ***Check the alarm status.***

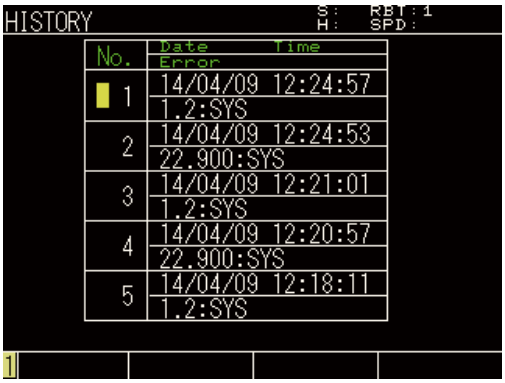
Send the command "@READ SCK" from the personal computer.
The alarm code is received when an alarm occurs.
The alarm code is not received when no alarm occurs.

2.2.2 Checking the alarm history

■ Checking the alarm history with the programming box

Select [System] - [History] from the initial screen.

Checking the alarm history



The alarms that occurred past will appear.
You can check up to 500 alarm records.

■ Checking the alarm from the RS-232C or Ethernet

Step 1 ***Connect the controller and personal computer.***

Connect the controller and personal computer with the RS-232C cable or Ethernet cable (category 5 or higher) and set the communication conditions so that the online command can be set.

Step 2 ***Check the alarm status.***

Send the command "@READ LOG" from the personal computer.
The alarm code is received when an alarm occurs.
You can check up to 500 alarm records.

2.3 Troubleshooting checkpoints

2.3.1 Installation and power supply

	Symptom	Possible cause	Check items	Corrective action
1	Controller won't turn on even with power supplied.	• Power not supplied. • Problem in controller internal power.	• Check power input terminal connection (L/N/L1/N1). • Check power input terminal voltage (L/N/L1/N1). • Check if "PWR" LED on front panel is lit.	• Connect the power input terminal correctly. • Supply the specified power voltage. • Replace the controller.
2	Controller turns on but no programming box display.	• Programming box not connected. • Wrong programming box connection. • Programming box malfunctioning. • Problem in controller internal power supply.	• Check PB connector. • Check how PB connector is inserted. • Replace programming box and check operation.	• Plug in PB connector correctly. • Replace the programming box. • Replace the controller.
3	Controller turns on, but the alarm number is displayed on the 7-segment LED on the front.	• Now in emergency stop.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check]) • Check the DO00 (Output of emergency stop input status) on the "MONITOR" screen displayed on the programming box.	• Release the emergency stop button on the programming box. • Connect the PB connector. • Connect the emergency stop terminal of SAFETY connector.
		• Alarm with alarm group number 17 occurred.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check])	• Check the axis from the alarm information. • Check the cause of the alarm from the alarm information. • Take the corrective action.
		• Error of error group No. 21, 22 occurred.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check])	• Check the cause of the alarm from the alarm information. • Take the corrective action.

2.3.2 Robot operation

	Symptom	Possible cause	Check items	Corrective action
1	Controller turns on but can't execute program and manual movement.	• Stop signal is in the open status.	• Check the input/output interface connector stop signal and 24V-power supply connections. • Check DI06 (stop) on the "MONITOR" screen displayed on the programming box.	• Connect the power input terminal correctly. • Supply the specified power voltage. • Replace the controller.
		• Now in emergency stop.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check]) • Check DO00 (Output of emergency stop input status) on the "MONITOR" screen displayed on the programming box.	• Release the emergency stop button on the programming box. • Connect the PB connector. • Connect the emergency stop terminal of SAFETY connector.
		• Alarm occurred.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check]) • Check the 7-segment LED display on the front of the controller.	• Check the cause of the alarm from the alarm information. • Take the corrective action.
2	Abnormal sound or vibration.	• Wrong robot or axis type setting.	• Connect programming box and check robot settings in SYSTEM mode. • Check if robot and controller are compatible.	• Change to correct robot or axis type setting. • Make sure robot and controller are compatible.
		• Tip weight or acceleration settings are incorrect.	• Check tip weight parameter setting in EDIT. • Check acceleration parameter setting in SYSTEM. • Check command setting of changing tip weight or changing acceleration. In program language.	• Set a correct tip weight parameter. • Set a correct acceleration parameter. • Make a correct setting in the program language.
		• Mechanical problem occurred.	• Check for resonance in robot frame. • Check for loose screws on robot cover. • Check for warping or damage on guides or ball screws.	• Reinforce the robot frame. • Tighten the robot cover screws. • Remove foreign matter if found. • Replace guides or ball screws if warping or damage is found.
		• Controller is defective.	• Replace with another controller and check operation.	• Replace the controller if operation is normal.
3	Position deviation occurred.*	• Position sensor device is defective. • Cable is defective.	• Move axis in emergency stop and check the pulse count.	• Replace motor if count is incorrect. • Replace cable if found to be defective.
		• Position detection error due to noise.	• Check grounding of robot and controller. • Check robot periphery for noise. • Check for noise sources around ROB I/O cable.	• Ground the robot and controller. • Isolate from noise sources around robot. • Isolate from noise sources around ROB I/O cable.
		• Mechanical error occurred.	• Check the belt tension • Check for warping or damage on guides or ball screws.	• Adjust to correct tension if necessary. • Remove foreign matter if found. • Replace guides or ball screws if warping or damage is found.
		• Controller is defective.	• Replace with another controller and check operation.	• Replace the controller if operation is normal.

* There are 2 main types of position deviation.
1.Electrical position deviation
2.Mechanical position deviation
In case 1, if position deviation occurs, you can perform return-to-origin. In case 2, you cannot return to original position.

2.3.3 I/O operation

	Symptom	Possible cause	Check items	Corrective action
1	Won't operate even when dedicated input signal is supplied.	• No 24V DC supply.	• Check the input/output interface connector stop signal and 24V-power supply connections. • Check DI06 (stop) on the "MONITOR" screen displayed on the programming box.	• Supply 24V DC.
		• Problem in signal connection.	• Check the input/output interface connector wiring.	• Correct the input/output interface connector wiring.
		• Alarm occurred.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check]) • Check the 7-segment LED display on the front of the controller.	• Check the cause of the alarm from the alarm information. • Take the corrective action.
2	No output of dedicated output signal.	• No 24V DC supply.	• Check the input/output interface connector 24V-power supply connections. • Check DI04 on the "MONITOR" screen displayed on the programming box.	• Supply 24V DC.
		• Problem in signal connection.	• Check the input/output interface connector wiring.	• Correct the input/output interface connector wiring.
		• Alarm occurred.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check]) • Check the 7-segment LED display on the front of the controller.	• Check the cause of the alarm from the alarm information. • Take the corrective action.
3	No output of general-purpose I/O signal.	• No 24V DC supply.	• Check the input/output interface connector 24V-power supply connections. • Check DI04 on the "MONITOR" screen displayed on the programming box. • Check the input/output interface 24V-power supply connection.	• Supply 24V DC.
		• Problem in signal connection.	• Check the input/output interface connector wiring.	• Correct the input/output interface connector wiring.
		• Problem in input/output interface setting.	• Check the ID setting of the input/output interface.	• Correct the ID setting of the input/output interface.
		• Alarm occurred.	• Connect the programming box and check the alarm by using self-diagnosis. ([System] - [Check]) • Check the 7-segment LED display on the front of the controller.	• Check the cause of the alarm from the alarm information. • Take the corrective action.

Revision record

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User's Manual

4-axis Robot Controller

RCX340

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http://global.yamaha-motor.com/business/robot/

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