Cat. No. I140E-EN-03B

SCARA Robots
YRC Series

YRC SCARA Robot Controller

USER´S MANUAL

OMRON

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Contents

1. Safety Information

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom when performing various manipulative tasks. To ensure safe and correct use of OMRON industrial robots and controllers, carefully read and comply with the safety instructions and precautions in this "Safety Instructions" guide. Failure to take necessary safety measures or incorrect handling may result in trouble or damage to the robot and controller, and also may cause personal 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 OMRON robots, please take appropriate safety measures as required by the user's individual system.

To use OMRON 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.

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 ACIDENT.

- 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.

1. Warning label 1 (SCARA 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.

2. Warning label 2 (SCARA robots)

WARNING

MOVING PARTS CAN PINCH OR CRUSH HANDS.
KEEP HANDS AWAY FROM THE MOVABLE PARTS OF THE ROBOT.

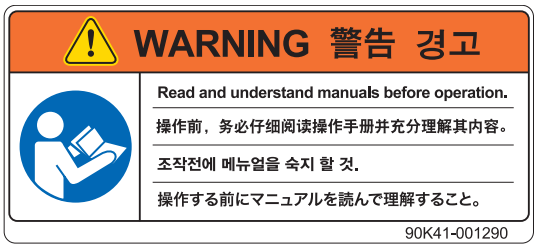
Instructions on this label
Use caution to prevent hands and fingers from being pinched or crushed by the movable parts of the robot when transporting or moving the robot or during teaching.

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.

3. Warning label 3 (SCARA robots)

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.

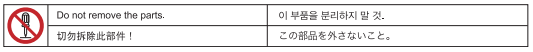


Instructions on this label	
• Be sure to read the warning label and this manual carefully to make you completely understand the contents before attempting installation and operation of the robot. • Before starting the robot operation, even after you have read through this manual, read again the corresponding 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.

4. Warning label 4 (SCARA robots)

CAUTION

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

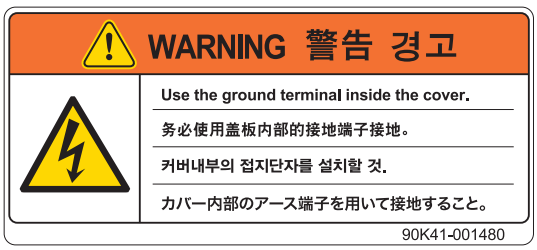


Instructions on this label
The Z-axis ball screw will be damaged if the upper end mechanical stopper on the Z-axis spline is removed or moved. Never attempt to remove or move it.

5. Warning label 5 (Controller)

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, always ground the robot using the ground terminal located inside the cover.	
Potential hazard to human body	Electrical shock
To avoid hazard	Ground the controller.

6. "Read instruction manual" label (Controller)*

* This label is attached to the front panel.

CAUTION

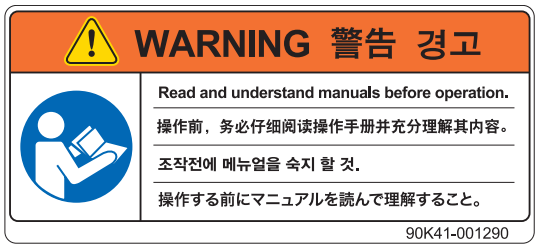
Refer to the manual.

	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.

3.1.2 Supplied warning labels

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

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

		SCARA robots
Warning label 1		●*1 ○
Warning label 2		●*1
Warning label 3		●*1

*1: See "Part names" in each SCARA robot manual for label positions.

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 OMRON 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.

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.

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.

4. Major precautions for each stage of use

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

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

DANGER

OMRON 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 handle the robot such as for teaching, programming, movement check, inspection, adjustment, and repair must receive appropriate training and also have the skills needed to perform the job correctly and safely. They must 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 standards for industrial robots.

WARNING

- THE ROBOT MUST BE OPERATED ONLY BY PERSONS WHO HAVE RECEIVED SAFETY AND OPERATION TRAINING. OPERATION BY AN UNTRAINED PERSON IS EXTREMELY HAZARDOUS.
- ADJUSTMENT AND MAINTENANCE BY REMOVING A COVER REQUIRE SPECIALIZED TECHNICAL KNOWLEDGE AND SKILLS, AND MAY ALSO INVOLVE HAZARDS IF ATTEMPTED BY AN UNSKILLED PERSON. THESE TASKS MUST BE PERFORMED ONLY BY PERSONS WHO HAVE ENOUGH ABILITY AND QUALIFICATIONS IN ACCORDANCE WITH LOCAL LAWS AND REGULATIONS. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

4.2 Design

4.2.1 Precautions for robots

1. Restricting the robot moving speed

WARNING

RESTRICTION ON THE ROBOT MOVING SPEED IS NOT A SAFETY-RELATED FUNCTION.
TO REDUCE THE RISK OF COLLISION BETWEEN THE ROBOT AND 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.).

4.2.2 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.

4.3 Moving and installation

4.3.1 Precautions for robots

■ Installation environment

1. Do not use in strong magnetic fields

WARNING
DO NOT USE THE ROBOT NEAR EQUIPMENT 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
- OMRON 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 the robot

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.
Refer to the Robot Manual for details.

■ 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 ATEMPTED BY AN UNSKILLED PERSON. THESE TASKS MUST BE PERFORMED ONLY BY PERSONS WHO HAVE ENOUGH ABILITY AND QUALIFICATIONS IN ACORDANCE WITH LOCAL LAWS AND REGULATIONS. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

4.3.2 Precautions for robot controllers

■ Installation environment

1. Installation environment

WARNING

OMRON 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 FOR THE L-SHAPED BRACKETS USED 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 CONTROLLER USING THE GROUND TERMINAL ON THE POWER TERMINAL BLOCK. POOR GROUNDING MAY CAUSE ELECTRICAL SHOCK.

4.4 Safety measures

4.4.1 Safety measures

1. Referring to warning labels and manual

WARNING

- BEFORE STARTING INSTALLATION OR OPERATION OF THE ROBOT, BE SURE TO READ THE WARNING LABELS AND 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.

4.4.2 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.

4.5 Operation

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

DANGER

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.

4.5.1 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 "2. Adjusting the origin" in Chapter 3.
Standard coordinate setting	**SCARA robots**	Follow the precautions and procedure described in "4. Setting the standard coordinates" in Chapter 3.
Soft limit settings	**SCARA robots**	Follow the precautions and procedure described in "3. Setting the soft limits" in Chapter 3.

Work with power turned on

Teaching	**SCARA 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.

4.5.2 Automatic operation

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

1. Checkpoints before starting automatic operation

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.

4.5.3 Precautions during operation

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

WARNING

- IF UNUSUAL ODORS, NOISE OR SMOKE OCCUR DURING OPERATION, IMMEDIATELY TURN OFF 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	Loads fall 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.

4.6 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.

4.6.1 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. FOR DETAILED INFORMATION, PLEASE CONTACT YOUR DISTRIBUTOR WHERE YOU PURCHASED THE PRODUCT.

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 30 MINUTES FOR THE YRC SERIES 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.

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.

4.6.2 Precautions during service work

1. 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.

2. 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.

3. 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.

4. 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 SINCE IT WILL DROP UNDER ITS OWN WEIGHT.

5. 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.

6. 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.
- Do not insert any SD memory card other than specified into the SD memory card slot in the programming box. Malfunction or breakdown may result if the wrong memory card is inserted.

4.7 Disposal

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

1. Disposal of lithium batteries

When disposing of lithium batteries, use the correct disposal method in compliance with your local regulations, or entrust disposal to a licensed 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:
YRC	Section 1, "Freeing a person caught by the 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 OMRON robots contain parts generating strong magnetic fields which may cause bodily injury, death, or device malfunction. Always comply with the following instructions.

- Persons wearing ID cards, purses, or wristwatches must keep away from the robot.
- Do not bring tools close to the magnet inside the robot.

7. Using the robot safely

7.1 Movement range

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

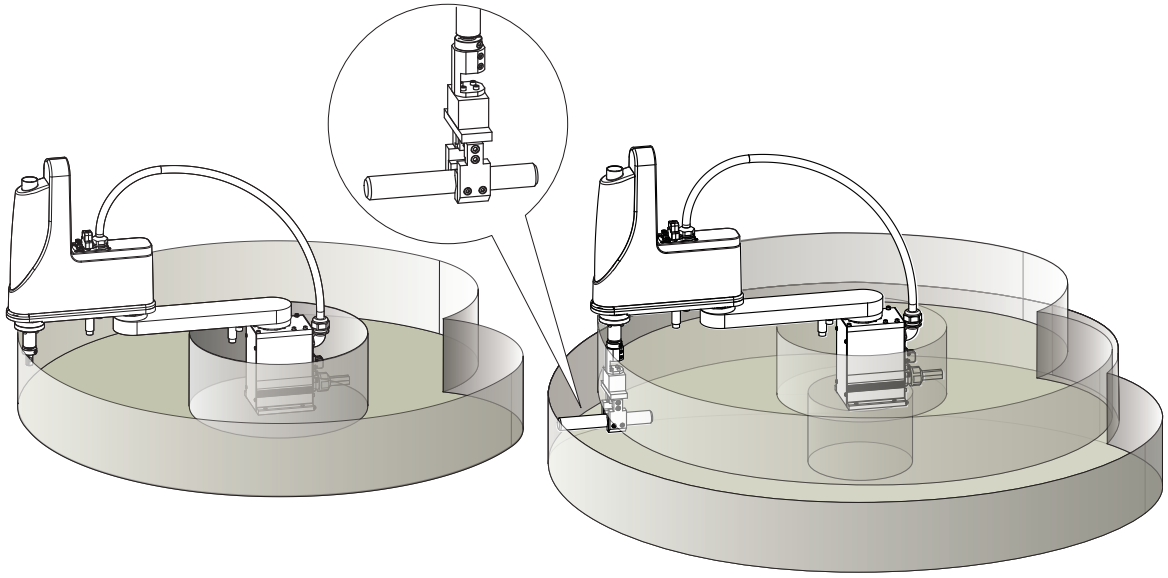


Figure A: Movement range of robot itself

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

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 OMRON 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.

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.

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 OMRON robots and controllers, System integrators and/or end users implement machinery safety design that conforms to ISO12100.
Residual risks for OMRON robots and controllers are described in the DANGER or WARNING instructions provided in each chapter and section. Read them carefully.

7.4 Special training for industrial robot operation

Operators or persons who handle the robot for tasks such as 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.

Warranty

The OMRON robot and/or related product you have purchased are warranted against the defects or malfunctions as described below.

■ Warranty description

If a failure or breakdown occurs due to defects in materials or workmanship in the genuine parts constituting this OMRON robot and/or related product within the warranty period, then OMRON shall supply free of charge the necessary replacement/ repair parts.

■ Warranty period

The warranty period ends 24 months after the date of manufacturing as shown on the products.

■ Exceptions to the warranty

This warranty will not apply in the following cases:

1. Fatigue arising due to the passage of time, natural wear and tear occurring during operation (natural fading of painted or planted surfaces, deterioration of parts subject to wear, etc.)
2. Minor natural phenomena that do not affect the capabilities of the robot and/or related product (noise from computers, motors, etc.)
3. Programs, point data and other internal data were changed or created by the user.

Failures resulting from the following causes are not covered by warranty.

1. Damage due to earthquakes, storms, floods, thunderbolt, fire or any other natural or man-made disaster.
2. Troubles caused by procedures prohibited in this manual.
3. Modifications to the robot and/or related product not approved by OMRON or OMRON sales representative.
4. Use of any other than genuine parts and specified grease and lubricant.
5. Incorrect or inadequate maintenance and inspection.
6. Repairs by other than authorized dealers.

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NONINFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUERIMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE OR INAPPROPIATE MODIFICATION OR REPAIR.

Important information before reading this manual

Contents

Introduction

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

This manual explains how to install and operate the OMRON robot controller. Be sure to read this manual carefully as well as related manuals and comply with their instructions for using the OMRON robot controller safely and correctly.

About this manual

Warnings and cautions listed in this manual relate to OMRON robot controller. To ensure safety of the user's final system that includes OMRON 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 OMRON 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 OMRON 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 YRC series

The OMRON YRC series robot controllers were developed based on years of OMRON experience and proven achievements in robotics and electronics. These controllers are specifically designed to operate OMRON industrial robots efficiently and accurately.
Major features and functions are:

1. Multi-task function

Up to 8 tasks* can be run simultaneously in a specified priority. (Low priority tasks are halted while high priority tasks are run.) I/O parallel processing and interrupt processing are also available, so that operational 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 YRC 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 and uses a compiling method* for rapid execution of programs.
(*: Standard Language for Industrial Manipulators)
(*: This compiling method checks the syntax in a robot language program, converts it into intermediate codes, and creates an execution file (object file) before actually performing the program.)

3. Movement command

Arch motion
Spatial movement during pick-and-place work can be freely set according to the work environment.
This is effective in reducing cycle time.

4. Maintenance

Software servo control provides unit standardization. This allows connection to most OMRON robot models and simplifies maintenance.

5. CE marking

As a OMRON robot series product, the YRC series robot controller is designed to conform to machinery directives and EMC (Electromagnetic compatibility) directives. In this case, the robot controller is set to operate under SAFE mode.
For CE marking compliance, refer to the CE marking supplement manual.

This manual explains how to handle and operate the OMRON 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 absolute reset 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 batteries shipped with the controller are unused, and the battery connectors are left disconnected to prevent discharge. After installing the controller, always connect the absolute batteries while referring to "8. Connecting the absolute battery" in Chapter 3 before connecting the robot 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

Absolute reset is always required when the robot controller power is first turned on after connecting the robot cable to the robot controller. Perform absolute reset while referring to the operator's manual. Absolute reset is also required after the robot cable was disconnected from the robot controller and then reconnected.

[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:

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

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

Contents

1. Freeing a person caught by the 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 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.

1 ***Press*** UTILITY (LOWER + ESC)***.***

The display changes to the UTILITY mode screen and a confirmation message appears on the guideline. When the controller is not in the emergency stop status, this message will not appear. In this case, skip step 2 and go to step 3.

2 ***Press the*** F4 ***(Yes) key to cancel the internal emergency stop flag.***

At this point, it is not necessary to release the emergency stop button on the programming box and the external emergency stop.

3 ***Press*** F1 ***(MOTOR) in UTILITY mode.***

4 ***Use the cursor keys (▲/▼) to select the axis for the target brake.***

5 ***Press*** F8 (UPPER + F3) ***(FREE) to release the brake.***

Make sure to prop up the vertical axis with a support stand before releasing the brake since the vertical axis will slide down when the brake is released.

To apply the brake again, press F2 (Brake) in the above screen.

▶ **Step 1** **Emergency stop screen**

```
UTILITY
─────────────────────────────────
Date, Time   : 08/06/20, 18:59:37   ( 36° C)
motor power: Off
Sequence     : DISABLE
Armtype      : RIGHTY

Cancel emergency flag?   YES   NO
```

▶ **Step 3** **Select "MOTOR"**

```
UTILITY
─────────────────────────────────
Date, Time   : 08/08/01, 18:59:37    (32° C)
motor power: Off
Sequence     : DISABLE
Armtype      : RIGHTY

MOTOR  SEQUENC  ARMTYPE          RST. DO
```

▶ **Step 4** **Selecting axis**

```
UTILITY>MOTOR
─────────────────────────────────
motor power : On
       D1=M1 :Servo       D5=M5 :no axis
       D2=M2 :Servo       D6=M6 :no axis
       D3=M3 :Servo
       D4=M4 :Servo

Servo  Brake
```

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 to stop operation.

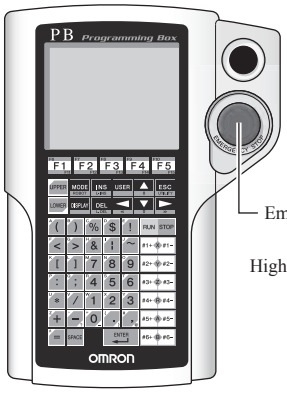
CAUTION

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 "5. SAFETY I/O interface" for details.

A message appears on the programming box screen, indicating that the controller is in emergency stop. The highlighted display for the mode name on the upper left of the screen is cancelled during emergency stop.

Emergency stop

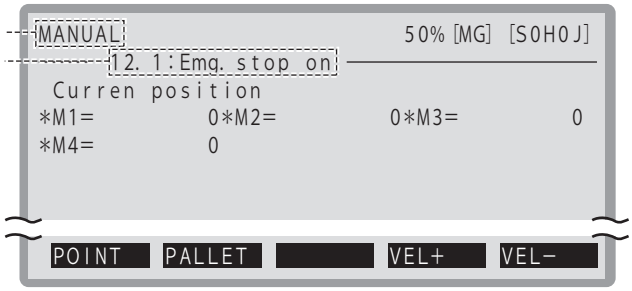
Programming box



Emergency stop button

Highlighted display is canceled

Message display



2.1 Emergency stop reset

To return to normal operation after emergency stop, emergency stop must be reset.

NOTE

- Emergency stop can also be triggered by an emergency stop input from the SAFETY I/O interface. To cancel this emergency stop, refer to chapter "5. SAFETY I/O interface".
- 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.

1 ***Cancel the emergency stop button on the programming box.***

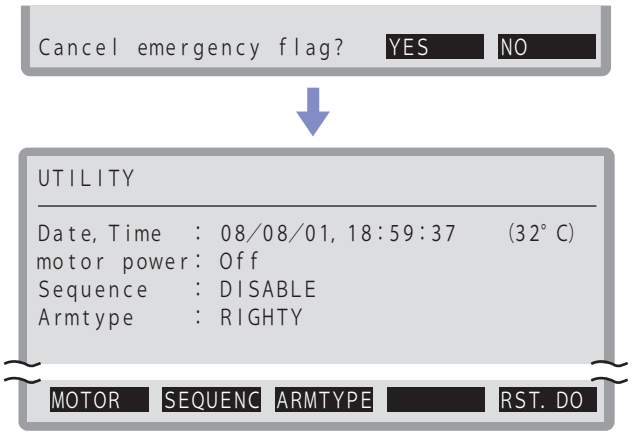
Turning the emergency stop button clockwise releases the emergency stop and turns off the alarm output.

2 ***Cancel the emergency stop flag.***

Press LOWER while holding down UTILITY. The screen then changes to UTILITY mode and a message appears asking whether to cancel the emergency stop flag. Press F4 (YES) to cancel it.

At this time, pressing ESC returns to the previous mode with the motor power still turned off. To turn on the motor power, continue the following operations.

▶ **Step 2** **Emergency stop reset**



1 ***Enter MOTOR mode.***

Press F1 (MOTOR) to enter UTILITY>MOTOR mode.

2 ***Turn on the motor power supply.***

Press F1 (On) to turn on the motor power supply.

The servomotor enters HOLD state and the mode name "UTILITY" on the system line (top line on the screen) is highlighted.

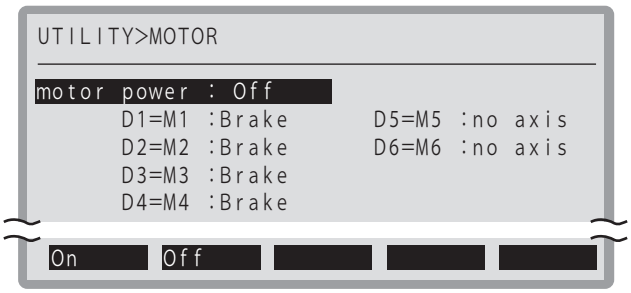
NOTE

If the motor power is turned off due to a serious error, the motor power will not turn on with UTILITY>MOTOR mode. In this case, the robot controller must be turned back on again.

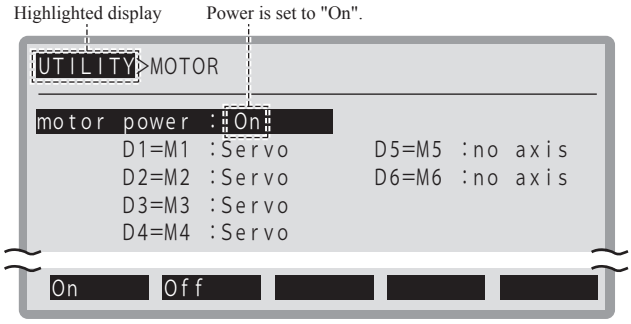
3 ***Exit MOTOR mode.***

Press ESC to return to the previous mode.

Step 1 **MOTOR mode**



Step 2 **Turn on the motor power supply**



2.2 Overload error reset

To return to normal operation after the “17.4: Overload” error state, reset the error after removing the cause of the overload error.

NOTE

- If the overload error occurs, the robot enters the emergency stop state.
- Origin positions are retained even when emergency stop is triggered by the overload error, so the robot can be restarted by canceling emergency stop without absolute reset or return-to-origin operation.
- The overload reset function is valid in software version Ver. 1.65M or later. If the overload error occurs in Ver. 1.64M or earlier, it is necessary to power off the controller, and then power it on again.

1 ***Cancel the emergency stop flag.***

Press UTILITY while holding down LOWER.

The screen then changes to UTILITY mode and a message appears asking whether to cancel the emergency stop flag. Press F4 (YES) to cancel it.

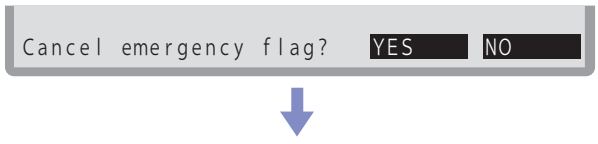
2 ***Cancel the overload error.***

After the emergency stop flag has been cancelled, the message appears asking whether to cancel the overload error. Press F4 (YES) to cancel it.

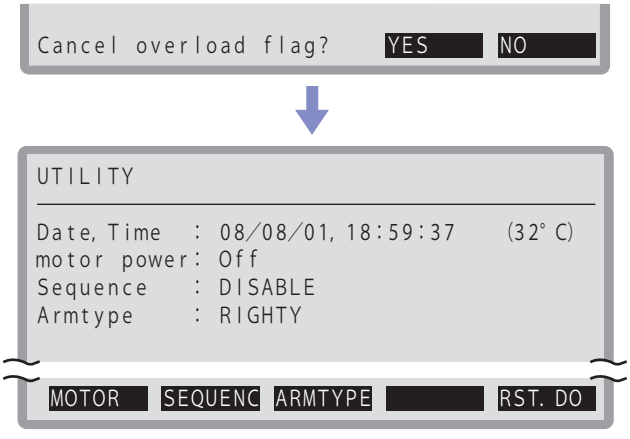
At this time, pressing ESC will return to the previous mode in the motor power off state. To turn on the motor power, turn it on from the MOTOR mode.

Additionally, when pressing F5 (NO), the overload error is not cancelled. If you attempt to turn on the motor power in the MOTOR mode without cancelling the overload error, the emergency flag turns on again. In this case, cancel the overload error again from Step 1.

Step 1 **Emergency stop reset**



Step 2 **Overload error reset**



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 "2.5 Other parameters" in chapter 7 for details.

1 ***Check the setup and connections.***
Make sure that the necessary setup and connections are correctly completed according to the instructions in this manual.

2 ***Activate emergency stop.***
Press the emergency stop button on the programming box to activate emergency stop.

3 ***Turn on the power.***
Supply the power to the AC IN terminal on the front panel of the robot controller.

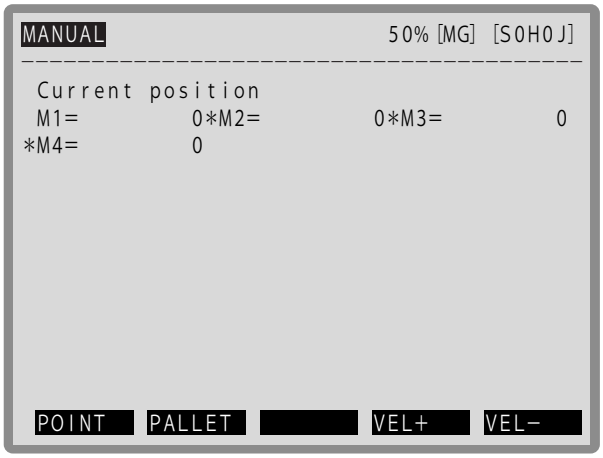
The "PWR" LED lights up and MANUAL mode screen appears. (After the "PWR" LED is lit, it will take a maximum of 3 seconds for the controller to operate normally.)

4 ***Cancel emergency stop.***
Turn the emergency stop button on the programming box clockwise to cancel emergency stop.

5 ***Turn on the servo.***
Refer to the operator's manual for details on how to turn the servo ON.

6 ***Perform return-to-origin.***
Refer to the operator's manual for details on return-to-origin.

Step 3 **MANUAL mode screen**



NOTE

- If an error message "Parameter destroyed" or "Memory destroyed" appears on the screen when the robot controller is turned on, be sure to initialize the parameters and memory in SYSTEM mode before performing absolute reset or return-to-origin. Refer to "5.1 Initializing the parameters" in chapter 7 for details.
- If an error message "10.21 : Sys. backup battery low voltage" appears while the power supply is turned on, replace the lithium battery (typically 4 years service life) in the robot 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.

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 1000 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

Contents

1. System overview

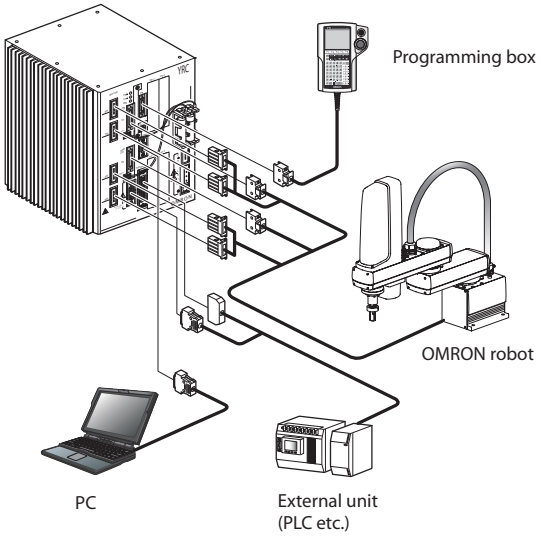
The YRC series controllers are designed for use with a SCARA robot, mainly for assembly and pick-and-place applications. Applications also include various inspection instruments, sealers and spray equipment utilizing linear and circular interpolation functions.

1.1 Main system configuration

■ Configuration: System for controlling one robot

Example : R6YXG500
All the axes on the robot controller are used as the main robot axes.

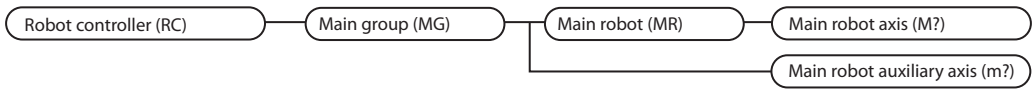
System for controlling one robot



1.2 Axis configuration for the YRC

The axis configuration for the OMRON YRC robot controller is shown below.

Axis configuration for the YRC



Robot controller	Indicates the entire robot controller and controls a maximum of 4 axes. The letters "RC" are displayed on the programming box.
Main group	Indicates the main robot and main auxiliary axes and has a maximum of 4 axes. The letters "MG" are displayed on the programming box.
Main robot	Indicates the robot name specified as a main robot, and includes all axes of the main robot. The letters "MR" are displayed on the programming box.
Main robot axes	Indicate the axes composing the main robot. These can be moved with the robot language MOVE command. The letters "M?" are displayed on the programming box. (?=1 to 4)
Main auxiliary axes	Indicates the single axes composing the main group. These cannot be moved with the robot language MOVE command. Use the DRIVE command to move these axes. The letters "m?" are displayed on the programming box. (?=1 to 4)

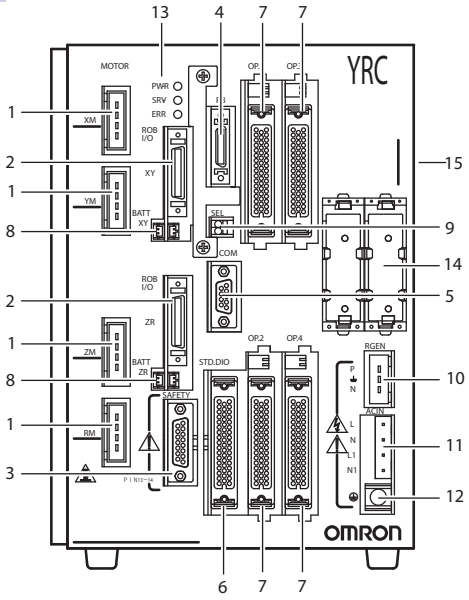
Only the main robot axes are usually specified.

2. Name of each part and control system

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

2.1 YRC external view

Name of each part



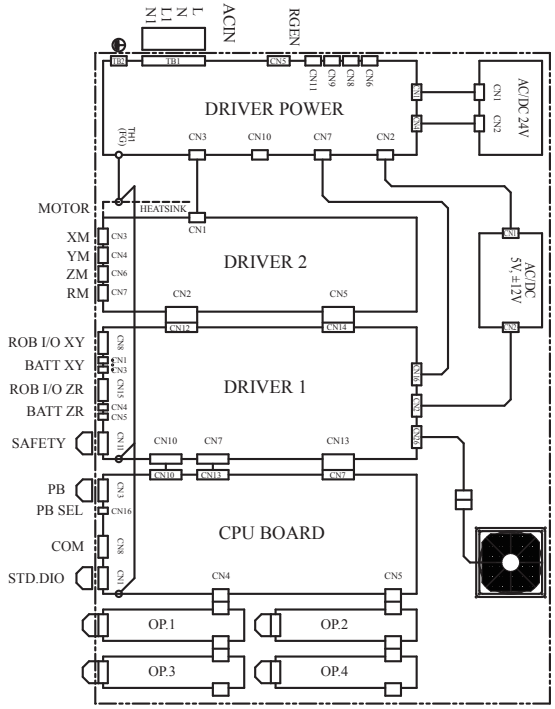
	Name	Function
1	XM/YM/ZM/RM	These connectors are used to drive the servo motor.
2	ROB I/O [XY/ZR]	These connectors are used for servo motor feedback and sensor signals.
3	SAFETY	This is a safety input/output connector for emergency stoppages, etc.
4	PB	This connector is used to connect the programming box.
5	COM	This is an RS-232C interface connector.
6	STD.DIO	This is a connector for dedicated inputs/outputs and for standard general-purpose inputs/outputs.
7	OP.1, 2, 3, 4	These are connectors for optional ports.
8	BATT [XY/ZR]	This connector is used to connect a battery for absolute backup battery.
9	PB SEL	These are programming box selector switch contacts.
10	RGEN [P/⏚/N]	This is a regenerative resistance connector.
11	ACIN [L/N/L1/N1]	This is the control power supply and main power supply (motor drive power supply).
12	FG	This is the ground terminal (⏚). D class grounding work is required.
13	LED	Indicates the controller or robot status. "PWR"LED : Lights up when the power is turned ON. "SRV"LED : Lights up when the motor power is turned ON, and turns off when the motor power is turned OFF. "ERR"LED : Lights up when a serious error or emergency stop condition occurs.
14	Battery holder	The absolute encoder battery is attached here.
15	Rear fan (on rear side)	Ensures that the temperature inside the controller is kept at a fixed level. When installing the YRC, leave a space of at least 30mm at the rear of the unit, and never cover the fan.

WARNING

TO PREVENT ELECTRIC SHOCK, NEVER TOUCH THE RGEN OR ACIN TERMINALS WITH THE ROBOT CONTROLLER POWER ON.

2.2 Controller system

Basic block diagram

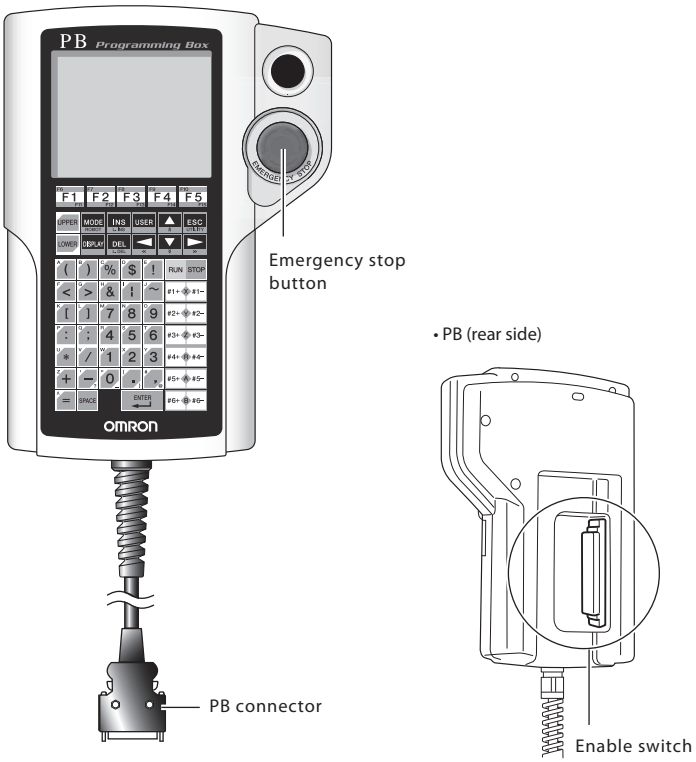


3. Optional devices

3.1 Programming box

The programming box is a hand-held device used to perform all robot operations, including robot manual operations, program input and editing, teaching and parameter settings.

Programming box

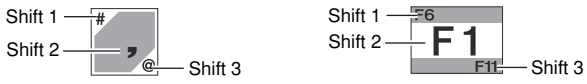


3.2 Basic key operation

Each operation key has 3 different functions as shown below.

Use UPPER or LOWER shift key as needed.

Key configuration



In this manual, the corresponding "shift key pressed" status is indicated when the "shift 1" and "shift 3" keys are pressed.

For example: LOWER + MODE (ROBOT) → ROBOT is indicated.

For key operation details, refer to the operator's 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.

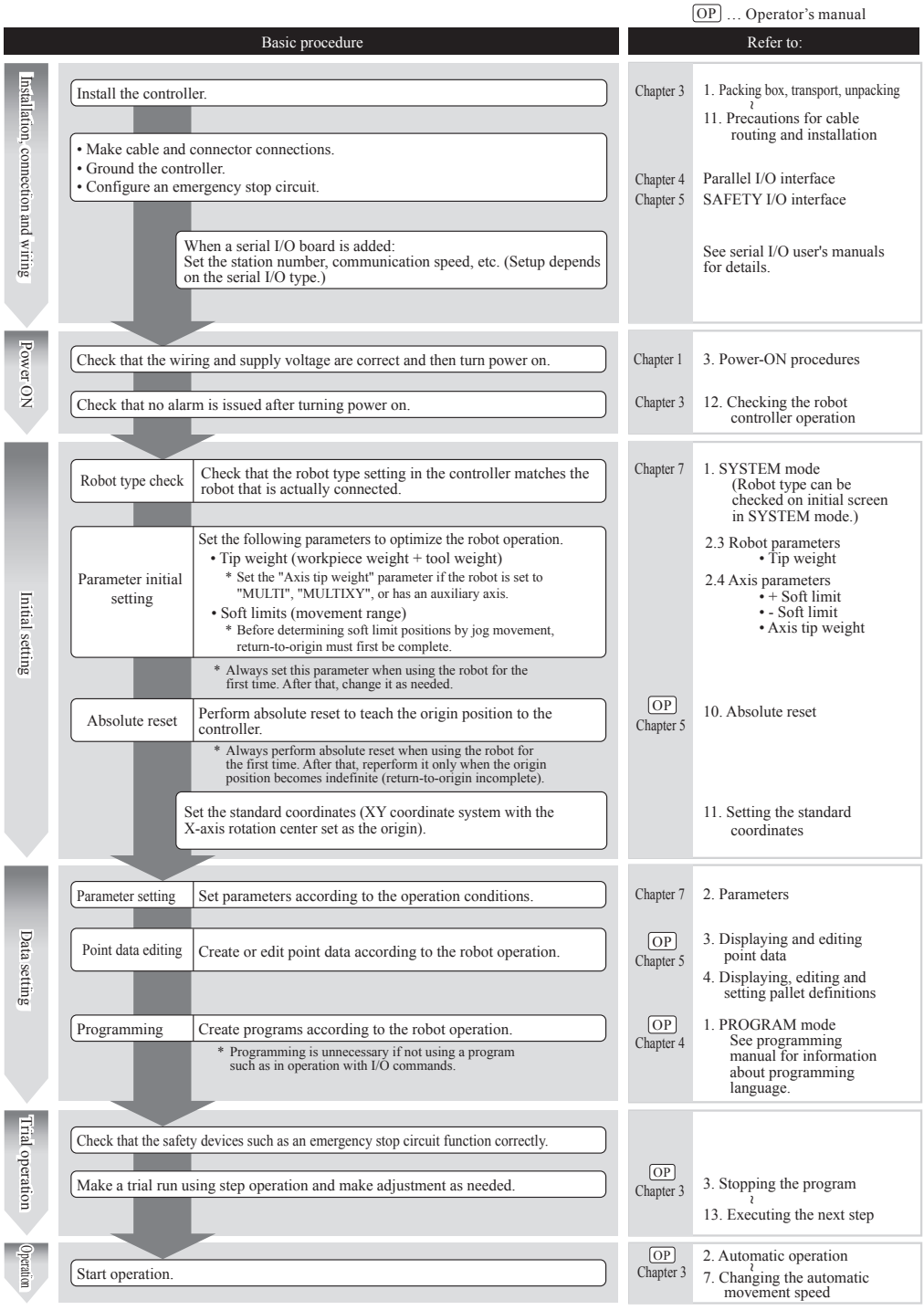
3.4 Regenerative unit

A regenerative unit may be required depending on the robot type.

4. Basic sequence from installation to operation

The basic sequence from installation to actual operation is shown below. Read this manual thoroughly before beginning work or operation.

4.1 When using absolute type axes only



Chapter 3 Installation

Contents

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.

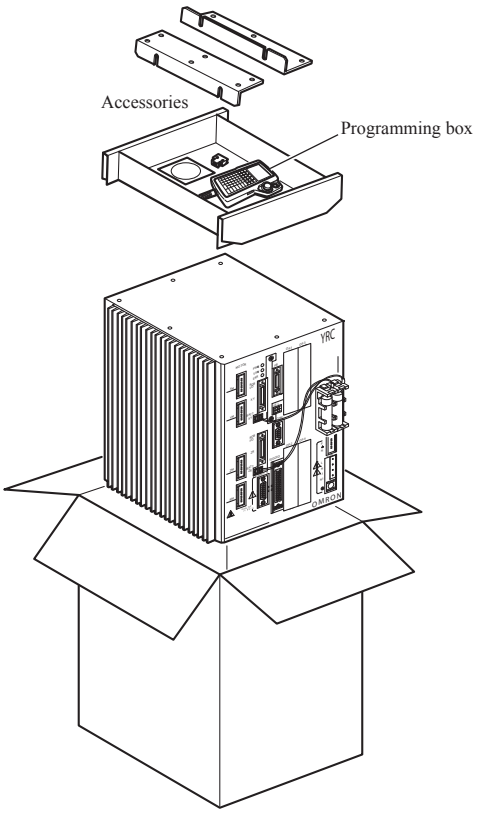
1.3 Unpacking

The robot controller is packed with accessories as shown below, according to the order specifications. 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.

Unpacking



	Accessories	
Standard	Power supply connector	1
	SAFETY connector	1
	PB terminator	1
	L-type bracket set for front and rear panels	2
	Connector guard for COM connector	1
	Ferrite core	3
	CD-ROM manual	1
Option	Programming box	1
	Absolute battery	1 to 4
	L-type brackets for side panel	2
	I/O connector *1	1
	Communication cable	1
	RGU-2 connection cable	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

When installing, choose a proper place for your robot controller, taking into account your system layout, accessibility for maintenance, etc.

2.1 Installation conditions

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

■ Installation location

Install the controller on a stable, flat surface inside the control panel.

■ Operating temperature and humidity

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

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

■ Operating environments to be avoided

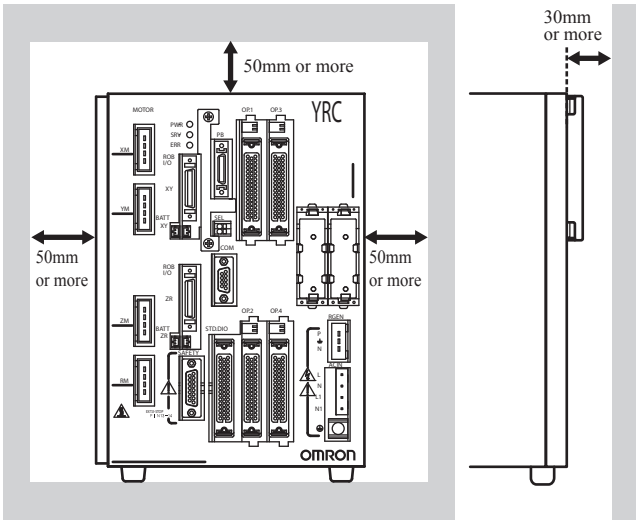
The controller should never be used in the following environments in order to ensure normal operation.

- 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

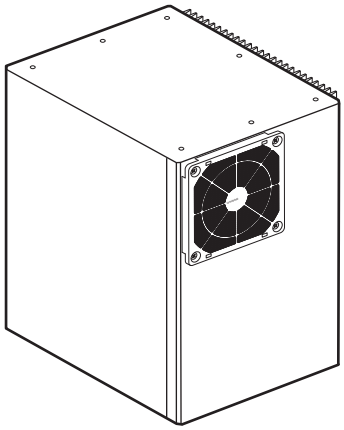
To prevent degradation or breakdowns, never use the controller in other than the specified installation conditions.

2.2 Installation methods

There are 4 methods for installing the robot controller as explained below.

1. Using the rubber feet (attached as standard parts)

Using the rubber feet



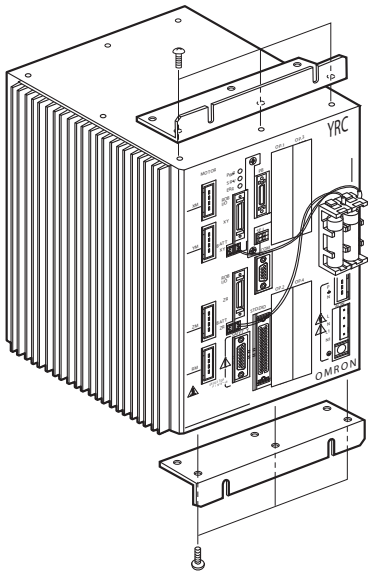
2. Attaching the L-type brackets (supplied as standard accessories) to the front

Remove the rubber feet from the bottom of the controller if attaching L-type brackets.

CAUTION

The L-type brackets have 2 locations for securing to the controller. Attach and secure based on the layout of the installation location.

Attaching the L-type brackets to the front

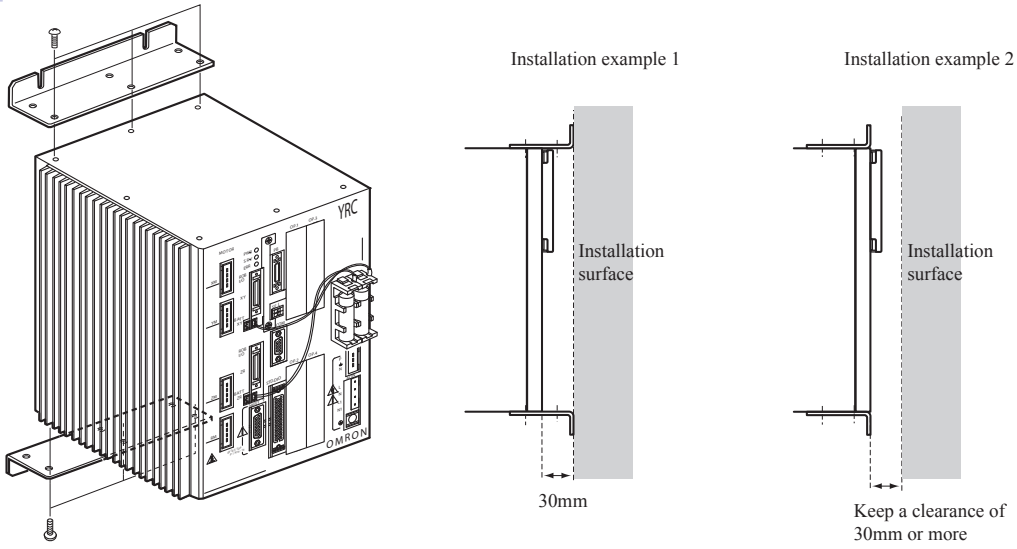


3. Attaching the L-type brackets (supplied as standard accessories) to the rear

CAUTION

- Provide a clearance of at least 30mm from the rear panel of the controller.
- The L-type brackets have mounting holes in two different position. Use the holes that best match the equipment layout.
- When the controller is installed using the L-type brackets as the Installation example 1 shows, a clearance of 30mm will be secured between the controller rear panel and the installation surface.

Attaching the L-type brackets to the rear

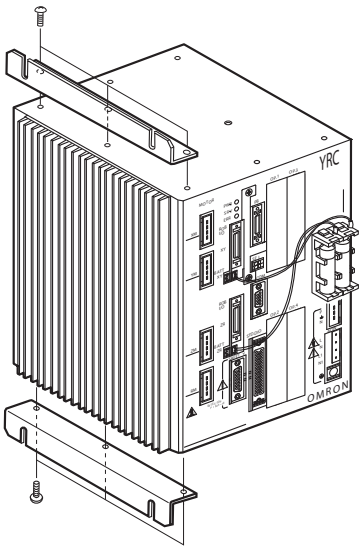


4. Attaching the L-type brackets (option) to the side

CAUTION

If attaching the L-type brackets to the side of the controller, ensure to leave a space of at least 50mm from the heat sink when installing.

Attaching the L-type brackets to the side



L-type bracket part No. (single item)

1	Standard (for front and rear)	KX0-M410H-003
2	Option (for side)	KX0-M410H-102

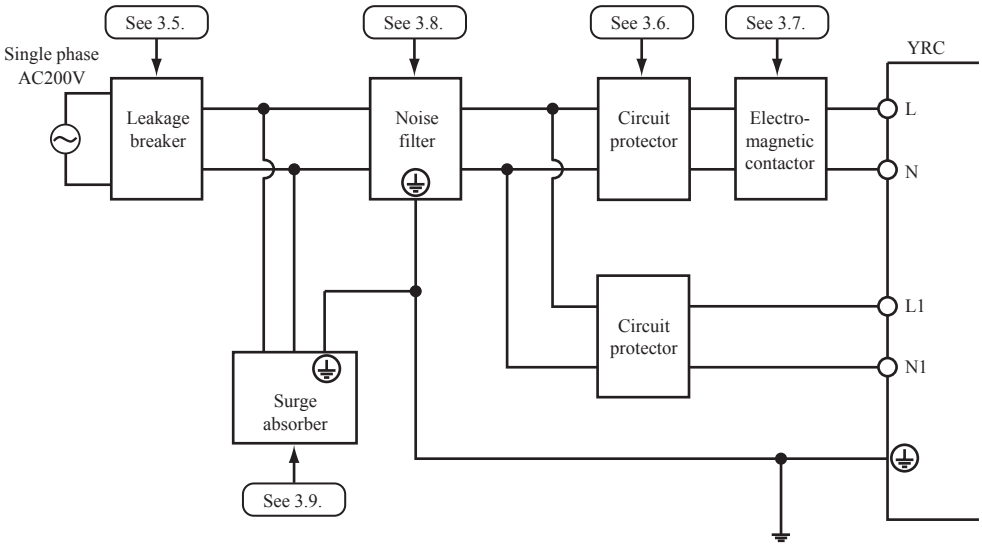
When installing the controller with L-type brackets, use two same brackets for one controller.

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		

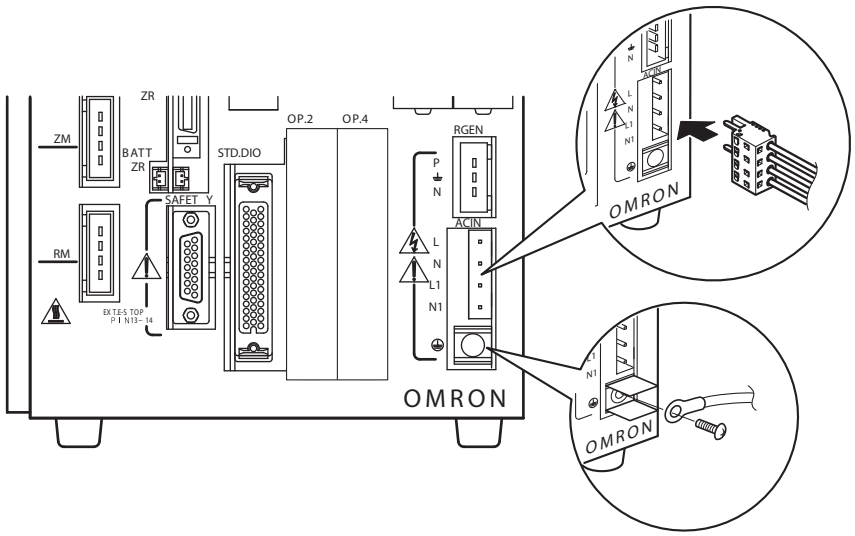
*sq (square) is a unit used to indicate the cross-sectional area of stranded wires, with 1sq indicating 1 square millimeter.

⏚	Ground	Class D grounding (100 ohms or less)	Tightening torque	1.4Nm

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

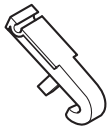


3.3 AC power connector wiring

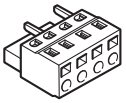
■ Requirements

Prepare the following to wire power connectors.

Requirements



Connection lever (provided)
or flat-blade screwdriver.



Connector (provided)

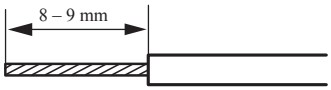
Wire

■ Wiring method

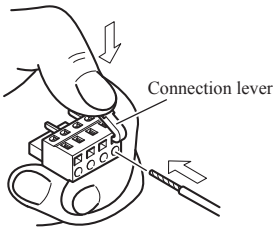
Strip the wire coating to expose 8 to 9mm of bare lead.
Use either of the methods shown below to insert the wire core into the opening in the power connector, and then ensure that the wire does not come out.

Wiring method

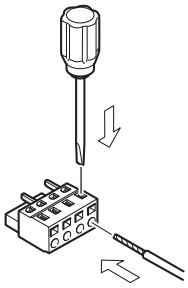
Strip 8 to 9 mm of coating.



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 robot controller may issue an abnormal voltage alarm causing the robot to trigger 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: YRC

1.When connected to SCARA robot

Robot model				Power capacity (VA)	Generated heat amount (W)
Standard type	Clean type	Dust-proof & drip-proof type	Wall-mount & inverse-mount type		
R6YXG120, R6YXG150				300	58
R6YXG180, R6YXG220	R6YXC180, R6YXC220			500	63
R6YXGL250, R6YXGL350, R6YXGL400, R6YXGL500, R6YXGL600	R6YXGLC250, R6YXGLC350, R6YXGLC400, R6YXGLC500, R6YXGLC600	R6YXGLP250, R6YXGLP350, R6YXGLP400, R6YXGLP500, R6YXGLP600	R6YXGS300, R6YXGS400	1000	75
	R6YXC500, R6YXC600			1500	88
R6YXG500, R6YXG600		R6YXGP500, R6YXGP600	R6YXGS500, R6YXGS600	1700	93
	R6YXC700, R6YXC800, R6YXC1000			2000	100
R6YXGH600, R6YXG700, R6YXG800, R6YXG900, R6YXG1000, R6YXX1200		R6YXGHP600, R6YXGP700, R6YXGP800, R6YXGP900, R6YXGP1000	R6YXGS700, R6YXGS800, R6YXGS900, R6YXGS1000	2500	113

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
YRC control power supply (L1, N1)	Total 4mA (MAX)
YRC 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
YRC control power supply (L1, N1)	5A	Slow type with inertia delay
YRC main power supply (L, N)	15A	

3.7 Installing an electromagnetic contactor

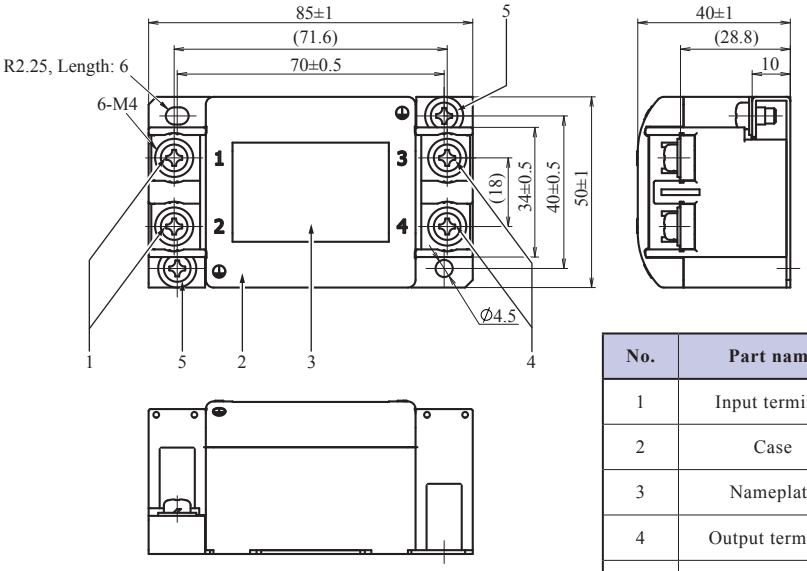
When controlling the power on/off operation of the robot controller using an external unit such as a PLC, an electromagnetic contactor should be installed on the AC power supply line for the controller. Select an electromagnetic contactor that falls under the required safety category and control the 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.

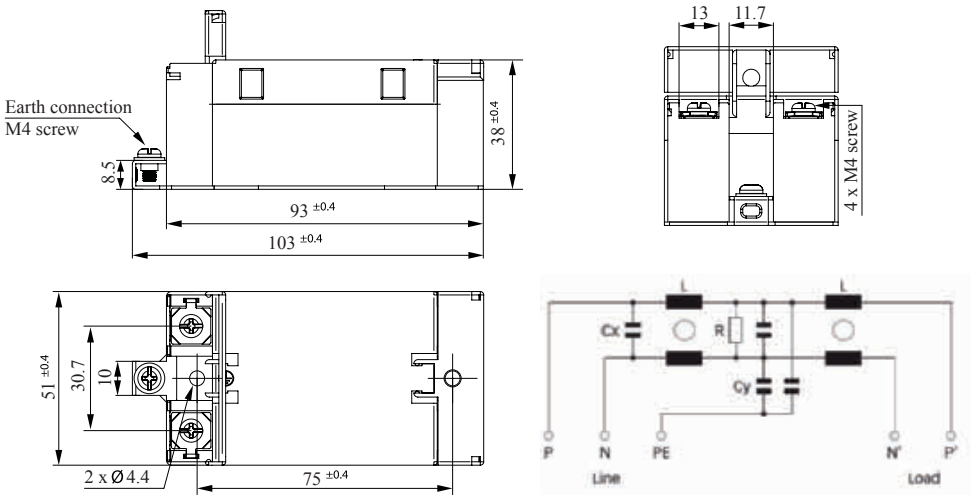
Dimensional outlines of recommended noise filter

Manufacturer : SOSHIN ELECTRIC CO., LTD.
Type No. : NF2020A-UP



No.	Part name	Note
1	Input terminal	M4
2	Case	PBT
3	Nameplate	
4	Output terminal	M4
5	Ground terminal	M4

Manufacturer : Schaffner EMV AG
Type No. : FN2450F-20-61

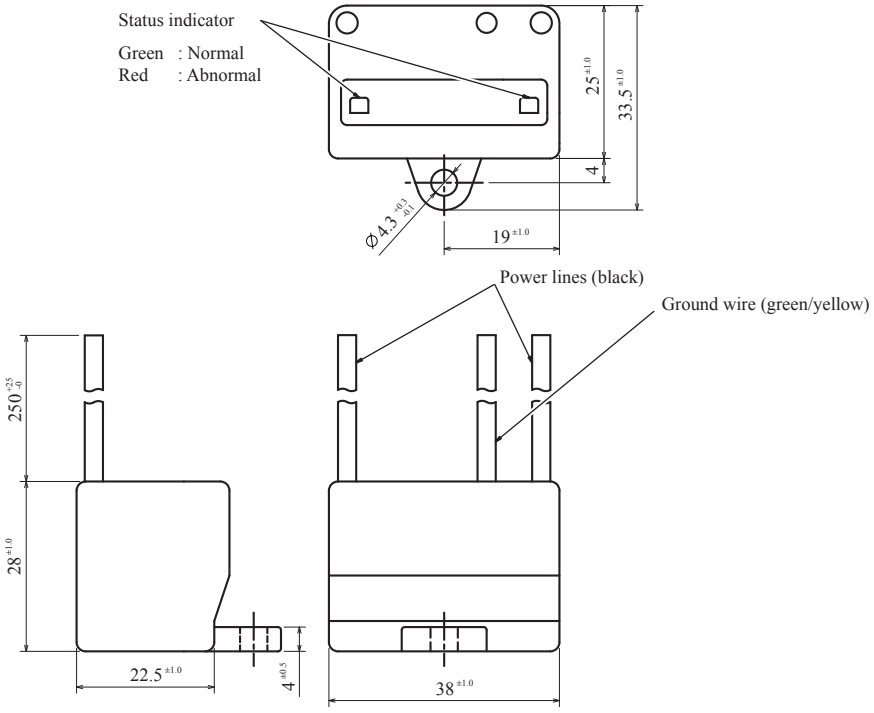


3.9 Installing a surge absorber

Users who wish to improve immunity to surge noise from lightning strikes should install a surge absorber.

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 cables to the mating connectors on the front panel of the controller as shown below. The "XM", "YM" and "ROB I/O XY" connectors are for axes 1 and 2, while the "ZM", "RM" and "ROB I/O ZR" connectors are for axes 3 and 4.
The robot cable specifications depend on the robot model, so refer to the Robot Manual for details.

NOTE

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

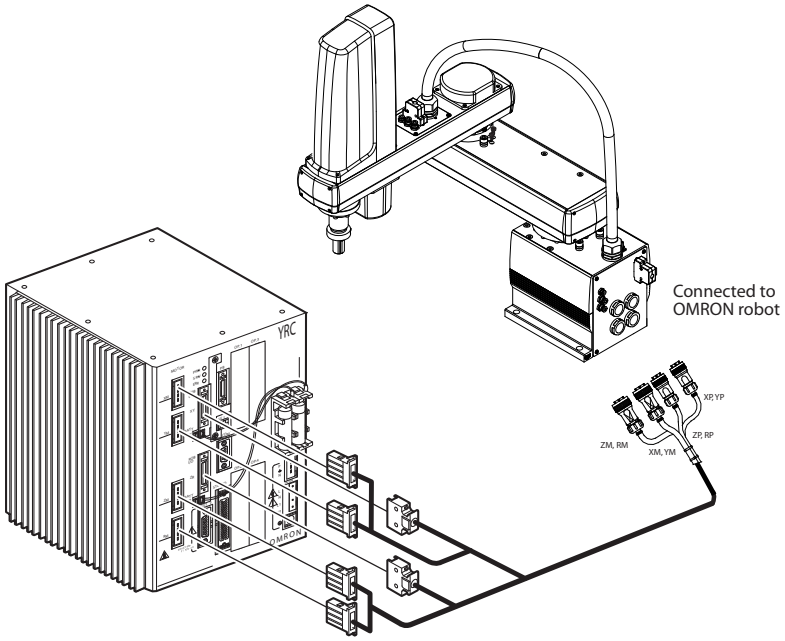
WARNING

- THE POWER TO THE CONTROLLER MUST BE OFF WHEN CONNECTING THE ROBOT CABLES.
- THE XM/YM/ZM/RM CONNECTOR AND ROB I/O CONNECTOR (XY/ZR) HAVE AN IDENTICAL SHAPE. DO NOT CONFUSE THESE CONNECTORS WHEN MAKING CONNECTIONS. A MISCONNECTION WILL CAUSE THE ROBOT TO MALFUNCTION.X
- KEEP THE ROBOT CABLES SEPARATE FROM THE POWER CABLES AND OTHER EQUIPMENT POWER LINES. FAILURE TO FOLLOW THIS INSTRUCION MAY CAUSE MALFUNCTIONS.

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.
Furthermore, make sure that the robot is properly grounded. For details on the connection method, refer to the Robot Manual.

Robot cable connection to controller



4.2 Noise countermeasures

The robot cables which are connected to the controller's XM, YM, ZM, and RM connectors are motor power cables, and these cables emit switching noise which occurs during motor control.
This noise could cause malfunctions in sensors, etc., which are located near these motor cables. If such malfunctions occur, the following countermeasures are recommended.

1. Install the sensor, etc., further away from the motor cable.
2. Use a shielded cable for the sensor, etc., and ground the shield.

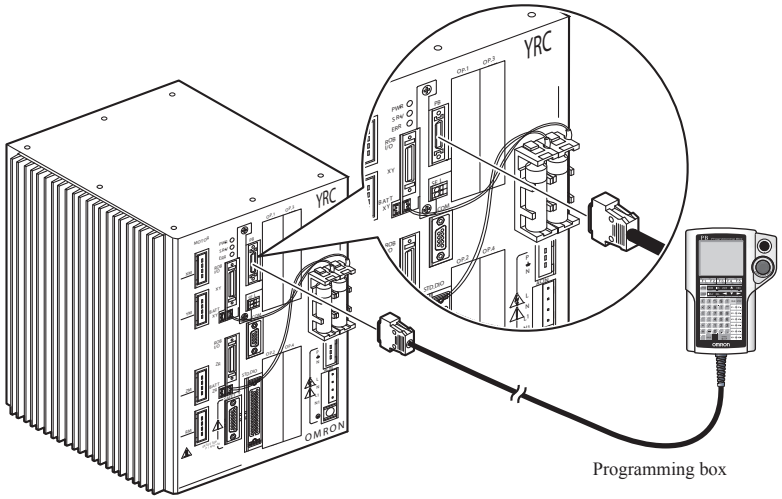
5. Connecting the programming box

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.

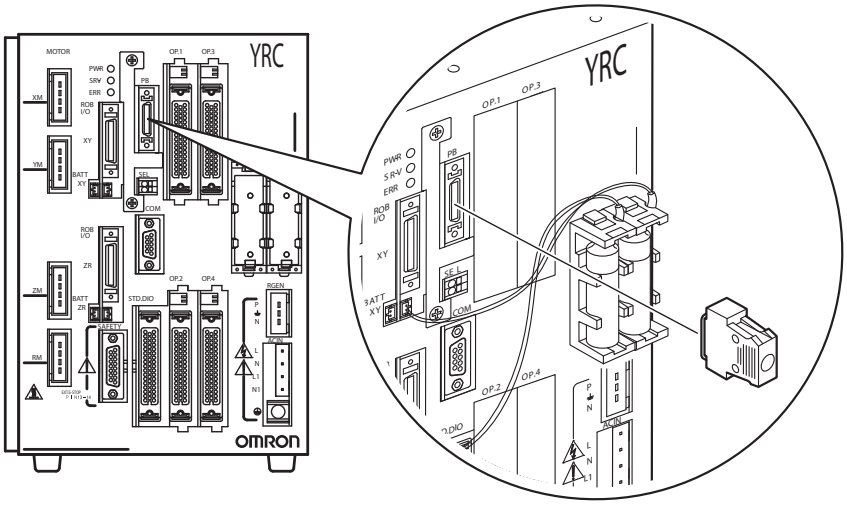
Programming box connection



Connecting a terminator

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

Connecting a terminator



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.

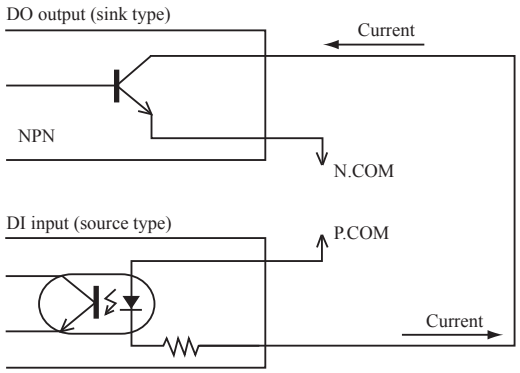
6. I/O connections

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. Parallel 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).

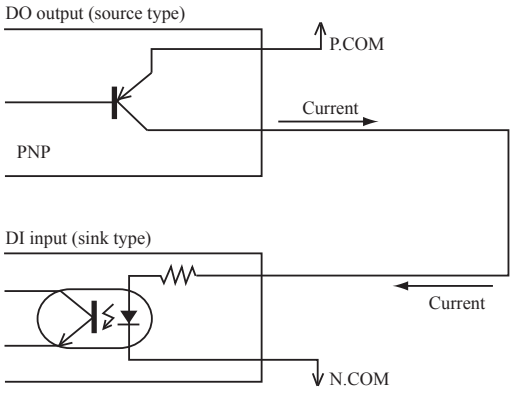
Connection for NPN specifications



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).

Connection for PNP specifications



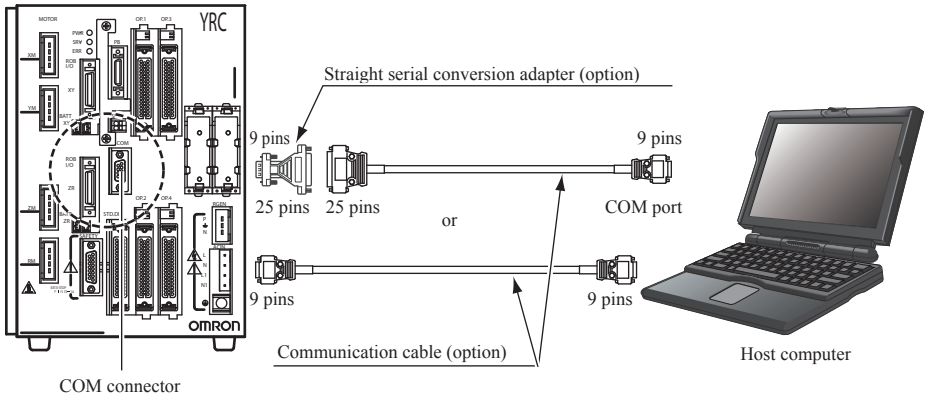
7. Connecting a host computer

As a standard feature, the robot controller has an RS-232C interface port for data communication with a host computer. This RS-232C interface is used to communicate with the host computer. Connect the RS-232C terminal on the host computer to the COM connector on the front of the robot controller with a dedicated communication cable.
Refer to chapter "6. RS-232C interface" for details on the RS-232C interface.

NOTE

D-SUB 9PIN (female) connector is for RS-232C interface.

Host computer connection

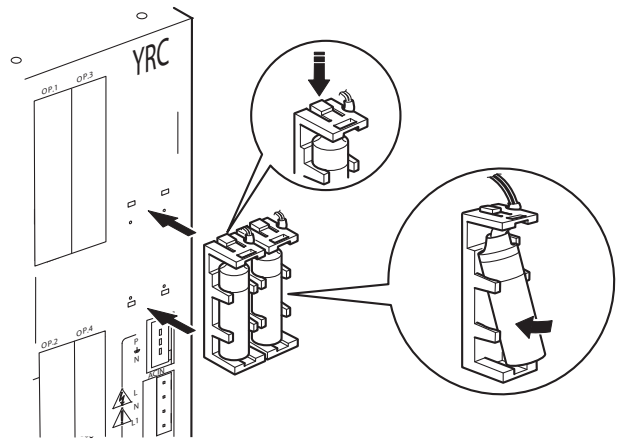


8. Connecting the absolute battery

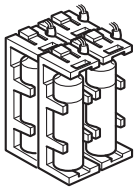
The absolute batteries shipped with the controller are unused, and the battery connectors are left disconnected to prevent discharge.
After installing the controller, always be sure to connect the absolute batteries before connecting the robot cable.

Insert the absolute battery slowly into the battery holder.
After inserting, make sure that the battery is properly secured with the holder clips.

Connecting the absolute battery

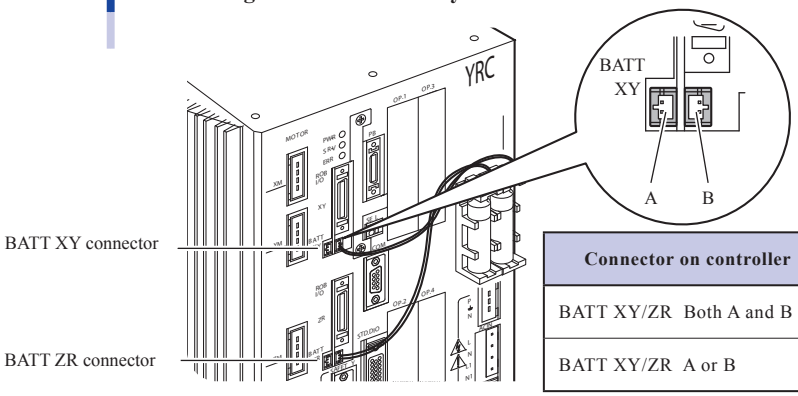


Battery holders can be stacked in 2 levels.



Absolute batteries should be connected to the BATT XY/ZR connectors on the front right of the controller.
The same absolute battery (or batteries) is shared by the X and Y axes or by the Z and R axes.
Connect the X and Y axis absolute battery to either of the two "BATT XY" connectors, and the Z and R axis absolute battery to either of the two "BATT ZR" connectors.
When the batteries are connected to both connectors (standard connection), the data retention time will be doubled compared to a single battery connection.

Connecting the absolute battery



Connector on controller	Backup time	Battery connection
BATT XY/ZR Both A and B	About 8,000 hours (approx. 1 year)	Standard (2 batteries)
BATT XY/ZR A or B	4,000 hours (approx. 6 months)	1 battery

CAUTION

If connecting absolute batteries to both A and B, both batteries should be replaced with new ones at the same time. Do not modify or extend the wiring. This could cause equipment malfunction or breakdown.

NOTE

- When connecting the absolute batteries in parallel, always connect the two absolute batteries to the connectors on the controller even if one of the axes is not used.
- Return-to-origin will be incomplete if an absolute battery is disconnected from the BATT connector while the controller power is turned off. Absolute batteries are not connected when the controller is shipped, and so an error message indicating that return-to-origin is incomplete is always issued when the power is first turned on. Please note that this does indicate an abnormality with the controller or robot.
- Battery replacement is required if the controller power is left off for longer than the backup time.
- If the controller is stored for periods of time greatly exceeding the backup time, disconnect the connectors to keep absolute battery consumption to a minimum.
- Attach absolute batteries with the +ve electrode facing upward.

9. Replacing the absolute battery

The absolute battery will wear down and must be replaced as needed. For example, when problems with backing up data occur, replace the battery since the battery has reached the end of the service life.
Though battery wear depends on the operating conditions, the battery should generally be replaced when the total time that the controller power has been off reaches 8,000 hours (approx. 1 year) after being connected to the controller.

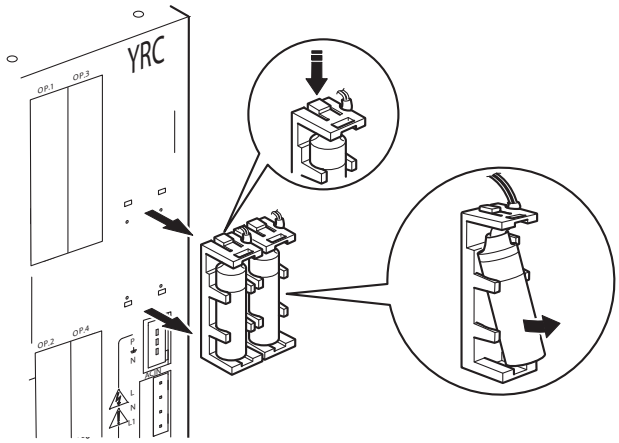
Battery type	3.6V, 2750mAH
Battery part No.	KAS-M53G0-11

Battery holder part No.	KBG-M5395-00

Replacing the absolute battery

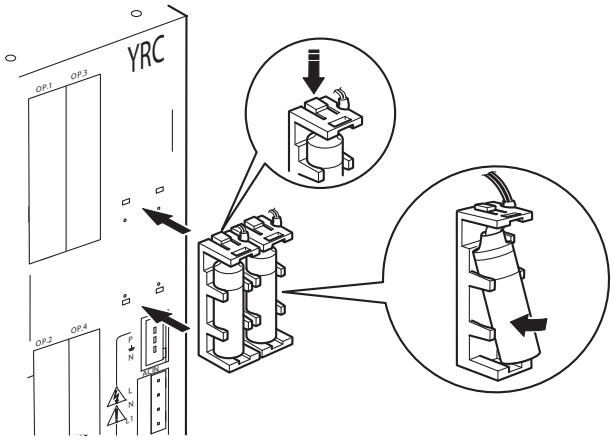
1) Remove the battery from the battery holder.

Removing the battery

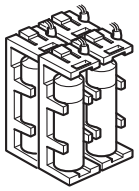


2) Insert the new battery slowly into the battery holder.
After inserting, check that the battery is securely installed in position by the holder.

Attaching the battery



Battery holders can be stacked in 2 levels.



10. Connecting a regenerative unit

When a regenerative unit is required, connect it between the RGEN connector on the front panel of the controller and the RGEN connector on the regenerative unit, by using the cable that comes with the regenerative unit.

NOTE

- The YRC may require a regenerative unit depending on the robot type to be connected.
- Make sure there are no bent or broken connector pins and no cable damage before connecting.

WARNING

- THE POWER TO THE CONTROLLER MUST BE OFF WHEN CONNECTING THE REGENERATIVE UNIT TO THE CONTROLLER.
- TO PREVENT ELECTRICAL SHOCKS, NEVER TOUCH THE RGEN CONNECTOR WHEN POWER IS SUPPLIED TO THE CONTROLLER.

CAUTION

Always securely connect the cable. Poor connections or contact failure may cause malfunctions.

Regenerative unit connection

RGEN connector

11. Precautions for cable routing and installation

11.1 Wiring methods

Various cables are used to connect the robot controller to peripheral devices. Follow the precautions below when making cable routing and connections to avoid malfunctions due to noise.

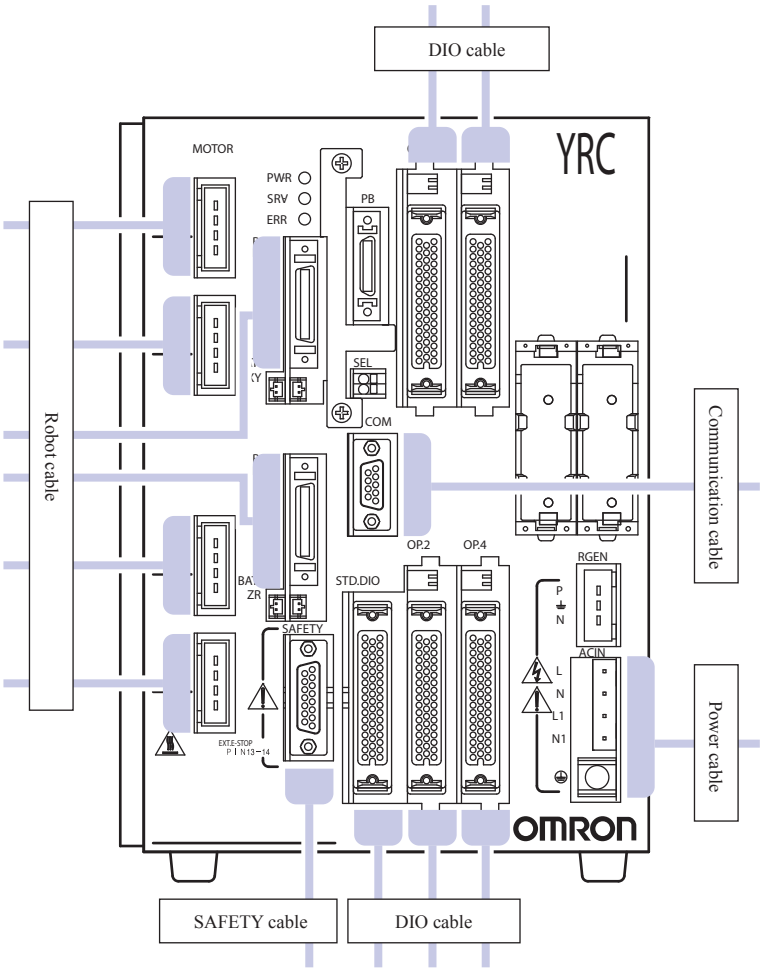
CAUTION

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

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

Refer to the drawing below when making the cable connections.

Cable connection



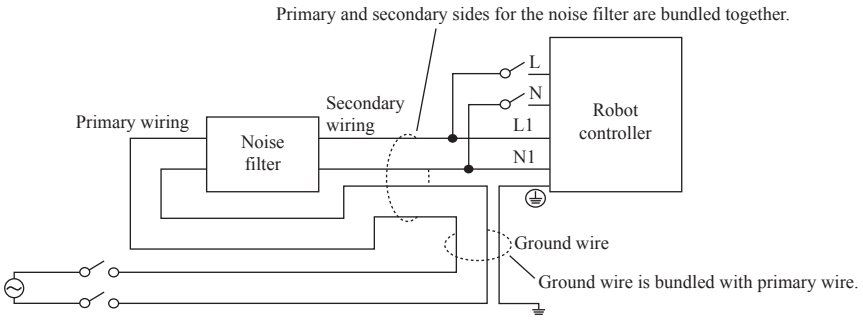
11.2 Methods of preventing malfunctions

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 example

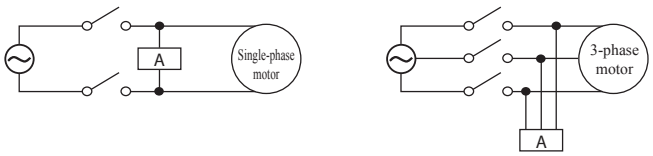


Refer to "11.3 Attaching ferrite cores" for details on ferrite cores.

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

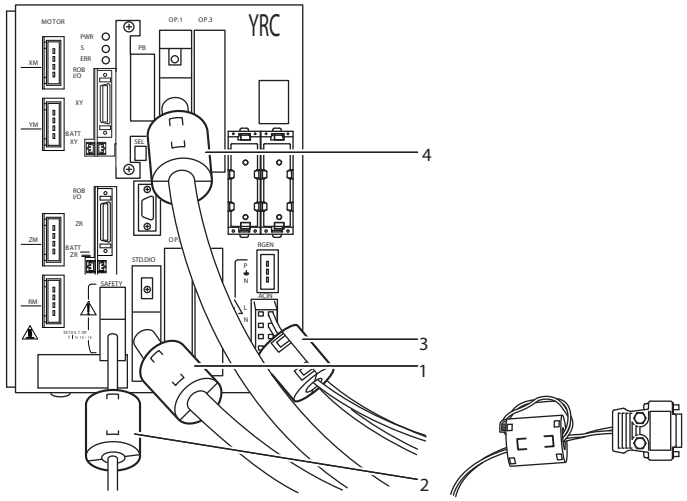
DC type
B: Diode, varistor, CR elements

AC type
C: Varistor, CR elements

11.3 Attaching ferrite cores

Depending on the environment in which the YRC robot controller is installed, external noise may cause malfunctions.
If required, attach ferrite cores as shown below using the ferrite cores provided.

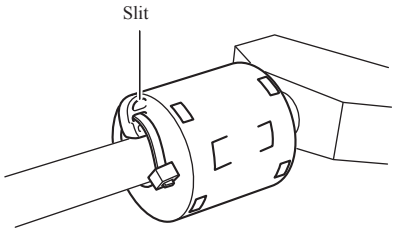
Attaching ferrite cores



	Ferrite core attachment location	Connection method
1	STD.DIO cable	1 core near STD.DIO connector
2	SAFETY cable	1 core per turn near SAFETY connector
3	Power cable	1 core near L, N, L1, N1 terminals
4	OP.DIO (NPN) cable OP.DIO (PNP) cable	1 core near optional slot I/O connector 1 core near optional slot I/O connector

Secure ferrite cores to the respective cables using the cable ties provided.
Pass the cable ties through the slits in the side of the ferrite cores, wind around the cables, and then secure.

Securing ferrite cores



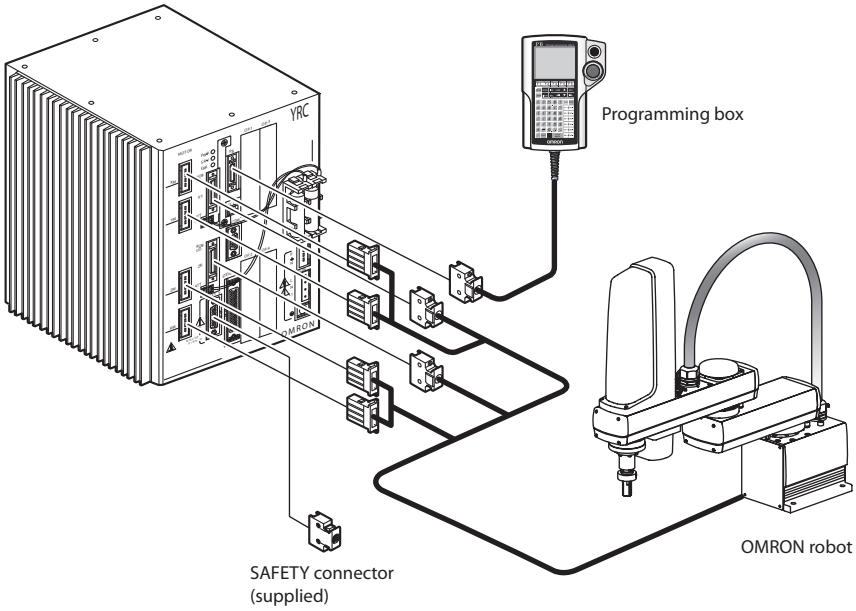
12. Checking the robot controller operation

This section explains how to check the controller operation using a special connector that comes with the controller and an applicable robot.
The following connections must be complete.

- 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)
  (Pin 3 is shorted to pin 13, and pin 4 is shorted to pin 14 in the SAFETY connector.)

12.1 Cable connection

Cable connection

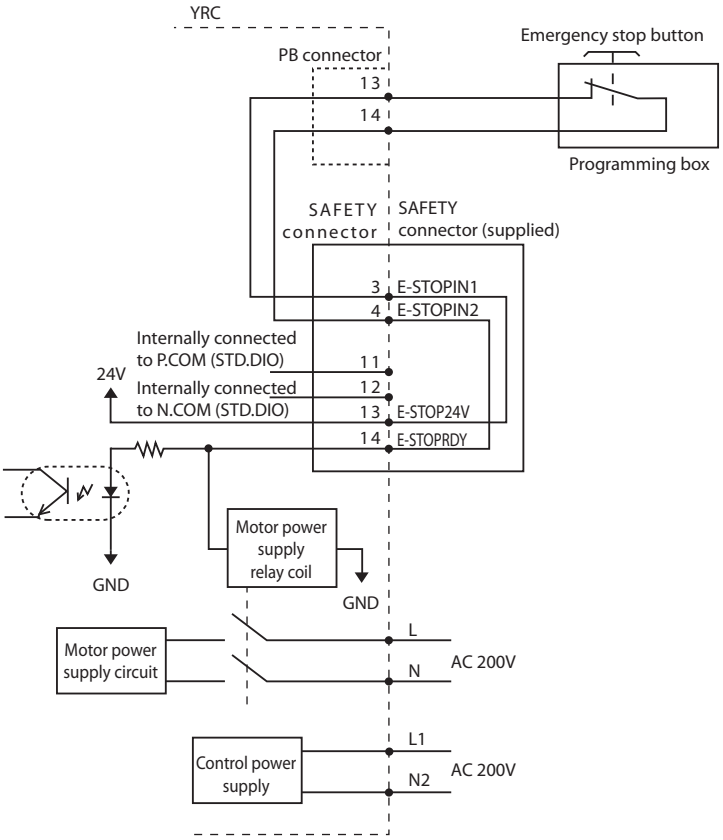


12.2 Emergency stop input signal connection

CAUTION

Both external emergency stops and the programming box emergency stop button are disabled when pin 13 and pin 14 are directly shorted to each other on the SAFETY connector. Make connections to ensure the system including the robot controller will always operate safely.

Emergency stop input signal connection



• The emergency stop button on the programming box is connected to the controller through the SAFETY connector.

12.3 Operation check

After connecting the robot and special connector (supplied) to the controller, turn on the power to the controller and check the following points.

NOTE

The STD.DIO connector is not connected, and therefore operation is always prohibited with the interlock function. This can be cancelled with a software parameter. Set the "STD.DIO DC24V power supply monitor" parameter to "INVALID".

Normal operation

- The "PWR" and "SRV" LED lamps on the front panel of the controller light up. The "ERR" LED lamp is off.
- When the SAFE mode setting is enabled and the serial I/O is connected, the "SRV" LED lamp does not light up.

Abnormal operation

- The "PWR" and "ERR" LED lamps on the front panel of the controller light up.
- Check the error message displayed on the programming box and take corrective action based on the description given in "Troubleshooting".

Chapter 4 Parallel I/O interface

Contents

1. Standard I/O interface overview

The robot controller has a standard I/O interface for compatibility with customer systems. A description of each I/O terminal and its connection is given here. Connect these I/O terminals correctly and efficiently.
This standard I/O interface contains 10 dedicated inputs and 11 outputs, and 16 general-purpose inputs and 8 outputs.
The type of standard I/O interface (NPN or PNP specifications) is set prior to shipment.
Inputs are referred to here as DI (Digital Inputs) and outputs as DO (Digital Outputs). If a serial IO (CC-Link, DeviceNet, etc.) is selected with the option board, the standard I/O interface's dedicated inputs other than DI11 (Interlock) will all be invalid.
For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

NOTE
On the robot controller with SAFE mode enabled, dedicated inputs may not be used in SERVICE mode depending on the operating device setting in SERVICE mode.

Specifications			Connector name	Connector type No.	Wire thickness
Standard	Input	Dedicated : 10	STD. DIO	MR-50LM (Honda Tsushin Kogyo)	0.3 sq or more
		General-purpose : 16			
	Output	Dedicated : 11			
		General-purpose : 8			

1.1 Power supply

The standard I/O interface needs to be connected to a 24V power supply. Connect the 24V and ground terminals of the external power supply to pins 47 to 50 of the STD.DIO connector.

CAUTION
Do not keep supplying the external 24V DC power to the standard I/O interface while controller power is off. The controller might malfunction if the external 24V is continuously supplied.

NOTE
- When not using the standard I/O interface, invalidate the "Watch on STD. DIO DC24V" setting under "PARAM>OTHERS".
- When using the SAFETY connector's DI02 input and MP READY output, it is necessary to supply the STD.DIO with power.
- Even if not using the standard I/O interface dedicated inputs and outputs, when supplying power to the STD.DIO connector is absolutely necessary to connect DI11 (interlock) and GND(N.COMPI).
  Example:
  Using the SAFETY connector DI02 input and the MP READY output together with using the serial IO.
  The serial IO is used in combination with the serial I/O interface general purpose input and output.

1.2 Connector I/O signals

PIN	I/O No.	Signal name	Remarks
1	DI05	I/O command execution trigger	Common terminals : P. COM DI N. COM DI Photocoupler input NPN specifications : source type PNP specifications : sink type
2	DI01	Servo ON input	
3	DI10	Sequence control	
4	DI11	Interlock	
5	DI12	Program start	
6	DI13	AUTO mode input	
7	DI14	Return-to-origin	
8	DI15	Program reset input	
9	DI16	MANUAL mode input	
10	DI17	Absolute reset/ Return-to-origin	
11	DI20	General-purpose input 20	
12	DI21	General-purpose input 21	
13	DI22	General-purpose input 22	
14	DI23	General-purpose input 23	
15	DI24	General-purpose input 24	
16	DI25	General-purpose input 25	
17	DI26	General-purpose input 26	
18	DI27	General-purpose input 27	
19	DI30	General-purpose input 30	
20	DI31	General-purpose input 31	
21	DI32	General-purpose input 32	
22	DI33	General-purpose input 33	
23	DI34	General-purpose input 34	
24	DI35	General-purpose input 35	
25	DI36	General-purpose input 36	
26	DI37	General-purpose input 37	

PIN	I/O No.	Signal name	Remarks
27	COMMON	Relay common	Relay output Maximum capacity of each terminal (resistance load) : 24V DC, 0.5A Common terminal : COMMON
28	DO01b	CPU_OK : contact B (normally closed)	
29	DO01a	CPU_OK : contact A (normally open)	
30	DO02b	Servo ON output : contact B (normally closed)	
31	DO02a	Servo ON output : contact A (normally open)	
32	DO03b	Alarm : contact B (normally closed)	
33	DO03a	Alarm : contact A (normally open)	
34	DO10	AUTO mode output	
35	DO11	Return-to-origin complete	
36	DO12	Sequence program-in-progress	
37	DO13	Robot program-in-progress	
38	DO14	Program reset status output	
39	DO20	General-purpose output 20	Transistor output NPN or PNP specifications Maximum capacity of each terminal (resistance load) : 0.1A + common terminal : +24V DC - common terminal : GND
40	DO21	General-purpose output 21	
41	DO22	General-purpose output 22	
42	DO23	General-purpose output 23	
43	DO24	General-purpose output 24	
44	DO25	General-purpose output 25	
45	DO26	General-purpose output 26	
46	DO27	General-purpose output 27	
47	DC24V	+24V DC (P.COMDI)	External power supply input
48			
49	GND	GND (N.COMDI)	
50			

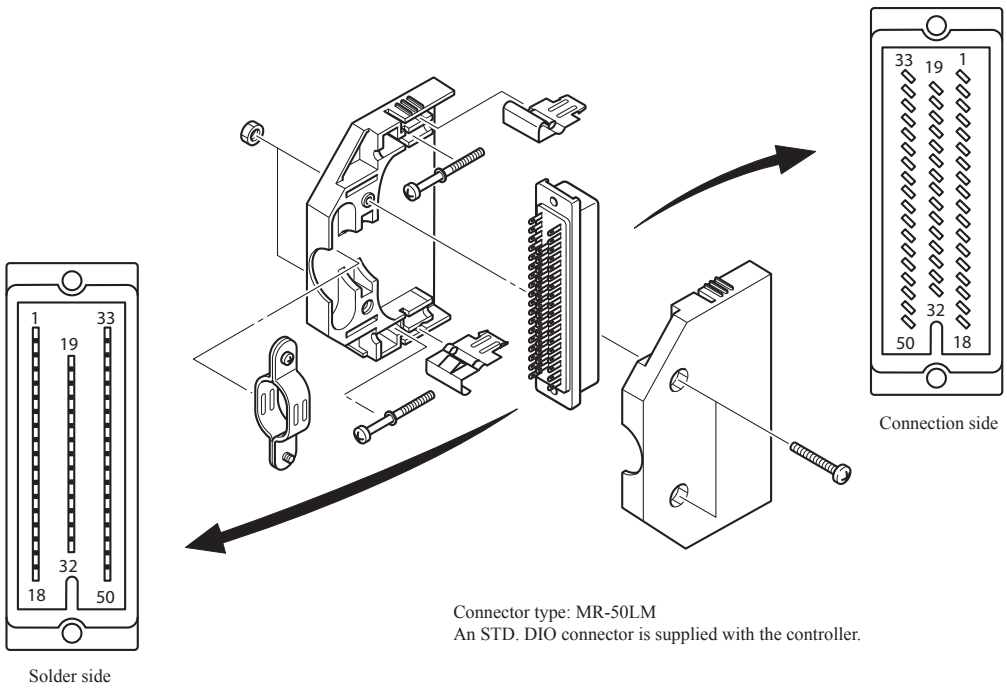
NOTE

The area check output can be assigned to DO20 to DO27.

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

1.3 Connector pin numbers

STD.DIO

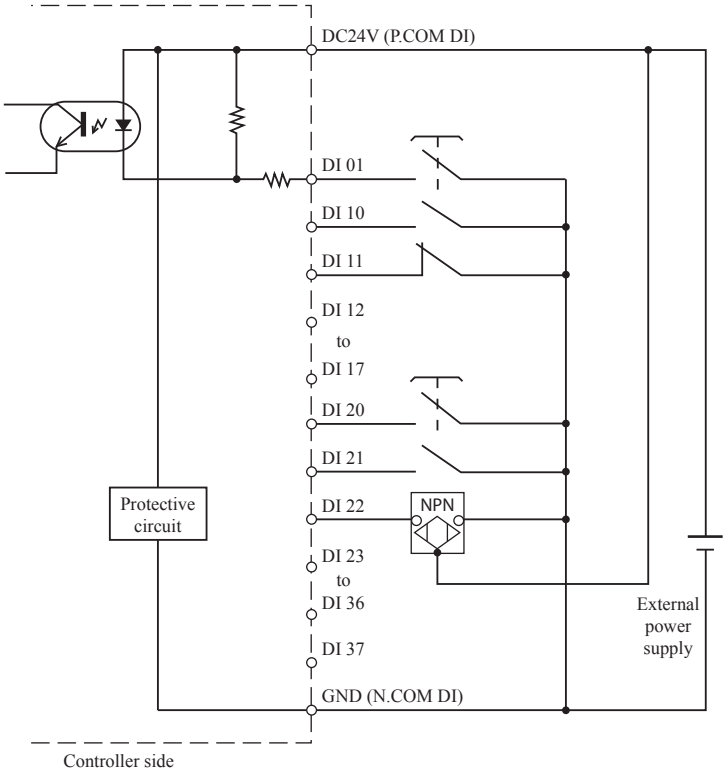


Connector type: MR-50LM
An STD. DIO connector is supplied with the controller.

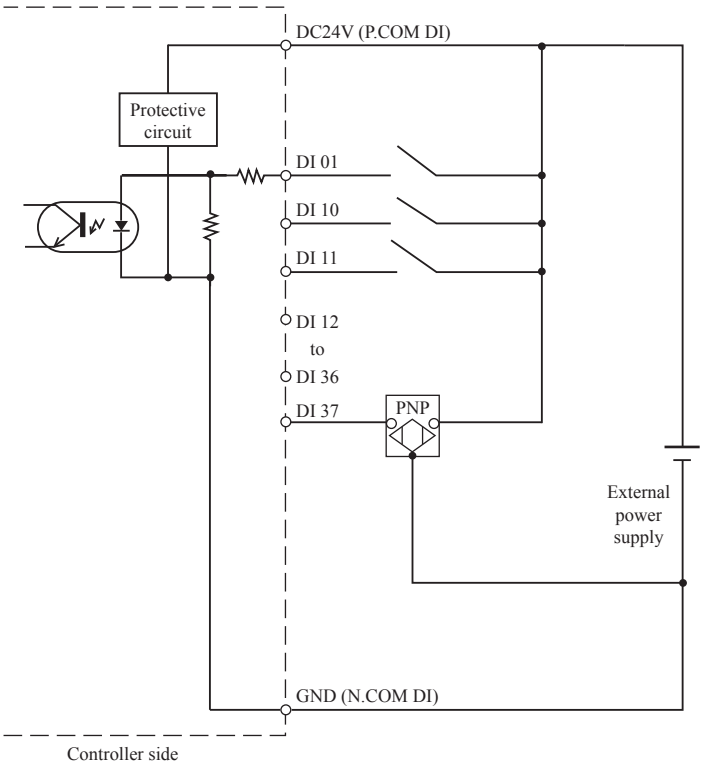
1.4 Typical input signal connection

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

NPN specifications



PNP specifications

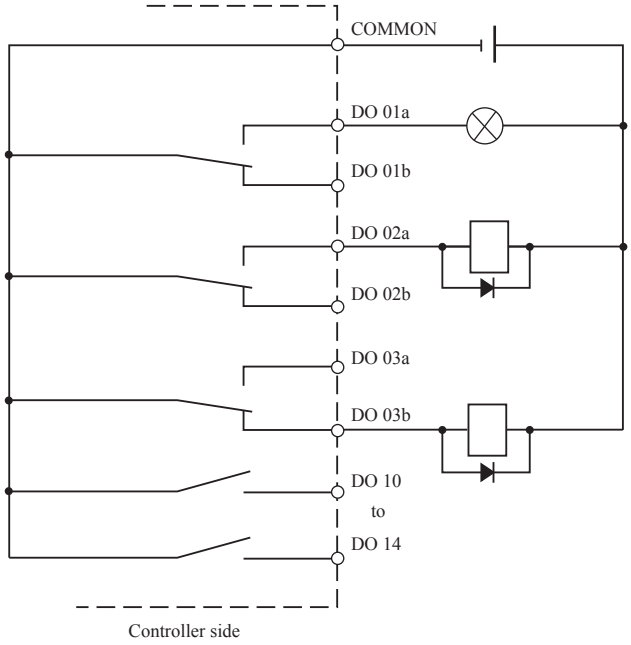


1.5 Typical output signal connection

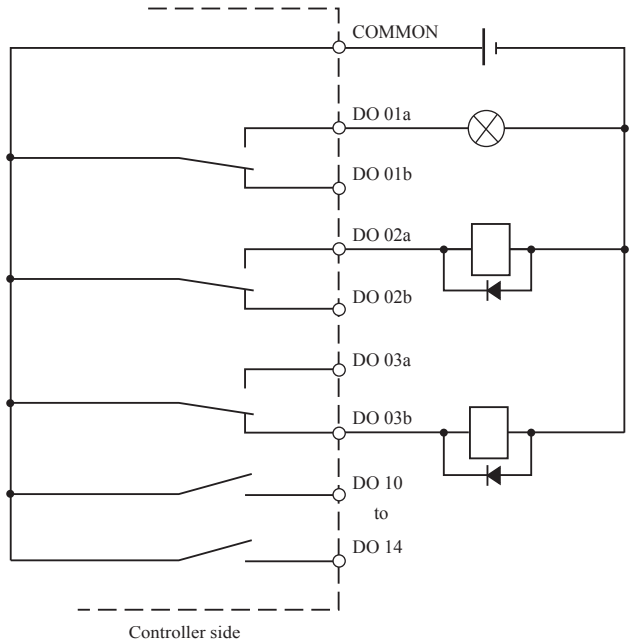
1.5.1 Dedicated outputs

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

NPN specifications



PNP specifications



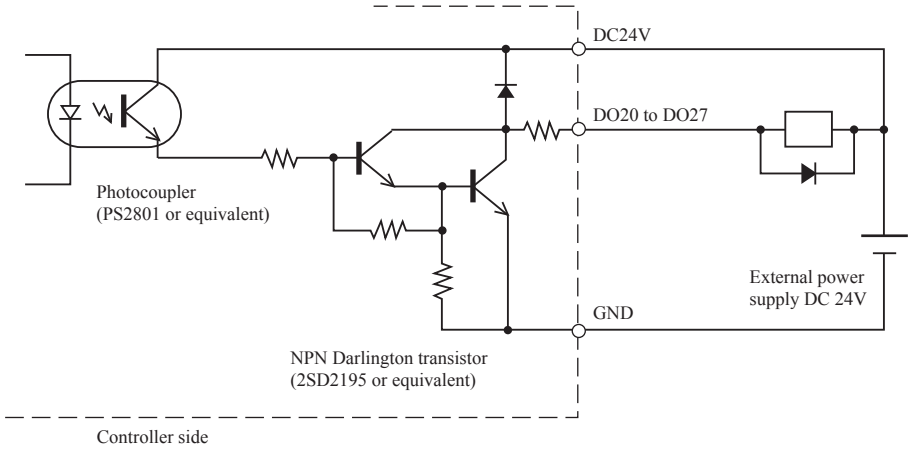
1.5.2 General-purpose outputs

CAUTION

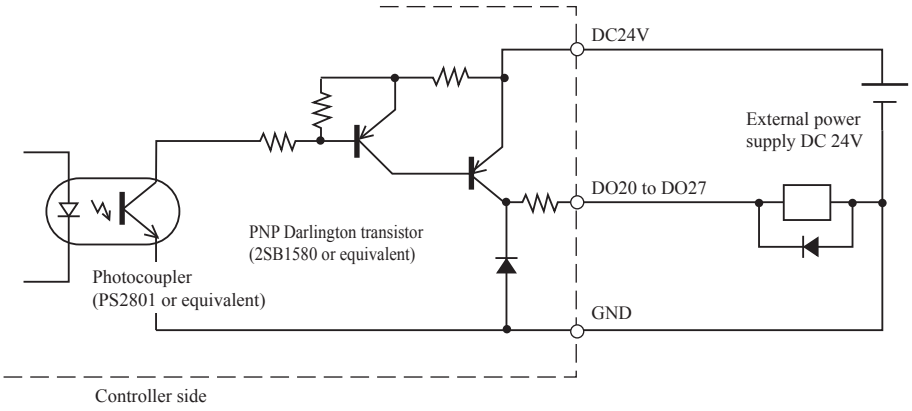
- When an inductive load (solenoid, relay, etc.) is used, always connect a diode in parallel as a surge killer.
- Never short the DO circuit with the 24V DC as this will damage the internal circuitry. (NPN specifications)
- Never short the DO circuit with the GND as this will damage the internal circuitry. (PNP specifications)

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

NPN specifications



PNP specifications



1.6 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.

1. DI01 Servo ON input

Use to cancel emergency stop and turn on the servo power (servo ON). (However, the emergency stop input signal contacts must be closed.)
When the DI01 contact is closed (ON), the servo power turns on as the signal pulse is established. If an alarm has been issued it is cleared.

- Input signal pulse width: 100ms minimum

2. DI05 I/O command execution trigger

DI05 is used to execute an I/O command.
When the command code to be executed is assigned to DI2() and command data to DI3() and DI4(), and the DI05 contact is closed (ON), the I/O command will be executed at the rise of the signal. Upon receiving the I/O command, the controller executes the required task. The progress information during the command execution and decision results after the command execution are output.

- Input signal pulse width: 100ms minimum

CAUTION

- If a rise of the DI05 is recognized, the robot might begin to move. In this case, the output signals of DO26 and DO27 will also change.
- When no I/O commands are used, set the "IO cmd (DI05) on STD.DIO/STDPRM" parameter to "INVALID" by referring to "2.5 Other parameters" in Chapter 7.

For detailed information on I/O commands, refer to the programming manual.

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.

4. DI11 Interlock

DI11 is used to temporarily stop robot movement during execution of a program or manual operation of a robot. When the DI11 contact is opened (OFF), the message "Interlock on" appears and robot operation stops. The program cannot be executed and robot manual operation is disabled when the DI11 contact is open.

WARNING

INTERLOCKS ARE NOT SAFETY INPUTS, AND SHOULD NOT BE USED FOR SAFETY PURPOSES.
SERVOS DO NOT SWITCH OFF EVEN IF AN INTERLOCK IS APPLIED.

NOTE

The interlock is always engaged if 24V DC is not being supplied to the STD. DIO connector. A parameter is available to cancel this status using the software.

5. DI12 Program 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

NOTE

Program start has the same function as the RUN key on the programming box.

CAUTION

When the program execution is stopped by a signal such as DI11 (Interlock), the program re-executes the command that has stopped.

6. DI13 AUTO mode input

DI13 is used to switch to AUTO mode.
When the DI13 contact is closed (ON), operation switches to AUTO mode at the rising edge of the signal pulse.

- Input signal pulse width: 100ms minimum

7. DI14 Return-to-origin

Performs return-to-origin on incremental type axes and semi-absolute type axes. When return-to-origin is performed, incremental type axes return to their origins. On semi-absolute type axes, an absolute search (also called absolute reset) is performed by return-to-origin operation.
When the DI14 contact is closed (ON) in MANUAL mode, 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.
If no incremental type axis and semi-absolute axis exist, an error "0.10: INC. motor disconnected" 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

8. DI15 Program reset input

DI15 is used to reset the program.
When a signal is input to DI15 while the program is stopped in AUTO mode, the robot program is reset. At this point, all general-purpose outputs and variables are reset. However, the general-purpose outputs are not reset under the following scenarios:

1. When the "program reset DO" in other parameters is set to "HOLD" (for details, refer to "2.5 Other parameters" in Chapter 7).
2. When a sequence program is being executed without enabling the DO to reset in the sequencer execution "ENABLE/DISABLE" flag settings (for details, refer to the operator's manual).

DO14 (Program reset status output) is output when the program is correctly reset.

- Input signal pulse width: 100ms minimum

9. DI16 MANUAL mode input

DI16 is used to switch to MANUAL mode.

- Input signal pulse width: 100ms minimum

10. DI17 Absolute reset/Return-to-origin

The robot motion may change according to the "DI17 Mode" setting of other parameters.

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

DI17 is only used for "absolute reset".
Absolute reset is performed on the absolute type axes.
When the DI17 contact is closed (ON) in MANUAL mode, absolute reset will then be carried out on each axis according to the return-to-origin sequence specified by the parameter as the signal pulse is established.
If no absolute type axis exists, an error "0.11: ABS motor disconnected" occurs. Absolute reset can only be performed on axes whose return-to-origin method is set to "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 used for both "absolute reset" and "return-to-origin".
Absolute reset is performed on absolute type axes. (See the above description of "1. When the "DI17 Mode" parameter is set to "ABS".)
Return-to-origin is performed on incremental type axes. (See DI14 (Return-to-origin) described earlier.)
When both absolute type axes and incremental type axes exist, absolute reset will be first performed on the absolute type axes, and then return-to-origin will be performed on the incremental type axes.

- 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.

NOTE
The absolute reset input will not work on axes using the mark method for return-to-origin.

CAUTION
DI01, DI12, DI13, DI15, DI16 and DI17 inputs are disabled while the program is being executed. Input these signals only after the program is halted.

1.7 Dedicated output signal description

1. DO01a CPU_OK: contact A (normally open)

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. DO01b CPU_OK: contact B (normally closed)

This is a complementary (inverted) logic output of the CPU_OK (A contact).

3. DO02a Servo ON output: contact A (normally open)

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.
After the emergency stop input contacts are closed, when the servo turns on in UTILITY mode or with DI01 (Servo ON input) of the I/O interface turned on, then DO02a turns on at the same time.
The servo will not turn on if a serious malfunction occurs or the emergency stop input contacts are open.

4. DO02b Servo ON output: contact B (normally closed)

This is a complementary (inverted) logic output of the servo ON (A contact) signal.

5. DO03a Alarm: contact A (normally open)

This output turns on in the following cases.

1) When contacts on the emergency stop button open.
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 battery voltage for retaining the memory is low or the battery is disconnected.

The "ERR" LED on the controller front panel lights up simultaneously when an alarm is triggered.

The alarm can be turned under the following conditions for each of the above cases.

In case 1)
After the emergency stop input contacts are closed, alarm turns off when the emergency stop flag is cancelled in UTILITY mode or DI01 (Servo ON input) of the I/O interface is turned on to cancel the emergency stop.
This alarm can also be cancelled after the power is turned on again.

In case 2)
Alarm turns off when the emergency stop flag is cancelled in UTILITY mode. However, the alarm condition is maintained while the driver unit still has power, so the power must be turned off and then on again in order to turn on the servos and restart the program.

In case 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 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.

6. DO03b Alarm: contact B (normally closed)

This is a complementary (inverted) logic output of the alarm (A contact) signal.

7. DO10 AUTO mode output

DO10 is always on when AUTO mode is selected.

8. 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.

9. DO12 Sequence program-in-progress

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

10. 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.

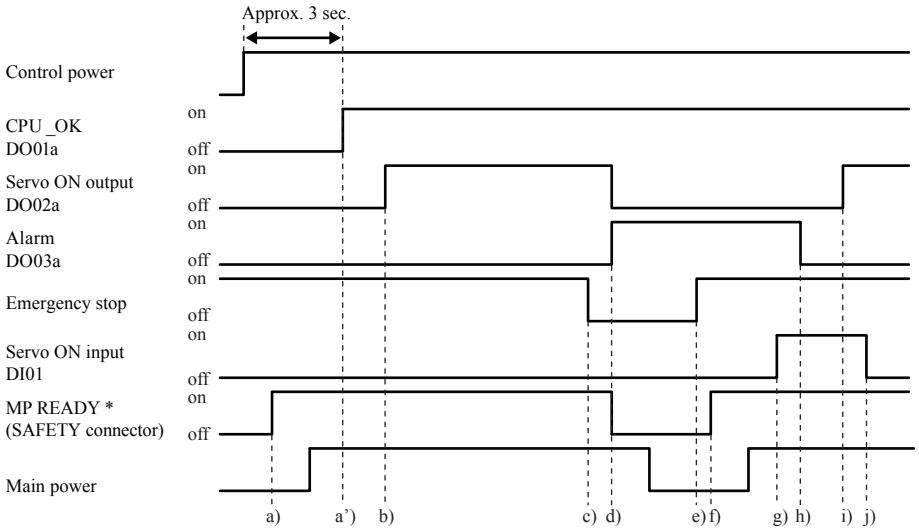
11. DO14 Program reset status output

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

1.8 Dedicated I/O signal timing chart

1.8.1 Controller power ON, servo ON and emergency stop

Controller power ON, servo ON and emergency stop



*For details on MP READY 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) MP READY output turns on. (Main power supply turns on after MP READY output turns on.)

a')CPU_OK output turns on.

b) When not in emergency stop, servo ON output turns on after servo ON processing.

Emergency stop

c) Emergency stop input turns off.

d) Alarm output turns on and servo ON output turns off, MP READY turns off.

Shifting from emergency stop to servo-on

e) Emergency stop input turns on.

f) MP READY output turns on. (Main power supply turns on after MP READY output turns on.)

g) Servo ON input turns on.

h) Alarm output turns off.

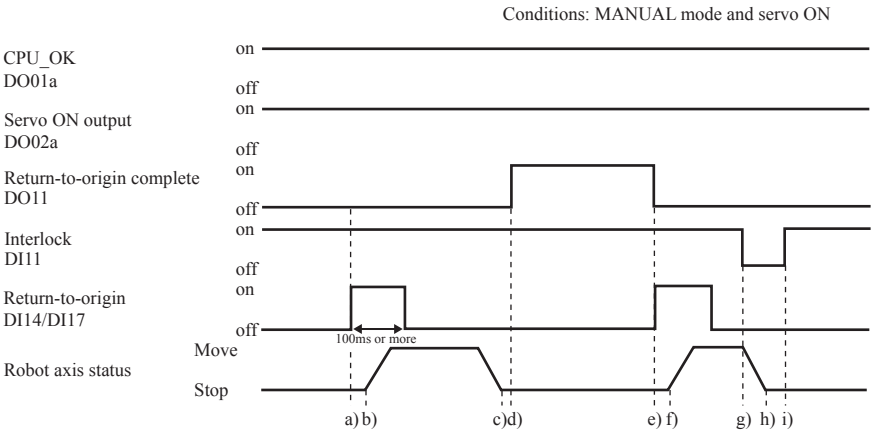
i) Servo ON output turns on.

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

* If the emergency stop input contacts are open or a major error occurs when the controller power is turned on, it starts up with the servo turned off. Likewise, if the "Servo on when power on" parameter is set to "INVALID", or SAFE mode is on or serial I/O setting is enabled, the controller starts up with the servo turned off.
* 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 READY" is turned on mains power is supplied.

1.8.2 Return-to-origin

Return-to-origin



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.

Interlocks 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) Interlock input turns off.

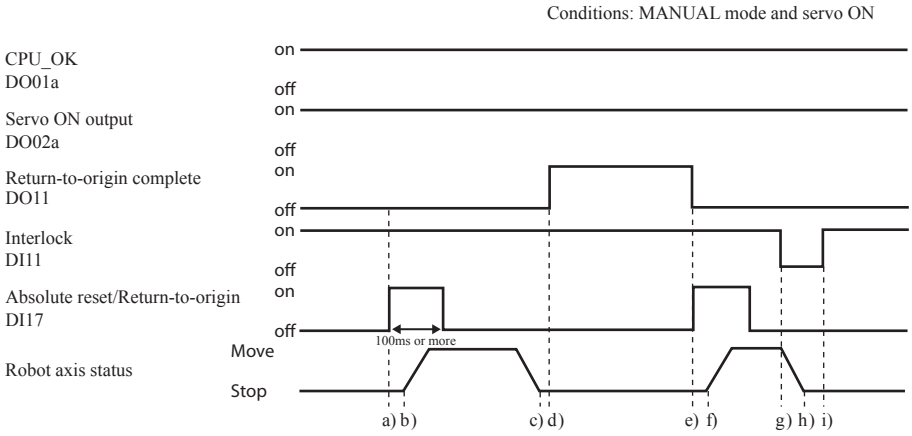
h) On-going robot axis movement stops.

i) Interlock 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.
* Return-to-origin is only possible in MANUAL mode with the servo power on.
* When the return-to-origin input is on, the return-to-origin complete output is off.
* When incremental type axes are included, return-to-origin complete output automatically turns off when the controller is turned on, because the origin positions become incomplete.
* 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 "1.6 Dedicated input signal description".

1.8.3 Absolute reset

Absolute reset



Absolute reset

a) Absolute reset 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.

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

Interlocks during absolute reset

e) Absolute reset 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) Interlock input turns off.

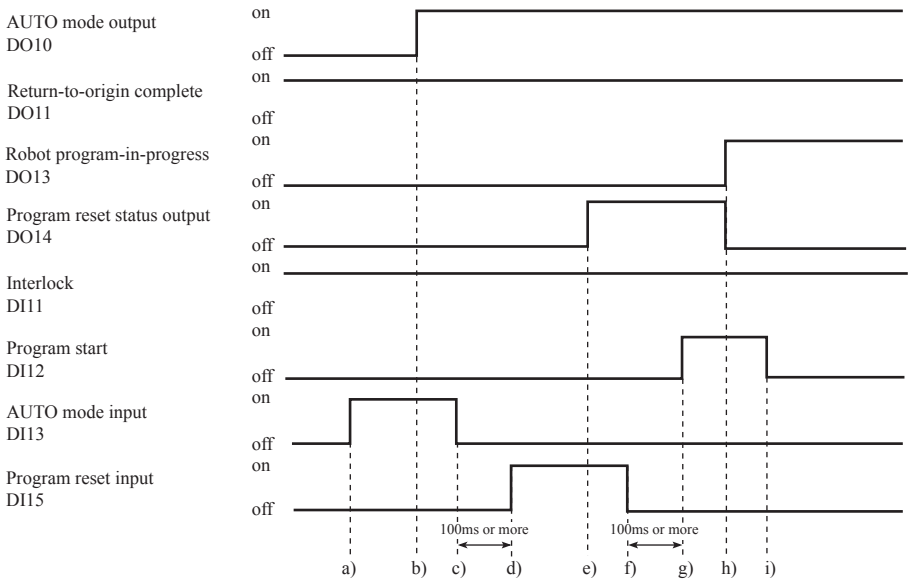
h) On-going robot axis movement stops.

i) Interlock input turns on.

* When the return-to-origin complete output is on, absolute reset does not have to be performed.
* Return-to-origin complete output remains on until absolute reset is required.
* Absolute reset cannot be performed unless in MANUAL mode and with the servo is on.
* When the absolute reset input is on, the return-to-origin output is off.
* Return-to-origin complete output automatically turns on when the controller is turned on, unless there are errors in the origin position information (only when the robot is configured with absolute type axes).

1.8.4 Switching to AUTO mode, program reset and execution

Switching to AUTO mode, program reset and execution



Switching to AUTO mode

a) AUTO mode input turns on.

b) AUTO mode output turns on.

c) AUTO mode input turns off after checking AUTO mode output is turned on.

Program reset

d) Program reset input turns on.

e) Program reset status output turns on.

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

Program execution

g) Program start input turns on.

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

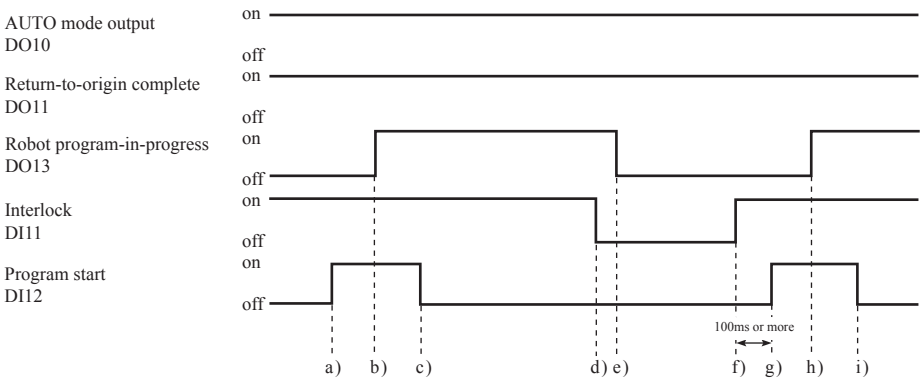
i) Program start input turns off after checking robot program-in-progress output is turned on.

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

* Depending on the execution level setting, it may not be possible to execute the program if the return-to-origin complete output is off.

1.8.5 Stopping due to program interlocks

Stopping due to program interlocks



Program execution

a) Program start input turns on.

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

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

Program stop due to interlock

d) Interlock input turns off.

e) Robot program-in-progress output turns off.

Program execution after stopping program due to interlock input

f) Interlock input turns on.

g) Program start input turns on.

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

i) Program start input turns off after checking that the robot program-in-progress output is turned 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

INTERLOCKS ARE NOT SAFETY INPUTS, AND SHOULD NOT BE USED FOR SAFETY PURPOSES.
SERVOS DO NOT SWITCH OFF EVEN IF AN INTERLOCK IS APPLIED.

CAUTION

When the program stops during execution due to interlock or other reasons, the program re-executes from the command where it was stopped. If the robot has been stopped during movement, the robot will start moving again when the program is re-executed. Take care when re-executing the program.

NOTE

IT is possible to carry out an automatic program reset in the program execution by changing the execution level settings. This enables you to always execute an instruction from the beginning of the program without using the program reset input.

1.9 General-purpose I/O signals

1.9.1 General-purpose input signals

These are a total of 16 signals consisting of 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

If the "8. DI noise filter" parameter is set to "VALID" (refer to "2.5 Other parameters" in Chapter 7), the on and off periods of input signals must be longer than 25ms.

1.9.2 General-purpose output signals

These are a total of 8 signals consisting of 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.
The area check output can be assigned to DO20 to DO27.

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.

1.9.3 General-purpose output signal reset (off)

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

1) When the F5 (RST.DO) was pressed in UTILITY mode.

2) When all of the following conditions a) to c) are met:

a) "DO cond. on PGM reset / RESCDO" in Other parameters is set to "RESET". (For details, See "2.5 Other parameters" in Chapter 7.)

b) No sequence program is being executed or the DO reset is enabled in the sequence execution flag setting even if a sequence program is being executed. (For details, refer to the operator's manual.)

c) Any of the following operations was performed.

When compile ended successfully in PROGRAM mode.

When a program was compiled in AUTO mode and the compile ended successfully.

When F1 (RESET) was executed in AUTO mode.

When the dedicated input signal DI15 (Program reset input) was turned on in AUTO mode while the program was stopped (Refer to "1.6 Dedicated input signal description" in this chapter.)

When either of the following was initialized in SYSTEM>INIT mode.

1. Program memory (SYSTEM>INIT>MEMORY>PROGRAM)
2. Entire memory (SYSTEM>INIT>MEMORY>ALL)

When the SWI command was executed by F7 (DIRECT) in AUTO mode.

(Reset (off) does not occur if the SWI statement was executed in the program.)

When the online commands @RESET, @INIT PGM, @INIT MEM, @INIT ALL, or @SWI were executed.

When the HALT statement was executed in the program.

2. Option I/O interface overview

The option I/O interface of the controller is expandable to a maximum of 4 units for compatibility with customer systems. A description of each I/O terminal and its connection is given here. Connect these I/O terminals correctly and efficiently.
This option I/O interface contains 24 general-purpose inputs and 16 outputs. The type of option I/O interface (NPN or PNP specifications) is set prior to shipment.
Inputs are referred to here as DI (Digital Inputs) and outputs as DO (Digital Outputs).

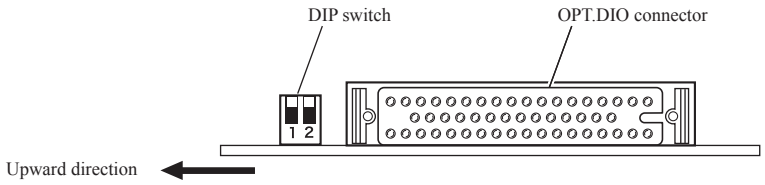
Specifications		Connector name	Connector type No.	Conductor wire
ID	Number of I/O points			
1	General-purpose input : 24 General-purpose output : 16	OPT. DIO	MR-50LM (Honda Tsushin Kogyo)	0.3 sq or more
2	General-purpose input : 24 General-purpose output : 16			
3	General-purpose input : 24 General-purpose output : 16			
4	General-purpose input : 24 General-purpose output : 16			

The ID in the above table are set by the DIP switch on the option I/O interface unit.
For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

2.1 ID settings

Use the DIP switch on the option I/O interface unit (adjacent to OPT. DIO connector) to set the ID.

DIP switch



The DI/DO ports are assigned based on these ID. (n : switch lever)

DIP switch	ID	Input port No.	Output port No.
1 2	1	DI40 to DI47 DI50 to DI57 DI60 to DI67	DO30 to DO37 DO40 to DO47
1 2	2	DI70 to DI77 DI100 to DI107 DI110 to DI117	DO50 to DO57 DO60 to DO67
1 2	3	DI120 to DI127 DI130 to DI137 DI140 to DI147	DO70 to DO77 DO100 to DO107
1 2	4	DI150 to DI157 DI160 to DI167 DI170 to DI177	DO110 to DO117 DO120 to DO127

CAUTION

Always use different ID when two or more option I/O interface units are used. If different units have the same ID, an option setting error is issued and correct operation cannot be guaranteed.

2.2 Power supply

The option I/O interface uses an external 24V power supply. Be sure to always connect the 24V and ground terminals of the external power supply to pins P.COMxx and N.COMxx of the OPT. DIO connector on the controller.
An error is issued when the controller power is turned on if the external 24V power supply is not connected.

CAUTION

Do not keep supplying the external 24V DC power to the optional I/O interface while controller power is off. The controller might malfunction if the external 24V is continuously supplied.

2.3 Connector I/O signals

PIN	I/O No.				Signal name				Remarks
	ID=1	ID=2	ID=3	ID=4	ID=1	ID=2	ID=3	ID=4	
1	P.COM DI				P.COM DI				+ common
2	N.COM DI				N.COM DI				- common
3	DI40	DI70	DI120	DI150	Input 40	Input 70	Input 120	Input 150	Common terminals: +common: P. COM DI - common: N. COM DI Photocoupler input NPN specifications : source type PNP specifications : sink type
4	DI41	DI71	DI121	DI151	Input 41	Input 71	Input 121	Input 151	
5	DI42	DI72	DI122	DI152	Input 42	Input 72	Input 122	Input 152	
6	DI43	DI73	DI123	DI153	Input 43	Input 73	Input 123	Input 153	
7	DI44	DI74	DI124	DI154	Input 44	Input 74	Input 124	Input 154	
8	DI45	DI75	DI125	DI155	Input 45	Input 75	Input 125	Input 155	
9	DI46	DI76	DI126	DI156	Input 46	Input 76	Input 126	Input 156	
10	DI47	DI77	DI127	DI157	Input 47	Input 77	Input 127	Input 157	
11	DI50	DI100	DI130	DI160	Input 50	Input 100	Input 130	Input 160	
12	DI51	DI101	DI131	DI161	Input 51	Input 101	Input 131	Input 161	
13	DI52	DI102	DI132	DI162	Input 52	Input 102	Input 132	Input 162	
14	DI53	DI103	DI133	DI163	Input 53	Input 103	Input 133	Input 163	
15	DI54	DI104	DI134	DI164	Input 54	Input 104	Input 134	Input 164	
16	DI55	DI105	DI135	DI165	Input 55	Input 105	Input 135	Input 165	
17	DI56	DI106	DI136	DI166	Input 56	Input 106	Input 136	Input 166	
18	DI57	DI107	DI137	DI167	Input 57	Input 107	Input 137	Input 167	
19	DI60	DI110	DI140	DI170	Input 60	Input 110	Input 140	Input 170	
20	DI61	DI111	DI141	DI171	Input 61	Input 111	Input 141	Input 171	
21	DI62	DI112	DI142	DI172	Input 62	Input 112	Input 142	Input 172	
22	DI63	DI113	DI143	DI173	Input 63	Input 113	Input 143	Input 173	
23	DI64	DI114	DI144	DI174	Input 64	Input 114	Input 144	Input 174	
24	DI65	DI115	DI145	DI175	Input 65	Input 115	Input 145	Input 175	
25	DI66	DI116	DI146	DI176	Input 66	Input 116	Input 146	Input 176	
26	DI67	DI117	DI147	DI177	Input 67	Input 117	Input 147	Input 177	
27	P.COM A				P.COM A				+ common
28	DO30	DO50	DO70	DO110	Output 30	Output 50	Output 70	Output 110	Transistor output NPN or PNP specifications Maximum capacity of each output terminal (resistance load): 100mA Common terminals: + common terminal : P. COM A - common terminal : N. COM A
29	DO31	DO51	DO71	DO111	Output 31	Output 51	Output 71	Output 111	
30	DO32	DO52	DO72	DO112	Output 32	Output 52	Output 72	Output 112	
31	DO33	DO53	DO73	DO113	Output 33	Output 53	Output 73	Output 113	
32	DO34	DO54	DO74	DO114	Output 34	Output 54	Output 74	Output 114	
33	DO35	DO55	DO75	DO115	Output 35	Output 55	Output 75	Output 115	
34	DO36	DO56	DO76	DO116	Output 36	Output 56	Output 76	Output 116	
35	DO37	DO57	DO77	DO117	Output 37	Output 57	Output 77	Output 117	
36	N.COM A				N.COM A				- common
37	P.COM B				P.COM B				+common
38	DO40	DO60	DO100	DO120	Output 40	Output 60	Output 100	Output 120	Transistor output NPN or PNP specifications Maximum capacity of each output terminal (resistance load): 100mA Common terminals: + common terminal : P. COM B - common terminal : N. COM B
39	DO41	DO61	DO101	DO121	Output 41	Output 61	Output 101	Output 121	
40	DO42	DO62	DO102	DO122	Output 42	Output 62	Output 102	Output 122	
41	DO43	DO63	DO103	DO123	Output 43	Output 63	Output 103	Output 123	
42	DO44	DO64	DO104	DO124	Output 44	Output 64	Output 104	Output 124	
43	DO45	DO65	DO105	DO125	Output 45	Output 65	Output 105	Output 125	
44	DO46	DO66	DO106	DO126	Output 46	Output 66	Output 106	Output 126	
45	DO47	DO67	DO107	DO127	Output 47	Output 67	Output 107	Output 127	
46	N.COM B				N.COM B				- common
47	NC								Not used
48									
49	NC								Not used
50									

* Input signals are determined by means of the ID.

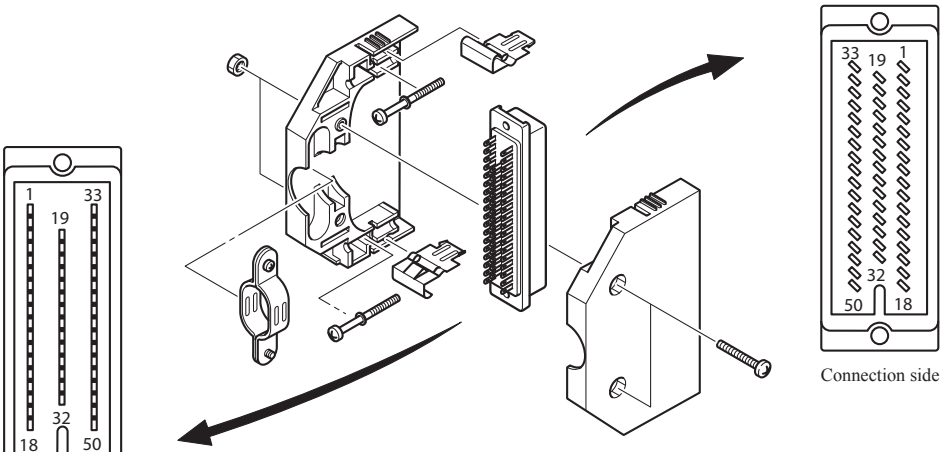
For details regarding the definition of NPN and PNP specifications, see "6. I/O connections" in Chapter 3.

NOTE

On the controllers from Ver.10.10 onwards, the area check output can be assigned to the following ports:
DO20 to DO27, DO30 to DO37, DO40 to DO47, DO50 to DO57, DO60 to DO67, DO70 to DO77, DO100 to DO107, DO110 to DO117, DO120 to DO127, DO130 to DO137, DO140 to DO147, DO150 to DO157 DO20 to DO27 are general-purpose output ports for the standard I/O interface. On the controllers prior to Ver.10.10, the area check output can only be assigned to DO20 to DO27.

2.4 Connector pin numbers

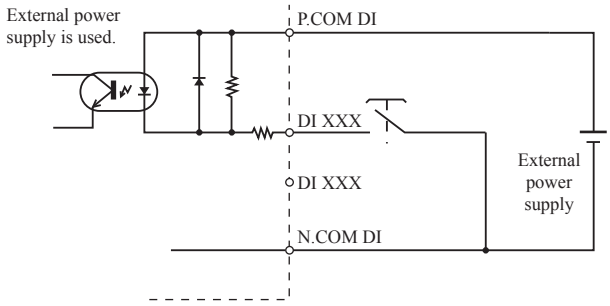
OPT.DIO



Connector type: MR-50LM
An OPT. DIO connector is supplied with the controller.

2.5 Typical input signal connection

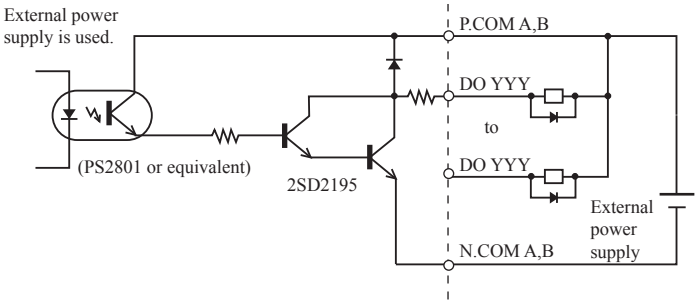
NPN specifications



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

2.6 Typical output signal connection

NPN specifications



2.7 General-purpose I/O signals

2.7.1 General-purpose input signals

The option I/O interface general-purpose inputs are all 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

If the "8. DI noise filter" parameter is set to "VALID" (refer to "2.5 Other parameters" in Chapter 7), the on and off periods of input signals must be longer than 25ms.

2.7.2 General-purpose output signals

All signals are Darlington transistor open-collector outputs.
The option I/O interface 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 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.

On the controllers from Ver.10.10 onwards, the area check output can be assigned to the following ports:

DO20 to DO27, DO30 to DO37, DO40 to DO47, DO50 to DO57, DO60 to DO67, DO70 to DO77, DO100 to DO107, DO110 to DO117, DO120 to DO127, DO130 to DO137, DO140 to DO147, DO150 to DO157 DO20 to DO27 are general-purpose output ports for the standard I/O interface. On the controllers prior to Ver.10.10, the area check output can only be assigned to DO20 to DO27.

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.

2.7.3 General-purpose output signal reset (off)

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

1) When F5 (RST.DO) is selected in UTILITY mode.

2) When all of the following conditions a) to c) are met:

a) "DO cond. on PGM reset / RESCDO" in Other parameters is set to "RESET". (For details, See "2.5 Other parameters" in Chapter 7.)

b) No sequence program is being executed or the DO reset is enabled in the sequence execution flag setting even if a sequence program is being executed. (For details, refer to the operator's manual.)

c) Any of the following operations was performed.

When compile ended successfully in PROGRAM mode.

When a program was compiled in AUTO mode and the compile ended successfully.

When F1 (RESET) was executed in AUTO mode.

When the dedicated input signal DI15 (Program reset input) was turned on in AUTO mode while the program was stopped. (Refer to "1.6 Dedicated input signal description" in this chapter.)

When either of the following was initialized in SYSTEM>INIT mode.

1. Program memory (SYSTEM>INIT>MEMORY>PROGRAM)

2. Entire memory (SYSTEM>INIT>MEMORY>ALL)

When the SWI command was executed by F7 (DIRECT) in AUTO mode.

(Reset (off) does not occur if the SWI statement was executed in the program.)

When the online commands @RESET, @INIT PGM, @INIT MEM, @INIT ALL, or @SWI were executed.

When the HALT statement was executed in the program.

3. Ratings

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

1. Input

NPN specifications

Method	DC input (positive common type) Photocoupler insulation method
Input power	24V DC ±10%, 7mA/point
Load	OFF voltage: 20.0V min (1.5mA)
	ON voltage: 3.0V max (5.5mA)
Response time	20ms Min. (during on/off)

PNP specifications

Method	DC input (negative common type) Photocoupler insulation method
Input power	24V DC ±10%, 7mA/point
Load	ON voltage: 20.5V min (5.5mA)
	OFF voltage: 4.0V max (1.5mA)
Response time	20ms Min. (during on/off)

2. Output

(1) Transistor output

NPN specifications

Method	NPN open-collector (negative common type) Photocoupler insulation method
Load	24V DC ±10%, 100mA/point (resistance load)
Residual voltage	2.5V or less
Response time	10ms Max.

PNP specifications

Method	PNP open-collector (positive common type) Photocoupler insulation method
Load	24V DC ±10%, 100mA/point (resistance load)
Residual voltage	1.5V or less
Response time	10ms Max.

(2) Relay contact output

Method	A contact (partly C contact) common ground
Load	24V DC, 0.5A Max.
	24V DC, 1mA Min.
Contact service life	Electrical open/close 100,000 times (24V DC with resistance load)
Response time	10ms Max.

4. Caution items

1. When using a dual-lead proximity sensor as an input signal, check whether or not it is within input signal specifications. If the sensor has a high residual voltage during on and off, this might cause possible malfunctions.

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 internal over-current protective circuit shuts off the interface circuit.
   Once this circuit is activated, it is necessary to replace parts in order to restore it to its previous state. Furthermore, heat generated inside might damage the internal circuits, so always draw current only within the rated load.

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

5. Do not keep supplying the external 24V DC power to the standard and optional I/O interfaces while controller power is off. The controller might malfunction if the external 24V is continuously supplied.

Chapter 5 SAFETY I/O interface

Contents

1. SAFETY I/O interface overview

The robot controller is provided with SAFETY I/O interfaces for compatibility with the system used by the customer. A description of the I/O terminals and connection methods are explained below.
Connect the I/O terminals correctly for effective operation.
Inputs are referred to here as DI (Digital Inputs) and outputs as DO (Digital Outputs).

Specifications	Connector name	Connector model No.	Wire thickness
SAFETY	SAFETY	D-SUB15 (male)	0.3 sq

1.1 Power

The emergency stop input utilizes the controller's internal power for emergency stop.
The dedicated input utilizes external 24V power connected via the standard I/O interface.

CAUTION

Do not keep supplying the external 24V DC power to the standard I/O interface while controller power is off. The controller might malfunction if the external 24V is continuously supplied.

1.2 Connector I/O signals

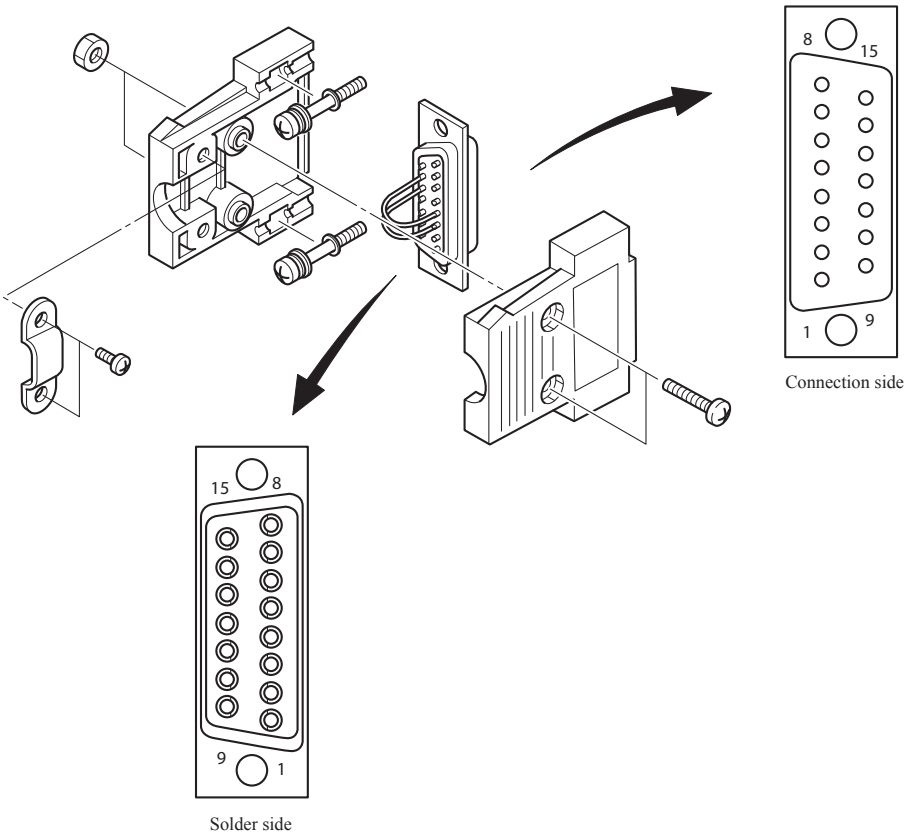
PIN	I/O No.	Name	Remarks
1	DI02	SERVICE mode	NPN/PNP specs conform to STD. DIO settings. Common terminal: P. COM / N. COM
2	MP READY	Motor power ready	
3	E-STOPIN1	Emergency stop input 1	
4	E-STOPIN2	Emergency stop input 2	
5	E-STOPIN3	Emergency stop input 3	Usable only when enable switch compatible programming box is used. (PB)
6	E-STOPIN4	Emergency stop input 4	
7	LCKIN1	Enable switch input 1	
8	LCKIN2	Enable switch input 2	
9	LCKIN3	Enable switch input 3	
10	LCKIN4	Enable switch input 4	
11	P.COM	+24V DC output	Outputs P.COMDI input of STD.DIO.
12	N.COM	GND (N.COMDI)	Connected to N.COMDI terminal of STD.DIO via diode.
13	E-STOP24V	Emergency stop input power	
14	E-STOPRDY	Emergency stop READY signal	
15	Reserved	Do not use.	

CAUTION

- On the SAFETY connector supplied with the controller, pin 3 is shorted to pin 13, and pin 4 is shorted to pin 14. Use these terminals to construct an actual emergency stop circuit to ensure the system, including the robot controller, operates safely.
- Do not connect an external 24V DC to E-STOP24V.
- Do not connect any external signals to the reserved terminals.
- When using DI02 and MP READY, supply power to the 24V DC and GND terminals of the STD.DIO connector.
- Maximum output current for MP READY is 100mA.

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

Connector exploded view



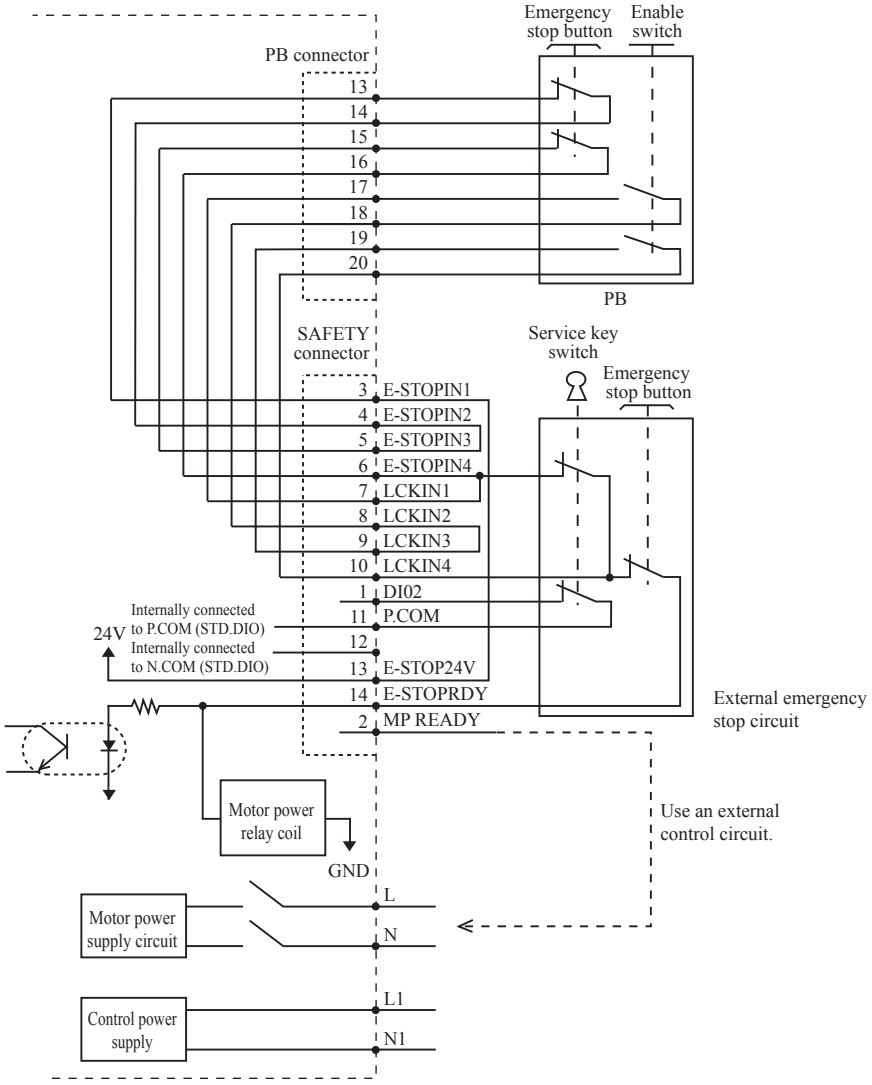
1.3 Connection example combining the programming box with external emergency stop circuitry

■ PB Connection example

CAUTION

- The external emergency stop function (including the emergency stop button on the programming box) is disabled when pin 13 and pin 14 are directly shorted to each other on the SAFETY connector. Make connections to ensure that the emergency stop function works properly on the whole system, including the robot controller.
- Voltage of 24V is required to operate MP READY. Supply pins 47 to 50 on the STD.DIO with a 24V power supply. However, while supplying a 24V power supply it is not possible to disable the "Watch on STD.DIO DC24V" parameter.
- The SAFETY connector's pin 11 and STD.DIO connector's P.COM, as well as the SAFETY connector's pin 12 and STD.DIO connector's N.COM, are connected inside the controller. To avoid causing damage, please connect the same power source to the safety connector and the STD.DIO connector.

Connections using the PB with external emergency stop circuit (PNP type)



Operation description:

- The PB emergency stop button and the external emergency stop button are connected in series. The enable switch is also connected in series to the PB emergency stop button, but can be bypassed with the service key switch.

1. When the service key switch contact is close:

The enable switch is inoperable.

a. In normal operation, E-STOP24V is connected to E-STOPRDY via the PB emergency stop button and SAFETY connector, and turns on the controller internal motor power relay.

b. When emergency stop is triggered, power to E-STOPRDY of the SAFETY connector is cut off and the motor power supply turns off.
Emergency stop is triggered if the PB and SAFETY connector are removed.

CAUTION

- E-STOPRDY requires at least 100mA for the relay and photocoupler drive current.
- Do not use E-STOP24V for anything other than emergency stop.

2. When the service key switch contact is open:

The enable switch is operable.

a. In normal operation, E-STOP24V is connected to E-STOPRDY via the PB emergency stop button, enable switch and SAFETY connector, and turns on the controller internal motor power relay.

b. When emergency stop is triggered, power to E-STOPRDY of the SAFETY connector is cut off and the motor power supply turns off.
Emergency stop is triggered if the PB and SAFETY connector are removed.

- Pins 13 and 14, pins 15 and 16, pins 17 and 18, and pins 19 and 20 on the PB connector are shorted in the PB terminator that comes with the robot controller.
- Pin 3 is shorted to pin 13, and pin 4 is shorted to pin 14 in the SAFETY connector that comes with the robot controller.

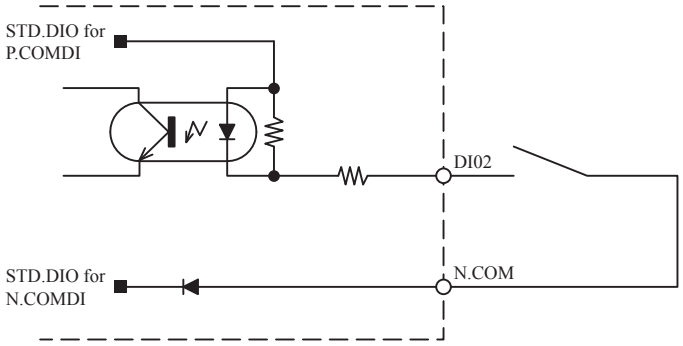
1.4 Dedicated input signal connections

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

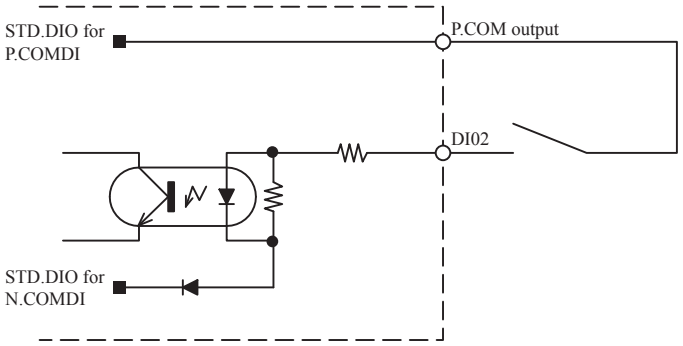
NOTE

Connect 24V DC and ground for STD. DIO.

NPN specifications



PNP specifications



1.5 Input signal description

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

1. SERVICE mode input (DI02)

The SERVICE mode input switches the controller between SERVICE mode and normal mode.
The SERVICE mode input can only be used on robot controllers with SAFE mode enabled.
When the DI02 contact is open (OFF), the controller is in "SERVICE mode" with the operation restrictions, operating speed limit, and exclusive control of the operating devices specified by the SERVICE mode parameters. When the DI02 contact is closed (ON), the controller is in NORMAL mode.
If a serial I/O option board is installed, SERVICE mode is entered when either one of the SI02 or DI02 contact is open (OFF). (Normal mode is entered only when both SI02 and DI02 contacts are closed (ON).)
In SERVICE mode the operation restrictions, operating speed limit, and exclusive control of the operating devices are specified by the SERVICE mode parameters.

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.

NOTE

- NPN and PNP specifications are determined by the STD. DIO setting.
- When the controller is in the SAFE mode, the following conditions occur if no external 24V power is being supplied to the STD.DIO connector:
  1. If the "Watch on STD.DIO DC24V" parameter is set to VALID, the SERVICE mode is established.
  2. If the "Watch on STD.DIO DC24V" parameter is set to INVALID, the NORMAL mode is established.
- This can be cancelled using a software parameter.
- A 7mA input current is required.

2. Emergency stop inputs (E-STOP24V, E-STOPRDY, E-STOPIN1, 2, 3, 4)

Emergency stop signal inputs are used to build an actual emergency stop circuit as a means of ensuring the system, including the robot controller, will operate safely. Contacts must be closed for the system to function normally. Refer to the connection examples in this chapter when making actual connections.
Closing the emergency stop contact points (ON) enables the servo power supply to be turned on. The servo power supply cannot be turned on when the emergency stop contact points are open (OFF).
Emergency stop signal inputs 3 and 4 are valid only when an PB is used.

3. Enable switch inputs (LCKIN1, 2, 3, 4)

Enable switch inputs are used to build an actual emergency stop circuit as a means of ensuring the system, including the robot controller, will operate safely. Refer to the connection examples in this chapter when making actual connections.
Enable switch inputs are valid only when an PB is used.

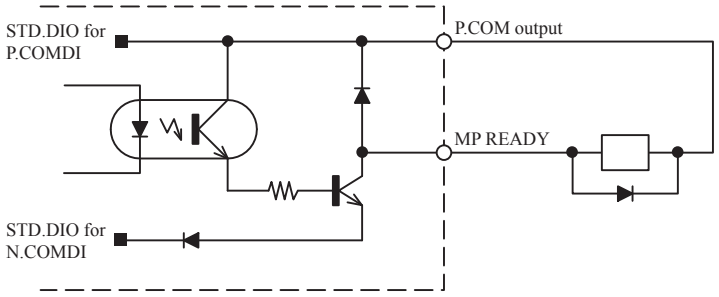
1.6 Dedicated output signal connections

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

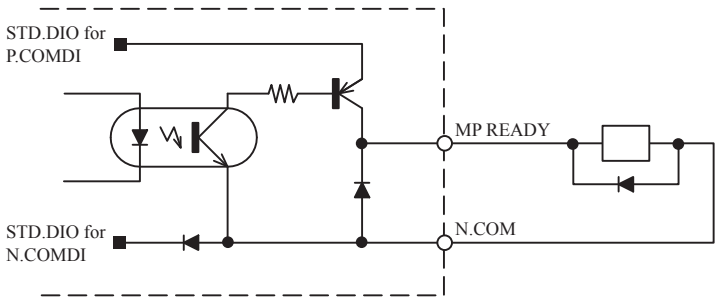
NOTE

Connect 24V DC and ground for STD. DIO.

NPN specifications



PNP specifications



1.7 Meaning of output signals

1. MP READY

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

This output signal turns on when the controller is ready to receive the main power input from an external device. When this output is on it indicates that it is possible to turn on the servo using the main power supply and operation of the servo ON input signal.

This signal turns off if an internal error occurs or the emergency stop input signal turns off. Supply this output to a sequencer or external device to allow it to determine the on/off conditions of the main power supply.

Maximum output current is 100mA.

Chapter 6 RS-232C interface

Contents

1. Communication overview

The robot controller can communicate with external devices in the following 2 modes using the RS-232C interface. These modes can be used individually or jointly on applications compatible with using RS-232C communication.

1. Data communication is performed by communication commands in robot language (SEND command).

Example: **SEND A TO CMU**

Variable A is transmitted to the external device.

SEND CMU TO P100

Point data P100 is received from the external device.

SEND CMU TO ALL

All system memories are received.

The robot controller communicates in compliance with the these commands.

2. Various commands are transmitted directly through a communication port from the external devices. These commands are called online commands. If this function is used, some operations on the controller can be performed from an external device.

Example: **@AUTO**

Switches to AUTO mode.

@RUN

Executes a program.

@READ PNT

All point data are read out.

@MOVE P,P123,SPEED=30

Moves to point 123 at 30% of maximum speed.

NOTE

On robot controllers with SAFE mode enabled, online commands through the RS-232C interface might not be used in SERVICE mode depending on the operating device setting in SERVICE mode.

2. Communication function overview

The controller has 2 types of communication mode.

1. OFFLINE mode

In OFFLINE mode, the communication between the robot and external unit is executed with SEND commands in the program.

- **SEND command (robot → external unit)**

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

- **SEND command (external unit → robot)**

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

2. ONLINE mode

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

- **ONLINE command format**

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

* The <termination code> is a CR(=0DH) code or CRLF (=0Dh+0Ah).

For detailed information on ONLINE commands, refer to the programming manual.

NOTE

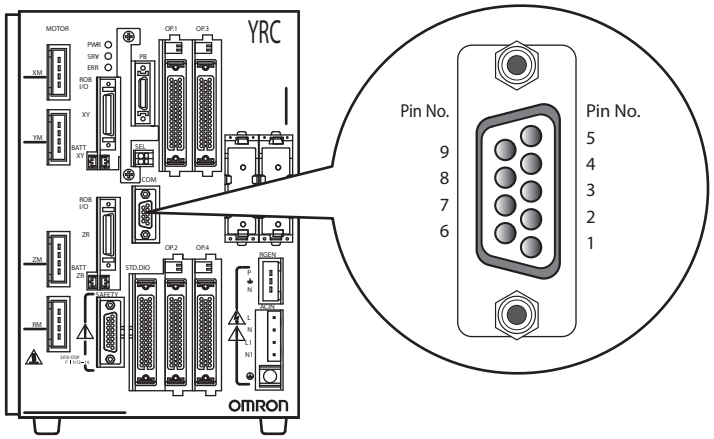
- In offline mode, online commands from external devices cannot be received.
- When using online commands be sure to switch to online mode.
- In offline mode it is not possible to connect to the controller using OMRON's PC software package "SCARA Studio". When connecting to the controller using the support software be sure to switch to online mode.

3. Communication specifications

3.1 Connector

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

RS-232C interface

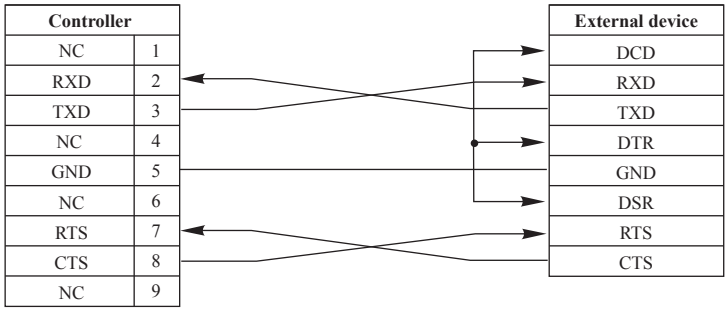


Pin No.	Name	Description	Input/ output
1	NC	Not used	
2	RXD	Receive data	Input
3	TXD	Send data	Output
4	NC	Not used	
5	GND	Ground	
6	NC	Not used	
7	RTS	Request to send	Output
8	CTS	Permission to send	Input
9	NC	Not used	

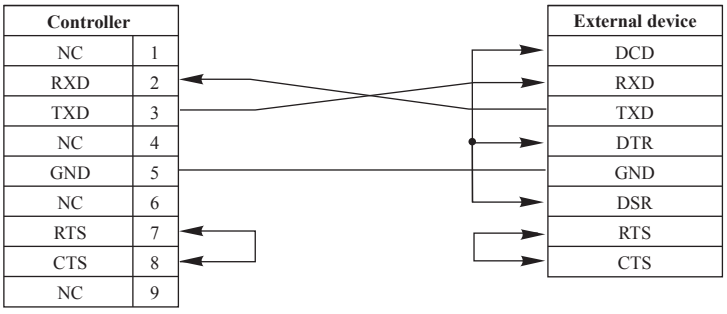
The controller connector is a 9-pin D-Sub female connector. A connection cable with 9-pin D-Sub male connector must therefore be used.

■ 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.

3.2 Transmission mode and communication parameters

Transmission mode	Full duplex
Synchronous system	Start-stop synchronization
Baud rate [bps]	4800, [9600], 19200, 38400, 57600
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.

3.3 Communication flow control

Software flow control (XON/XOFF) and hardware flow control (RTS/CTS) methods can be selected by specifying the communication parameters.

3.3.1 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.

3.3.2 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

The flow controls the functions separately. For instance, when all flow controls are set to "Yes" and the receive buffer capacity is low, an XOFF is transmitted, and RTS is turned off. Later, when the receive buffer capacity is restored, an XON is transmitted, and RTS is turned on.

3.4 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 statement or OFFLINE statement was executed according to the robot language.
- When the communication parameter was changed in SYSTEM mode or when 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 statement or OFFLINE statement at the top of the program.
- Turn the external device on before turning the controller on.

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).

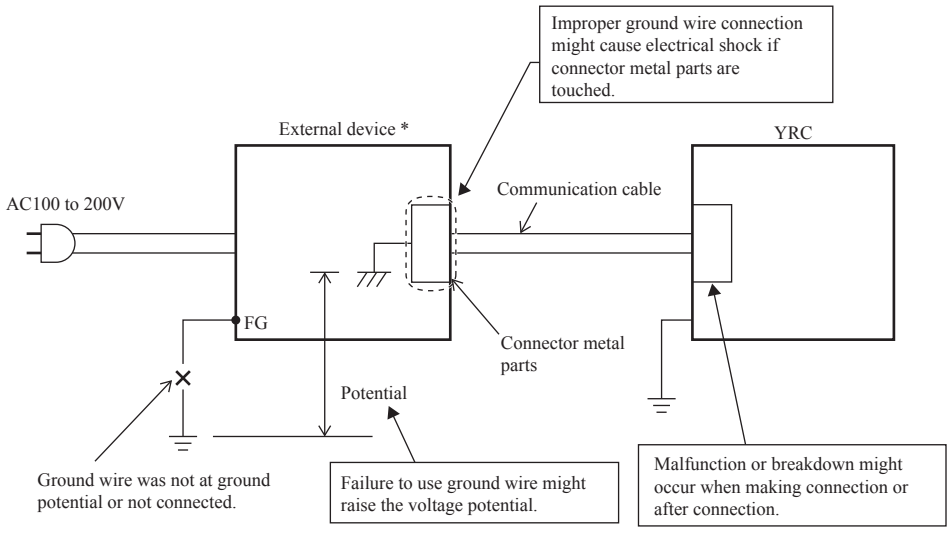
4) When the communication speed is set at a high rate, communication errors might occur due to external noise or other factors.In this case, take countermeasures such as reducing the communication speed.

5) It is not possible to respond to external transmissions during direct command execution or point trace execution in AUTO mode. A response is issued after execution.

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.

3.5 Character code table

HEX.	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0			SP	0	@	P		p				ー	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.

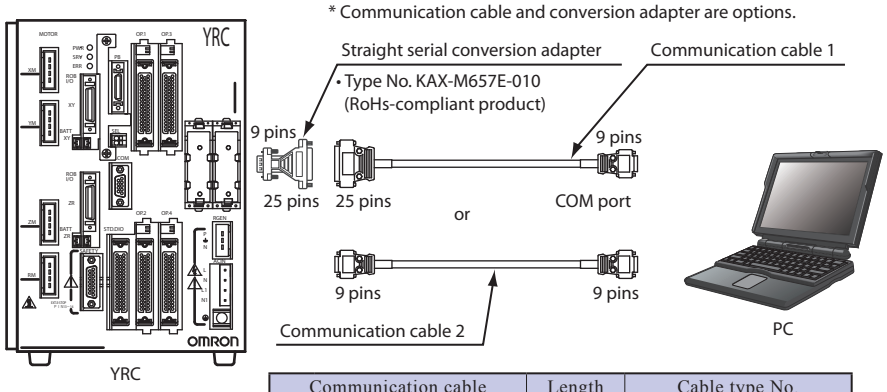
Note 5: TAB is replaced with one space.

3.6 Connecting to a PC

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

1. Using the PC's COM port

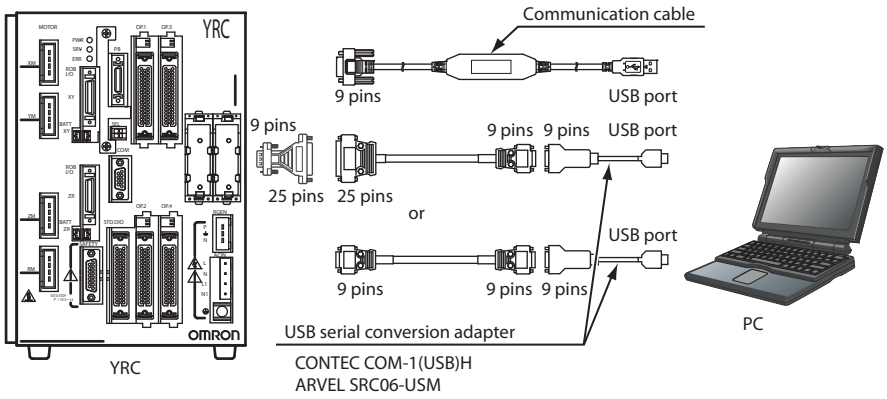
COM port



Communication cable		Length	Cable type No.
1	25 pins ↔ 9 pins	3.5m	KR7-M538F-10
		5m	KR7-M538F-30
2	9 pins ↔ 9 pins	3.5m	KAS-M538F-00
		5m	KAS-M538F-10

2. Using the PC's USB port

USB port



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

CAUTION

Operation has been verified using only the USB serial conversion adapter listed here. Operation has not been verified using conversion adapters with the other part numbers or other manufacturers' products.

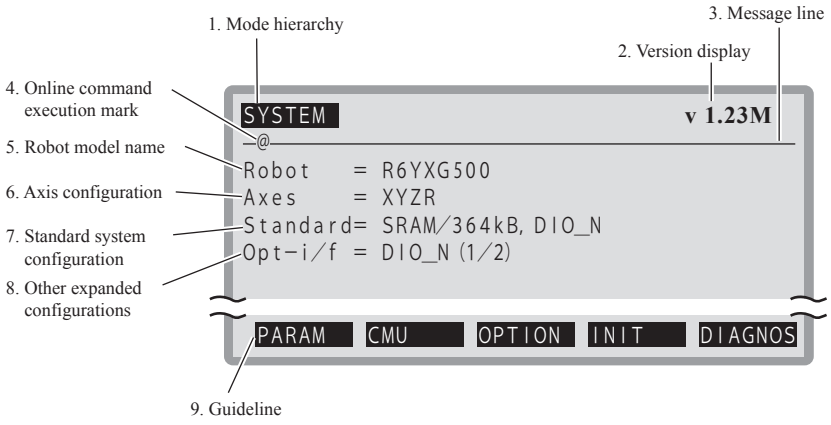
Chapter 7 Controller system settings

Contents

1. SYSTEM mode

SYSTEM mode is used to specify settings for the robot system, and to display information controlled by the robot controller.
The initial SYSTEM mode screen is shown below.

SYSTEM mode



1. Mode hierarchy

Shows the current mode hierarchy. When the highest mode (in this case "SYSTEM") is highlighted, it means that the servo motor power is on. When not highlighted, it means that the servo motor power is off.

2. Version display

Shows the version number of the software currently installed in the robot controller.

3. Message line

Displays messages that occur at the robot controller.

4. Online command execution mark

When an online command is being executed, a "@" mark appears in the second column on the second line. This mark changes to a dot (·) when the online command ends.

5. Robot model name

Shows the robot model name set in the controller.
When two robots are set, they appear as "main robot model name / sub robot model name" .

6. Axis configuration

Shows the Axis configuration set in the controller.
If an auxiliary axis is added, it appears as "main robot axis configuration + auxiliary axis configuration".

7. Standard system configuration

Shows the memory type and size and standard DIO type.

Display	Meaning
DIO_N	Standard DIO works on NPN specifications.
DIO_P	Standard DIO works on PNP specifications.

Refer to "6. I/O connections" in chapter 3 for a definition of NPN and PNP specifications.

8. Other expanded configurations

When expansion boards are installed into the option slot of the controller, the board type and mode setting appear here.

Display	Meaning
DIO_N(m/n..)	An optional DIO with NPN specifications is installed. The number in parentheses is an ID number.
DIO_P(i/j..)	An optional DIO with PNP specifications is installed. The number in parentheses is an ID number.
CCLNK(n/m)	A CC-Link unit is installed. The number in parentheses indicates a station number "n" and a communication speed "m".
D_Net(n/m)	A DeviceNet unit is installed. The number in parentheses indicates a MAC ID number "n" and a communication speed "m".
Profi(n/m)	A PROFIBUS unit is installed. Letters in parentheses indicate a Station address "n" and communication speed "m".
E_Net	An Ethernet unit is installed.
YCLnk(Mn)	An YC-Link unit is installed. The number in parentheses indicates a station number "n".
Vision	An iVY (VISION) unit is installed.
V_Plus	A lighting control unit is installed.
V_Plus_TRK	A tracking control unit is installed.
Gripper1	Electric gripper (1st) is installed.
Gripper2	Electric gripper (2nd) is installed.

- Refer to "6. I/O connections" in chapter 3 for a definition of NPN and PNP specifications.
- For detailed information on serial I/O units such as CC-Link, Ethernet, YC-Link, and iVY system, refer to the respective user's manuals.

NOTE

If two electric grippers are installed, "Gripper1" and "Gripper2" appears.

When set to SAFE mode, the following display appears.

Display	Meaning
safemode	Operation mode is set to SAFE mode that enables SERVICE mode.

For details on SERVICE mode setting, refer to "4.2 Setting the SERVICE mode".

9. Guideline

Content assigned to the programming box function keys is highlighted.

Valid keys and submenu descriptions in SYSTEM mode are shown below.

Valid keys	Menu	Function
F1	PARAM	Sets parameters for the controller and for robot operation.
F2	CMU	Sets communication parameters.
F3	OPTION	Sets parameters for expansion function.
F4	INIT	Initializes data.
F5	DIAGNOS	Performs diagnostics and calls up error history, etc.
F9	BACKUP	Saves and restores data on internal flash ROM.

2. Parameters

There are 4 types of parameters: robot parameters and axis parameters for robot operation, controller setting parameters and option board parameters.

CAUTION

- Parameters are important data that match the robot and controller with their specifications. Incorrect settings may cause errors or breakdowns. Be sure that the correct settings are specified.
- Before and after setting parameters, always save the data files (program, point, point comment, parameter, shift, hand and pallet) stored in the YRC into an external storage unit such as a personal computer.
- If a parameter is changed incorrectly, it may have significant adverse effects on robot operation and/or cause danger to the operator. Always consult the distributer when changing a parameter.
- An absolute reset or return-to-origin may be required after changing parameters.

2.1 Parameter setting

To set parameters relating to the controller setting and robot operation, follow these steps.

1 ***Display the PARAM screen.***

Press F1 (PARAM) in SYSTEM mode.

The PARAM screen appears.

2 ***Display each parameter item.***

Press F1 (ROBOT) to F5 (OP. BRD).

3 ***Select the parameter item.***

Select with the cursor keys (▲/▼).

Or press F2 (JUMP) and enter a parameter number to jump to that parameter item.

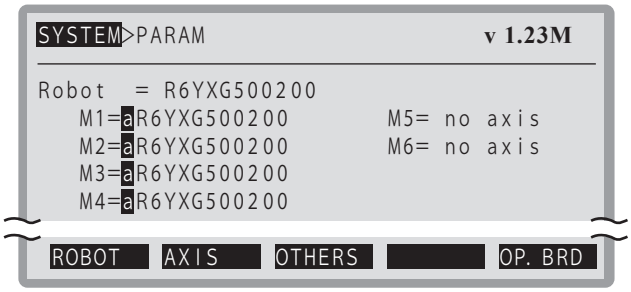
4 ***Edit the selected parameter.***

Press F1 (EDIT).

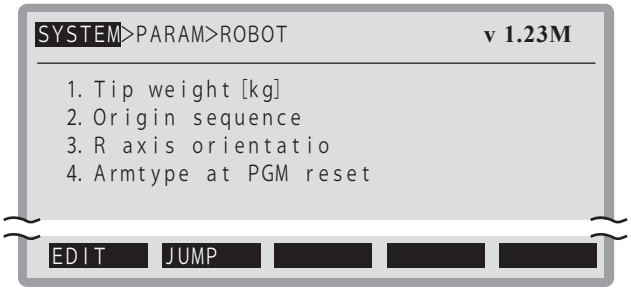
There are 2 ways to edit parameters. The first is by entering data with the numeric keys, and the second is by selecting items with the function keys.
When entering data with the numeric keys, values entered outside the allowable range are converted automatically to the upper or lower limit value.
Refer to the description of each item for details on each parameter.

5 ***Press ESC to quit the parameter editing.***

Step 2 **PARAM screen**



Step 3 **Robot parameters**



Valid keys and submenu descriptions in SYSTEM>PARAM mode are shown below.

Valid keys	Menu	Function
F1	ROBOT	Sets robot parameters for robot operation.
F2	AXIS	Sets axis parameters for robot operation.
F3	OTHERS	Sets other parameters for setting the controller.
F5	OP. BRD	Sets parameters for option boards.
F10	PASSWRD	Allows write-prohibited axis parameters to be written.

2.2 Parameter list

■ Robot parameters

Refer to "2.3 Robot parameters" in this chapter for details on parameters.

No.	Name	Displayed name	Identifier	Setting range	Default setting	Unit
1	Tip weight *1	Tip weight [kg]	WEIGHT	0 to 200	Robot type	kg
2	Return-to-origin sequence	Origin sequence	ORIGIN	0 to 654321	312456	–
3	R-axis direction retention	R axis orientation	RORIEN	KEEP, FREE	KEEP	–
4	Arm type at program reset	Armtype at PGM reset	ARMTYP	RIGHTY, LEFTY	RIGHTY	–

■ Axis parameters

Refer to "2.4 Axis parameters" in this chapter for details on parameters.

No.	Name	Displayed name	Identifier	Setting range	Default setting	Unit
1	Acceleration coefficient	Accel. coefficient [%]	ACCEL	1 to100	100	%
2	Deceleration rate	Decel. rate [%]	DECRAT	1 to100	Robot type	%
3	+ software limit	+Soft limit [pulse]	PLMT+	-6144000 to +6144000	Robot type	pulse
4	- software limit	-Soft limit [pulse]	PLMT-	-6144000 to +6144000	Robot type	pulse
5	Tolerance	Tolerance [pulse]	TOLE	1 or more robot type	80	pulse
6	OUT effective position	OUT position [pulse]	OUTPOS	1 to 6144000	Robot type	pulse
7	Arch position	Arch position [pulse]	ARCH	1 to 6144000	Robot type	pulse
8	Return-to-origin speed	Origin speed [pulse/ms]	ORGSPD	1 or more robot type	20	pulse/ms
9	Acceleration during manual mode	Manual accel [%]	MANACC	1 to 100	100	%
10	Origin position shift	Origin shift [pulse]	SHIFT	-6144000 to +6144000	0	pulse
11	Arm length	Arm length [mm]	ARMLEN	0 to 10000	0	mm
12	Offset pulse	Offset pulse	OFFSET	-6144000 to +6144000	0	pulse
13	Axis tip weight *1	Axis tip weight [kg]	AXSTIP	0 or more robot type		kg
14	Return-to-origin method	Origin method	ORGSNS	SENSOR, TORQUE, MARK	Robot type	–
15	Return-to-origin direction	Origin direction	ORGDIR	---, +++	Robot type	–
16	Robot movement direction	Motor direction	MOTDIR	---, +++	Robot type	–
17	Limitless motion	Limitless motion	NOLMT	INVALID, VALID	INVALID	–

*1 Transport weight settings

By setting the weight of workpieces transported by the robot in the parameters, the robot controller optimizes acceleration when the robot is moving.

■ Other parameters

Refer to "2.5 Other parameters" in this chapter for details on parameters.

No.	Name	Displayed name	Identifier	Setting range	Default setting	Unit
1	Display language	Display language (JPN/ENG)	DSPLNG	JAPANESE, ENGLISH	ENGLISH	–
2	Data display length	Data display length	DATLEN	6 char, 8 char	6 char	–
3	Parameter display unit	Parameter display unit	PDUNIT	PULSE, MM/DEG	PULSE	–
4	DO output at emergency stop	DO cond. on EMG	EMGCDO	RESET, HOLD	HOLD	–
5	STD.DIO 24V DC monitor	Watch on STD.DIO DC24V	STDWCH	VALID, INVALID	VALID	–
6	Incremental mode control	Incremental Mode control	INCMOD	VALID, INVALID	INVALID	–
7	IO command from STD. DIO	IO cmd (DI05)	STDPRM	VALID, INVALID	INVALID	–
8	DI noise canceling	DI noise filter	SCANMD	VALID, INVALID	VALID	–
9	TRUE condition	TRUE condition	EXPCFG	-1, no 0	-1	–
10	Unit selection	Unit select	PTUNIT	Normal, J (pulse), X (mm/°), T (mm/°)	Normal	–
11	Error output port	Error output (DO & SO)	ERPORT	OFF, 20 to 27	OFF	–
12	MOVEI/DRIVEI start position	MOVEI/DRIVEI start pos.	MOVIMD	Keep, Reset	Keep	–
13	DI17 mode	DI17 mode	DI17MD	ABS, ABS/ORG	ABS	–
14	Servo ON at power-on	Servo on when power on	SRVOON	YES, NO	YES	–
15	Battery alarm output (DO & SO)	Battery alarm (DO & SO)	BTALRM	OFF, 20 to 27, 30 to 33	OFF	–
16	Manual movement mode	Manual move mode	MOVMOD	NORMAL, MODE1	NORMAL	–
17	DO output at Program reset	DO cond. on PGM reset	RESCDO	RESET, HOLD	RESET	–
18 *1	Point number echo back	Echo point No.	PNECHO	NO, MODE1, MODE2	NO	–
19 *2	Gripper servo at emergency stop	Gripper servo when E. stop	GEMGMD	ON, OFF	ON	–
20 *2	Gripper operation at return-to-origin	Include Gripper in Origin	GORGMD	NO, YES	YES	–
21 *2	Manual gripper holding operation	Manual Holding of Gripper	GMHLMD	INVALID, VALID	VALID	–
22 *2	G1 status output	G1 status output (DO & SO)	G1STAT	off, 2 to 7, 10 to 15	off	–
23 *2	G2 status output	G2 status output (DO & SO)	G2STAT	off, 2 to 7, 10 to 15	off	–
24	Do not load undefined parameters	Skip undefined parameters	–	INVALID VALID	INVALID	–

*1 This parameter is a special parameter and must be set to "NO".

*2 These parameters are dedicated to the electric gripper.

Parameters for option boards

Refer to "2.6 Parameters for option boards" in this chapter for details on parameters.

No.	Name	Displayed name	Setting range	Default setting	Unit
l Option DIO					
1	Enable/disable 24V power input monitor	Board condition	INVALID, VALID	VALID	–
l Serial I/O					
1	Enable/disable serial I/O board	Board condition	INVALID, VALID	VALID	–
2	Enable/disable remote command and I/O command functions	Remote cmd / IO cmd (SI05)	INVALID, VALID	VALID	–
3	Enable/disable function of message number output to SOW (1)	Output MSG to SOW (1)	INVALID, VALID	INVALID	–
4	I/O size (DeviceNet only)	IO size	Large, Small	Large	–
l Network setting					
1	Enable/disable Ethernet board	Board condition	INVALID, VALID	VALID	–
2	IP address	IP address	–		–
3	Subnet mask	Subnet mask	–		–
4	Gateway	Gateway	–		–
5	Communication mode	communication mode	OFFLINE, ONLINE	ONLINE	–

2.3 Robot parameters

Robot parameters appear in the following format on the programming box robot parameter editing screen.

Main group parameters

MG=<value>

Main robot parameters

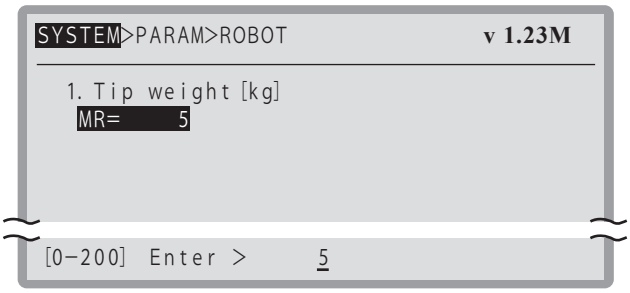
MR=<value>

NOTE

This chapter explains robot parameters 1 to 4.
Parameter 5 and onward are normally write-prohibited. Please contact the distributor if parameter changes are required.

Robot parameter setting

One-robot setting



Valid keys and submenu descriptions for editing robot parameters are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⏫ / ⏬		Scrolls through screens.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

1. Tip weight [kg] /WEIGHT

This parameter sets the tip weight of robot (workpiece weight + tool weight) in kg units.
However, set the tip weight in 0.1kg units when the set robot is R6YXG120, R6YXG150, R6YXG180 or R6YXG220.
The maximum value depends on the set robot model.
The maximum allowable value is determined automatically according to the current robot model.

NOTE

- To set the auxiliary axis tip weight, use the axis tip weight settings of axis parameters.
- When the electric gripper is used, the gripper weight must be added to the tool weight.

1 ***Select "1.Tip weight [kg]".***

Select "1.Tip weight [kg]" with the cursor keys (▲ / ▼), and then press F1 (EDIT).

2 ***Enter the tip weight value.***

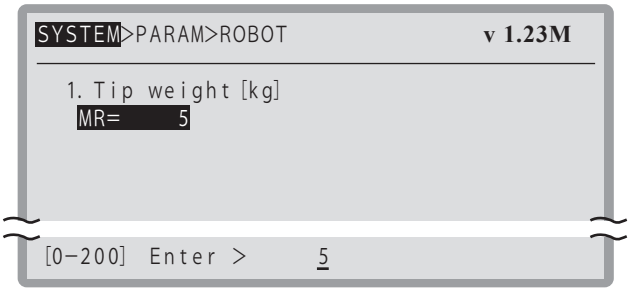
Enter the value with 0 to 9 and then press ENTER.

CAUTION

Factors such as optimal speed are set automatically according to this parameter value. Setting to a weight lower than the actual axis tip weight might adversely affect the robot body so be sure to enter a suitable value.

3 ***Press ESC to quit the edit mode.***

▶ **Step 2** **Setting the "Tip weight [kg]"**



2. Origin sequence /ORIGIN

This parameter sets the sequence for performing return-to-origin, allowing the robot to set each axis motor position. The numbers 3 1 2 4 5 6 are set automatically when the parameters are initialized.
Enter axis numbers of the robot in the sequence for performing return-to-origin. For example, when the numbers 1, 2, 3, 4, 5, 6 are entered, return-to-origin is performed in sequence from axis 1 to axis 6.
Return-to-origin is performed for the axis corresponding to the number in order from left to right. Return-to-origin is performed simultaneously at the end for any axes that are not set.

NOTE
Perform origin-return first for those axes that might interfere with surrounding equipment.

1 ***Select "2.Origin sequence".***
Select "2.Origin sequence" with the cursor keys (▲/▼), and then press F1 (EDIT).

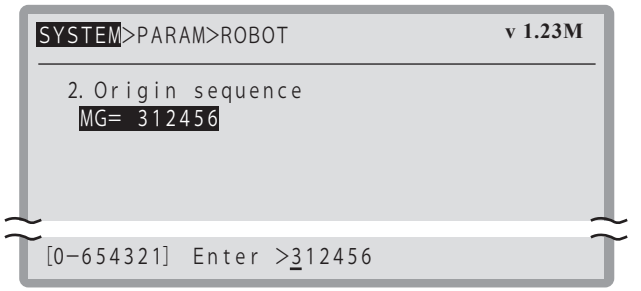
2 ***Enter the return-to-origin sequence.***
Enter the value with 0 to 9, and then press ENTER to set.

NOTE
Origin sequence includes both the robot axes and auxiliary axes.

CAUTION
Emergency stop might be triggered if return-to-origin is simultaneously performed on three or more axes whose return-to-origin method is the stroke end detection method. In this case, change the setting so that stroke end return-to-origin is simultaneously performed on two axes or is performed separately on each axis.

3 ***Press ESC to quit the edit mode.***

Step 2 Setting the "Origin sequence"



If there are axes with different position detection method (absolute type or incremental type) for a single robot, the sequence for the return-to-origin operation will differ depending on how it is performed.

Example:
Robot axis configuration: XYZR
Return-to-origin sequence setting: 312456
Position detection method for each axis: X-, Y-axis → incremental type, Z-, R-axis → absolute type

1. When performing absolute reset operation only

Return-to-origin is performed for absolute type axes only in order from the left in the return-to-origin sequence setting.

3	→	1	→	2	→	4	→	5	→	6
Z-axis movement		X-axis cancel		Y-axis cancel		R-axis movement		A-axis cancel		B-axis cancel

2. When performing origin reset operation only

Return-to-origin is performed for incremental type axes only in order from the left in the return-to-origin sequence setting.

3	→	1	→	2	→	4	→	5	→	6
Z-axis cancel		X-axis movement		Y-axis movement		R-axis cancel		A-axis cancel		B-axis cancel

3. When performing both absolute reset operation and origin reset operation

Return-to-origin is first performed for absolute type axes only in order from the left in the return-to-origin sequence setting.

Return-to-origin is then performed for incremental type axes only.

3	→	1	→	2	→	4	→	5	→	6
Z-axis movement		X-axis cancel		Y-axis cancel		R-axis movement		A-axis cancel		B-axis cancel
3	→	1	→	2	→	4	→	5	→	6
Z-axis cancel		X-axis movement		Y-axis movement		R-axis cancel		A-axis cancel		B-axis cancel

Details of the return-to-origin procedure are shown below.

	Programming box operation		PGM execution	I/O operation	
	Mode	Key operation	Command	Input port	DI17 mode *
Absolute reset only	MANUAL	Absolute reset	ABS RST	DI17	ABS
Origin reset only	MANUAL	Origin	ORIGIN	DI14	ABS
Both simultaneously	No possible		No possible	DI17	ABS/ORG

* This is the "Other parameters" DI17 mode.

3. R-axis orientation /RORIEN

This parameter sets whether or not to maintain the R-axis direction (orientation) when moving manually across the XY axes.
"KEEP" is set when the parameters are initialized.
If maintaining the direction, and the arm tip is moved in the X or Y directions, the R-axis automatically rotates to maintain its current direction.

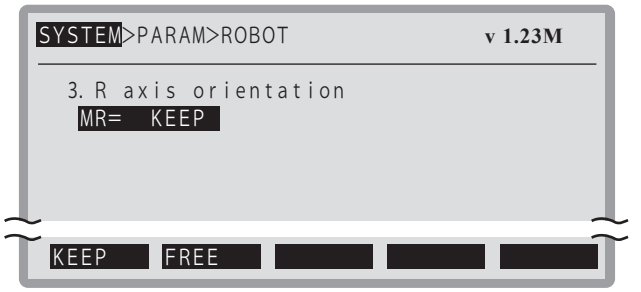
1 ***Select "3.R axis orientation".***
Select "3.R axis orientation" with the cursor keys (▲/▼), and then press F1 (EDIT).

2 ***Set the parameter.***
Press F1 (KEEP) or F2 (FREE) to enter the setting.

3 ***Press ESC to quit the edit mode.***

NOTE
This function is invalid if there is no R-axis or the R-axis is an auxiliary axis.

▶ **Step 2** **Setting the "R axis orientation"**



4. Armtype at PGM reset/ARMTYP

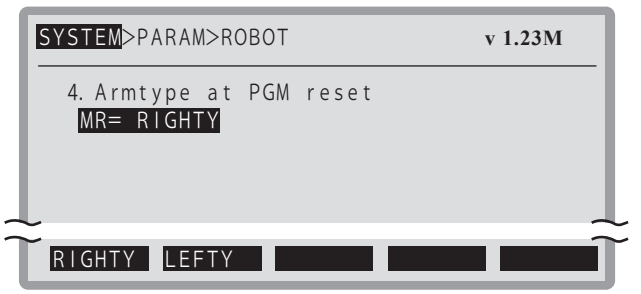
This parameter sets the hand system selected when the program is reset.
The right-handed system is selected when the parameters are initialized.
The hand system setting is important when moving along XY coordinates or when converting point data (joint coordinates ↔ Cartesian coordinates).

1 ***Select "4. Armtype at PGM reset".***
Select "4. Armtype at PGM reset" with the cursor keys (▲/▼), and then press F1 (EDIT).

2 ***Set the arm type.***
Press F1 (RIGHTY) or F2 (LEFTY) to enter the setting.

3 ***Press ESC to quit the edit mode.***

▶ **Step 2** **Setting the "Armtype at PGM reset"**



2.4 Axis parameters

Axis parameters appear in the following format on each programming box axis parameter editing screen.

Main robot axis setting

M?=<value>

Main auxiliary axis setting

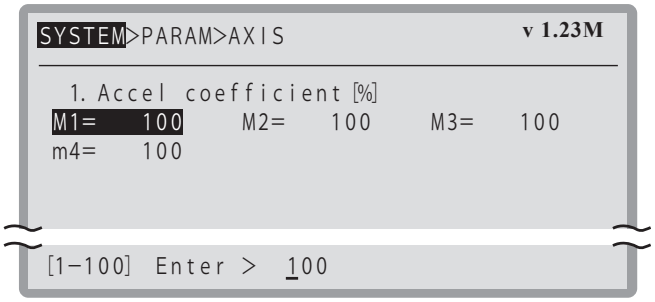
m?=<value>

NOTE

This chapter explains axis parameters 1 to 17.
Parameter 18 and onward are normally write-prohibited. Please contact the distributor if parameter changes are required.

Axis parameter setting

One-robot setting



Valid keys and submenu descriptions for editing robot parameters are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⏫ / ⏬		Scrolls up and down the screen.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

■ Setting by numerical entry

The setting method is shown below using acceleration coefficient as an example.

1 ***Select " 1.Accel coefficient [%]".***

Select "1.Accel coefficient [%]" under "SYSTEM>PARAM>AXIS", and then press F1 (EDIT).

2 ***Select the robot axis.***

Select the robot axis with the cursor keys (/).

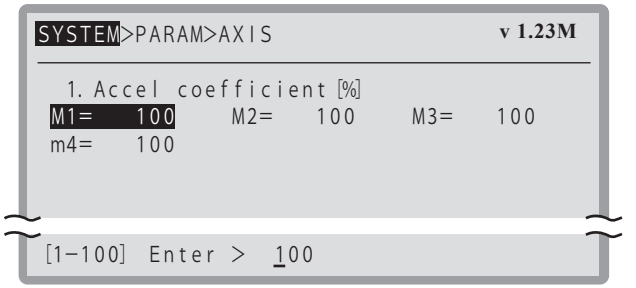
3 ***Enter the acceleration coefficient.***

Enter the value with 0 to 9, and then press ENTER to set.

If necessary, repeat steps 2 to 3, and then enter the acceleration coefficient for any other axes.

4 ***Press ESC to quit the edit mode.***

▶ **Step 3** **Acceleration coefficient entry**



■ Setting by selection

The setting method is shown below using the return-to-origin method as an example.

1 ***Select "14. Return-to-origin method".***

Select "14. Return-to-origin method " under "SYSTEM>PARAM>AXIS", and then press F1 (EDIT).

2 ***Select the robot axis.***

Select the robot axis with the cursor keys (/).

3 ***Select the return-to-origin method.***

Press F1 (SENSOR), F2 (TORQUE), or F3 (MARK) to set.

4 ***Press ESC to quit the edit mode.***

1. Accel coefficient [%] /ACCEL

This parameter sets acceleration in AUTO mode in a range from 1 to 100% during movement by robot movement command.
This is automatically set to 100% when the parameters are initialized.
This coefficient ensures that optimum performance is achieved with a setting of 100% relative to the tip weight setting.

NOTE

If the robot arm tip shakes or sways during acceleration, lower this value to suppress the shaking.

CAUTION

Lowering the acceleration coefficient lengthens the time needed to stop, when the STOP was pressed or an interlock was triggered. Take sufficient care when using the robot with the acceleration coefficient set excessively low.

2. Decel. rate [%]/DECRAT

This parameter sets the deceleration rate in a range from 1 to 100% during movement by robot movement command. This parameter value is a rate to the acceleration.
A deceleration rate inherent to each axis is automatically set when the parameters are initialized.

NOTE

If the robot arm tip shakes or sways during acceleration, lower this value to suppress the shaking.

CAUTION

Lowering the deceleration rate lengthens the time needed to stop, when the STOP key was pressed or an interlock was triggered. Take sufficient care when using the robot with the deceleration rate set excessively low.

3. +Soft limit [pulse] /PLMT+

4. -Soft limit [pulse] /PLMT-

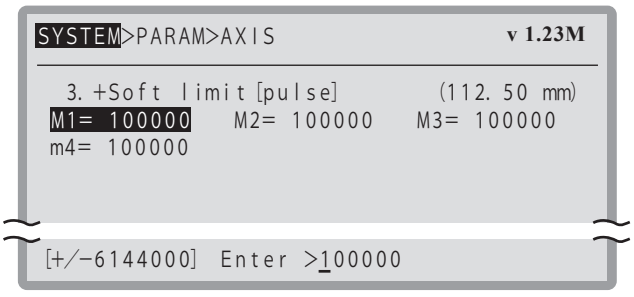
The range within which the axis can move is set with an upper limit (+ soft limit) and lower limit (- soft limit).
Unique values inherent to each model are set if the parameters are initialized.
The robot controller checks whether or not the specified point data is within the soft limit range during automatic operation or point teaching. Settings for the selected axis are displayed in converted units next to the parameter name on the programming box.

NOTE

Enter soft limit values with 0 to 9, . and −.

If the values entered by key entry are real values (numbers with periods), they are automatically converted to pulse values.

Setting the "+Soft limit [pulse]"



WARNING

MAKE SURE TO SET THE SOFTWARE LIMIT WITHIN THE OPERATING RANGE (DETERMINED BY THE MECHANICAL STOPPER) OF THE AXIS. IF SET OUTSIDE THE MECHANICAL OPERATING RANGE, THE AXIS MAY COLLIDE WITH THE MECHANICAL STOPPER AT HIGH SPEED, RESULTING IN BREAKDOWN OF THE ROBOT AND SCATTERING OF THE WORKPIECE HELD BY THE END EFFECTOR.

CAUTION

- This is a critical parameter for establishing the robot operating range so set it to a correct value.
- Make sure that the total movement range of the "+" and "-" software limits for X-axis and Y-axis does not exceed 360 degrees. If the setting exceeds 360 degrees, then errors might occur in the coordinate conversion results.
- Functions using soft limits are disabled when return-to-origin is incomplete. Caution is required when jogging the robot.

5. Tolerance [pulse] /TOLE

This parameter sets the positioning complete range for the target position when the robot moves. Unique values inherent to each model are set if the parameters are initialized.

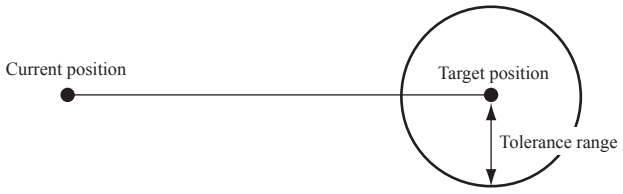
If the current position of the robot enters the set range, the system judges that positioning is complete. The higher this value, the shorter the time until positioning is complete.
Settings for the selected axis are displayed in converted units next to the parameter name on the programming box.

NOTE

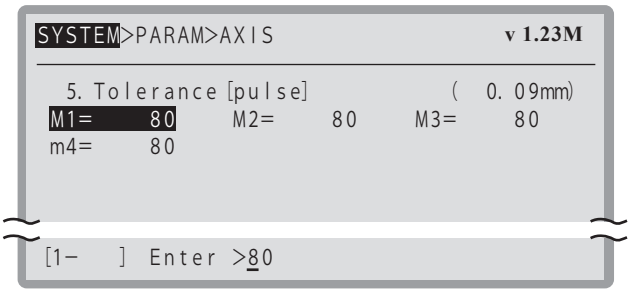
Enter tolerance values with 0 to 9, . and −.

If the values entered by key entry are real values (numbers with periods), they are automatically converted to pulse values.

Tolerance range



Setting the "Tolerance [pulse]"



CAUTION

- This is a critical parameter for determining the robot movement neat the target position so set it to a correct value.
- If the tolerance range was reduced to a drastically small value, then the time needed for robot positioning might vary.
- The maximum tolerance value is determined by the motor model.

6. Out position [pulse] /OUTPOS

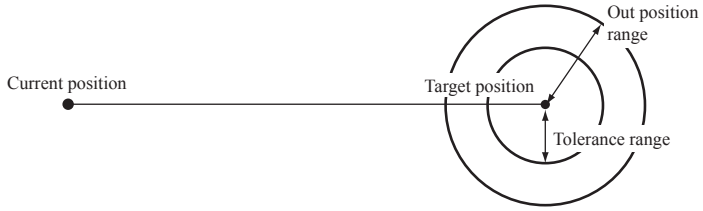
This parameter sets the execution complete range relative to the target position when a movement command is executed in the program. However, this only applies to PTP movements.
Unique values inherent to each model are set if the parameters are initialized.
If the current position of the robot enters the set range, the system judges that execution of the movement command is complete. However, the robot continues moving to the target position. The higher this value, the shorter the time until the next command is executed.
If executing movement commands consecutively, it will not be possible to execute the next movement command until positioning is complete, even if execution of the previous command is complete.
Settings for the selected axis are displayed in converted units next to the parameter name on the programming box.

NOTE

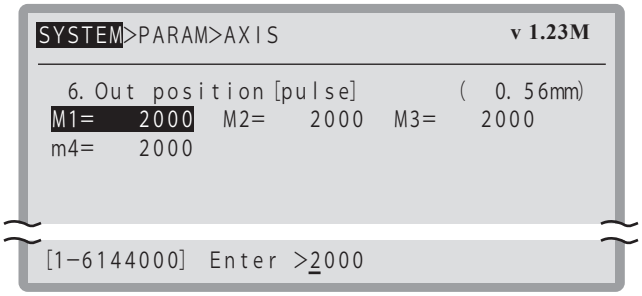
Enter OUT position values with 0 to 9, . and −.

If the values entered by key entry are real values (numbers with periods), they are automatically converted to pulse values.

OUT position range



Setting the "Out position [pulse]"



CAUTION

When the tolerance range is larger than the OUT position range, positioning is complete together with completion of command execution at the point the robot enters the OUT position range.

7. Arch position [pulse] /ARCH

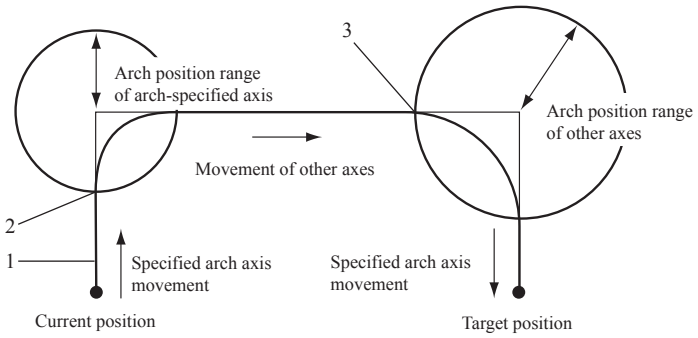
This parameter sets the start range for arch motion, a PTP movement option. Arch motion is started when the current position of each axis enters the set range. The values which are inherent to each model are set if the parameters are initialized.
The higher this value, the larger area of axis movement overlap, and shorter the movement execution time.
Settings for the selected axis display in converted units.

NOTE

Enter the arch position values with 0 to 9, . and −.

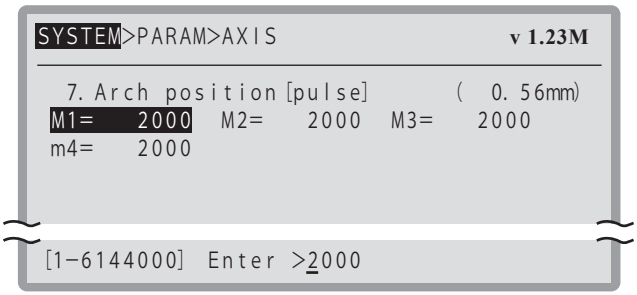
If the values entered by key entry are real values (numbers with periods), they are automatically converted to pulse values.

Arch motion



1. The axis for which arch motion is specified moves toward the optional specified position, and the PTP movement starts.
2. If the robot enters the range specified at the arch position, axes other than those for which arch motion is specified start moving.
3. If an axis other than those for which arch motion is specified enters the range specified at the arch position, the axis for which arch motion is specified moves toward the optional specified position, and the PTP movement is performed.

Setting the "Arch position [pulse]"



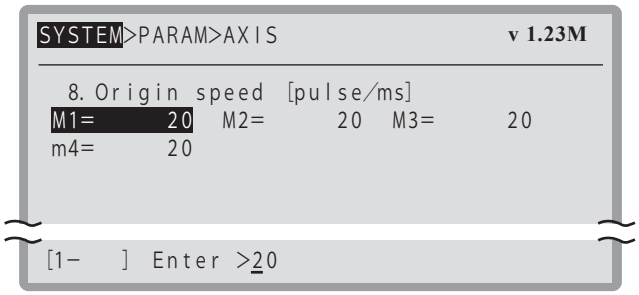
CAUTION

- There may be times when the axis for which arch motion is specified reaches the target position before other axes if the arch position is large. Set an accurate value for the arch position.
- The arch movement trajectory differs depending on the movement speed. Perform an interference check at the speed at which the robot actually moves.

8. Origin speed [pulse/ms] /ORGSPD

This parameter sets the movement speed when performing the return-to-origin movement.
Unique values inherent to each model are set for incremental type axes and absolute type axes if the parameters are initialized. On semi-absolute type axes, this parameter is set to 20 pulses/ms (=20mm/s).

Setting the "Origin speed [pulse/ms]"



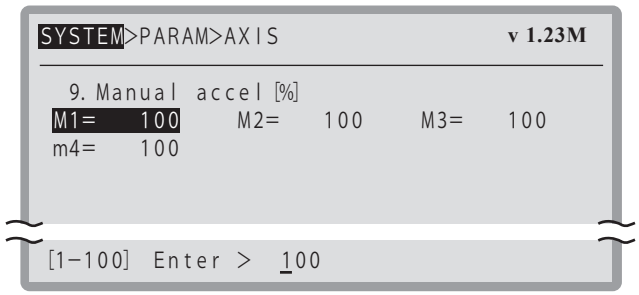
CAUTION

The maximum return-to-origin speed for incremental type and absolute type axes is determined by the motor.
The maximum return-to-origin speed for semi-absolute axes is 20 pulses/ms (=20mm/s).

9. Manual accel [%] /MANACC

This parameter sets the acceleration coefficient within a range of 1 to 100% when the robot is moved manually.
The manual acceleration is automatically set to 100 when the parameters are initialized.
This coefficient ensures that optimum performance is achieved with a setting of 100% relative to the tip weight setting.

Setting the "Manual accel [%]"



NOTE

If the robot arm tip shakes or sways during manual movement acceleration, lower this value to suppress the shaking.

CAUTION

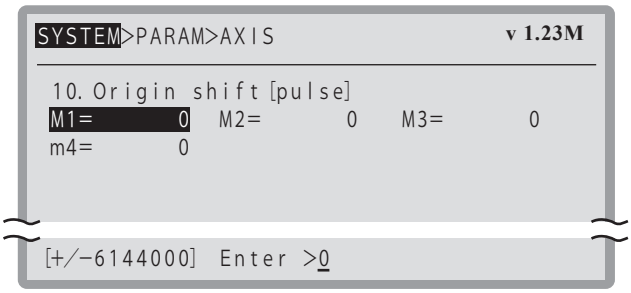
Lowering the acceleration coefficient lengthens the time needed to stop, when the STOP was pressed or an interlock was triggered. Take sufficient care when setting the value if using the robot with the acceleration coefficient set excessively low.

10. Origin shift [pulse] /SHIFT

This parameter is used to offset the shift amount for each axis if the motor is replaced or work position is displaced due to impact.
This parameter is set to 0 when initialized.
This parameter sets the shift amount for the electronic origin position relative to the mechanical origin position, and is the current motor position immediately after performing return-to-origin.

Example :
If the B pulses represent the origin position that the robot arm moved to after position error, and the A pulses are the origin position before position error, then enter a value of "A - B".

Setting the "Origin shift [pulse]"



CAUTION

- Origin shift is a critical parameter for determining the robot position so set it to a correct value. Change this parameter only when necessary.
- Origin return will be incomplete if this parameter is changed.
- This parameter is enabled after absolute reset or return-to-origin.

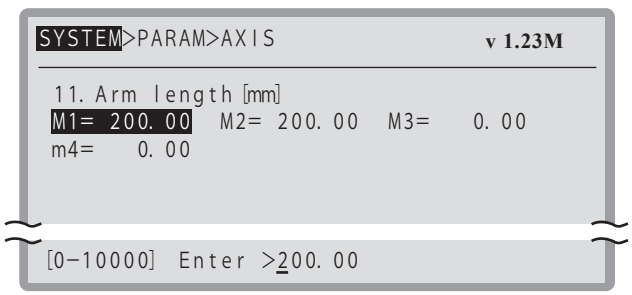
11. Arm length [mm] /ARMLEN

This parameter sets the X- and Y-axis arm length.
Unique values inherent to each model are set if the parameters are initialized.
Furthermore, this parameter is set automatically if the standard coordinates have been set.
This value is set to 0 if the parameters are initialized.

NOTE

Enter the arm length with 0 to 9, . and -.

Setting the "Arm length [mm]"



CAUTION

The arm length and offset pulses are used to convert coordinates to Cartesian coordinates. Make sure that the arm length setting is accurate.

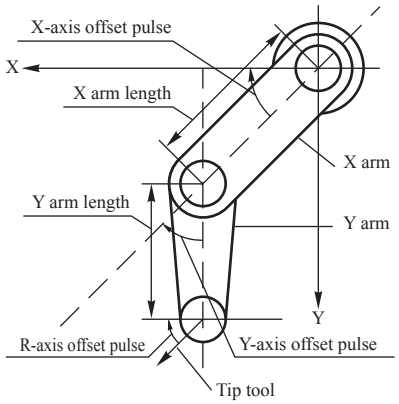
12. Offset pulse /OFFSET

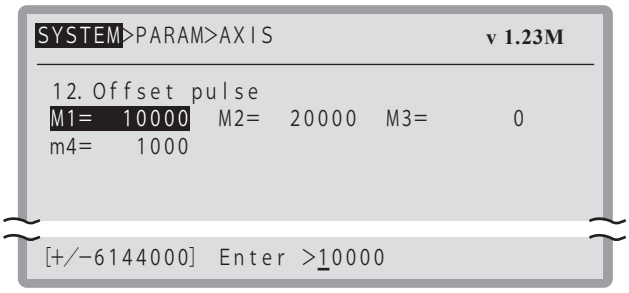
This parameter sets the arm orientation and angle relative to the standard coordinate axes when the X-, Y-, and R-axis motor positions are all at 0 pulses. A setting of "0" is specified if the parameters are initialized.

- X-axis offset pulses .....Angle formed by X axis arm and +X-axis on standard coordinates (unit: pulses)
- Y-axis offset pulses .....Angle formed by X axis arm and Y axis arm (unit: pulses)
- R-axis offset pulses .....Angle formed by R axis origin and +X-axis on standard coordinates (unit: pulses)

Furthermore, this parameter is set automatically if the standard coordinates have been set.

Setting the "Offset pulse"





CAUTION

- The arm length and offset pulses are used to convert coordinates to Cartesian coordinates. Make sure that the arm length setting is accurate.
- If data is entered (ENTER is pressed with entry cursor displayed) in this parameter, standard coordinates are set.

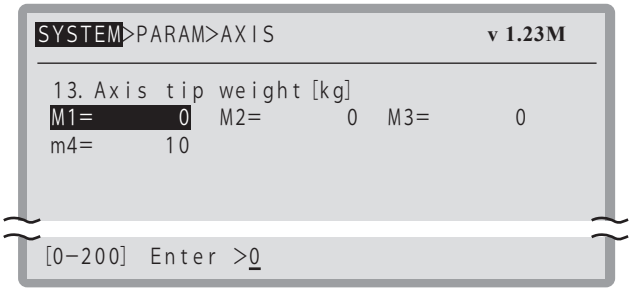
13. Axis tip weight [kg] /AXSTIP

This parameter sets the tip weight (workpiece weight + tool weight) in kg units for each axis when the robot setting is MULTI type robot or MULTIXY type robot, and the set axis is an auxiliary axis. A maximum value is set when the parameters are initialized.
The maximum is set automatically based on the robot model.

NOTE

- This parameter cannot be entered if the robot setting is other than MULTI type robot or MULTIXY type robot when the axis is other than an auxiliary axis.
- Set the tip weight robot parameter if the robot setting is other than MULTI type robot or MULTIXY type robot.

Setting the "Axis tip weight [kg]"



CAUTION

Optimum values are automatically set for acceleration and so on with this parameter value. The robot body may therefore be adversely affected if set to a lower value than the actual axis tip weight, so be sure to enter a correct value.

14. Origin method /ORGSNS

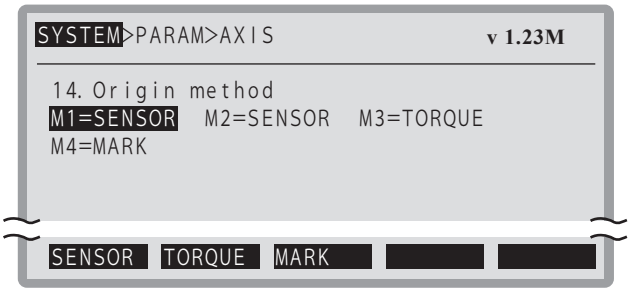
This parameter selects the method for performing return-to-origin on the robot.
If the parameters are initialized:

"sensor" ..... : Origin is detected by sensor input.

"torque" ..... : Origin is detected when the axis moves against the mechanical stroke end.

"mark" ..... : Origin position is set by the user, such as with mating marks. (Axis specified as the "mark" does not perform return-to-origin.)

Setting the "Origin method"



CAUTION

- This parameter is set based on the robot specifications when the robot is shipped.
- The distributor shall not be held responsible for any problems that occur after changing settings without prior consultation.
- Return-to-origin will be incomplete if this parameter is changed.

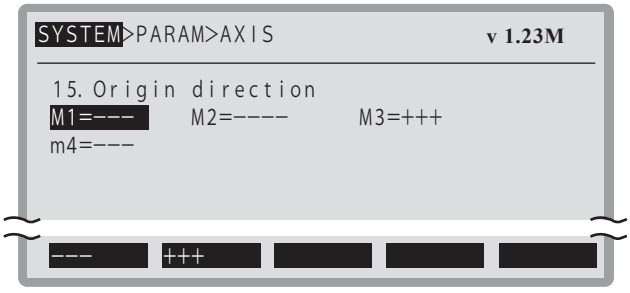
15. Origin direction /ORGDIR

This parameter specifies the direction for return-to-origin. The direction which is inherent to the robot model will be set if the parameters are initialized.

−−−..... Motor position - direction is movement direction for return-to-origin movement.

+++..... Motor position + direction is movement direction for return-to-origin movement.

Setting the "Origin direction"



CAUTION

- Do not change the default settings if any of the following conditions apply.

Condition	Problem when setting changed
Model is F14H with 5mm leads	Return-to-origin does not stabilize when air end system return-to-origin is performed at the non-motor side.
iVY system is used.	Camera calibration is not performed properly.

  Consult with the distributor if it is necessary to change the settings.
- The distributor shall not be held responsible for any problems that occur after changing settings without prior consultation.
- Return-to-origin will be incomplete if this parameter is changed.

16. Motor direction /MOTDIR

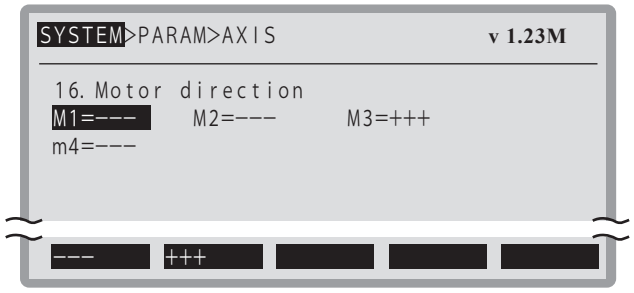
This parameter specifies the robot movement direction.
The direction which is inherent to the robot model will be set if the parameters are initialized.

−−−..... Motor - direction is axis – direction.

+++..... Motor + direction is axis + direction.

This parameter cannot be changed while the servo is on. To change the parameter, make sure the servo is off.
Refer to the "Robot movement direction list" for details on the robot movement direction relative to the motor - direction.

Setting the "Motor direction"



CAUTION

- Do not change the default settings if any of the following conditions apply.

Condition	Problem when setting changed
Model is F14H with 5mm leads	Return-to-origin does not stabilize when air end system return-to-origin is performed at the non-motor side.
iVY system is used.	Camera calibraiton is not performed properly.

  Consult with the distributor if it is necessary to change the settings.
- The distributor shall not be held responsible for any problems that occur after changing settings without prior consultation.
- Return-to-origin will be incomplete if this parameter is changed.
- Problems will occur with functions using Cartesian coordinates if the default values are changed.

17. Limitless motion / NOLMT

Specifies an axis where "limitless motion" is permitted. When parameters are initialized, this item is set as INVALID for all axes (default setting).

INVALID ..... Disables "limitless motion" at the specified axis (movement is restricted to the soft limit's motion range).

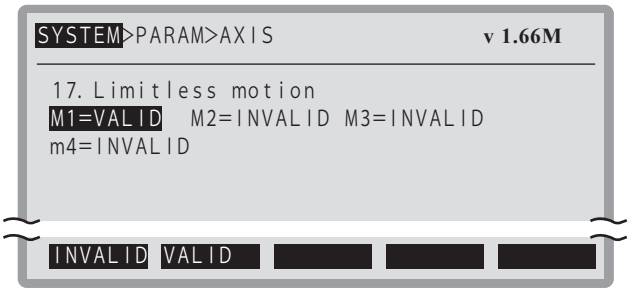
VALID ..... Enables "limitless motion" at the specified axis.

Limitless motion can be executed by the DRIVE, DRIVEI, DRIVE2, and DRIVEI2 statements.
The soft limit values during execution of these statements are shown below.
Plus-direction soft limit : 67,000,000 [pulses]
Minus-direction soft limit : -67,000,000 [pulses]

* Soft limit values represent upper limit values determined by the hardware, and they cannot be changed.

For details regarding "limitless motion", refer to the Programming Manual.

"Limitless motion" setting



CAUTION

The "Limitless motion" function applies to axes for which an "additional axis" setting has been specified in the system generation data. Be sure to specify the "additional axis" setting for the relevant axes. The "2.29: Cannot move without the limit" error occurs if MOVE statement or Point Trace movement is attempted with a "limitless motion" VALID setting for an axis without an "additional axis" designation.

NOTE

- This parameter is available in software Ver.1.66M or later.

2.5 Other parameters

This section explains other parameters edited with the programming box. Other parameters are shown in the following list.

	Valid key / item name	Setting	Default setting
1	Display language /DSPLNG	F1 JAPANESE, F2 ENGLISH	ENGLISH
2	Data display length /DATLEN	F1 6 char, F2 8 char	6 char
3	Parameter display unit /PDUNIT	F1 PULSE, F2 mm/deg	PULSE
4	DO cond. on EMG /EMGCDO	F1 RESET, F2 HOLD	HOLD
5	Watch on STD.DIO DC24V /STDWCH	F1 INVALID, F2 VALID	VALID
6	Incremental Mode control /INCMOD	F1 INVALID, F2 VALID	INVALID
7	IO cmd (DI05) on STD.DIO /STDPRM	F1 INVALID, F2 VALID	INVALID
8	DI noise filter /SCANMD	F1 INVALID, F2 VALID	VALID
9	TRUE condition /EXPCFG	F1 -1, F2 not 0	-1
10	Unit select /PTUNIT	F1 Normal, F2 J (pulse), F3 X(mm/°), F4 T(mm/°)	Normal
11	Error output (DO & SO) /ERPORT	F1 OFF, F2 20, F3 21, F4 22, F5 23, F6 24, F7 25, F8 26, F9 27	OFF
12	MOVEI/DRIVEI start pos. /MOVIMD	F1 Keep, F2 Reset	Keep
13	DI17 mode /DI17MD	F1 ABS, F2 ABS/ORG	ABS
14	Servo on when power on /SRVOON	F1 YES, F2 NO	YES
15	Battery alarm (DO & SO) /BTALRM	F1 OFF, F2 20, F3 21, F4 22, F5 23, F6 24, F7 25, F8 26, F9 27, F11 30, F12 31, F13 32, F14 33	OFF
16	Manual move mode /MOVMOD	F1 NORMAL, F2 MODE1	NORMAL
17	DO cond. on PGM reset	F1 RESET, F2 HOLD	RESET
24 *	Skip undefined parameters	F1 INVALID, F2 VALID	INVALID

* The parameter number differs depending on the robot controller version.

Controller version	Parameter No.
Prior to Ver. 1.24M	16.
Ver. 1.24M to Ver. 1.31M	22.
Ver. 1.32M to Ver. 1.60M	23.
Ver. 1.61M and later	24.

Valid keys and submenu descriptions for editing other parameters are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⏫ / ⏬		Scrolls through screens
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

1 ***Display the other parameters screen.***

Press F3 (OTHER) at "SYSTEM>PARAM".

The other parameters screen appears.

2 ***Select a parameter.***

Select a parameter with the cursor keys (▲/▼).

It is also possible to jump to an item by pressing F2 (JUMP) and entering the desired parameter number. The page keys (⏫, ⏬) can also be used.

3 ***Select edit mode.***

Press F1 (EDIT) to select edit mode.

Edit mode is valid until the next time ESC is pressed, allowing multiple items to be set consecutively.

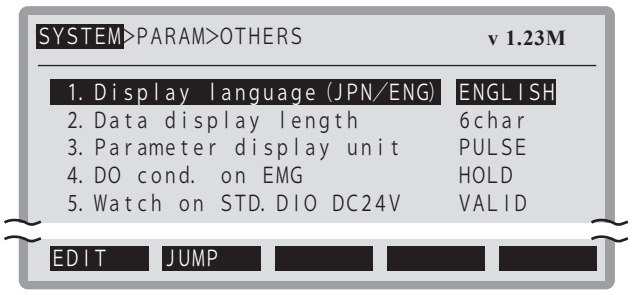
Select subsequent items to be set with the cursor keys (▲/▼).

4 ***Enter the parameters.***

Select from the items that appear on the guideline, and then use the function keys to set parameters.

5 ***Press ESC to quit the edit mode.***

Step 1 **Other parameters screen**



1. Display language/DSPLNG

This parameter sets the language for displaying messages on the programming box.

NOTE

This parameter doesn't change even if parameters are initialized.

2. Data display length/DATLEN

This parameter sets the number of digits to display such as for point data. This is automatically set to "6char" (6 digits) when the parameters are initialized.

3. Parameter display unit/PDUNIT

This parameter sets the units for showing axis parameters. This is automatically set to "PULSE" when the parameters are initialized.

4. DO cond. on EMG /EMGCDO

This parameter sets whether or not to hold output of the DO/MO/LO/TO/SO ports when an emergency stop signal is input to the controller.
When the setting is enabled, an error will occur if the 24V DC power supply is not ON.
This is automatically set to "HOLD" when the parameters are initialized.

CAUTION

Functions using this parameter will be disabled if the sequence program is running.

5. Watch on STD.DIO DC24V /STDWCH

This parameter sets whether to monitor the status of the 24V DC power supply to the STD.DIO connector.
When the setting is enabled, an error will occur if the 24V DC power supply is not ON.
This is automatically enabled "VALID" when the parameters are initialized.

NOTE

The setting is automatically enabled when 24V DC is supplied to STD.DIO.

CAUTION

Interlock signals are used to stop robot operation. If the interlock setting is off (INVALID) use caution during robot operation.

6. Incremental Mode control /INCMOD

This parameter sets whether to always set to the return-to-origin incomplete status when the controller starts up.
This is automatically set to "INVALID" when the parameters are initialized.

NOTE

- If this parameters is enabled, the return-to-origin incomplete status is always set when the controller power is turned ON.
- Enable this parameter if using an absolute type axis with no absolute battery installed.

CAUTION

This parameter must be disabled (INVALID) if the robot has an axis using the mark method for origin detection.

7. IO cmd (DI05) on STD.DIO/STDPRM

This parameter sets whether to enable or disable the command function that uses DI05 (I/O command execution trigger) of the STD.DIO connector. This is automatically set to "INVALID" when the parameters are initialized.

NOTE

- Command functions using DI05 (I/O command execution trigger) of the STD.DIO connector utilize part of the general-purpose input and output. When utilizing a general-purpose input and output, sufficient care should be taken.
- For detailed information on I/O commands, refer to the programming manual.

8. DI noise filter/SCANMD

This parameter cancels external input signals (dedicated input signals, general-purpose input signals) in the form of short pulses. It works by preventing unintentional input signals such as those caused by noise.
When this parameter is set to "VALID", the on and off periods of input signals must be longer than 25ms since the controller does not respond to any signal input shorter than 25ms. Input signals of 25ms or shorted are canceled.

9. TRUE condition /EXPCFG

This parameter selects the operation in the case where the conditional expression used in the program is one that expresses numerical values.

- IF statement (including ELSEIF)
- WHILE to WEND statement
- WAIT statement
- Movement command STOPON condition option for MOVE statement or DRIVE statement, etc.

This parameter is set to "-1" when the parameters are initialized.

Setting	Meaning
-1 (default setting)	The result is "TRUE" when the conditional expression value is -1, and "FALSE" when the value is 0. If the value is other than -1 and 0, an error "6.35: EXPRESSION ERROR" occurs.
not 0	The result is "TRUE" when the conditional expression value is other than 0, and "FALSE" when the value is 0.

10. Unit select /PTUNIT

This parameter sets the point data unit system to be used when the controller is started.
This parameter is set to "Normal" when the parameters are initialized.

NOTE

Tool coordinates are enabled when R-axis is set for the robot and the definition for the hand installed on the R-axis is selected. If R-axis is not set or the definition for the hand installed on the R-axis is not selected, the unit system will automatically change to X (mm/°) after starting the controller even if T (mm/°) is selected with the parameter.

Setting	Meaning
Normal (default setting)	Sets to the unit system that was last selected.
J (pls)	Sets the parameter in pulse units.
X (mm/°)	Sets the parameter in the standard (when other than tool coordinates) mm units.
T (mm/°)	Sets the parameter in mm units for tool coordinates.

11. Error output (DO & SO) /ERPORT

The parameter sets the error output to the general-purpose output signal when an error has occurred at the controller for some reason. This parameter is set to "OFF" when the parameters are initialized.
The following ports can be used as error output ports: DO20 to DO27, SO20 to SO27.

NOTE

- This does not apply when the group number for the error that occurs is 0. (E.g., 0.1: Origin incomplete)
- If a serial board such as a CC-Link serial board is added to the option board slot, then errors are also output to the SO of the same number as DO.

Setting	Meaning
OFF (default setting)	Does not output errors.
20 to 27	Outputs errors from the specified port (DO and SO).

In any of the following cases, the general-purpose output selected for error output turns off.

1. When servo was turned on
2. When a program was reset
3. When automatic operation started
4. When STEP, SKIP or NEXT execution started
5. Return-to-origin or absolute reset started
6. When an I/O command was received
7. When a remote command was received
8. When manual movement started with the programming box in MANUAL mode
9. When an online command was executed

12. MOVEI/DRIVEI start pos./MOVIMD

This parameter sets the movement performed when re-executing a relative motion command after being stopped by an interlock or emergency stop, etc.
This parameter is set to "Keep" when the parameters are initialized.

NOTE

This parameter's factory setting (when shipped) is "Keep".

• Controller with Ver.1.23M to 1.36M, or Ver.1.50M to 1.56M

Setting	Meaning
Keep (default setting)	Motion to the original specified target position occurs when operation resumes after a relative motion interruption. Target position is unchanged.
Reset	Motion to a new, current position referenced target position occurs when operation resumes after a relative motion interruption. The original target position (prior to re-execution) is changed to a new target position. (Compatible with previous versions)

• Controller with Ver.1.37M to version prior to 1.50M, or Ver.1.57M or later

Setting	Meaning
Keep (default setting)	Motion to the original specified target position occurs when operation resumes after a relative motion interruption. Target position is unchanged. When performing return-to-origin or an absolute reset, the target position after the relative motion interruption is reset.
Reset	Motion to a new, current position referenced target position occurs when operation resumes after a relative motion interruption. The original target position (prior to re-execution) is changed to a new target position.
Keep 2	Motion to the original specified target position occurs when operation resumes after a relative motion interruption. Target position is unchanged. The target position after the relative motion interruption is not reset even when performing return-to-origin or an absolute reset. (Compatible with previous versions)

13. DI17 mode /DI17MD

Set the operation to be performed by dedicated input DI17/SI17.
This parameter is set to "ABS" when the parameters are initialized.

Setting	Meaning
ABS	DI17/SI17 are only used for "absolute reset". Perform absolute reset by signal input on the origin points of absolute type motor axes according to the return-to-origin sequence. Return-to-origin is performed on incremental type motor axes are reset by inputting DI14/SI14.
ABS/ORG	Set DI17/SI17 to "absolute reset" and "return-to-origin". Perform absolute reset and return-to-origin by signal input. If absolute type motor axes exist first perform absolute reset on these. Following this, perform a return-to-origin on any incremental axes.

NOTE

Under normal operation set to "ABS" and perform absolute reset with DI17 and return-to-origin with DI14.
Only use the "ABS/ORG" setting when performing a return-to-origin with DI17/SI17 input.

14. Servo on when power on /SRVOON

Use this parameter to select whether to start the controller with servo ON or servo OFF when the controller power is turned on.
This parameter is set to "YES" when the parameters are initialized.

Setting	Meaning
YES	The controller starts with servo ON when the controller power is turned on. However, when SAFE mode setting or serial I/O setting is enabled, the controller starts with servo OFF.
NO	The controller normally starts with servo OFF when the power is turned on.

15. Battery alarm (DO & SO) /BTALRM

Use this parameter to set the general-purpose output signal to the alarm output in the case that the battery alarm sounds on the controller.
This parameter is set to "OFF" when the parameters are initialized.
Use this parameter to set the port to output a battery alarm.
The ports that can be used to output the alarm are DO20 to 27, DO30 to 33, and SO20 to 27, SO30 to 33.
When robot numbers are set by generation, this parameter is reset to "OFF".

Setting	Meaning
OFF	Does not output battery alarms.
20 to 27, 30 to 33	Outputs battery alarms from a specified DO or SO port.

NOTE

The battery alarm output corresponds to both the system backup battery and the absolute battery.

16. Manual move mode /MOVMOD

When an axis movement key is held down, inching movement switches to continuous movement.
This parameter can also be used for the online command @JOG and jog movement command of remote commands.
This parameter is set to "NORMAL" when the parameters are initialized.

NOTE

- This parameter is enabled from controllers with software version 1.32M onwards.
- When the parameter is set to "MODE 1", use this to shorten the time taken to switch from inching to continuous movement.

Setting	Meaning		
NORMAL	Standard operation	Manual movement	Switches to continuous movement when an axis movement key is held down for a certain time (approx. 0.2 sec.) after inching movement is complete.
		@JOG (online command) Jog movement command (remote command)	Switches to continuous movement when a certain time (approx. 0.2 sec.) has elapsed after inching movement is complete.
MODE1	Continuous movement begins immediately after inching movement is complete.	Manual movement	Switches to continuous movement immediately after inching movement is complete.
		@JOG (online command) Jog movement command (remote command)	

17. Program reset DO/RESCDO

This parameter sets whether or not to hold output of the DO/MO/LO/TO/SO ports when a program reset or HALT command input, etc., occurs.
This parameter is set to "RESET" when the parameters are initialized.

NOTE

This parameter is enabled from controllers with software version 1.61M onwards.

Setting	Meaning	
RESET	Standard operation (Default setting)	The DO/MO/LO/TO/SO port outputs are reset when any of the following operations are executed. However, the outputs are not reset if a sequence program is being executed without enabling the DO reset in the sequence execution flag setting. The outputs are reset: When compile ended successfully in "PROGRAM" mode. When a program was compiled in "AUTO" mode and the compile ended successfully. When F1 (RESET) was executed in "AUTO" mode. In "AUTO" mode, when the dedicated input signal DI15 or SI15 (Program reset input) was turned on while the program was stopped. (See "1.6 Dedicated input signal description" in Chapter 6.) When either of the following was initialized in "SYSTEM>INIT" mode. 1. Program memory (SYSTEM>INIT>MEMORY>PROGRAM) 2. All memories (SYSTEM>INIT>MEMORY>ALL) When the SWI command was executed by "DIRECT" in "AUTO" mode. (Reset (off) does not occur when the SWI command was executed in the program.) When an online command @RESET, @INIT PGM, @INIT MEM, @INIT ALL or @SWI was executed. When the HALT statement was executed in the program.
HOLD	Outputs are not reset.	The DO/MO/LO/TO/SO port outputs are not reset even when any of the followings are executed. The outputs are not reset even: When compile ended successfully in "PROGRAM" mode. When a program was compiled in "AUTO" mode and the compile ended successfully. When F1 (RESET) was executed in "AUTO" mode. In "AUTO" mode, when the dedicated input signal DI15 or SI15 (Program reset input) was turned on while the program was stopped. (See "1.6 Dedicated input signal description" in Chapter 6.) When either of the following was initialized in "SYSTEM>INIT" mode. 1. Program memory (SYSTEM>INIT>MEMORY>PROGRAM) 2. All memories (SYSTEM>INIT>MEMORY>ALL) When the SWI command was executed by "DIRECT" in "AUTO" mode. When an online command @RESET, @INIT PGM, @INIT MEM, @INIT ALL or @SWI was executed. When the HALT or SWI statement was executed in the program.

24.Skip undefined parameters

This parameter is used to determine whether or not undefined data in the parameter file loaded to the controller (parameters not compatible with the controller) is skipped.
If this parameter is set to "VALID", the undefined parameters in the file will be skipped when the parameter file is loaded.
This parameter is not contained in the parameter file and is always set to "INVALID" each time the power to the controller is turned on.

CAUTION

- If this parameter is set to "VALID", then misspellings in the parameter file cannot be detected. Do not set this parameter to VALID unless it is absolutely necessary to load new version parameters to an old version controller.
- This parameter number changes according to the controller version.

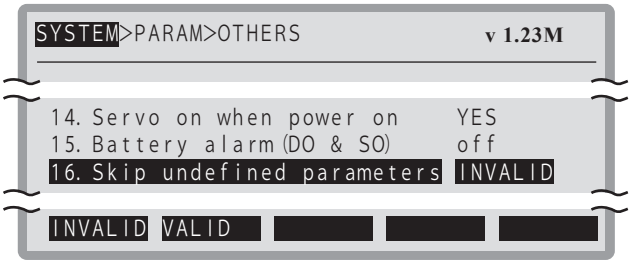
Controller version	Parameter number
Prior to Ver.1.24M	16.
Ver.1.24M to Ver.1.31M	22.
Ver.1.32M to Ver.1.60M	23.
Ver.1.61M onwards	24.

NOTE

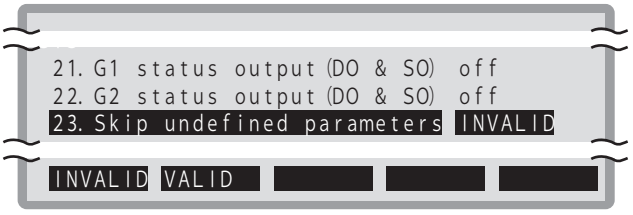
There are cases where new parameters are added according to the software upgrading for robot controllers. If you attempt to load the parameter file containing these new parameters into a controller of an earlier version, an error "10.14:Undefined parameter found" occurs.

Setting the "Skip undefined parameters"

Controller prior to Ver. 1.24M



Controller from Ver. 1.32M onwards



2.6 Parameters for option boards

This section explains how to set parameters for option boards from the programming box.
Option boards are divided into several types.

NOTE

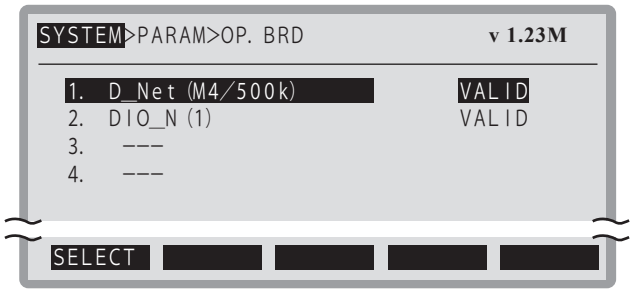
- For detailed information on serial I/O units such as CC-Link, Ethernet, YC-Link, and iVY system, refer to the respective user's manuals.
- No parameter setting is required for the YC-Link.

1 *Display the option board parameter screen*

In SYSTEM>PARAM mode, press F5 (OP.BRD).

The option board parameter setting mode is entered and the connected option boards are displayed in numeric order.

Option board parameter screen



2 *Check the option board settings*

The types of option board connected to the option slot are displayed.
To change the settings, refer to sections "2.6.1" to "2.6.3".
The board types and their displays are shown below.

Type	Display	Meaning
Option DIO	DIO_N(n)	An option DIO board of NPN specifications is installed. The number in parentheses is an ID number.
	DIO_P(n)	An option DIO board of PNP specifications is installed. The number in parentheses is an ID number.
Serial I/O	CCLnk(n/m)	A CC-Link unit is installed. Letters in parentheses indicate a station number "n" and a communication speed "m".
	D_Net(n/m)	A DeviceNet unit is installed. Letters in parentheses indicate a MAC ID number "n" and communication speed "m".
	Profi(n/m)	A PROFIBUS unit is installed. Letters in parentheses indicate a station address "n" and communication speed "m".
Network	E_Net	An Ethernet unit is installed.
YC-Link	YCLnk(Mn)	A YC-Link is installed. The number in parentheses indicates a station number "n".
iVY system	Vision	An iVY (VISION) unit is installed.
	V_Plus	A lighting control unit is installed.
	V_Plus_TRK	A tracking control unit is installed.
Electric gripper	Gripper1	Electric gripper (1st) is installed.
	Gripper2	Electric gripper (2nd) is installed.

When editing the parameters for option boards, the following keys and submenu are valid.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
F1	SELECT	Selects the option board for parameter setting.

2.6.1 Option DIO setting

The following parameter for option DIO (NPN or PNP specifications) boards is used to enable or disable monitoring of the 24V DC supply input.

	Parameter	Meaning
1	Board condition	Enables or disables monitoring of the 24V supply input. When set to "VALID", an error message will be issued if the 24V DC supply is shut off. When set to "INVALID", no error message will be issued if the 24V DC supply is shut off.

NOTE

Setting to "VALID" is recommended so that the 24V supply for the option board is monitored. Set to "INVALID" only when option boards that are not to be used are installed.

CAUTION

The robot controller itself operates even if 24V DC is not supplied to the option board. However, an option board not supplied with 24V DC will not perform input/output operations correctly.

1 ***Select the option DIO.***

In SYSTEM>PARAM>OP.BRD mode, select the desired option DIO with the cursor keys (▲ / ▼) and press F1 (SELECT).

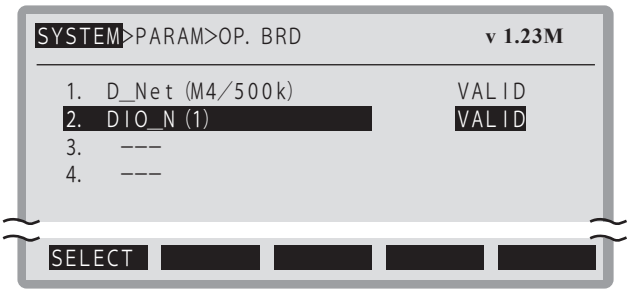
2 ***Select whether to enable or disable monitoring of the 24V DC power input.***

Press F1 (EDIT).

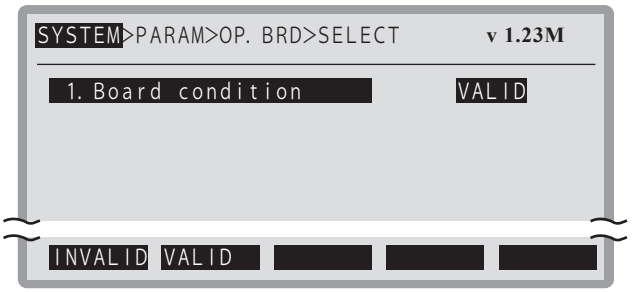
Next, press F1 (INVALID) or F2 (VALID) to select whether to monitor the 24V DC power input.

3 ***Press ESC to quit the edit mode.***

Step 1 **Option DIO setting**



Step 2 **Option DIO setting**



2.6.2 Serial I/O setting

For serial I/O boards (CC-Link/DeviceNet/PROFIBUS), there are 3 parameters (4 parameters for DeviceNet only) to be set, including the parameter to enable or disable the serial I/O unit.

	Parameter	Meaning
1	Board condition	Enables or disables the serial I/O board. When set to "VALID" the serial I/O can be used. When set to "INVALID" the serial I/O cannot be used.
2	Remote cmd / IO cmd (SI05)	Enables or disables the functions of remote commands and I/O commands using word information and bit information. When set to "VALID" the remote commands and I/O commands can be used. When set to "INVALID" the remote commands and I/O commands cannot be used. This parameter cannot be set to "VALID" simultaneously with parameter 3. When parameter 4 is set to "Small", the remote command cannot be used, although this parameter can be set to "VALID". (The I/O commands can be used, but use of them is limited partly.)
3	Output MSG to SOW(1)	Enables or disables the function that sends a message number, which is displayed on the programming box, to word information SOW(1). When set to "VALID" the message number to be displayed on the programming box will be output. When set to "INVALID" the message number to be displayed on the programming box will not be output. This parameter cannot be set to "VALID" simultaneously with parameter 2. Also, this parameter cannot be set to "VALID" when parameter 4 is set to "Small".
4	IO size (DeviceNet only)	Selects the number of channels occupied by the DeviceNet compatible module, from "Large" or "Small". (Default setting: Large) When set to "Large", 24 channels each are occupied by the input/output. When set to "Small", 2 channels each are occupied by the input/output. This parameter cannot be set to "Small" when parameter 3 is set to "VALID".

NOTE

- Set the Board status parameter to "INVALID" when not using serial I/O boards.
- When the Board status parameter is set to "INVALID", the dedicated input/output of the STD.DIO connector is enabled. When the Board status parameter is set to "VALID", the dedicated input (except DI11) of the STD.DIO is disabled.
- For remote commands and I/O commands, refer to the command reference manual.
- For a description of codes issued from the message output function for SOW (1), refer to the "Error messages" section in this manual.
- When the Remote command & I/O command parameter is set to "VALID", the Output MSG to SOW(1) parameter cannot be set to "VALID". Likewise, when the Output MSG to SOW(1) parameter is set to "VALID", the Remote command & I/O command parameter cannot be set to "VALID".
- When the IO size is set to "Small" (2CH each of input/output), the I/O commands can be used but the remote commands cannot be used. Note that use of the I/O command function is partly limited.
- When the IO size is set to "Small" (2CH each of input/output), the "Output MSG to SOW(1)" parameter function cannot be used.

1 ***Select the serial I/O.***

Select the desired serial I/O with the cursor keys and press F1 (SELECT).

2 ***Select the parameter.***

Select the parameter to be set with the up/down cursor keys (▲/▼) and then Press F1 (EDIT).

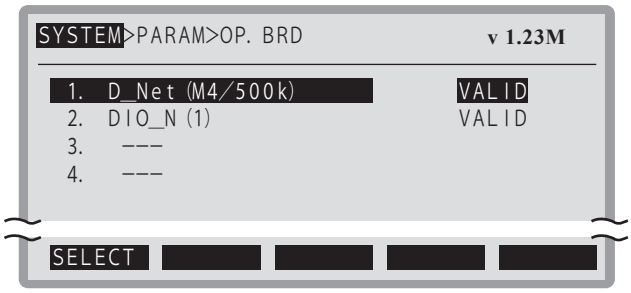
3 ***Set the parameter.***

Press F1 (INVALID) or F2 (VALID) to enter the setting.

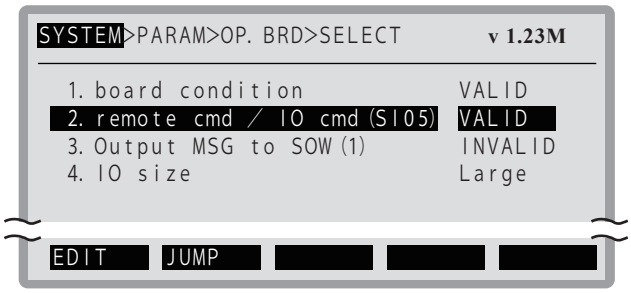
To select "4. IO size", press F1 (Large) or F2 (Small).

4 ***Press ESC to quit the edit mode.***

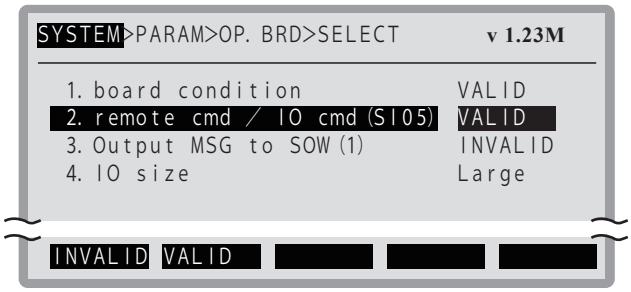
Step 1 **Selecting the serial I/O**



Step 2 **Set the serial I/O**



Step 3 **Set the parameter**



2.6.3 Setting the network parameters

When using Ethernet, you set five parameters including the parameter to enable or disable the Ethernet board.

CAUTION

When carrying out Ethernet communication, you will need to set parameters other than those shown below. For more details, see the Ethernet manual.

	Parameter	Meaning
1	Board condition	Enables or disables the Ethernet board. When set to "VALID" the Ethernet can be used. When set to "INVALID" Ethernet cannot be used.
2	IP address	Sets the IP address.
3	Subnet mask	Sets the subnet mask.
4	Gateway	Sets the gateway.
5	Communication mode	Sets the communication mode (online/offline). Online commands can be run only in the online mode.

NOTE

- The "communication mode" parameter is applicable to controllers with Ver. 1.23M onwards.
- The communication mode parameter can also be changed by the ONLINE or OFFLINE statement of the robot language.

1 ***Select "E_Net".***

Select "E_Net" with the cursor keys and press F1 (SELECT).

2 ***Select the parameter.***

Select the parameter to be set with the up/down (▲/▼) cursor keys and press F1 (Edit).

CAUTION

Changes you made to the IP address and subnet mask are enabled after restarting the robot controller. When connecting the robot controller to an existing network, always consult with the network administrator for the IP address, subnet mask and gateway settings.

3 ***Set the parameters.***

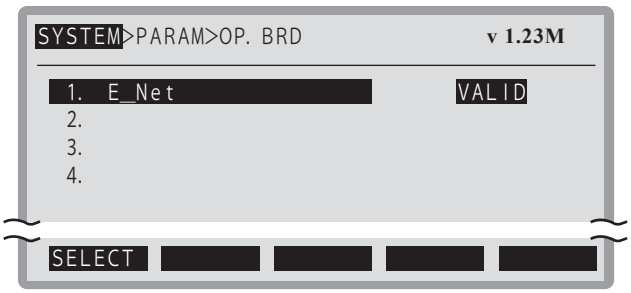
Press F1 (INVALID) or F2 (VALID) to change the "Board condition" setting.

Press F1 (OFFLINE) or F2 (ONLINE) to change the "Communication mode" setting.

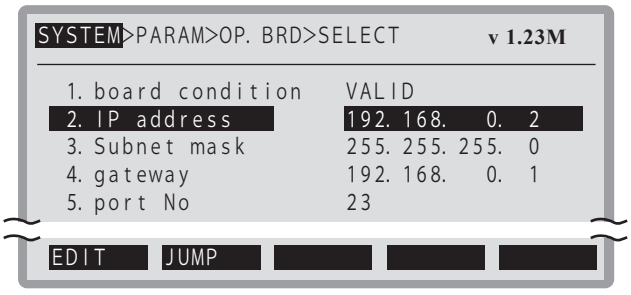
When changing other parameters, use 0 to 9 and . to make the setting and then press ENTER [Enter].

4 ***Press ESC to quit the edit mode.***

▶ **Step 1** **Select E_Net**



▶ **Step 2** **Network settings**



3. Communication parameters

Set the following parameters for communication procedures when using the RS-232C interface.

There are 8 kinds of communication parameters. The values to set the parameters are shown below.

	Name	Setting values	Reset value	Remarks
1	Communication mode	F1 Offline, F2 Online	Offline	Set the mode of communication with external equipment. Online commands are only executable when in online mode. Can be changed using ONLINE and OFFLINE commands in robot language.
2	Data bit	F1 7, F2 8	8	Sets the data bit length.
3	Baud rate	F1 4800, F2 9600, F3 19200, F4 38400, F5 57600	9600	Sets the communication speed. As the communication speed is increased it becomes easier for communication errors to occur. If communication errors occur frequently please set a lower communication speed.
4	Stop bit	F1 1, F2 2	1	Sets the stop bit length. If communication errors occur frequently please set to 2 bits.
5	Parity	F1 Off, F2 Odd, F3 Even	Odd	Sets the parity check. Please use parity check as much as possible.
6	Termination code	F1 CR, F2 CRLF	CRLF	Sets the line feed code.
7	XON/XOFF control	F1 Yes, F2 No	Yes	Sets whether or not data flow control using XON/XOFF codes is carried out. If data flow control is not carried out this may cause loss of data. Please use as much as possible.
8	RTS/CTS control	F1 Yes, F2 No	No	Carries out data flow control using RTS/CTS signals.

For detailed information, refer to Chapter 6, "RS-232C interface".

1 ***Press F2 (CMU) in SYSTEM mode.***

The communication parameter screen appears.

2 ***Select the parameter with the cursor (▲/▼) keys.***

Or press F2 (JUMP) and enter a parameter number to jump to that parameter item. Page keys (⏫, ⏬) can be also used.

3 ***Press F1 (EDIT).***

The edit mode entered by pressing F1 (EDIT) is effective until ESC is next pressed. Multiple parameter items can be set continuously.

4 ***Set the value.***

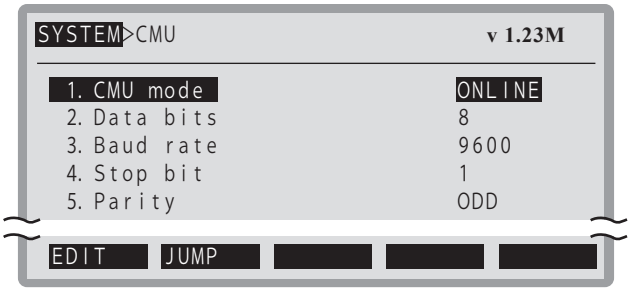
Set the value with the function keys.
The selectable values or items are displayed on the guideline.
To continue setting other items, use the cursor (▲/▼) keys to select them.

5 ***Press ESC to quit the edit mode.***

Valid keys and submenu descriptions in SYSTEM>CMU mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⏫ / ⏬		Switches to other screens.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

▶ **Step 1** **Communication parameter screen**



4. OPTION parameters

The OPTION parameters are used to set expanded controller functions.

Parameters consist of 4 types:

1. Parameters for the area check output
2. Parameters relating to the SAFE mode
3. Parameters relating to the serial I/O
4. Parameters relating to the individual axis return-to-origin function by general-purpose DI/SI

1 ***Enter SYSTEM, SYSTEM>OPTION mode.***

Press F3 (OPTION) in SYSTEM mode.

2 ***Display each parameter item.***

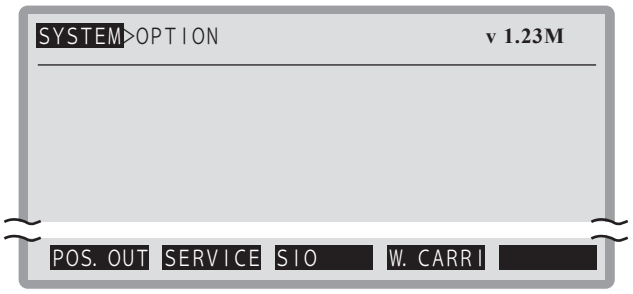
Press a key from F1 (POS. OUT) to F6 (DI. ORG).

3 ***Edit the parameters.***

Parameters can be edited by entering data with the number keys or by selecting the function keys. Refer to each parameter item for detailed information.

4 ***Press ESC to quit the parameter editing.***

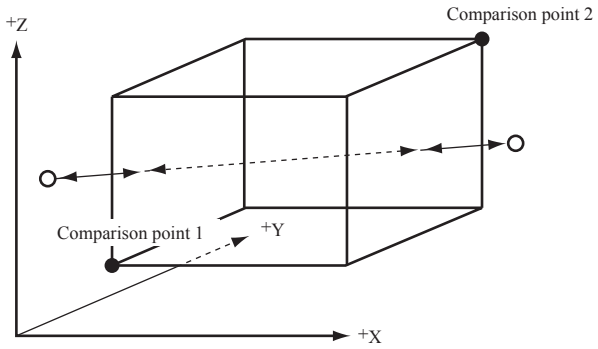
Step 2 **OPTION parameter setting**



4.1 Setting the area check output

This function checks whether the current robot position is within an area defined by the area check output parameter's point data, and outputs the result to the specified port.
When the comparison points ● are set as shown below, and the robot axis tip is moved between the ○ marks, the output is off at ◄——► and the output is on at ◄- - -►. (when the condition of the area check output is set to inside the area - "ON")

Setting area check output



The maximum number of areas that can be checked using controllers prior to Ver. 1.23M is 4. The maximum number of areas that can be checked using controllers from Ver. 1.23M onwards is 8.
The area check output includes the following 5 parameters.

1. **Area check on/off**
   Selects the robot for the area check.
2. **Area check output port No.**
   Selects the port to output the area check results to.
   The following port numbers can be used.

   • Controllers prior to Ver. 1.23M

DO/SO	Port No.
DO	20 to 27
SO	20 to 27

   • Controller from Ver. 1.23M onwards

DO/SO	Port No.
DO	20 to 27, 30 to 37, 40 to 47, 50 to 57, 60 to 67, 70 to 77, 100 to 107 110 to 117, 120 to 127, 130 to 137, 140 to 147, 150 to 157
SO	20 to 27, 30 to 37, 40 to 47, 50 to 57, 60 to 67, 70 to 77, 100 to 107 110 to 117, 120 to 127, 130 to 137, 140 to 147, 150 to 157

3. **Comparison point No. 1**
4. **Comparison point No. 2**

   Specify the point numbers to define the area.
   The area is applied to all set axes.
   If the R axis is set, always make sure that the comparison point's R axis data is set.
5. **Condition for area check output**
   Selects the condition that allows the area check output to turn on, from either when the robot is within a specified area or when outside it.

NOTE

- 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.
- Use caution to ensure that comparison point numbers do not overlap with point numbers used for other purposes.
  Example: Point numbers used for movement commands, point numbers used for pallet definition
- If the same port is designated for a different area check output, OR will be output.
- The area check cannot be performed and an error is displayed unless comparison points exist or the units of comparison points are the same. If this situation occurs during automatic operation, the automatic operation stops and an error is displayed. The area check output where the error occurred then turns off. Automatic operation cannot be performed until the error is cleared.
- Area check output will not function if return-to-origin is incomplete.
- The area check is carried out on all set axes. Use caution when setting the R axis point if using a system with four axes.
- If a port number which does not exist as hardware is specified as the area check output port number, nothing is output to external devices.

1 ***Display the area check output settings screen.***

Press F1 (POS. OUT).

2 ***Select an area check output number.***

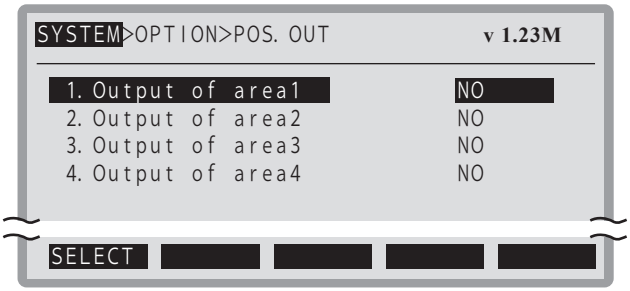
Use the cursor keys (▲/▼) to select the area check output number and press F1 (SELECT).

3 ***Select the area check output parameters.***

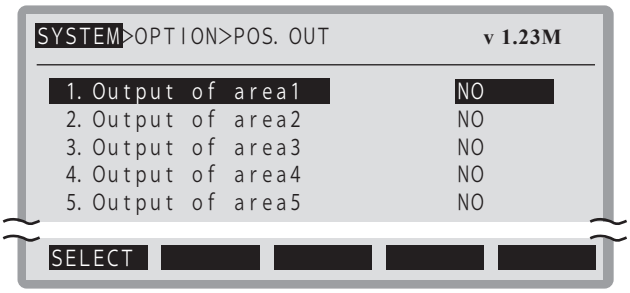
Select the parameter items with the cursor keys (▲/▼).

Step 1 **Selecting the area check output number**

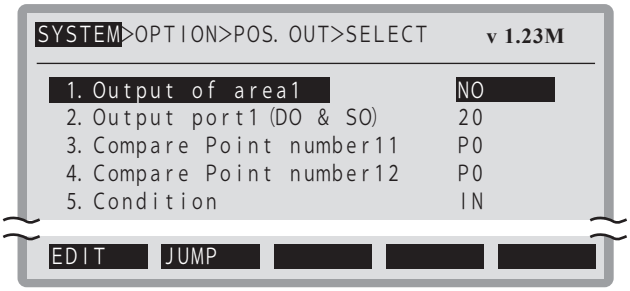
Controller prior to Ver. 1.23M



controller from Ver. 1.23M onwards



Step 3 **Selecting the area check output parameters**



Valid keys and submenu descriptions in this mode are shown below.

Valid keys	Menu	Function
▲/▼		Selects the area check output parameter.
F1	EDIT	Edits the area check output parameter.
F2	JUMP	Moves to the specified area check output parameter.

1. Area check output on/off

This parameter sets whether or not to use the area check output function.

Robot	Details
NO	The area check output is not executed.
MAIN	The area check output is executed for the main robot.
SUB	The area check output is executed for the sub robot.

NOTE

- Select the robot for the area check.
- "SUB" cannot be selected if there is no sub robot.

1 ***Select "1. Output of area n".***

Use the cursor keys (▲ / ▼) to select "1. Output of area n", and press F1 (EDIT).

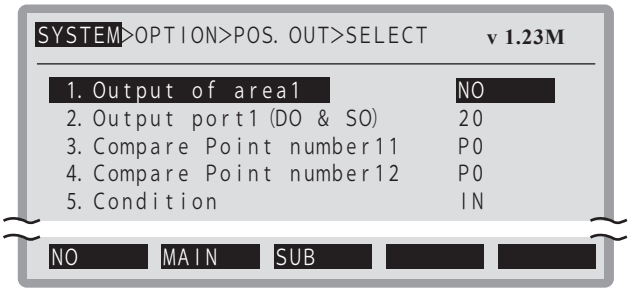
2 ***Select the robot for the area check.***

Select the robot for the area check by pressing F1 (NO) to F3 (SUB).

o continue setting other items, use the cursor (▲ / ▼) keys to select them.

3 ***Press ESC to quit the editing.***

Step 1 **Selecting the area check output target robots**



2. Area check output port No.

This parameter specifies the port to output the area check results to. The following ports can be used as area check output ports.

• Controllers prior to Ver. 1.23M

DO/SO	Port No.
DO	20 to 27
SO	20 to 27

• Controller from Ver. 1.23M onwards

DO/SO	Port No.
DO	20 to 27, 30 to 37, 40 to 47, 50 to 57, 60 to 67, 70 to 77, 100 to 107 110 to 117, 120 to 127, 130 to 137, 140 to 147, 150 to 157
SO	20 to 27, 30 to 37, 40 to 47, 50 to 57, 60 to 67, 70 to 77, 100 to 107 110 to 117, 120 to 127, 130 to 137, 140 to 147, 150 to 157

NOTE

- 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.
- If the serial I/O is enabled, the result will be output to the same numbered DO and SO ports.

1 ***Select "2. Output port1 (DO & SO)".***

Use the cursor keys (▲ / ▼) to select "2. Output port1 (DO & SO)" and press F1 (EDIT).

2 ***Select the output port.***

Controllers prior to Ver. 1.23M:

Press a key from F1 (20) to F8 (27) to select the output port.

Controllers of Ver. 1.23M onwards:

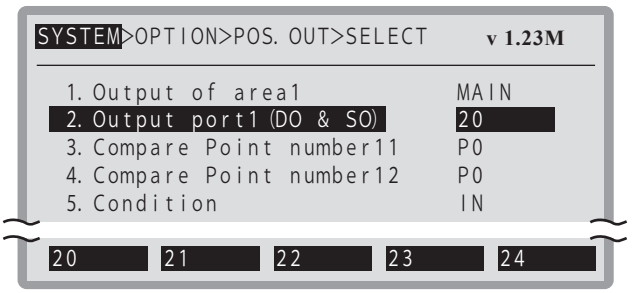
Enter the port number using the number keys 0 to 9 and press ENTER.

To continue setting other items, use the cursor (▲ / ▼) keys to select them.

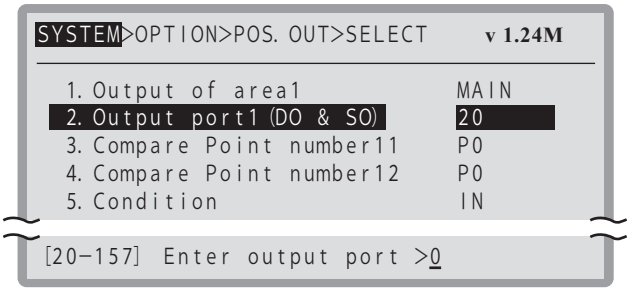
3 ***Press ESC to quit the editing.***

▶ **Step 2** **Selecting the output port**

Controllers prior to Ver. 1.24M



Controllers of Ver. 1.24M onwards



3. Comparison point No. 1

4. Comparison point No. 2

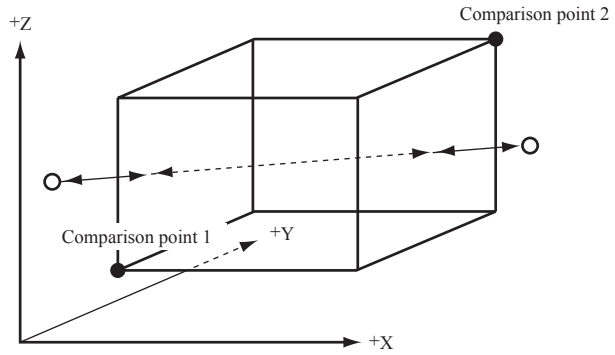
Set the point numbers for determining the area to perform area check. In controller software versions prior to Ver.1.69M, the usable area definition point numbers are P0 to P4000. From Ver.1.69M onwards, the usable area definition point numbers are P0 to P9999.

Example: When the comparison points ● are set as shown below, and the robot axis tip is moved between the ○ marks, the output is off at ◄——► and the output is on at ◄- - -►. (when "5. Condition" is set to "IN")

NOTE

By changing the "5. Condition" setting, it is possible to select whether the robot position should be within a specified area or outside it in order to turn on the output status.

When points are designated in Cartesian coordinates ("mm" unit system)



NOTE

- The units of comparison point numbers 1 and 2 must be the same to perform correct operation.
- The area check cannot be performed and an error is displayed unless comparison points exist or the units of comparison points are the same. If this situation occurs during automatic operation, the automatic operation stops and an error is displayed. The area check output where the error occurred then turns off. Automatic operation will not function when an error is occurring.
- The area check is carried out on all set axes. Take care when setting the R axis point if using the system with four axes.
- Always provide a margin when setting the comparison point data. Area checking may become unreliable when the data from 2 comparison points is almost identical.

1 ***Select "3. Compare point number n1".***

Use the cursor keys (▲ / ▼) to select "3. Compare point number n1", and press F1 (EDIT).

2 ***Enter the point number.***

Enter the point number using the 0 to 9 number keys and press ENTER.

3 ***Select "4. Compare Point number n2".***

Use the cursor keys (▲ / ▼) to select "4. Compare point number n2", and enter the point number using the same method as in Step 2.

To continue setting other items, use the cursor (▲ / ▼) keys to select them.

4 ***Press ESC to quit the editing.***

Step 2 **Entering the comparison point numbers for area check output**

```
SYSTEM>OPTION>POS. OUT>SELECT      v 1.23M

  1. Output of area1               MAIN
  2. Output port1 (DO & SO)        20
  3. Compare Point number11        P0
  4. Compare Point number12        P0
  5. Condition                     IN

[0-4000] Enter point no. >0
```

5. Condition for area check output

Selects the condition that allows the area check output to turn on, from either when the robot is within a specified area or when outside it.

Setting	Meaning
IN	Turns on when the robot enters a specified area.
OUT	Turns on when the robot goes out of a specified area.

NOTE

- Any point on the boundary of the specified area is determined to be within the area.
- If the area check cannot be performed correctly due to return-to-origin incomplete, operation other than MANUAL or AUTO mode, or a memory error, then the area check output will turn off regardless of the criterion setting.If the specified port is the same as the port used by the program, then the area check output has priority.
- The default setting is "IN" (output is on within specified area).

1 ***Select "5. Condition".***

Use the cursor keys (▲ / ▼) to select "5. Condition" in SYSTEM>OPTION>POS. OUT>SELECT mode, and press F1 (EDIT].

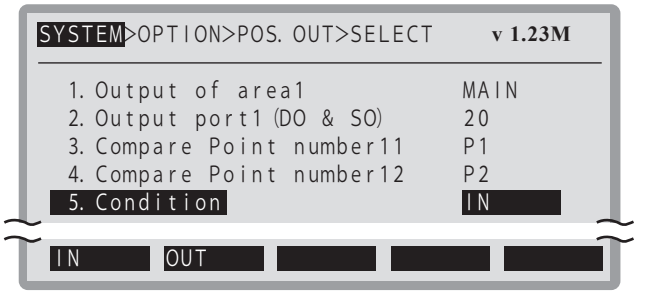
2 ***Select the criterion for area check output.***

Press F1 (IN) or F2 (OUT).

To continue setting other items, use the cursor (▲ / ▼) keys to select them.

3 ***Press ESC to quit the editing.***

Step 1 **Criterion selection for area check output**



4.2 Setting the SERVICE mode

When using SERVICE mode to safely perform tasks using the programming box within the robot system safety enclosure, make parameter settings as explained in this section.
Unless changes to parameter settings are saved, they are only valid until the controller power is turned off.
SERVICE mode is enabled or disabled by input through the ID02/SI02 (service mode) ports.

NOTE

SERVICE mode functions can only be utilized when the necessary settings were made by the distributor prior to shipping.

WARNING

IN SERVICE MODE, 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.

CAUTION

The dedicated input is SI when the serial board is connected.

There are 3 parameters for SERVICE mode.

■ SERVICE mode level

Select the SERVICE mode level by referring to the table below.

	Description	
	Hold to Run function	**AUTO mode operation**
Level 0	Disabled	Allowed
Level 1	Enabled	Allowed
Level 2	Disabled	Prohibited
Level 3 (default setting)	Enabled	Prohibited

* The Hold to Run function indicates that the robot operation (including program execution) is executed only when the keys are held down on the programming box.

■ Operating speed limits in SERVICE mode

Specify the maximum robot operating speed.

	Description
<3% (default setting)	Sets robot operation within 3% of maximum operating speed.
<100%	Sets no limit on robot operating speed.

■ Operating device during SERVICE mode

Specify the operating device to use.

	Description
PB (default setting)	Only programming box operation is allowed.
PB/DI	Allows programming box and dedicated input.
PB/COM	Allows programming box and online commands.
ALL	Allows operation by all devices.

NOTE

The settings made here are only valid until the controller power is turned off. Save these settings if you want to use them again after power is turned off.

WARNING

ALTHOUGH SETTING CHANGES ARE POSSIBLE ONLY IN CASES WHERE JUDGED NOT HAZARDOUS, ADEQUATE CARE SHOULD BE TAKEN TO ENSURE SAFETY.

1 ***Display the SERVICE mode settings screen.***

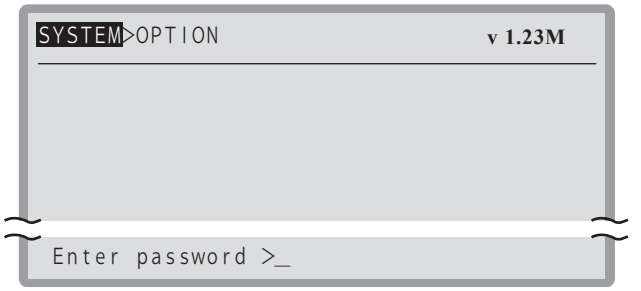
Press F2 (SERVICE) in SYSTEM>OPTION mode and an "Enter password" message will appear on the guideline.

2 ***Enter the password.***

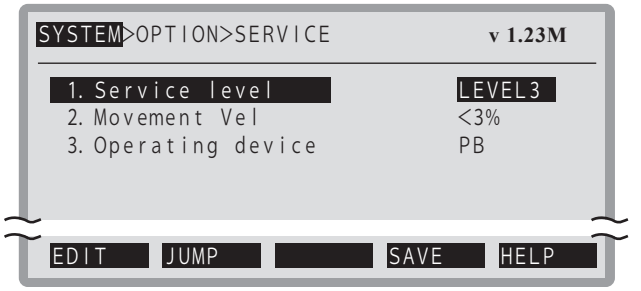
Enter the password, "SAF", and press ENTER.

When the password is correctly entered the "SYSTEM>OPTION>SERVICE" screen will appear.

Step 1 Entering the SERVICE mode setting password



Step 2 SERVICE mode initial screen



Valid keys and submenu descriptions in this mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Selects the SERVICE mode parameters.
F1	EDIT	Edits the SERVICE mode parameters.
F2	JUMP	Moves to the designated SERVICE mode parameter.
F4	SAVE	Saves the designated SERVICE mode parameter.
F5	HELP	Displays the help message for each setting.

An example of how to change the parameter settings in SERVICE mode is shown below. The example shows how to change the service level.

1 ***Select "1. Service level".***

Select "1. Service level" in SYSTEM>OPTION>SERVICE mode, and press F1 (EDIT).

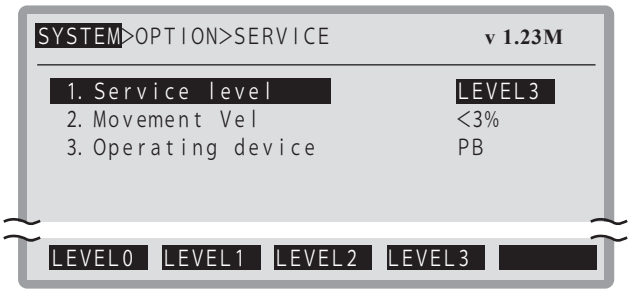
2 ***Select the SERVICE mode level.***

Press a key from F1 (LEVEL0) to F4 (LEVEL3) to select the SERVICE mode level.

To continue setting other items, use the cursor (▲ / ▼) keys to select them.

3 ***Press ESC to quit the editing.***

Step 2 **Select service mode level**



4.2.1 Saving the SERVICE mode parameters

This section explains how to save changes to the SERVICE mode parameters.
Unless changes to parameter settings are saved, they are only valid until the controller power is turned off.

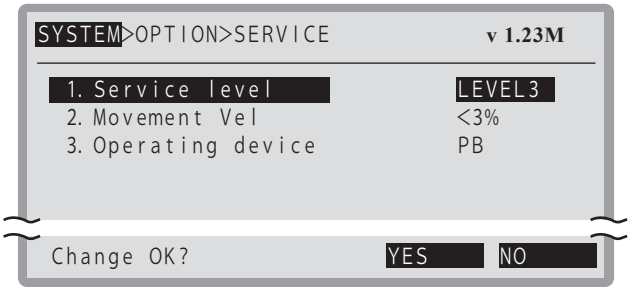
WARNING

IN SERVICE MODE, CHANGING THE SETTINGS FROM THEIR DEFAULT VALUES IS LIKELY TO INCREASE HAZARDS TO THE ROBOT OPERATOR DURING MAINTENANCE OR OPERATION. ALTHOUGH SETTING CHANGES ARE POSSIBLE ONLY IN CASES WHERE JUDGED NOT HAZARDOUS, ADEQUATE CARE SHOULD BE TAKEN TO ENSURE SAFETY.

Press F4 (SAVE) in SYSTEM>OPTION>SERVICE mode.

When you have made changes to the parameters, a message appears on the guideline asking if you want to save the setting.

Saving the SERVICE mode parameters



Press F4 (YES) to save the setting.

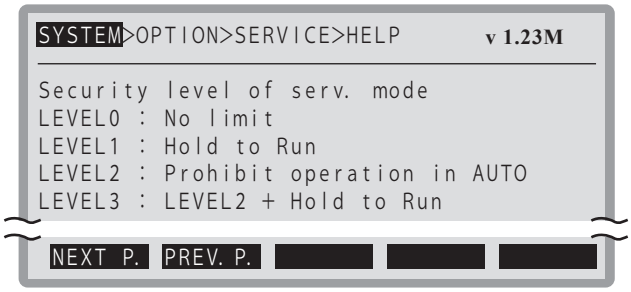
Press F5 (NO) if you want to cancel the setting.

4.2.2 Help display in SERVICE mode

To display the help messages for SERVICE mode parameters, proceed as follows.

Press F5 (HELP) in SYSTEM>OPTION>SERVICE mode to display help messages.

Help display in SERVICE mode



Press F1 (NEXT P.) to display the next message page.

Press F2 (PREV. P.) to display the previous message page.

Press ESC to quit this mode.

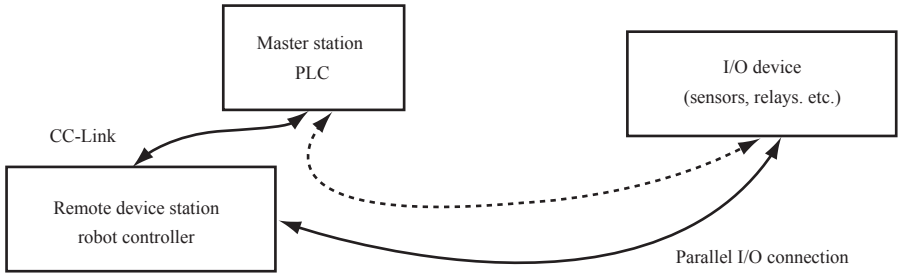
4.3 SIO settings

This sets the pseudo-serialization function of the parallel I/O.
The pseudo-serialization function allows the master station sequencer (PLC) to send and receive parallel I/O ON/ OFF data connected to the robot controller via the serial I/O.
This function allows using I/O devices such as sensors and relays as serial-connected devices.

NOTE

- If the port used by the user program is duplicated, the output data might change.
- These settings are only valid when the serial I/O unit is connected.

SIO overview

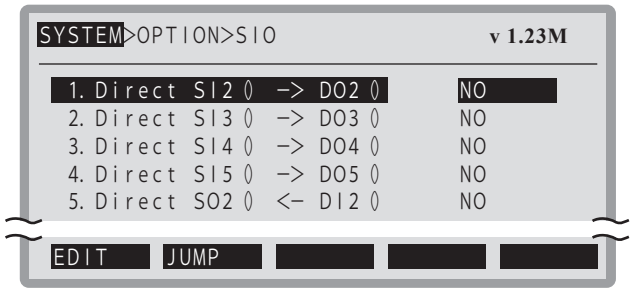


The relation between parallel and serial ports that can be set are shown below.

Input devices such as sensors		Output devices such as valves	
DI port → SO port		DO port ← SI port	
DI2()	SO2()	DO2()	SI2()
DI3()	SO3()	DO3()	SI3()
DI4()	SO4()	DO4()	SI4()
DI5()	SO5()	DO5()	SI5()

In SYSTEM>OPTION mode, pressing F3 (SIO) displays the SYSTEM>OPTION>SIO mode screen.

SIO setting screen



Valid keys and submenu descriptions in this mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Selects the SIO parameter.
F1	EDIT	Changes the SIO parameter.
F2	JUMP	Moves the cursor to the designated SIO parameter.

1. Direct connection from SI n ( ) to DO n ( )

The serial port input can be directly connected to parallel port output. The relation between parallel and serial ports that can be set is as follows.

NOTE

If the port used by the user program is duplicated, the output data might change.

Output devices such as valves	
DO port ← SI port	
DO2()	SI2()
DO3()	SI3()
DO4()	SI4()
DO5()	SI5()

1 ***Select the port number.***

Select from 1 to 4 in SYSTEM>OPTION>SIO mode and press F1 (EDIT).

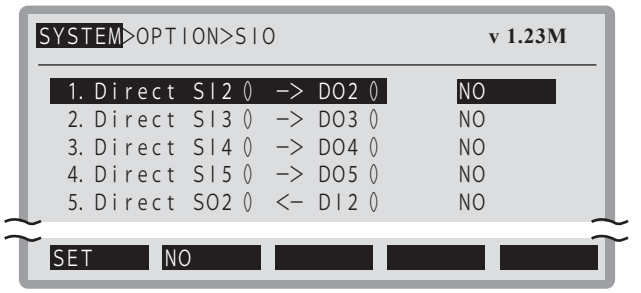
2 ***Set the parameter.***

Press F1 (SET) or F2 (NO) to enter the setting.

To continue setting other items, use the cursor (▲/▼) keys to select them.

3 ***Press ESC to quit the editing.***

Step 1 **Editing the SIO settings (1)**



2. Direct connection from DI n ( ) to SO n ( )

This section shows how to set parallel port input to be directly connected to serial port output.
The relation between serial and parallel ports that can be set is as follows.

NOTE

If the port used by the user program is duplicated, the output data might change.

Input devices such as sensors	
DI port → SO port	
DI2()	SO2()
DI3()	SO3()
DI4()	SO4()
DI5()	SO5()

1 ***Select the port number.***

Select from 5 to 8 in SYSTEM>OPTION>SIO mode and press F1 (EDIT).

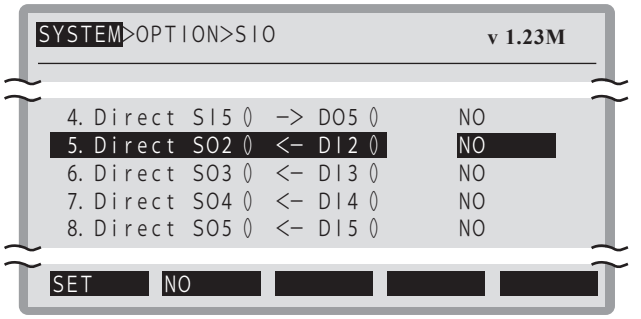
2 ***Set the parameter.***

Press F1 (SET) or F2 (NO) to enter the setting.

To continue setting other items, use the cursor (▲/▼) keys to select them.

3 Press ESC to quit the editing.

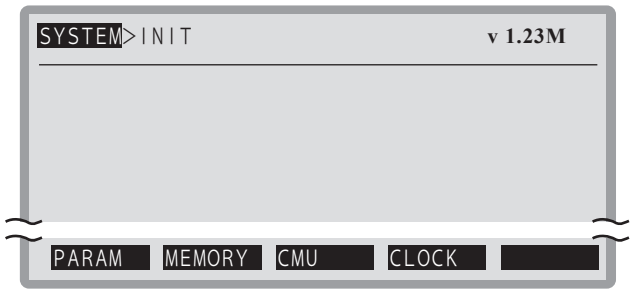
Step 1 **Editing the SIO settings (2)**



5. Initialization

This section shows how to initialize the controller's data.
In SYSTEM mode, pressing F4 (INIT) displays the SYSTEM>INIT mode initialization screen.

Initialization screen



Select the item to initialize with F1 (PARAM) to F4 (CLOCK).

Valid keys and submenu descriptions in the SYSTEM>INIT mode are shown below.

Valid keys	Menu	Function
F1	PARAM	Initializes the parameter settings.
F2	MEMORY	Deletes the user memory.
F3	CMU	Sets the communication parameters to the initial values.
F4	CLOCK	Sets the clock.
F6	GENERAT	Sets the robot model. (A password must be entered to release the lock.)
F10	PASSWRD	Enter the password required to release the F6 lock.

5.1 Initializing the parameters

To initialize the "robot" parameters, "axis" parameters and "other" parameters, follow the procedure below.
The "Display language (JPN/ENG)" setting among "other" parameters is not changed by initialization.

NOTE

- Entire parameter is initialized. (Except for display letters.)
- Return-to-origin will be incomplete if this parameter is changed.

1 ***Select the parameter.***

Press F1 (PARAM).

A message "Enter password" appears on the guideline.

2 ***Input the password.***

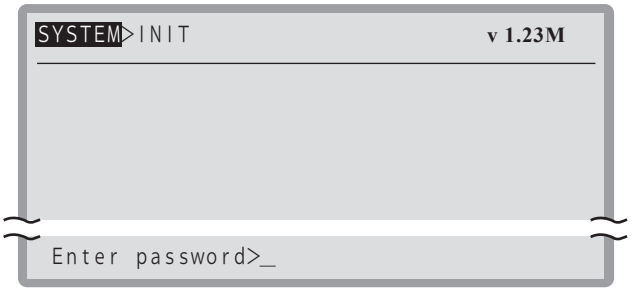
Enter "INI" as the password and press ENTER.

3 ***Initialize the parameters.***

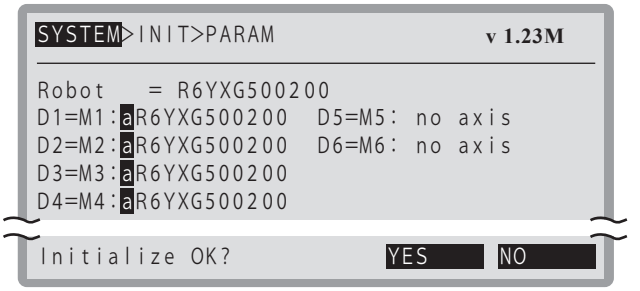
A confirmation message appears on the guideline when the correct password is entered. Press F4 (YES) to initialize the parameters.

If you do not wish to initialize, press F5 (NO).

Step 2 **Initializing the parameters**
Password entry



Step 3 **Initializing the parameter**



5.2 Initializing the memory

This initializes the program, point data, shift coordinates, hand definitions and pallet definitions.
Before initializing, make sure that the currently input data is no longer needed.

NOTE

- External data must be input to restore the memory after it has been initialized.
- The memory must be initialized if damaged due to some kind of problem.

Valid keys and submenu descriptions in SYSTEM>INIT>MEMORY mode are shown below.

Valid keys	Menu	Function
F1	PROGRAM	Deletes the program data.
F2	POINT	Deletes the point data.
F3	SHIFT	Initializes the shift coordinate data.
F4	HAND	Initializes the hand definition data.
F5	ALL	Deletes/initializes all data (program, point, shift coordinates, hand definition, pallet definition, point comment).
F6	PALLET	Deletes the pallet definition data.
F7	COMMENT	Deletes the point comment data.

1 ***Select "MEMORY".***

Press F2 (MEMORY).

2 ***Select the item to initialize.***

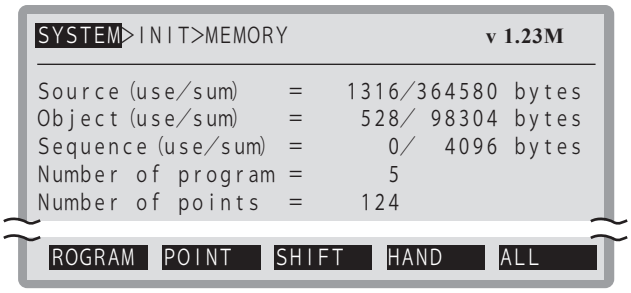
Press a key from F1 (PROGRAM) to F7 (COMMENT) to select the item to initialize.
A confirmation message appears on the guideline.

3 ***Initialize.***

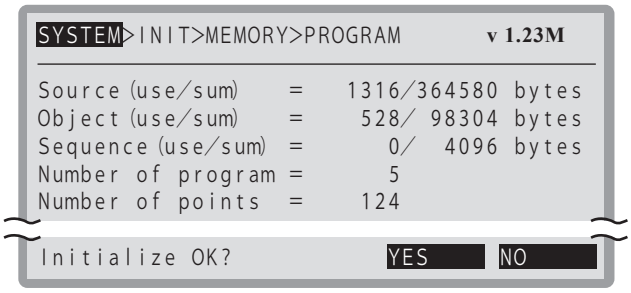
Press F4 (YES) to initialize the selected item.

If not initializing, press F5 (NO).

Step 1 **Initializing the memory**



Step 2 **Initializing the memory (program)**



5.3 Initializing the communication parameters

To initialize the communication parameters, proceed as follows.

1 ***Select "CMU".***

Press F3 (CMU).

A confirmation message appears on the guideline.

2 ***Initialize.***

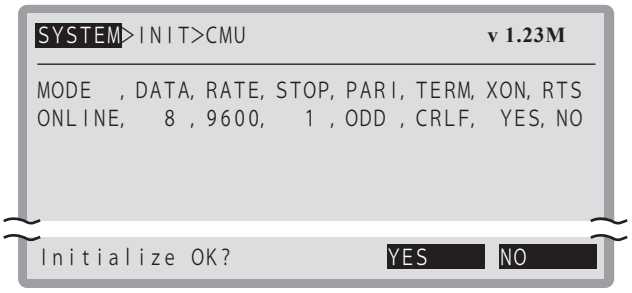
Press F4 (YES) to initialize the selected item.

If not initializing, press F5 (NO).

Values to be set are as follows.

1. Communication mode = ONLINE
2. Data bit = 8 bits
3. Baud rate = 9600bps
4. Stop bit = 1 bit
5. Parity = ODD
6. Termination code = CRLF
7. XON/XOFF control = YES
8. RTS/CTS control = NO

Step 1 **Initializing the communication parameters**



5.4 Clock setting

A clock function is provided in the controller for setting the date and time.

CAUTION

The time on the clock used in the controller might differ from the correct time.
If this happens, set the correct time.

1 ***Press F4 (CLOCK) in SYSTEM>INIT mode.***

The present date and time are displayed.

2 ***Select the item to set.***

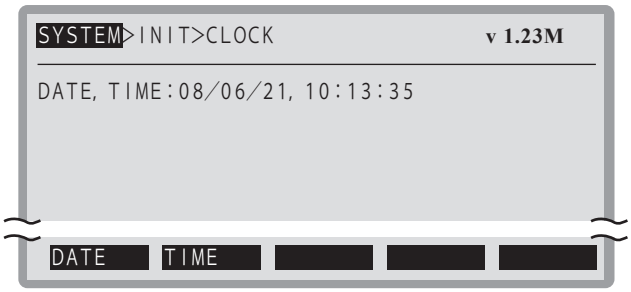
Press F1 (DATE) or F2 (TIME).

A confirmation message appears on the guideline.

3 ***Enter the date or time in the specified format.***

Use 0 to 9, /, and : to enter the date or time, and press ENTER.

Step 1 Initializing the clock



Valid keys	Menu	Function
F1	DATE	Sets the year/month/date.
F2	TIME	Sets the hours/minutes/seconds.

5.5 System generation

When F6 (GENERAT) is pressed in SYSTEM>INIT mode, the system generation settings screen is displayed.

However, this display is normally locked.
Prior to shipment the specifications for the robot being connected and the axis configurations are set in in the robot controller's system generation. Therefore the user does not need to set the system generation.

Should the memory for the system generation be destroyed by some serious problem the user must make the correct system generation settings. To protect the equipment against such accidents, save the initial parameter data when shipped from OMRON and the parameter data from system upgrades onto an external PC storage device by way of the RS-232C.

Please contact the distributor for system generation operating methods.

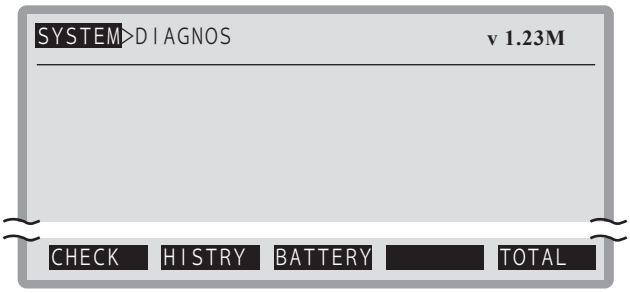
CAUTION

- If you change the system generation by mistake, this may adversely effect robot operation or create operator hazards. Always consult the distributor if changes have been made.
- Please note that the distributor cannot be held liable for problems resulting from changing the system generation settings without first consulting the distributor .

6. Self diagnosis

In SYSTEM mode, pressing F5 (CHECK) displays the SYSTEM>DIAGNOS mode screen.
This screen allows checking the controller and displays the error history.

Self diagnosis



Valid keys and submenu descriptions in SYSTEM>DIAGNOS mode are shown below.

Valid keys	Menu	Function
F1	CHECK	Makes a check of the controller.
F2	HISTORY	Displays the past error history.
F3	BATTERY	Checks to see if the battery voltage is low.
F5	TOTAL	Allows checking the controller operation time.
F15	SYS.CHK	Displays details of major software errors that occurred in the past.

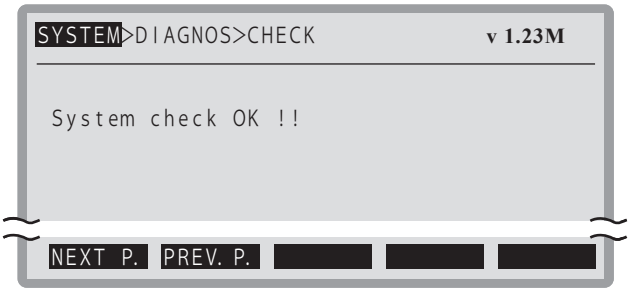
6.1 Controller check

This makes a self-diagnosis check of the controller.

NOTE
An error message will always appear if 24V DC power is not supplied to STD.DIO.
An error message will always appear if 24V DC power is not supplied to the option DIO.

Press F1 (CHECK) in SYSTEM>DIAGNOS mode.
The controller is then checked, and a "System check OK" message appears if no errors are detected.
An error message appears if an error is detected.
Press ESC to return to SYSTEM>DIAGNOS mode.

System check



6.2 Error history display

To display past errors that occurred, follow the procedure below. A maximum of 500 items may be stored in the error history.

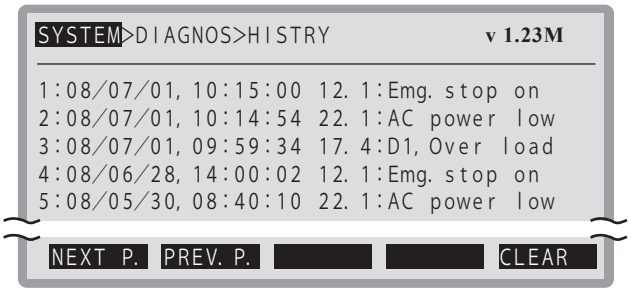
Press F2 (HISTRY) in SYSTEM>DIAGNOS mode.

One screen displays the past 5 errors in order from the most recent error.

Error information is displayed in the following format.

Number: <Date>, <Time (hour:minute:second)> <Error No.>:<Error message>

Error history



Use the cursor keys (▲/▼) to scroll the error history screen up or down one line.

Use F1 (NEXT P.) or F2 (PREV. P.) to scroll the screen up or down one page.

CAUTION

The error history contains extremely important information required to correct robot problems. Use care to avoid accidentally initializing the error history.

NOTE

- History is deleted from the oldest item first if the number of error history items exceeds 500.
- Errors are not recorded when identical to a preceding error that just occurred.
- The error category "0" is not recorded.

To reset the error history, press F5 (CLEAR).

Press ESC to return to SYSTEM>DIAGNOS mode.

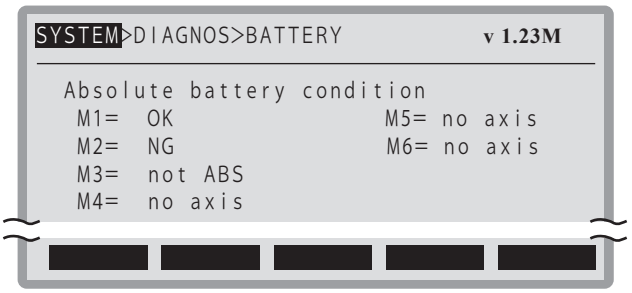
6.3 Displaying the absolute battery condition

Use the following procedure to check whether the battery for retaining absolute data is low or not.

Press F3 (BATTERY) in SYSTEM>DIAGNOS mode.

The condition of each battery is displayed.

Displaying the absolute battery condition



The display shows "OK" when the absolute battery voltage is higher than a preset value.
The display shows "NG" (no good) when the voltage is lower than a preset value.
The message "not ABS" appears for non-absolute type axes.

Press ESC to return to SYSTEM>DIAGNOS mode.

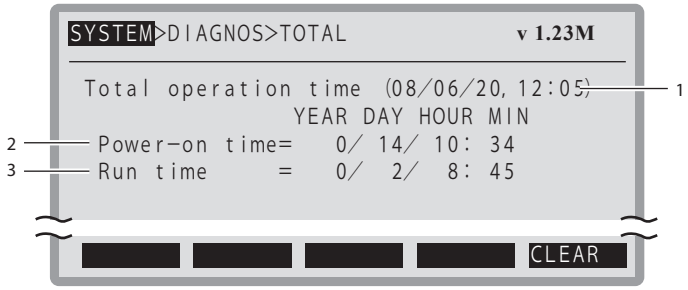
6.4 Displaying the total operation time

Use the following procedure to check the total controller operation time.

Press F5 (TOTAL) in SYSTEM>DIAGNOS mode.

The total controller operation time is displayed.

Displaying the total operation time



1. The 3rd line shows the date and time that the total operation time was reset.
2. The "Power-on time" is the total time that the controller power has been on.
3. The "Run time" is the total time that the controller has performed automatic operation.

To reset the total operation time, press F5 (CLEAR).

This will calculate the new total operation time starting from the date and time after the reset.

Press ESC to return to SYSTEM>DIAGNOS mode.

6.5 System error details display

Details of important software errors that have occurred in the past can be displayed.

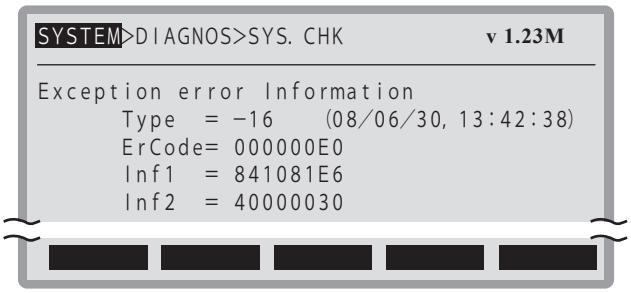
NOTE

When the error history is initialized, this will also initialize information regarding severe software errors.

Press F15 (SYS. CHK) in SYSTEM>DIAGNOS mode.

Details of the errors that have occurred are displayed.
"No system error code" will appear if no error has occurred.

Error details

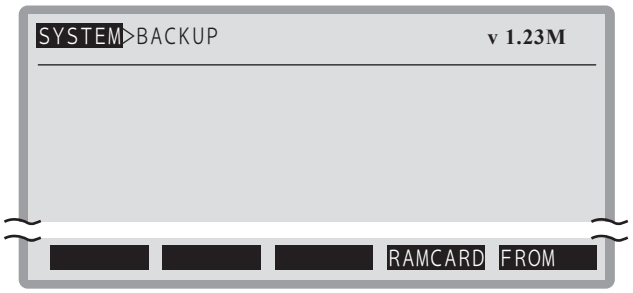


Press ESC to return to the SYSTEM>DIAGNOS mode.

7. Backup processes

In SYSTEM mode, pressing F9 (BACKUP) displays the SYSTEM>BACKUP mode screen. The various data can be backed up to the internal flash ROM in the controller's internal memory.

Backup



Valid keys and submenu descriptions in SYSTEM>BACKUP mode are shown below.

Valid keys	Menu	Function
F4	RAM CARD	Does not function.
F5	FROM	Saves and recovers data with the internal flash ROM.

7.1 Internal flash ROM

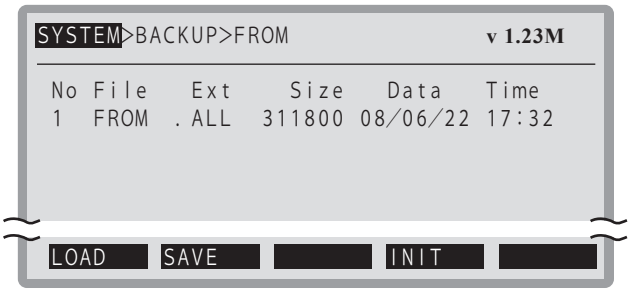
The controller's internal flash ROM contains an area where data can be saved.
Various data from the controller's internal memory can be saved to the flash ROM. Data saved in the flash ROM can also be loaded back into the controller's internal memory.

NOTE

If data in the internal memory is destroyed for any reason, it can be restored to the controller's internal memory by loading the saved data from the internal flash ROM.
We recommend backing up the data in the internal flash ROM before starting the robot system.

In SYSTEM>BACKUP mode, pressing F5 (FROM) displays the SYSTEM>BACKUP>FROM mode screen.

Backup screen



CAUTION

- If the internal flash ROM suffers a hardware failure, saved data cannot be loaded back. Always save the data onto an external storage device such as a PC.
- If an abnormal process occurs, such as the power being turned OFF while data is being saved, the data cannot be guaranteed.

Valid keys and submenu descriptions in SYSTEM>BACKUP>FROM mode are shown below.

Valid keys	Menu	Function
F1	LOAD	Loads the data backed up in the internal flash ROM into the controller's internal memory.
F2	SAVE	Saves the controller's internal memory data into the internal flash ROM as backup data.
F4	INIT	Initializes the internal flash ROM data. All data in the flash ROM is erased.

7.2 Loading files

The various data saved in the internal flash ROM can be loaded back into the controller's internal memory.

NOTE

If data in the internal memory is destroyed for any reason, it can be restored to the controller's internal memory by loading the saved data from the internal flash ROM.
We recommend backing up the data in the internal flash ROM before starting the robot system.

1 ***Press F1 (LOAD) in the SYSTEM>BACKUP>FROM mode.***

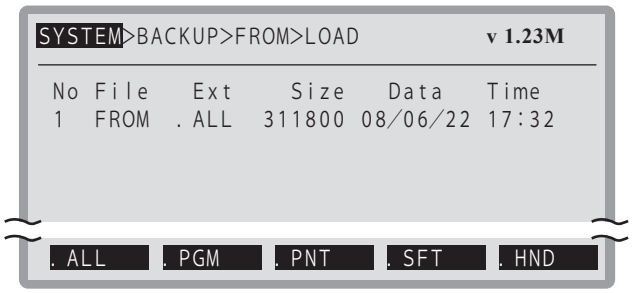
The types of files will appear in the guideline.

2 ***Select the type of file to be loaded.***

Select the type of file to be loaded by pressing F1 (.ALL) to F9 (.PCM).

A confirmation message appears on the guideline.

Step 2 Loading FROM



CAUTION

- When reading data as ALL files or as parameter files, the controller's servo must be turned off. After the files are read, the return-to-origin incomplete state will be set.
- If the internal flash ROM suffers a hardware failure, saved data cannot be loaded back. Always save the data onto an external storage device such as a PC.
- If an abnormal process occurs, such as the power being turned OFF while data is being saved, the data cannot be guaranteed.

Valid keys and submenu descriptions in SYSTEM>BACKUP>FROM>LOAD mode are shown below.

Valid keys	Menu	Function
F1	.ALL	Data is loaded in ALL file format.
F2	.PGM	Data is loaded in program file format.
F3	.PNT	Data is loaded in point file format.
F4	.SFT	Data is loaded in shift file format.
F5	.HND	Data is loaded in hand file format.
F6	.PRM	Data is loaded in parameter file format.
F8	.PLT	Data is loaded in pallet file format.
F9	.PCM	Data is loaded in point comment file format.

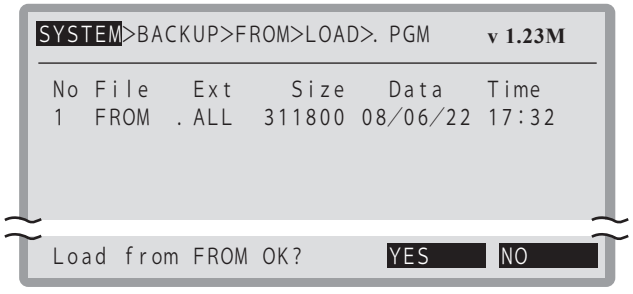
3 ***Load data***

Press F4 (YES) to load the data.

Press F5 (NO) to cancel the procedure.

The message "0.5: Accessing" appears during loading.

Step 3 Check of FROM loading



7.3 Saving files

The data in the controller's internal memory are saved as ALL files on the internal flash ROM. The data cannot be saved separately. If data is already saved then it is not possible to save new data. Before saving data, initialize (reset) the internal flash ROM.

NOTE

If data in the internal memory is destroyed for any reason, it can be restored to the controller's internal memory by loading the saved data from the internal flash ROM.
We recommend backing up the data in the internal flash ROM before starting the robot system.

1 ***Press F2 (SAVE) in the SYSTEM>BACKUP>FROM mode.***

A confirmation message appears on the guidelines.

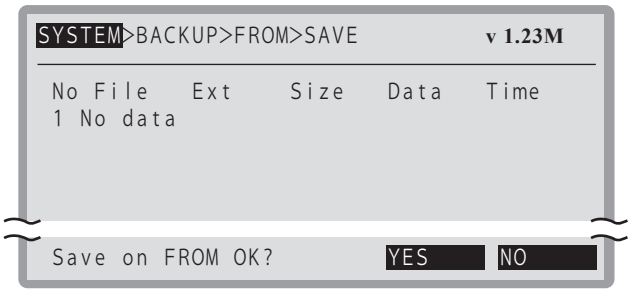
2 ***Save data.***

Press F4 (YES) to save the data.

Press F5 (NO) to cancel saving the data.

The message "0.5: Accessing" appears during saving.

Step 2 Check of saving on FROM



CAUTION

- If the internal flash ROM suffers a hardware failure, saved data cannot be loaded back. Always save the data onto an external storage device such as a PC.
- If an abnormal process occurs, such as the power being turned OFF while data is being saved, the data cannot be guaranteed.
- The "Skip undefined parameters" setting among "other" parameters will not be saved.

7.4 Initializing the files

The data saved on the controller's flash ROM is initialized.

NOTE

If data in the internal memory is destroyed for any reason, it can be restored to the controller's internal memory by loading the saved data from the internal flash ROM.
We recommend backing up the data in the internal flash ROM before starting the robot system.

1 ***Press F4 (INIT) in the SYSTEM>BACKUP>FROM mode.***

A confirmation message appears on the guidelines.

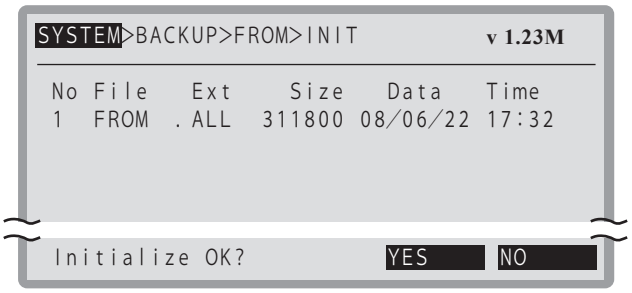
2 ***Initialize.***

Press F4 (YES) to initialize the data.

Press F5 (NO) to cancel the procedure.

The message "0.5: Accessing" appears during initialization.

▶ **Step 2** **Check of FROM initialization**



CAUTION

- If data is already written in, the data must be saved after the initialization process.
- If the internal flash ROM suffers a hardware failure, saved data cannot be loaded back. Always save the data onto an external storage device such as a PC.
- If an abnormal process occurs, such as the power being turned OFF while data is being saved, the data cannot be guaranteed.

Chapter 8 Periodic inspection

Contents

1. Before carrying out work

In order to operate the robot safely and more efficiently, carry out periodic inspections 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.

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.

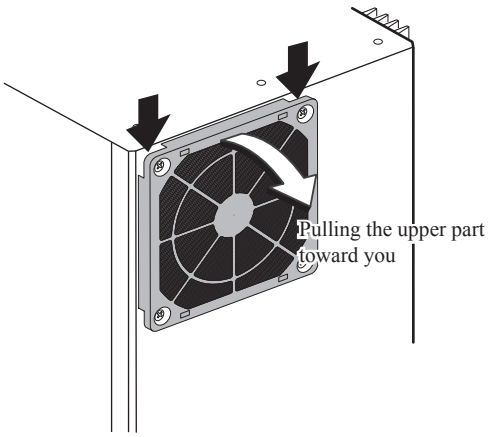
2 ***Check the fan filter for dirt and damage.***

Replace the filter if it is dirty or is damaged.

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**



4. Maintenance parts

■ Consumable parts

Part name	Part No.	Remarks
Absolute battery	KAS-M53G0-11	3.6V 2750mAH
Fan filter	KX0-M427G-00	5 / bag

■ Other parts

Part name	Part No.	Remarks
Absolute battery holder	KBG-M5395-00	

Chapter 9 Specifications

Contents

1. Controller

1.1 YRC basic specifications

Item			YRC
Basic specifications	Applicable robots		OMRON SCARA robots
	Connected motor capacity		1600W or less (in total for 4 axes)
	Power capacity		2500VA
	Dimensions		W180 × H250 × D235 (main unit)
	Weight		6.5kg (main unit)
	Power supply voltage		Single phase 200 to 230VAC ±10%, 50/60Hz
Axis control	Number of controllable axes		4 axes maximum (simultaneous control: 4 axes)
	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, mm (millimeters), deg (degrees)
	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		Conforming to JIS B8439 (SLIM language)
	Multitask		8 tasks maximum
	Sequence program		1 program
	Memory size		364KB (Total of program and point data) (Available size for program when the maximum of point is used: 84KB)
	Program		100 programs (maximum number of programs) 9999 lines (maximum lines per program) 98KB (maximum capacity per program, maximum capacity per object program)
	Point		10000 points (maximum number of points)
	Point teaching		MDI (coordinate data input), direct teaching, teaching playback, offline teaching (data input from external unit)
	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	STD. DIO	Input	Dedicated 10 points, general-purpose 16 points
		Output	Dedicated 11 points, general-purpose 8 points
	SAFETY	Input	Emergency stop input Service mode input (NPN/PNP specifications conform to STD.DIO setting.) Enable switch input (enabled only when PB is used)
		Output	Motor power ready output
	Break output		Relay contact
	Origin sensor input		Connectable to 24V DC NC contact (normally closed) sensor
	External communications		RS-232C : 1 channel (D-SUB 9-pin female connector) RS-422 : 1 channel (for programming box only)
	Regenerative unit connection		RGEN connector

Item			YRC
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		IP10
Options	Options board	Option slot	4 slots
		Parallel I/O board	General-purpose input 24 points/board, output 16 points/board (4 boards maximum, NPN/PNP specifications)
		CC-Link board	Dedicated input 16 points, dedicated output 16 points General-purpose input 96 points, general-purpose output 96 points
		DeviceNet board	Dedicated input 16 points, dedicated output 16 points General-purpose input 96 points, general-purpose output 96 points
		PROFIBUS board	Dedicated input 16 points, dedicated output 16 points General-purpose input 96 points, general-purpose output 96 points
		Ethernet board	Conforms to IEEE802.3, 10Mbps (10BASE-T)
		iVY board	Camera input (2 channels), camera trigger input, and PC connection input
		Tracking board	Encoder input, lighting trigger input, and lighting power input/output
		Lighting control board	Lighting trigger input, and lighting power input/output
		Gripper control board	Number of controllable axes : 1 Position detection method : Optical rotary encoder Minimum setting unit : 0.01 mm
	Programming box		PB
	Absolute battery		XY axes : 3.6V 5400mAH (2700mAH, 2 pieces) ZR axes : 3.6V 5400mAH (2700mAH, 2 pieces) Backup retention time: about 1 year
	Regenerative unit		RGU-2, RGU-3
	PC software		SCARA Studio

CAUTION

Specifications and appearance are subject to change without prior notice.

See "6. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

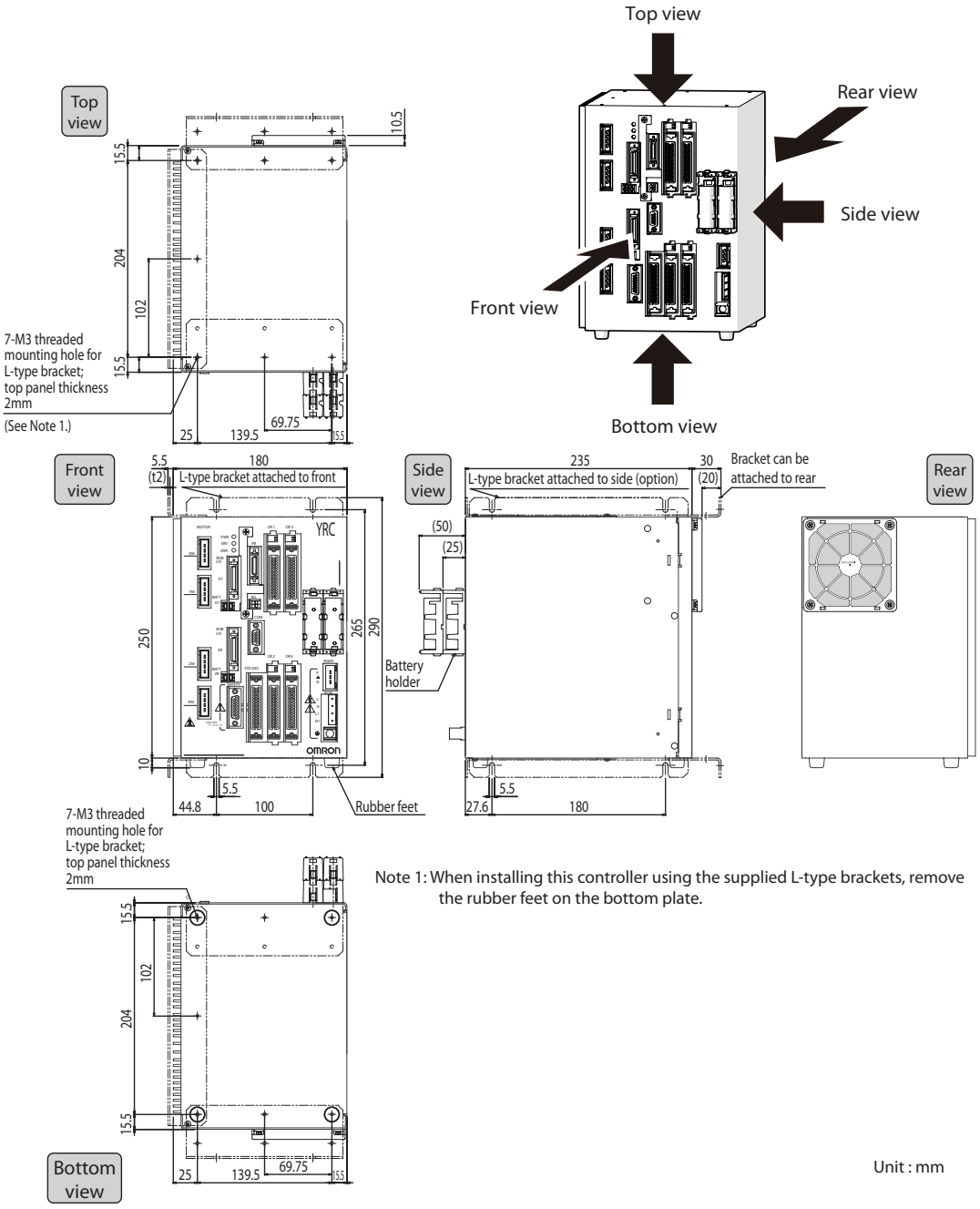
2. Controller basic functions

Function	Description
Operation modes	AUTO mode (Major functions: program execution, step execution, etc.) PROGRAM mode (Major functions: program creation and editing, etc.) MANUAL mode (Major functions: jog movement, point data teaching, etc.) SYSTEM mode (Major functions: parameter editing, data initializing, etc.) UTILITY mode (Major functions: motor power supply control, 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 Element variables (point element variables, shift element 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	Key operation commands (AUTO, RUN, RESET, STEP, etc.) Utility commands (COPY, ERA, INIT, etc.) Data handling commands (READ, WRITE, ?VER, ?CONFIG, etc.) Robot language commands (independent-executable commands)
Data files	Program, point, parameter, shift, hand, all, error history etc.
Internal timer	Timer count variable (TCOUNTER), 10ms intervals
Program break points	4 points maximum

3. Robot controller external view

3.1 YRC external view

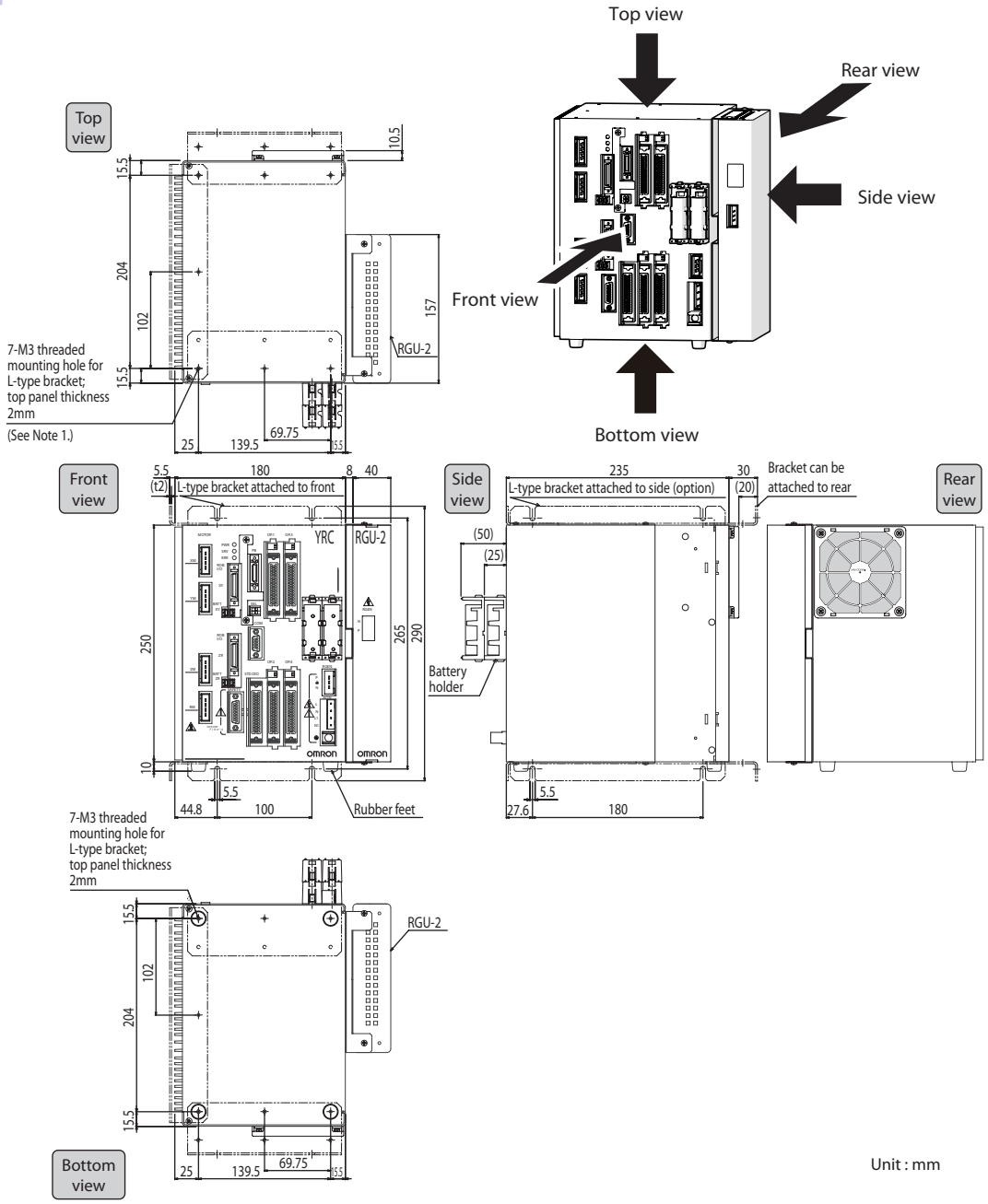
Standard YRC



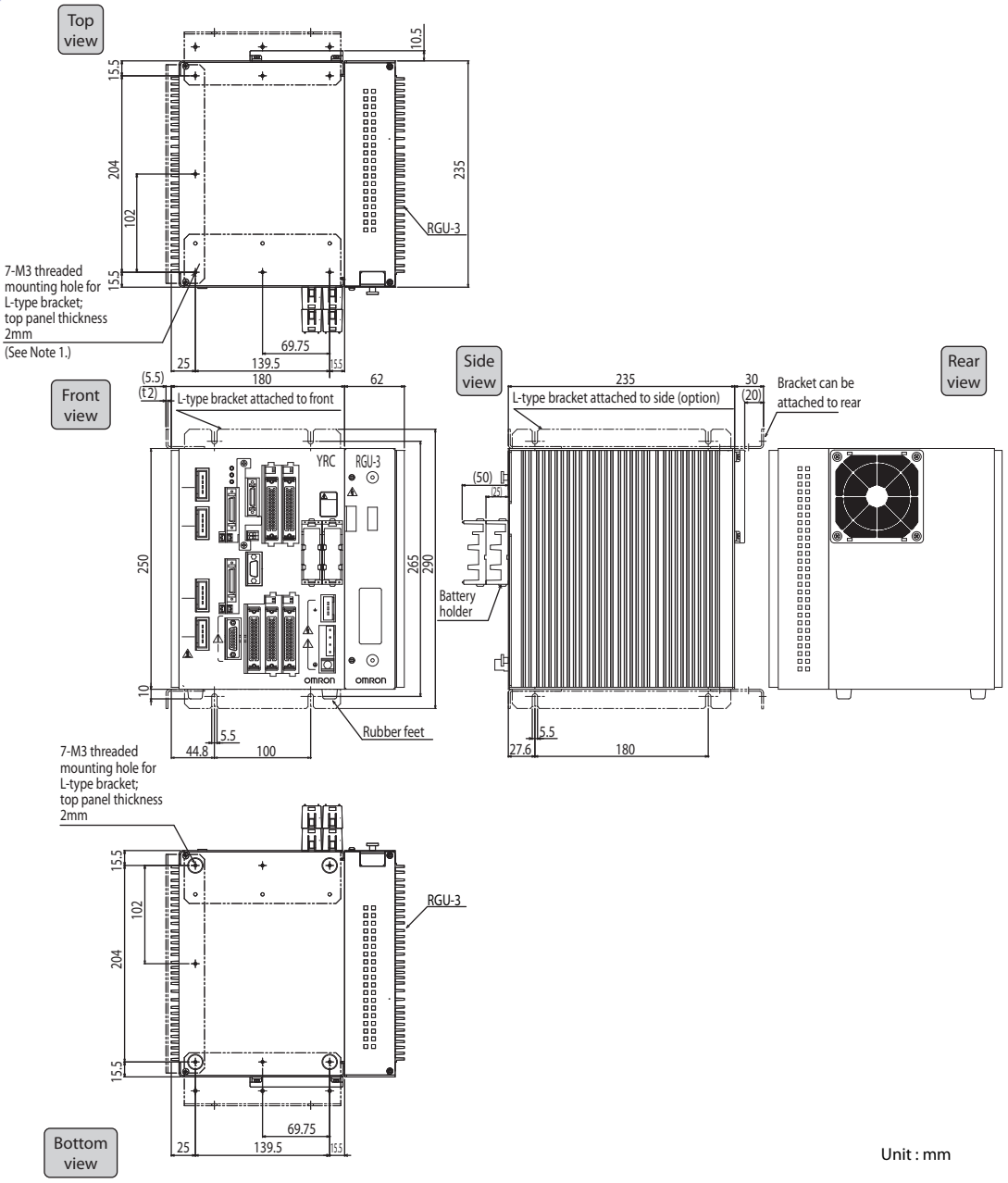
Note 1: When installing this controller using the supplied L-type brackets, remove the rubber feet on the bottom plate.

Unit : mm

YRC with RGU-2 option installed



YRC with RGU-3 option installed

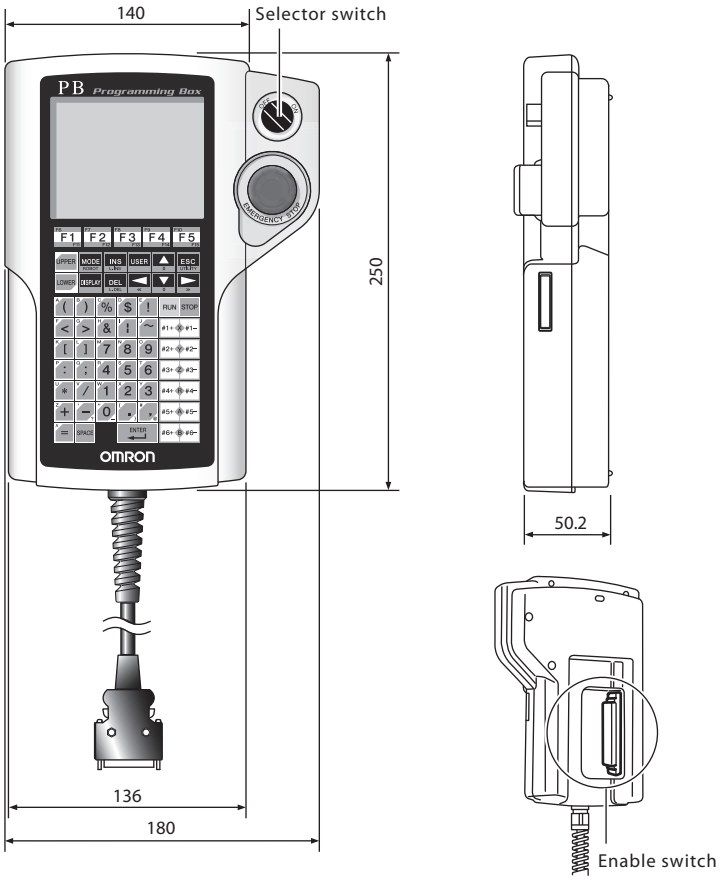


4. Programming box basic specifications and external view

Programming box basic specifications and external view

Item	PB
Display screen	Liquid crystal display (40 characters × 15 lines)
Emergency stop button	Normally-closed contract (with lock function)
Enable switch	3-position type
Power	+12VDC (Supplied from controller)
Operating environment	Ambient temperature : 0 to 40°C, Storage temperature : -10 to 65°C Humidity : 35 to 80% (no condensation)
Dimensions (mm)	W180×H250×D50 (excluding projecting parts)
Cable length	5m
Weight	630g (excluding cable)

PB external view



Troubleshooting

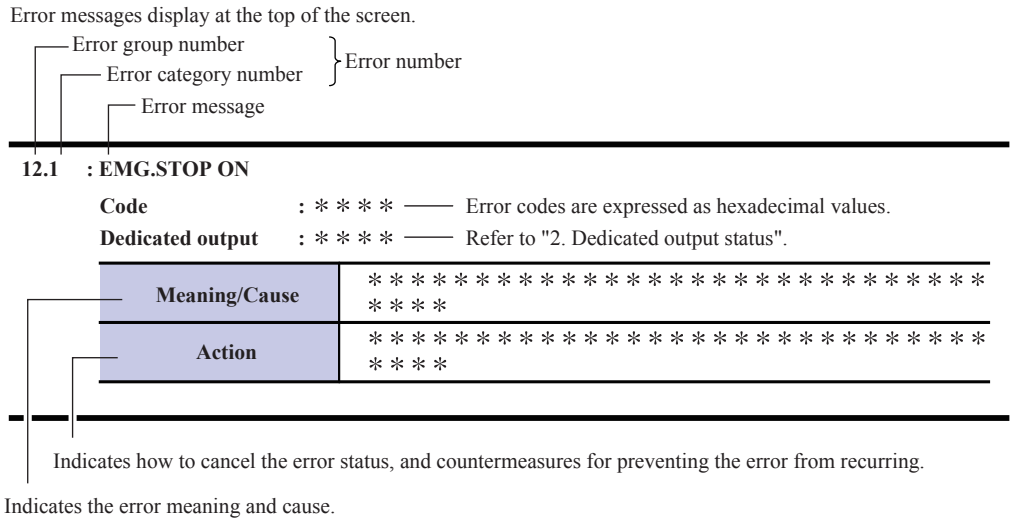
Contents

1. Error messages

1.1 Robot controller error messages

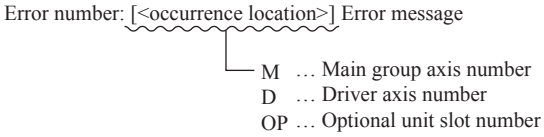
When an error occurs, an error message appears on the message line of the programming box.
The error messages and their explanations are given below.

[Error message display format]



NOTE
Please contact your distributor if the recommended countermeasures fail to resolve an error.

* In some cases information about the error occurrence location (axis, optional unit, etc.) is inserted at the beginning of the error message.



For example, the "2.1: M1, Over soft limit" error message indicates that a "soft limit over" error occurred at the 1st axis of a main group robot. In the same manner, the "17.4:D2, Over load" error message indicates that an "overload" error occurred at the 2nd axis of the driver unit.
Although the axis No. is normally 1-to-1 as viewed from both the robot and the driver, there are cases, like in a dual drive axis system, where the axis configuration may appear as the 1st axis when viewed from the robot, but the 2nd axis when viewed from the driver.

1. Error group number

Error messages are classified by content into groups [0] to [22]. Contents of each error group are shown below.

Group No.	Contents
[0]	Warnings and messages
[1]	Warnings (error history entry)
[2]	Robot operating area errors
[3]	Program file operating errors
[4]	Data entry and edit errors
[5]	Robot language syntax (compiling) errors
[6]	Robot language execution errors
[7]	(Not used)
[8]	(Not used)
[9]	Memory errors
[10]	System setting or hardware errors
[11]	(Not used)
[12]	I/O and option board errors
[13]	Programming box errors
[14]	RS-232C communication errors
[15]	Memory card errors
[16]	(Not used)
[17]	Motor control errors
[18]	(Not used)
[19]	YC-Link related error
[20]	iVY system errors
[21]	Major software errors
[22]	Major hardware errors
[26]	"Alarm message" occurred in electric gripper main body (serious error)
[27]	"Error message" occurred in electric gripper main body

NOTE

Messages for group No. 0 are not stored in the error history.

2. Dedicated output status

Dedicated output status items described below in *1 to *3 show the following contents.

***1... CPU stop**

• Turn the power ON again to reset.

DO01a (CPU OK) =OFF
DO02a (SERVO ON) =OFF
DO03a (ALARM) =ON

***2 ... Driver stop**

• Turn the power ON again to reset.

DO01a (CPU OK) =ON
DO02a (SERVO ON) =OFF
DO03a (ALARM) =ON

***3 ... Servo stop**

• Turn the power ON again in UTILITY mode to reset.

DO01a (CPU OK) =ON
DO02a (SERVO ON) =OFF
DO03a (ALARM) =ON

3. [26] Alarm messages occurred in electric gripper main body

If an alarm message described in error group number 26 (Alarm message occurred in electric gripper main body) appears, the electric gripper enters the status shown below.

• Origin incomplete
• Servo-off

To recover from the alarm status, follow the steps below.

1. Remove the cause of the alarm.
2. Reset the emergency stop flag.
3. Turn on the servo of all axes.
4. Perform the return-to-origin of the electric gripper, in which the alarm occurred.

[0] Warnings and messages

0.0 : Undefined error

Code : &H0000

Meaning/Cause	Undefined system error.
Action	Contact your distributor with details of the problem.

0.1 : Origin incomplete

*** If the cause of the origin incomplete error can be pinpointed, an error code will be attached in parentheses at the end.**

Code : &H0001

Meaning/Cause	a. One of the following operations was performed while return-to-origin was incomplete. • Execution of program or command was attempted. • Point teaching was attempted. • Movement on Cartesian coordinates was attempted. Absolute reset for absolute type axis has not been performed, or return-to-origin for increment type axis has not been performed. b. Absolute battery was removed from controller or robot position data becomes undefined due to battery voltage drop. c. ROB I/O cable was removed or disconnected. d. Absolute reset was interrupted. e. System generation was changed or parameters initialized. Or parameters for specifying the origin position such as for the return-to-origin direction or axis polarity were changed. (Equivalent to writing ALL or PRM file on controller.)
Action	Perform absolute reset or return-to-origin so that "origin complete" status is set.

0.2 : Running

Code : &H0002

Meaning/Cause	Program or command is running.
Action	—

0.3 : Program terminated by "HALT"

Code : &H0003

Meaning/Cause	Program execution was terminated by a HALT command.
Action	—

0.4 : Compiling

Code : &H0004

Meaning/Cause	Robot language compiling (making an object program) is in progress.
Action	—

0.5 : Busy

Code : &H0005

Meaning/Cause	Data is being saved on a memory card or internal ROM.
Action	—

0.6 : Program suspended by "HOLD"

Code : &H0006

Meaning/Cause	Program execution was interrupted by a HOLD command.
Action	Press the RUN key to cancel hold condition and start running the program from the next command.

0.7 : Turn on power again

Code : &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 controller on again.

0.8 : Try again

Code : &H0008

Meaning/Cause	Operation failed.
Action	Try again.

0.9 : Arrived at breakpoint

Code : &H0009

Meaning/Cause	Break point was reached during program execution.
Action	—

0.10 : INC.motor disconnected

Code : &H000A

Meaning/Cause	Return-to-origin command was attempted on an absolute axis or an axis that does not exist.
Action	1. Specify the correct axis. 2. Check the system generation data.

0.11 : ABS.motor disconnected

Code : &H000B

Meaning/Cause	Absolute reset was attempted on an incremental type axis or semi-absolute type axis, or an axis that does not exist.
Action	1. Specify the correct axis. 2. Check the system generation data.

0.14 : Stop excuted

Code : &H000E

Meaning/Cause	An external stop command was input during execution of a direct command, so operation was interrupted.
Action	—

0.15 : Can't execute while servo on

Code : &H000F

Meaning/Cause	Writing in "ALL" or "PRM" files was attempted during servo ON. "ALL" or "PRM" files cannot be written in servo ON.
Action	Turn off the servo before writing files.

0.16 : Changed SERVICE mode input

Code : &H0010

Meaning/Cause	Writing in "ALL" or "PRM" files was attempted during servo ON. "ALL" or "PRM" files cannot be written in servo ON.
Action	Turn off the servo before writing files.

0.17 : Can't edit while STD.DIO DC24V on

Code : &H0011

Meaning/Cause	Setting to disable the 24VDC monitoring function of STD.DIO was attempted even though 24VDC was being supplied at STD.DIO connector. (Monitor function cannot be disabled while 24VDC is being supplied to STD. DIO.)
Action	To disable the monitor function, change the parameter after first stopping the 24VDC supply.

0.18 : Gripper not included in Origin

Code : &H0012

Meaning/Cause	A gripper axis other than the command target axis was specified for the gripper axis when the other parameter, "Include Gripper in Origin", was set at "NO" and any of the following commands was executed. (1) "ORIGIN" command (2) "@ORGRTN" command (3) "@ORGRTN2" command
Action	1. Set "Include Gripper in Origin" to "YES". 2. For "@ORGRTN" and "@ORGRTN2" commands, execute an axis other than the gripper axis individually.

[1] Warnings (error history entry)

1.31 : CPU Reset start

Code : &H011F

Meaning/Cause	Power was turned on and CPU operation commenced.
Action	—

1.32 : CPU Normal start

Code : &H0120

Meaning/Cause	Start-up checks and initialization ended and controller operation started.
Action	—

1.33 : ABS.Backup start

Code : &H0121

Meaning/Cause	Power was cut off so backup of robot position data commenced.
Action	—

1.34 : ABS.Backup fin

Code : &H0122

Meaning/Cause	Finished making backup of robot position data during power cutoff.
Action	—

[2] Robot operating area errors

2.1 : Over soft limit

Code : &H0201

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.

2.2 : Std. coord. doesn't exist

Code : &H0202

Meaning/Cause	Setting of standard coordinates is incomplete.
Action	1. Set the standard coordinates. 2. Set the parameter arm length and offset pulse.

2.3 : Coordinate cal. failed

Code : &H0203

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.

2.5 : Shift cal. failed

Code : &H0205

Meaning/Cause	Calculating for setting shift coordinates failed.
Action	Set shift coordinates correctly.

2.6 : Hand cal. failed

Code : &H0206

Meaning/Cause	Calculation for setting hand definition failed.
Action	Set hand definition correctly.

2.7 : Illegal Pallet parameter

Code : &H0207

Meaning/Cause	Calculation for setting pallet definition failed.
Action	Set pallet definition correctly.

2.8 : Movable range cal. failed

Code : &H0208

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.

2.9 : Overlap soft limit

Code : &H0209

Meaning/Cause	The sum of the absolute values for the X-axis (or Y-axis) minus soft limit and the X-axis (or Y-axis) plus soft limit is making the arm move 1 rotation or more.
Action	1. Set the soft limit values correctly. 2. Set the soft limit values so that the movement range of the arm is less than 1 rotation.

2.10 : Exceeded movable range

Code : &H020A

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.

2.11 : ? exceeded shift coord. range

Code : &H020B

Meaning/Cause	Shift coordinate range ? value was exceeded.
Action	1. Change the operating position of ? value to within the shift coordinates range. 2. Change shift coordinates range ? value.

2.17 : Arch condition bad

Code : &H0211

Meaning/Cause	Arch motion cannot be performed on the X and Y axes if the arch position is specified in "mm" units. Arch motion cannot be performed on the X and Y axes if the target position is specified in "mm" units.
Action	Change to correct arch motion command.

2.18 : RIGHTY now selected

Code : &H0212

Meaning/Cause	The arm will now use the right-handed system for starting Cartesian movement.
Action	—

2.19 : LEFTY now selected

Code : &H0213

Meaning/Cause	The arm will now use the left-handed system for starting Cartesian movement.
Action	—

2.20 : Illegal hand type

Code : &H0214

Meaning/Cause	An R-axis hand definition was attempted on a robot not having an R-axis.
Action	1. Change to Y-axis hand definition. 2. Do not use a hand definition.

2.22 : Arm length is 0

Code : &H0216

Meaning/Cause	When arm length setting is 0, movement on Cartesian coordinates was attempted.
Action	1. Set standard coordinates. 2. Set the arm length parameter.

2.23 : Cannot move(RIGHTY to LEFTY)

Code : &H0217

Meaning/Cause	Interpolation movement shifting from the right-handed system to the left-handed system was executed.
Action	Check the current hand system and point data hand system flag.

2.24 : Cannot move(LEFTY to RIGHTY)

Code : &H0218

Meaning/Cause	Interpolation movement shifting from the left-handed system to the right-handed system was executed.
Action	Check the current hand system and point data hand system flag.

2.25 : Cannot use TOOL coord.

Code : &H0219

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. Set the hand data while a hand or gripper is attached to the tip of the R-axis.

2.26 : Collision in W.carrier

Code : &H021A

Meaning/Cause	Failed to move the double-carrier axis, because one carrier will interfere with the other carrier.
Action	If this error occurred during MANUAL mode: 1. Move the other carrier to a position where the two carriers will not interfere with each other and then move the robot manually. If this error occurred during AUTO mode: 1. Change the target position of one carrier so it will not interfere with the other carrier. 2. Move the other carrier to a position where it will not interfere with the first carrier's target position, and then move that first carrier. 3. Set the double-carrier parameter control mode to "Off" or "On". When set to "Off", this error does not occur, but the anti-collision function for double-carriers will not work so the carriers might collide with each other. When set to "On", one carrier starts moving after waiting until the other carrier moves to a position where no interference occurs.

2.27 : W.carrier deadlock

Code : &H021B

Meaning/Cause	Failed to move the double carrier axis and a deadlock occurred, because the target positions of both carriers will interfere with each other.
Action	Check the robot program.

2.29 : Cannot move without the limit

Code : &H021D

Meaning/Cause	1. The DRIVE statement used a "movement direction option" for an axis where the "limitless motion" parameter is set to INVALID. 2. DRIVE statement movement was attempted with a "limitless motion" VALID setting for the SCARA robot's X or Y axis. 3. DRIVE statement movement was attempted with a "limitless motion" VALID setting for a non-rotary type axis. 4. The attempted simultaneous movement of multiple axes by a MOVE or MOVEI statement, etc., included an axis with a "limitless motion" VALID setting. 5. A Point Trace was executed with a "limitless motion" VALID setting specified at one of the robot axes.
Action	1. Use the DRIVE statement to perform movement without the "movement direction option". Or, set the "limitless motion" parameter to VALID. 2. Set the "limitless motion" parameter to INVALID. 3. Set the "limitless motion" parameter to INVALID. 4. Set the "limitless motion" parameter to INVALID. Or, specify an "additional axis" setting in the system generation data for the axis where "limitless motion" is desired.*1 5. Set the "limitless motion" parameter to INVALID. Or, specify an "additional axis" setting in the system generation data for the axis where "limitless motion" is desired.*1

*1 An "additional axis" is excluded from the axes which are moved by a MOVE statement, etc. An "additional axis" can be moved by using the DRIVE statement.

[3] Program file operating errors

3.1 : Too mamy programs

Code : &H0301

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 : &H0302

Meaning/Cause	An attempt to make/copy/transmit (by using SEND command) a new program with a name already registered was attempted.
Action	Making a new program/copy/transmission (by using SEND command) using a new (unregistered) program name.

3.3 : Program doesn't exist

Code : &H0303

Meaning/Cause	A registered program of the specified name does not exist.
Action	Correctly enter a registered program name.

3.4 : Writing prohibited

Code : &H0304

Meaning/Cause	The specified program is write protected.
Action	Use a program that is not write protected.

3.5 : File type error

Code : &H0305

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of the problem.

3.6 : Too many breakpoints

Code : &H0306

Meaning/Cause	Setting of break point exceeding 4 points was attempted.
Action	After deleting unnecessary break points, set the new break point. (Up to 4 break points can be set in one program.)

3.7 : Breakpoint doesn't exist

Code : &H0307

Meaning/Cause	Break point was not found during search.
Action	Set a break point if needed.

3.9 : Cannot find strings

Code : &H0309

Meaning/Cause	Could not find specified character string during search.
Action	If needed change the character string and try searching again.

3.10 : Object program doesn't exist

Code : &H030A

Meaning/Cause	The object program name is not registered.
Action	Make an object program.

3.11 : Cannot use function

Code : &H030B

Meaning/Cause	Unable to execute or unneeded hierarchy was selected.
Action	—

3.12 : Cannot overwrite

Code : &H030C

Meaning/Cause	In AUTO mode or PROGRAM mode, overwrite of a program being selected cannot be made by communication with a program of the same name.
Action	1. Change the mode. 2. Change the program name.

3.13 : Changing data prohibited

Code : &H030D

Meaning/Cause	Data cannot be changed because access level is not at 0.
Action	Set the access level to 0.

3.14 : Cannot use mode

Code : &H030E

Meaning/Cause	Specified mode cannot be changed because access level is set to level 2 or level 3.
Action	Change the access level to 0 or 1.

3.15 : Illegal password

Code : &H030F

Meaning/Cause	There is a mistake in the password entry.
Action	Enter the correct password.

3.16 : Cannot reset ABS

Code : &H0310

Meaning/Cause	Failed to perform absolute reset or return-to-origin correctly.
Action	1. Perform absolute reset or return-to-origin again. 2. Replace the robot cable. 3. Replace the controller.

3.17 : Cannot erase current program

Code : &H0311

Meaning/Cause	Currently selected program cannot be deleted.
Action	1. Cancel deletion of program. 2. Change the specified program.

3.18 : Duplicated Breakpoint

Code : &H0312

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.

[4] Data entry and edit errors

4.1 : Point number error

Code : &H0401

Meaning/Cause	A point number was entered exceeding P9999.
Action	Input a correct point number.

4.2 : Input format error

Code : &H0402

Meaning/Cause	Wrong format was used to enter the data.
Action	Use the correct data format.

4.3 : Undefined pallet

Code : &H0403

Meaning/Cause	Specified pallet is undefined.
Action	1. Change the specified pallet. 2. Define the pallet.

4.4 : Undefined robot number

Code : &H0404

Meaning/Cause	Specified robot number does not exist.
Action	Enter a correct robot number.

4.5 : Undefined axis number

Code : &H0405

Meaning/Cause	Specified axis number does not exist.
Action	Enter a correct axis number.

4.6 : Invalid input number

Code : &H0406

Meaning/Cause	Invalid data was entered. a. Invalid data was entered in the area check output port number. b. Same port number was set for "G1 status output (DO & SO)" and "G2 status output (DO & SO)" of electrical gripper.
Action	1. Enter a port number that can be used. 2. Enter different port numbers.

4.7 : Invalid input axis

Code : &H0407

Meaning/Cause	An axis specified as "no axis" was selected for one axis of double carrier.
Action	Select an axis that is not specified as "no axis".

[5] Robot language syntax (compiling) errors

5.1 : Syntax error

Code : &H0501

Meaning/Cause	Syntax error found in program.
Action	Change to the correct syntax.

5.2 : Data error

Code : &H0502

Meaning/Cause	Data entered in wrong format.
Action	Input the data in the correct format.

5.3 : Number error

Code : &H0503

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 : &H0504

Meaning/Cause	Specified bit number is not within 0 to 7.
Action	Change to the correct bit number.

5.5 : Port number error

Code : &H0505

Meaning/Cause	a. Port number specified for DO, DI, MO, SI, SO ports is outside the range 0 to 7, 10 to 17, or 20 to 27. b. Specified port number for LO, TO is not 0. c. An output to port 0 or port 1 was set for ports DO, MO, SO.
Action	1. Change to the correct port number. 2. Change output for ports DO, MO, SO to a port other than port 0 or port 1.

5.6 : Digit number error

Code : &H0506

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 : &H0507

Meaning/Cause	Robot axis name is wrong.
Action	Change to the correct axis name.

5.8 : Illegal order

Code : &H0508

Meaning/Cause	Wrong bit specified for input/output port.
Action	Change to ascending order starting from right.

5.10 : Too many characters

Code : &H050A

Meaning/Cause	a. Character string was defined in excess of 75 characters. b. Addition to the character string total exceeds 75 characters.
Action	1. Change to character string count of 75 characters or less. 2. Change additions to character string to a total of 75 characters or less.

5.12 : Stack overflow

Code : &H050C

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 : &H050D

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 : &H050E

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 : &H050F

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 : &H0510

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 : &H0511

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 : &H0512

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 : &H0513

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 : &H0514

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 : &H0515

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 : &H0516

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 : &H0517

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 : &H0518

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 : &H0519

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 : &H051A

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 : &H051B

Meaning/Cause	Two or more identifiers were defined for the same name.
Action	Define another identifier.

5.28 : Duplicated label

Code : &H051C

Meaning/Cause	Two or more of the same labels were defined.
Action	Define another label.

5.29 : Undefined array

Code : &H051D

Meaning/Cause	Assignment/reference was made for undefined array.
Action	Define the undefined array.

5.30 : Undefined identifier

Code : &H051E

Meaning/Cause	An undefined identifier was used.
Action	Define an identifier for undefined identifier.

5.31 : Undefined label

Code : &H051F

Meaning/Cause	Reference made to undefined label.
Action	Set definition for undefined label.

5.32 : Undefined user function

Code : &H0520

Meaning/Cause	Undefined function was called.
Action	Set definition for undefined function.

5.34 : Too many dimensions

Code : &H0522

Meaning/Cause	An array exceeding 3 dimensions was defined.
Action	Change array to within 3 dimensions.

5.35 : Dimension mismatch

Code : &H0523

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 : &H0524

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.

5.37 : Specification mismatch

Code : &H0525

Meaning/Cause	Cannot execute command under present robot specifications.
Action	Change command for execution.

5.38 : Illegal option

Code : &H0526

Meaning/Cause	Error is present in command option.
Action	Define another identifier.

5.39 : Illegal identifier

Code : &H0527

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 : &H0528

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 proce.

Code : &H0529

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 : &H052A

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 : &H052B

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 : &H052C

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 : &H052D

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 8 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 8 characters or less in the program name.

5.46 : Too many identifiers

Code : &H052E

Meaning/Cause	Number of identifiers exceeded 500.
Action	Ensure the number of identifiers is within 500 items.

5.47 : CASE without SELECT

Code : &H052F

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 : &H0530

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 : &H0531

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 : &H0532

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 : &H0533

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 : &H0534

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 : &H0535

Meaning/Cause	Error occurred in software.
Action	Contact your distributor with details of the problem.

5.54 : ELSEIF without IF

Code : &H0536

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 : &H0537

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.

[6] Robot language execution errors

6.1 : Illegal command

Code : &H0601

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 : &H0602

Meaning/Cause	The expression "ON <expression> GOTO"/"ON <expression> GOSUB" command was a negative value.
Action	Change <expression> to a positive value.

6.3 : Division by 0

Code : &H0603

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 : &H0604

Meaning/Cause	Assignment/movement/reference to an undefined point was attempted.
Action	Define the point.

6.5 : Coordinate type error

Code : &H0605

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 : &H0606

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 : &H0607

Meaning/Cause	RETURN command was executed without executing the GOSUB command.
Action	Confirm execution of GOSUB command.

6.8 : END SUB without CALL

Code : &H0608

Meaning/Cause	END SUB command was executed without executing CALL command.
Action	Confirm execution of SUB command.

6.9 : EXIT SUB without CALL

Code : &H0609

Meaning/Cause	EXIT SUB command was executed without executing CALL command.
Action	Confirm execution of SUB command.

6.10 : SUSPEND without START

Code : &H060A

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 : &H060B

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 : &H060C

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 : &H060D

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 : &H060E

Meaning/Cause	a. Task number is outside the range 2 to 8. 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 : &H060F

Meaning/Cause	START command was executed for a task currently in operation.
Action	Delete START command.

6.16 : Task suspending

Code : &H0610

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 : &H0611

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 : &H0612

Meaning/Cause	EXIT FOR command was executed without executing FOR command.
Action	Confirm execution of FOR command.

6.19 : SUB without CALL

Code : &H0613

Meaning/Cause	SUB command was executed without executing CALL command.
Action	Confirm execution of CALL command.

6.20 : Not execute CALL

Code : &H0614

Meaning/Cause	CALL command was not executed.
Action	Confirm execution of CALL command.

6.21 : Same point exists

Code : &H0615

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.

6.22 : 3 points on line

Code : &H0616

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.

6.23 : Circular arc radius too small

Code : &H0617

Meaning/Cause	MOVE C command radius is less than 1mm.
Action	Change MOVE C command to 1mm or more for circular arc radius.

6.24 : Circular arc radius too large

Code : &H0618

Meaning/Cause	MOVE C command radius exceeded 5000mm (5 meters).
Action	Change MOVE C command to within 5000mm (5 meters) for circular arc radius.

6.25 : Too low speed

Code : &H0619

Meaning/Cause	Specified speed was too low so movement time exceeded 300 seconds. Maximum movement time is 300 seconds.
Action	Increase the specified speed.

6.26 : No sufficient memory for OUT

Code : &H061A

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.

6.27 : PATH without SET

Code : &H061B

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.

6.28 : PATH without END

Code : &H061C

Meaning/Cause	PATH START was executed without executing PATH END.
Action	Execute PATH END to end the path setting and then execute PATH START.

6.29 : No PATH data

Code : &H061D

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.

6.30 : Too many PATH data

Code : &H061E

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.

6.31 : Not PATH start position

Code : &H061F

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.

6.32 : PATH execute error

Code : &H0620

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.

6.33 : ABS of MARK incomplete

Code : &H0621

Meaning/Cause	Absolute reset was attempted with an ABSRST statement or dedicated input while absolute reset on an axis whose return-to-origin method is set to "Mark" is incomplete.
Action	First perform absolute reset on the axes whose return-to-origin method is set to "Mark".

6.34 : MARK method is not allowed

Code : &H0622

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.

6.35 : Expression value error

Code : &H0623

Meaning/Cause	The expression value is other than -1 and 0 even though conditional expression is a numeric expression.
Action	1. Set the expression value correctly. 2. Change the "TRUE condition" parameter setting.

[9] Memory errors

9.1 : Program destroyed

Code : &H0901

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.

9.2 : Point data destroyed

Code : &H0902

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.

9.3 : Memory destroyed

Code : &H0903

Meaning/Cause	Error or malfunction occurred in the memory.
Action	Initialize memory.

9.4 : Parameter destroyed

Code : &H0904

Meaning/Cause	Part or all of the parameter data has been destroyed.
Action	Initialize the parameter data.

9.5 : Illegal object code

Code : &H0905

Meaning/Cause	An object program has been destroyed.
Action	Compile and make an object program.

9.6 : Shift data destroyed

Code : &H0906

Meaning/Cause	Part or all of the shift data has been destroyed.
Action	Initialize the shift data.

9.7 : Hand data destroyed

Code : &H0907

Meaning/Cause	Part or all of the hand data has been destroyed.
Action	Initialize the hand data.

9.8 : POS.OUT data destroyed

Code : &H0908

Meaning/Cause	Part or all of the POS.OUT data was destroyed.
Action	Initialize the POS.OUT data.

9.9 : Pallet data destroyed

Code : &H0909

Meaning/Cause	Part or all of the pallet definition data was destroyed.
Action	Initialize the pallet definition data.

9.31 : Memory full

Code : &H091F

Meaning/Cause	No available space in the program/point data area.
Action	Delete unnecessary programs/points.

9.32 : Object memory full

Code : &H0920

Meaning/Cause	Object program size exceeded the upper limit.
Action	Compress the source program size, so that the object program size is smaller.

9.33 : Sys. generation destroyed

Code : &H0921

Meaning/Cause	Part or all of the system generation data has been destroyed.
Action	Remake the system generation data correctly.

9.34 : Sys. generation mismatch

Code : &H0922

Meaning/Cause	Mistake made in specifying the robot type/axis number of system generation data.
Action	Redo the system generation correctly.

9.35 : Program too big

Code : &H0923

Meaning/Cause	Source program size exceeded the permissible size.
Action	Compress the source program size.

9.36 : Task data destroyed

Code : &H0924

Meaning/Cause	Part or all of the data used in a task has been destroyed.
Action	Reset the program.

9.37 : Object program destroyed

Code : &H0925

Meaning/Cause	Part or all of an object program has been destroyed.
Action	Make the object program again.

9.38 : Sequence object memory full

Code : &H0926

Meaning/Cause	Sequence object program exceeded its memory capacity.
Action	Compress the source size of sequence program, so that the object program size is reduced.

9.39 : Sequence object destroyed

Code : &H0927

Meaning/Cause	Part or all of the sequence object program has been destroyed.
Action	Make the sequence object program again.

9.40 : Cannot found sequence object

Code : &H0928

Meaning/Cause	No sequence object program.
Action	Make the sequence object program.

9.41 : Local variable memory full

Code : &H0929

Meaning/Cause	Number of local variables defined within subroutine has exceeded upper limit.
Action	1. Reduce number of local variables defined in the subroutine. 2. Use the global variable.

9.50 : Indiv. origin data destroyed

Code : &H0932

Meaning/Cause	Part or all of the definition data of the individual axis origin return function by DI/SI has been destroyed. The individual axis origin return definition data by DI/SI is initialized.
Action	—

9.51 : Gripper origin data destroyed

Code : &H0933

Meaning/Cause	Part or all of the data saved after completion of the return-to-origin of the electric gripper was destroyed.
Action	Perform the return-to-origin of the electric gripper.

[10] System setting or hardware errors

10.1 : Robot disconnected

Code : &H0A01

Meaning/Cause	Axis control was attempted with "no axis" specified for all axes of system generation.
Action	Re-perform the system generation.

10.3 : D.unit disconnected

Code : &H0A03

Meaning/Cause	Manual movement was attempted on the axis that is not specified.
Action	Do not perform any axis-related operation.

10.6 : DRIVER.unit version mismatch

Code : &H0A06

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 : &H0A07

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 : &H0A08

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
Action	1. Do not set an auxiliary axis. 2. Change the axis setting.

10.9 : Cannot set no axis

Code : &H0A09

Meaning/Cause	A no-axis setting was attempted on an axis which cannot accept it.
Action	1. Do not make a no-axis setting. 2. Change the axis setting.

10.10 : Cannot change axis

Code : &H0A0A

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.

10.13 : Cannot set Dualdrive

Code : &H0A0D

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 : &H0A0E

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 : Cannot set YC-Link

Code : &H0A0F

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 : &H0A11

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 : &H0A12

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 : CPU soft version mismatch

Code : &H0A13

Meaning/Cause	Combination of CPU board and software is wrong.
Action	Install the software that supports the CPU board.

10.21 : Sys. backup battery low voltage

Code : &H0A15

Dedicated output : DO03a (Alarm) and the port set by the "Battery alarm output port (DO & SO)" parameter turn on.

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.

10.22 : STD.DIO DC24V power low

Code : &H0A16

Meaning/Cause	a. 24VDC not supplied to STD.DIO connector. b. Drop in 24VDC being supplied for STD.DIO. c. STD.DIO connector is not connected.
Action	1. Supply 24VDC to STD.DIO connector. 2. Check if line to STD.DIO connector is shorted, broken or miswired. 3. Check if load connected to STD.DIO is beyond capacity of 24VDC supply. 4. If STD.DIO is not used, make the "Watch on STD.DIO 24V DC" parameter invalid in SYSTEM>PARAM>OTHER mode.

10.26 : Gripper software version mismatch

Code : &H0A1A

Meaning/Cause	Software for gripper option board is incorrect.
Action	Use the same software version for the two CPUs on the gripper option board.

[12] I/O and option board errors

12.1 : Emg.stop on

Code : &H0C01

Dedicated output : *3

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 programming box emergency stop button. 2. Close the emergency stop terminals on SAFETY connector. 3. Connect programming box or terminator to PB connector. 4. Attach the SAFETY connector.

12.2 : Interlock on

Code : &H0C02

Meaning/Cause	a. Program was executed or moving of axis attempted while interlock signal was still input. b. Interlock signal turned ON during execution of program or axis movement. c. 24VDC not supplied to STD.DIO connector. d. STD.DIO connector is not connected.
Action	1. Cancel the interlock signal, and execute program or move axis. 2. Supply 24VDC to STD.DIO connector. 3. Connect the STD.DIO connector. 4. Disable the "Watch on STD.DIO 24VDC" parameter when not using STD.DIO.

12.3 : Arm locked

Code : &H0C03

Meaning/Cause	Movement of an arm was attempted while the arm lock variable LO was ON.
Action	Clear the arm lock variable LO.

12.11 : CC-Link communication error

Code : &H0C0B

Meaning/Cause	a. Error in cable for CC-Link system. b. Wrong communication setting for CC-Link system. c. Master station sequencer 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 if the master station sequencer is operating correctly. 4. Replace the corresponding CC-Link compatible unit.

12.12 : CC-Link overtime error

Code : &H0C0C

Meaning/Cause	1. Error in CC-Link system communications due to noise pickup, etc. 2. Master station sequencer (PLC) power is turned off or has stopped operating.
Action	1. Implement countermeasures to protect the CC-Link system cable and controller from noise. 2. Check if the master station sequencer (PLC) is operating correctly.

12.16 : DeviceNet link error

Code : &H0C10

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 PLC's 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 whether the communication power is supplied. 4. Check whether the master PLC is operating correctly. 5. Replace the DeviceNet compatible unit.

12.17 : DeviceNet hardware error

Code : &H0C11

Meaning/Cause	Breakdown in DeviceNet compatible unit.
Action	Replace the DeviceNet compatible unit.

12.18 : Incorrect DeviceNet setting

Code : &H0C12

Meaning/Cause	The MacID or communication speed setting is incorrect.
Action	Check the MacID and communication speed settings.

12.19 : DeviceNet link error(Explicit)

Code : &H0C13

Meaning/Cause	The DeviceNet board was reset by an Explicit message request (Reset request to Identity Obj) from the client (master PLC).
Action	

12.21 : PROFIBUS link error

Code : &H0C15

Meaning/Cause	a. Error in cable for PROFIBUS system. b. The PROFIBUS system's station address setting is incorrect. c. The master station PLC 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 station PLC is operating correctly. 4. Check the hardware configuration settings. 5. Replace the PROFIBUS compatible unit.

12.22 : PROFIBUS hardware error

Code : &H0C16

Meaning/Cause	Breakdown in PROFIBUS compatible unit.
Action	Replace the PROFIBUS compatible unit.

12.31 : DI DC24V disconnected

Code : &H0C1F

Meaning/Cause	a. 24VDC not being supplied to DI section of OPT.DIO unit. b. Drop in 24VDC supply voltage to DI section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24VDC to DI section of OPT.DIO. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if a sufficient 24VDC is supplied to DI section of OPT.DIO unit.

12.32 : DO1 DC24V disconnected

Code : &H0C20

Meaning/Cause	a. 24VDC not being supplied to DO1 section of OPT.DIO unit. b. Drop in 24VDC supply voltage to DO1 section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24VDC 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 24VDC supply to handle.

12.33 : DO2 DC24V disconnected

Code : &H0C21

Meaning/Cause	a. 24VDC not being supplied to DO2 section of OPT.DIO unit. b. Drop in 24VDC supply voltage to DO2 section of OPT.DIO unit. c. OPT.DIO connector is not connected.
Action	1. Supply 24VDC 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 24VDC supply to handle.

12.34 : POS.OUT Point not exist

Code : &H0C22

Meaning/Cause	Comparison point data does not exist.
Action	Set comparison point data correctly.

12.35 : POS.OUT Point unit error

Code : &H0C23

Meaning/Cause	Comparison points 1 and 2 do not use the same unit system.
Action	Change them to the same unit system.

12.41 : EtherNet link error

Code : &H0C29

Meaning/Cause	TELENET is disconnected. a. The cable is broken or disconnected. b. Communicating with a client was off for more than the time specified by the "7. timeout [min]" parameter for EtherNet. c. Logout was attempted while the 11. 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 "7. timeout [min]" parameter, or set the parameter to "0" to disable the timeout function. 3. Set the "11. logout" parameter to "CONT." to avoid errors during logout. 4. Check whether the client is responding to the keep-alive packet, or set the "12. keep-alive [sec]" parameter to "0" to stop the keep-alive packet from being sent out.

12.42 : EtherNet hardware error

Code : &H0C2A

Meaning/Cause	Breakdown in EtherNet compatible unit.
Action	Replace the EtherNet compatible unit.

12.51 : EtherNet/IP link error

Code : &H0C33

Meaning/Cause	An error occurred at the EtherNet/IP option board.
Action	Contact your distributor with details of the problem.

12.70 : Incorrect option setting

Code : &H0C46

Meaning/Cause	a. Error in DIP switch setting on option unit. b. Mismatched option units have been installed. c. Cannot identify the installed option unit.
Action	1. Check the DIP switch settings on the option unit. 2. Install the correct unit. 3. Replace the option unit. 4. Replace the controller.

12.75 : Illegal remote command

Code : &H0C4B

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 : &H0C50

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 : &H0C55

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)".

[13] Programming box errors

13.1 : PB communication error

Code : &H0D01

Meaning/Cause	Error occurred in communication with programming box.
Action	1. Install the programming box correctly. 2. Replace the programming box. 3. Replace the controller.

13.2 : PB parity error

Code : &H0D02

Meaning/Cause	Abnormal data was entered in communication with programming box.
Action	1. Install the programming box correctly. 2. Install the programming box in a good operating environment. (Do not install near sources of noise.)

13.11 : PB version mismatch

Code : &H0D0B

Meaning/Cause	Programming box version does not match the controller, and connection refused.
Action	Use an programming box version that matches the controller.

13.12 : PB system error

Code : &H0D0C

Meaning/Cause	Error occurred in communication with programming box.
Action	1. Replace the programming box. 2. Replace the controller.

[14] RS-232C communication errors

14.1 : Communication error

Code : &H0E01

Meaning/Cause	a. During external communication via the RS-232C, an error occurred. b. An overrun error or framing error occurred via the RS-232C. c. Power supply for external device turned on or off after connecting communication cable with the external device.
Action	1. Change to a correct system environment for RS-232C. (Do not install near sources of noise.) 2. Replace the communications cable. 3. Check the communication parameter settings.

14.2 : Parity error

Code : &H0E02

Meaning/Cause	During external communication via the RS-232C, an error occurred.
Action	Check the communication parameter settings.

14.11 : Receive buffer overflow

Code : &H0E0B

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 : &H0E0C

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 : &H0E14

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 : &H0E15

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 : &H0E16

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 : &H0E17

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 : &H0E18

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.

14.25 : Illegal command in this mode

Code : &H0E19

Meaning/Cause	Cannot execute the specified online command in the current mode.
Action	1. Stop the online command. 2. Change the mode.

14.26 : Illegal command,SERVICE mode

Code : &H0E1A

Meaning/Cause	Unable to execute since operation is in SERVICE mode.
Action	1. Cancel SERVICE mode. 2. Change the exclusive control setting so it can be used in SERVICE mode.

14.31 : Illegal port type

Code : &H0E1F

Meaning/Cause	Communication port not specified.
Action	Contact your distributor with details on this problem.

[15] Memory card errors

15.1 : Invalid file attribute

Code : &H0F01

Meaning/Cause	a. Directory was accessed. b. Read/write protected file was accessed.
Action	1. Change to a file which can be accessed. 2. Change to a file allowing read/write.

15.2 : Read only file

Code : &H0F02

Meaning/Cause	Writing was attempted on a write protected file.
Action	1. Change to another file. 2. Change to a file not write protected.

15.3 : Same file name already exists

Code : &H0F03

Meaning/Cause	File name change was attempted but the same file name already exists.
Action	Change it to an unused file name.

15.4 : File doesn't exist

Code : &H0F04

Meaning/Cause	Loading of file was attempted but file name does not exist.
Action	Change to a file name that currently exists.

15.11 : Directory full

Code : &H0F0B

Meaning/Cause	The file storage capacity was exceeded.
Action	1. Use a new memory card. 2. Change the directory to save. 3. Delete unnecessary files.

15.12 : Disk full

Code : &H0F0C

Meaning/Cause	Write failed. No space is available on memory card. (File contents cannot be guaranteed.)
Action	1. Use a new memory card. 2. Delete unnecessary files.

15.13 : Unformatted media

Code : &H0F0D

Meaning/Cause	a. Memory card was not formatted. b. Wrong memory card format.
Action	1. Format correctly. 2. Replace memory card backup battery.

15.14 : Media protected

Code : &H0F0E

Meaning/Cause	Cannot write. Memory card has been set to write protect.
Action	1. Change to allow writing. 2. Use another memory card.

15.15 : Media type mismatch

Code : &H0F0F

Meaning/Cause	Memory card is unusable.
Action	Replace the memory card.

15.16 : Media data destroyed

Code : &H0F10

Meaning/Cause	All or part of data stored on memory card is damaged.
Action	1. Format the memory card. 2. Overwrite the damaged portion with new data. 3. Replace the memory card backup battery. 4. Replace the memory card.

15.21 : Cannot find media

Code : &H0F15

Meaning/Cause	Memory card not inserted correctly in slot.
Action	Insert the memory card correctly unit.

15.23 : Aborted

Code : &H0F17

Meaning/Cause	STOP key was pressed during reading/writing from or into memory card, and the operation halted.
Action	—

15.24 : Media hardware error

Code : &H0F18

Meaning/Cause	a. Memory card is defective b. Error occurred in controller.
Action	1. Replace the memory card. 2. Replace the controller.

15.27 : Data read error

Code : &H0F1B

Meaning/Cause	Failed to load file.
Action	1. Try to reload the file. 2. Replace the memory card. 3. Replace the controller.

15.28 : Data write error

Code : &H0F1C

Meaning/Cause	Failed to write file.
Action	1. Try rewriting the file. 2. Replace the memory card. 3. Replace the controller.

15.29 : Timeout error

Code : &H0F1D

Meaning/Cause	Failed to load/write file.
Action	1. Try to reload/rewrite the file. 2. Replace the memory card. 3. Replace the controller.

[17] Motor control errors

17.1 : System error (DRIVER)

Code : &H1101

Dedicated output : *2

Meaning/Cause	Error occurred in software for driver unit.
Action	Contact your distributor with details of the problem.

17.2 : Watchdog error (DRIVER)

Code : &H1102

Dedicated output : *2

Meaning/Cause	a. Malfunction occurred in driver unit due to external noise. b. Controller is defective.
Action	1. Turn the power on again. 2. Replace the controller.

17.3 : Over current

Code : &H1103

Dedicated output : *2

Meaning/Cause	a. Short in motor cable. b. Malfunction occurred in motor.
Action	1. Replace the motor cable. 2. Replace the motor.

17.4 : Over load

Code : &H1104

Dedicated output : *2

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 24VDC from SAFETY connector as power source for external loads.

17.5 : Over heat

Code : &H1105

Dedicated output : *2

Meaning/Cause	Temperature in power module of driver unit exceeded 80°C.
Action	1. Improve the equipment environment. 2. Check that cooling fan is working correctly. 3. Lower the robot duty cycle and decrease the amount of heat generated. 4. Replace the controller.

17.6 : P.E.counter overflow

Code : &H1106

Dedicated output : *2

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 24VDC from SAFETY connector as power source for driving external loads.

17.9 : Command error

Code : &H1109

Dedicated output : *2

Meaning/Cause	Driver cannot identify commands from CPU.
Action	Check the versions of the CPU unit and driver unit.

17.10 : Feedback error 1

Code : &H110A

Dedicated output : *2

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.

17.11 : Feedback error 2

Code : &H110B

Dedicated output : *2

Meaning/Cause	Motor cable is broken.
Action	Replace the motor cable or encoder cable.

17.16 : Over velocity 1

Code : &H1110

Dedicated output : *2

Meaning/Cause	Axis movement speed exceeded the limit during linear interpolation, circular interpolation or manual orthogonal movement.
Action	1. Reduce the acceleration. 2. Reduce the speed.

17.17 : Mode error

Code : &H1111

Dedicated output : *2

Meaning/Cause	Driver unit is in abnormal control mode status.
Action	Contact your distributor with details on the problem.

17.18 : DPRAM data error

Code : &H1112

Dedicated output : *2

Meaning/Cause	2 tries at loading the dual port RAM failed.
Action	Contact your distributor with details on the problem.

17.19 : Coord. value error

Code : &H1113

Dedicated output : *2

Meaning/Cause	Error occurred during linear interpolation, circular interpolation or manual orthogonal movement.
Action	Contact your distributor with details on the problem.

17.20 : Motor type error

Code : &H1114

Meaning/Cause	A motor type unidentifiable by drive unit was selected.
Action	1. Redo the system generation. 2. Replace the controller.

17.21 : Bad origin sensor

Code : &H1115

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.

17.22 : Bad PZ

Code : &H1116

Meaning/Cause	a. Motor is defective. b. Resolver signal wire is broken.
Action	1. Replace the motor. 2. Replace the ROB I/O cable.

17.28 : Dual P.E.counter overflow

Code : &H111C

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.

17.30 : Bad position

Code : &H111E

Dedicated output : *2

Meaning/Cause	Cannot perform positioning.
Action	1. Turn the power off and then on again. 2. Replace the controller.

17.31 : Servo off

Code : &H111F

Meaning/Cause	Movement command was attempted in servo-off state.
Action	Change status to servo-on.

17.33 : Busy now

Code : &H1121

Dedicated output : *2

Meaning/Cause	a. Servo OFF command was attempted while the driver was stopped. b. Return-to-origin command was attempted before manual movement was complete.
Action	1. Turn off the power to the controller and then turn it back on. 2. Wait until the command has finished.

17.34 : Servo on failed

Code : &H1122

Meaning/Cause	a. Servo ON was attempted for each axis while motor power was off. b. Servo ON processing failed because the drive unit had been stopped.
Action	1. First turn on the motor power if servo ON for each axis was attempted. 2. Turn the power off and then on again.

17.35 : Axis weight over

Code : &H1123

Meaning/Cause	The weight (sum of work weight + axis weight) on a particular robot axis exceeded the maximum payload of that axis.
Action	1. Redo the system generation. 2. Select the axis weight parameter to a correct value.

17.39 : Servo off failed

Code : &H1127

Dedicated output : *2

Meaning/Cause	Servo OFF processing failed because the drive unit had been stopped.
Action	Turn the power off and then on again.

17.40 : Torque mode now

Code : &H1128

Meaning/Cause	Manual movement attempted while in torque mode.
Action	Cancel the torque mode.

17.42 : Cannot reset position

Code : &H112A

Meaning/Cause	a. The ABSINIT statement was executed at a position where a "current position reset" is not possible. b. The ABSINIT2 statement was executed at a position where a "current position reset" is not possible.
Action	1. Execute the ABSINIT statement after moving to a position where a "current position reset" is possible. 2. Execute the ABSINIT2 statement after moving to a position where a "current position reset" is possible.

17.73 : Resolver wire breakage

Code : &H1149

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.

17.78 : Power module error

Code : &H114E

Meaning/Cause	a. Power module overheated. b. Power module/motor drew excessive current.
Action	Lighten the load on the robot.

17.81 : ABS.battery wire breakage

Code : &H1151

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.

17.82 : CS read error

Code : &H1152

Meaning/Cause	a. Readout check of resolver electrical angle information failed twice. b. Over-acceleration occurs due to collision, etc.
Action	1. Perform absolute reset or return-to-origin operation. 2. Replace the motor. 3. Replace the controller. 4. Change the operation pattern to avoid over-acceleration.

17.83 : Backup position data error 1

Code : &H1153

Meaning/Cause	Backup position information did not match the resolver angle information when robot position information was recalculated at controller startup.
Action	Perform absolute reset.

17.84 : Over velocity 2

Code : &H1154

Meaning/Cause	Movement speed is too high during power-off of the controller.
Action	Perform absolute reset.

17.85 : Backup position data error 2

Code : &H1155

Meaning/Cause	Failed to read out the robot position data during start-up of the controller.
Action	Perform absolute reset.

17.90 : DRIVE2 module type error

Code : &H115A

Meaning/Cause	Motor specifications do not match current sensor specifications.
Action	1. Replace the controller. 2. Redo the system generation.

17.91 : Cannot perform ABS.reset

Code : &H115B

Meaning/Cause	Absolute reset was attempted at a position where absolute reset cannot be performed.
Action	Move the axis to a position (machine reference from 44 to 56%) where absolute reset can be performed, and then try again.

17.92 : Resolver disconnected during power off

Code : &H115C

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.

17.93 : Position backup counter overflow

Code : &H115D

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.

17.94 : ABS.battery low voltage

Code : &H115E

Dedicated output : When the absolute battery voltage becomes low, DO03a (Alarm) and the port set by the "Battery alarm output port (DO & SO)" parameter turn on.

Meaning/Cause	Battery for retaining absolute data is low or not installed.
Action	1. Replace battery. 2. Install battery.

17.99 : Pole Search Error

Code : &H1163

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.

17.111:Controller fan failed

Code : &H116F

Meaning/Cause	Power is not supplied to controller cooling fan. a. Open-circuit fault in controller cooling fan cable. b. Short-circuit of ROB I/O cable. c. Controller is at fault. Abnormal condition occurred in controller cooling fan. d. Controller cooling fan is at fault. e. Controller is at fault.
Action	1. Replace the controller cooling fan cable. 2. Replace the ROB I/O cable. 3. Replace the controller. 4. Replace the controller cooling fan. 5. Replace the controller.

[19] YC-Link related error

19.1 : OVER LOAD

Code : &H1301

Meaning/Cause	a. Motor current higher than rated current has flown due to excessive load on motor. b. Motor drive parts were mechanically locked. c. Electromagnetic brake failure or wire breakage. d. Robot number setting is incorrect.
Action	1. Reduce the load on the motor. Set the payload and acceleration to their optimal values. Lower the operation duty on the robot. 2. Check the conditions of the movable parts. Perform maintenance on the robot. 3. Replace the electromagnetic brake. 4. Set the correct robot number and initialize the parameters.

19.2 : OVER CURRENT

Code : &H1302

Meaning/Cause	a. Short-circuit, earth fault or wire breakage occurred in motor cable. b. Motor failure. c. Controller board is defective. d. Robot number setting is incorrect.
Action	1. Replace the motor cable. 2. Replace the motor. 3. Replace the controller. 4. Set the correct robot number and initialize the parameters.

19.3 : OVER HEAT

Code : &H1303

Meaning/Cause	a. Ambient temperature around the controller is above 40°C. b. Excessive load on motor. c. Cooling fan stopped working. d. Thermal sensor failed.
Action	1. Correct the ambient conditions so that temperature is below 40°C. 2. Lower the load on the motor. 3. Replace the controller.

19.4 : POWER DOWN

Code : &H1304

Meaning/Cause	a. AC power line voltage is less than 80V. b. Momentary power outage occurred.
Action	1. Use the correct AC line voltage. 2. Reset the alarm to resume operation.

19.5 : BATT.LOW-VOLTAGE

Code : &H1305

Meaning/Cause	a. Battery connection is incorrect. b. Battery voltage is lower than specified.
Action	1. Connect the battery correctly. 2. Replace the battery.

19.6 : 24V POWER OFF

Code : &H1306

Meaning/Cause	Internal 24V circuit failure. Controller board failed.
Action	Replace the controller.

19.7 : P.E. COUNTER OVER

Code : &H1307

Meaning/Cause	Deviation counter error.
Action	—

19.11 : SYSTEM FAULT

Code : &H130B

Meaning/Cause	a. Driver was not recognized correctly at power-on. b. External noise has disrupted software program. c. RS-232C receiving buffer has overflown.
Action	1. Replace the controller. 2. Check the environment for noise. 3. Select the XON/XOFF control with the host device.

19.12 : BAD ORG-SENSOR

Code : &H130C

Meaning/Cause	a. Origin sensor connection is incorrect. b. Origin sensor wire broke or sensor became defective. c. Origin sensor dog (target) is not properly adjusted.
Action	1. Connect the origin sensor correctly. 2. Replace the origin sensor. 3. Adjust the origin sensor dog correctly.

19.13 : BAD PZ

Code : &H130D

Meaning/Cause	a. Position detector failure. b. Phase Z detection error.
Action	1. Replace the motor or robot. 2. Connect the ROB I/O cable correctly. 3. Replace the ROB I/O cable.

19.14 : FEEDBACK ERROR 1

Code : &H130E

Meaning/Cause	a. Controller position detection circuit failed. b. Position detector (motor) failed.
Action	1. Replace the controller. 2. Replace the motor.

19.15 : FEEDBACK ERROR 2

Code : &H130F

Meaning/Cause	a. ROB I/O cable connection is incorrect. b. ROB I/O cable is broken.
Action	1. Connect the ROB I/O cable correctly. 2. Replace the ROB I/O cable.

19.16 : ABNORMAL VOLTAGE

Code : &H1310

Meaning/Cause	a. AC power line voltage is too high. b. Regenerative unit (RG1) connection is incorrect. c. Temperature of regenerative absorption resistance is too high (above 120°C). d. RGEN cable failed. e. Regenerative unit failed. f. Power supply voltage setting (200V/100V) is incorrect.
Action	1. Use the correct AC line voltage. 2. Connect the regenerative unit correctly. 3. Reduce the ambient temperature. Use the correct AC line voltage. Lower the operation duty on the robot. 4. Replace the RGEN cable. 5. Replace the regenerative unit. 6. Check the wiring on the input voltage select terminals.

19.17 : SYSTEM FAULT 2

Code : &H1311

Meaning/Cause	Controller board failed.
Action	Replace the controller.

19.18 : FEEDBACK ERROR 3

Code : &H1312

Meaning/Cause	Motor drive parts are mechanically locked.
Action	Check the conditions of the movable parts. Perform maintenance on the robot. Correctly adjust the Mechanical locking detect level (PRM142).

19.19 : SYSTEM FAULT 3

Code : &H1313

Meaning/Cause	a. External noise has disrupted software program. b. CPU failure or malfunction.
Action	1. Check the environment for noise. 2. Replace the controller.

19.21 : BAD NETWORK

Code : &H1315

Meaning/Cause	a. Poor connection of communication cable. b. Open-circuit fault of communication cable.
Action	1. Connect the communication cable securely. 2. Replace the communication cable.

19.23 : ABS.BAT.L-VOLTAGE

Code : &H1317

Meaning/Cause	Absolute battery voltage is less than 3.1V.
Action	Replace the absolute battery.

19.24 : ABS.DATA ERROR

Code : &H1318

Meaning/Cause	Absolute search for "semi-absolute" ended abnormally.
Action	1. Register the correct stroke length (PRM102). 2. Initialize the parameters.

19.26 : FEEDBACK ERROR 4

Code : &H131A

Meaning/Cause	a. Motor cable connection is incorrect. b. Motor cable broke or failed. c. Motor failed. d. Controller board failed.
Action	1. Connect the motor cable correctly. 2. Replace the motor cable. 3. Replace the motor. 4. Replace the controller.

19.27 : POLE SEARCH ERROR

Code : &H131B

Meaning/Cause	a. Motor cable connection is incorrect. b. Motor cable broke or failed. c. ROB I/O cable connection is incorrect. d. ROB I/O cable broke. e. Motor failed. f. Controller board failed. g. Robot number setting is incorrect.
Action	1. Connect the motor cable correctly. 2. Replace the motor cable. 3. Connect the ROB I/O cable correctly. 4. Replace the ROB I/O cable. 5. Replace the motor. 6. Replace the controller. 7. Set the correct robot number and initialize the parameters.

19.28 : COORD.VAL. ERROR

Code : &H131C

Meaning/Cause	a. Poor connection of communication cable. b. Open-circuit fault of communication cable. c. Data destruction due to external noise.
Action	1. Connect the communication cable securely. 2. Replace the communication cable. 3. Check the ambient conditions.

19.29 : NET DATA ERROR

Code : &H131D

Meaning/Cause	Data destruction due to external noise.
Action	Check the ambient conditions.

19.32 : 12V POWER OFF

Code : &H1320

Meaning/Cause	Internal 12V circuit failure. Controller board failed.
Action	Replace the controller.

19.33 : MAIN POWER OFF

Code : &H1321

Meaning/Cause	a. AC power line voltage is less than 100V (when 200V is selected). b. AC power line voltage is less than 40V (when 100V is selected). c. Power supply voltage setting (200V/100V) is incorrect. d. Controller failed.
Action	1. Use the correct AC line voltage. 2. Use the correct AC line voltage. 3. Check the wiring on the input voltage select terminals. 4. Replace the controller.

19.34 : LOW VOLTAGE

Code : &H1322

Meaning/Cause	a. AC line voltage is low. b. Power supply voltage setting (200V/100V) is incorrect.
Action	1. Use the correct AC line voltage. 2. Check the wiring on the input voltage select terminals.

19.35 : DRIVER DISCONNECT

Code : &H1323

Meaning/Cause	Driver board connection failure
Action	Replace the controller.

19.40 : ABS.OS ERROR

Code : &H1328

Meaning/Cause	—
Action	—

19.41 : ABS.RO ERROR

Code : &H1329

Meaning/Cause	ROB I/O cable broke during power-off.
Action	—

19.42 : ABS.RE ERROR

Code : &H132A

Meaning/Cause	ROB I/O cable broke during power-on.
Action	—

19.43 : ABS.OF ERROR

Code : &H132B

Meaning/Cause	—
Action	—

19.44 : ABS.ME ERROR

Code : &H132C

Meaning/Cause	—
Action	—

19.45 : ABS.BAT ERROR

Code : &H132D

Meaning/Cause	Absolute battery voltage is less than 2.5V.
Action	Replace the absolute battery.

[20] iVY system errors

20.0 : Vision not installed

Code : &H1400

Meaning/Cause	No robot vision function settings.
Action	Check to see if the iVY board is properly connected.

20.1 : Vision init. error

Code : &H1401

Meaning/Cause	Error occurred during iVY board initial processing.
Action	Contact your distributor with details of the problem.

20.2 : Vision control mode error

Code : &H1402

Meaning/Cause	Vision system robot language commands and parameter changes, etc., are not possible in the "Host PC" vision control mode.
Action	Switch to the "Controller" vision control mode.

20.3 : Vision camera disconnected

Code : &H1403

Meaning/Cause	Camera recognition problem.
Action	1. Check the camera cable connection. 2. Check the camera channel. 3. Check for severed/disconnected camera cable. 4. Check power supply wiring for the iVY board.

20.4 : Vision undefined error

Code : &H1404

Meaning/Cause	"Undefined" error occurred at iVY board.
Action	Contact your distributor with details of the problem.

20.5 : Vision not ready

Code : &H1405

Meaning/Cause	iVY board startup is in progress.
Action	Do not attempt operation until the iVY board's board status LED (green) changes from a "blinking" to "constant on" (not blinking) condition.

20.7 : Vision hardware error

Code : &H1407

Meaning/Cause	Hardware error occurred at the iVY board.
Action	Contact your distributor with details of the problem.

20.8 : Vision calibration error

Code : &H1408

Meaning/Cause	Error occurred during camera calibration.
Action	1. Check to see if fiducial marks have been registered. 2. Check to see if fiducial marks are being recognized properly. 3. Check the calibration settings.

20.9 : Vision calibration in prog.

Code : &H1409

Meaning/Cause	Switching to the "Host PC" vision control mode is not possible during camera calibration.
Action	Switch the mode after camera calibration is completed.

20.10 : Vision calibration not set

Code : &H140A

Meaning/Cause	Incorrect calibration number specified.
Action	1. Change the specified calibration number. 2. Perform a camera calibration setting operation.

20.11 : Vision calib. data type error

Code : &H140B

Meaning/Cause	Mismatch between calibration data and the robot configuration.
Action	1. Check the specified calibration number. 2. Specify the calibration setting operation again.

20.12 : Vision calib. data destroyed

Code : &H140C

Meaning/Cause	Calibration data error occurred.
Action	Contact your distributor with details of the problem.

20.13 : Vision no pattern data

Code : &H140D

Meaning/Cause	No model has been registered for the specified model number.
Action	1. Change the specified model number. 2. Register the model.

20.14 : Vision trigger timeout

Code : &H140E

Meaning/Cause	Trigger timeout occurred.
Action	1. Check the "Trigger timeout (9. Trigger timeout [sec]) setting in iVY board's parameter data. 2. Check the camera trigger input cable wiring and connection. 3. Check for severed/disconnected camera trigger input cable.

20.15 : Vision Disk full

Code : &H140F

Meaning/Cause	iVY board's disk is full.
Action	Read out image data and erase unnecessary data from the iVY board.

20.16 : Vision parameter error

Code : &H1410

Meaning/Cause	Incorrect parameter value specified.
Action	Change the specified parameter value.

20.17 : Vision search timeout

Code : &H1411

Meaning/Cause	Search ended due to timeout.
Action	Change the timeout setting for the specified model.

20.50 : V_Plus not installed

Code : &H1432

Meaning/Cause	No settings are made for the lighting control function and/or conveyor tracking function.
Action	Check whether the lighting control board and tracking board are correctly connected.

20.51 : V_Plus Watchdog error

Code : &H1433

Meaning/Cause	Lighting control board or tracking board operation is abnormal. Bits which should be reversed periodically are not being reversed due to a stopped clock or CPLD freeze, etc.
Action	Perform a restart power. If the restart fails to restore a normal condition, check the board connection condition and the board recognition at the programming box.

20.52 : V_Plus counter wire breakage

Code : &H1434

Meaning/Cause	Disconnected encoder input cable detected.
Action	Set unused encoder input channels to "INVALID". Verify that the cable connector is not disconnected or severed. Check to see if the encoder is operating normally.

20.53 : V_Plus Tracking error

Code : &H1435

Meaning/Cause	Tracking was attempted during tracking.
Action	Review the robot program and change it so that the CTMOVE statement will not be executed during tracking.

20.54 : V_Plus Not Tracking error

Code : &H1436

Meaning/Cause	A command that should be executed during tracking was executed while tracking is not in progress.
Action	Review the robot program and change it so that the command will be executed during tracking.

20.55 : V_Plus not have Z Axis error

Code : &H1437

Meaning/Cause	The CTDRIVE statement was executed for the robot with no Z-axis.
Action	Change the main robot setting to a robot with the third axis.

20.56 : V_Plus parameter error

Code : &H1438

Meaning/Cause	The lighting control board parameter and/or tracking board parameter are incorrect.
Action	Initialize the parameters and set them correctly.

20.57 : V_Plus calibration not set

Code : &H1439

Meaning/Cause	Conveyor calibration data is not set.
Action	Set the conveyor calibration data and re-execute calibration.

20.58 : V_Plus out of Tracking work area

Code : &H143A

Meaning/Cause	Tracking was attempted after the first point data in the position monitoring array has passed the work area.
Action	Use the CRMVQUE command to delete the data that indicates the first point data in the position monitoring array has passed the work area, and then review the robot program and change it so that the CTMOVE statement will be executed.

20.59 : V_Plus Tracking queue empty

Code : &H143B

Meaning/Cause	Tracking was attempted while no data is registered in the position monitoring array.
Action	Use the CADDQUE command to add data to the position monitoring array, and then review the robot program and change it so that the CTMOVE statement will be executed.

[21] Major software errors

21.1 : System error (JOG)

Code : &H1501

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.2 : System error (srvmod)

Code : &H1502

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.3 : System error (TaskID)

Code : &H1503

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.4 : System error (drcom)

Code : &H1504

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.5 : System error (drmod)

Code : &H1505

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.6 : System error (Gen.Data)

Code : &H1506

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.10 : Watchdog error (CPU)

Code : &H150A

Dedicated output : *1

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.

21.11 : System error (EmgHalt)

Code : &H150B

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.12 : System error (RTOS)

Code : &H150C

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.13 : System error (CRFPOS)

Code : &H150D

Meaning/Cause	Current position of driver does not match the instructed position.
Action	1. Replace the driver. 2. Replace the controller.

21.14 : DPRAM error (PTP data)

Code : &H150E

Meaning/Cause	Failed to write PTP command data into driver.
Action	1. Replace the driver. 2. Replace the controller.

21.15 : System error (Gripper)

Code : &H150F

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.16 : System error (EherNet/IP)

Code : &1510

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

21.41 : System error (EXCEPTION)

Code : &H1529

Meaning/Cause	Software error occurred.
Action	Contact your distributor with details of this problem.

[22] Major hardware errors

22.1 : AC power low

Code : &H1601

Dedicated output : *1

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.

22.3 : DC24V power low

Code : &H1603

Dedicated output : *1

Meaning/Cause	a. 24VDC power supply malfunctioned and the voltage dropped. b. Electromagnetic brake for vertical axis is defective. c. Wiring for electromagnetic brake of vertical axis is shorted. d. Short in 24VDC for safety connector.
Action	1. Replace the controller. 2. Replace the vertical axis electromagnetic brake. 3. Replace the ROB I/O cable. 4. Check the SAFETY connector wiring.

22.9 : Abnormal over voltage

Code : &H1609

Meaning/Cause	a. Output voltage for motor power supply exceeded 420 volts. b. Regenerative unit not connected to controller. c. Regenerative unit safety device triggered due to temperature rise (120°C or more) in regeneration damping resistor. d. Cable connecting regenerative unit and controller is defective. e. Regenerative unit is defective. f. Safety connector is used incorrectly.
Action	1. Check the power supply voltage. 2. Connect the regenerative unit. 3. Lower the robot operating duty. 4. Replace the RGEN cable. 5. Replace the regenerative unit. 6. Do not supply 24VDC to SAFETY connector from external source.

22.10 : Abnormal drop in voltage

Code : &H160A

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 24VDC to SAFETY connector from external source. 6. Do not use 24VDC from SAFETY connector as power source for driving external loads.

22.12 : Abnormal temperature

Code : &H160C

Dedicated output : *1

Meaning/Cause	Controller internal temperature rose to 60°C or more.
Action	1. Improve the operating environment. 2. Check if the cooling fan is operating correctly. 3. Replace the controller.

22.13 : Bus interface overtime

Code : &H160D

Dedicated output : *1

Meaning/Cause	Could not acquire access rights to dual port RAM.
Action	Replace the controller.

22.14 : Abnormal DRIVER unit error

Code : &H160E

Dedicated output : *1

Meaning/Cause	Error occurred in hardware.
Action	Contact your distributor with details of the problem.

22.20 : DRIVER unit disconnected

Code : &H1614

Dedicated output : *1

Meaning/Cause	a. CPU unit could not recognize driver unit. b. Dual port RAM is defective.
Action	Replace the controller.

22.30 : DRIVER unit abnormality

Code : &H161E

Dedicated output : *1 or *2

Meaning/Cause	a. Wrong DIP switch setting on drive unit. b. Drive unit not operating correctly. c. Dual port RAM is defective.
Action	Replace the controller.

22.40 : PCMCIA interface overtime

Code : &H1628

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for PCMCIA interface.
Action	1. Replace the PCMCIA interface driver. 2. Replace the controller.

22.41 : OPT.1 interface overtime

Code : &H1629

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 1.
Action	1. Replace the option board connected to option slot 1. 2. Replace the controller.

22.42 : OPT.2 interface overtime

Code : &H162A

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 2.
Action	1. Replace the option board connected to option slot 2. 2. Replace the controller.

22.43 : OPT.3 interface overtime

Code : &H162B

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 3.
Action	1. Replace the option board connected to option slot 3. 2. Replace the controller.

22.44 : OPT.4 interface overtime

Code : &H162C

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with option board connected to option slot 4.
Action	1. Replace the option board connected to option slot 4. 2. Replace the controller.

22.45 : DRIVER interface overtime

Code : &H162D

Dedicated output : *1

Meaning/Cause	Failed to acquire access privilege for interface with driver.
Action	1. Replace the driver. 2. Replace the controller.

22.50 : YC-Link disconnect

Code : &H1632

Meaning/Cause	The secondary station connection test failed at primary station startup. a. The secondary station power is OFF. b. The YC-link communication cable and terminal resistor are disconnected. c. The secondary station's "station No." setting is incorrect.
Action	1. Configure so that the secondary station power switches ON before or simultaneously with the primary station power ON. 2. Verify that the YC-link cable and the terminal resistor are connected. 3. Check the station No. settings.

22.51 : YC-Link error

Code : &H1633

Meaning/Cause	The secondary station failed to start properly. a. Secondary station communication failure.
Action	Verify that the YC-link cable and the terminal resistor are connected.

22.52 : YC-Link type error

Code : &H1634

Meaning/Cause	Mismatch between the secondary station specifications and the setting. a. The secondary station controller or the current sensor specification has been changed (controller was replaced).
Action	1. Check the connected controller and the current sensor specification. 2. Verify that the station No. setting is correct. 3. Perform a system generation.

22.53 : YC-Link robot-type error

Code : &H1635

Meaning/Cause	Mismatch between the secondary station robot No. and the setting. a. The secondary station controller setting was changed, or the controller was replaced.
Action	1. Verify that the correct controller is connected. 2. Verify that the station No. setting is correct. 3. Perform a system generation.

22.54 : YC-Link parameter error

Code : &H1636

Meaning/Cause	Mismatch between the secondary station parameter and the setting. a. The secondary station parameter setting was changed, or the controller was replaced.
Action	1. Verify that the correct controller is connected. 2. Verify that the station No. setting is correct. 3. Perform a system generation.

22.55 : YC-Link network error

Code : &H1637

Meaning/Cause	The secondary station failed to reply. a. The communication cable is disconnected. b. The communication is malfunctioning due to noise. c. A serious failure has occurred at the secondary station controller.
Action	1. Verify that the communication cable is connected. 2. Implement noise countermeasures. 3. Check the secondary station controller's condition.

22.56 : YC-Link Emg. stop on

Code : &H1638

Meaning/Cause	The secondary station is in emergency stop.
Action	Release the secondary station emergency stop.

22.70 : Gripper disconnect

Code : &H1646

Meaning/Cause	It was attempted to execute a gripper dedicated robot language command even though the gripper option was not set.
Action	Set the gripper option.

22.71 : Gripper timeout error

Code : &H1647

Meaning/Cause	Execution of the command sent to the gripper control board ended due to timeout.
Action	Contact your distributor with details of this problem.

22.72 : Gripper cannot get error

Code : &H1648

Meaning/Cause	It was failed to obtain the error that occurred in the gripper main body.
Action	Contact your distributor with details of this problem.

22.73 : Gripper not initialized

Code : &H1649

Meaning/Cause	The gripper initial setting was not complete.
Action	Execute the initial setting of the gripper axis using the generation.

22.74 : Gripper DC24V power low

Code : &H164A

Meaning/Cause	The 24VDC power voltage of the gripper dropped.
Action	Check the 24VDC power voltage.

[26] Alarm messages occurred in electric gripper main body (Fatal error)

26.1 : Gripper Over load

Code : &H1A01

Meaning/Cause	The motor overload occurred. a. The motor was faulty. b. The parameter was faulty. c. The capacity of the power line was insufficient. d. The friction of the machine main body was large.
Action	1. If a symptom, such as excessively heavy motion is found when the motor is moved manually, replace the motor. 2. Initialize the parameters. 3. Check the power capacity. If the power capacity is insufficient, adjust the power voltage to its correct range. 4. Check the movable part of the mechanical part for heavy motion. If the motion is excessively heavy, make the readjustment.

26.2 : Gripper Over current

Code : &H1A02

Meaning/Cause	The motor overcurrent occurred. a. The motor cable was short-circuited. b. The gripper control board was faulty. c. The parameter was faulty.
Action	1. Inspect the electric continuity of the motor cable. If any fault is found, replace the motor. 2. Replace the gripper control board. 3. Initialize the parameters.

26.3 : Gripper Machine reference over

Code : &H1A03

Meaning/Cause	The encoder Z-phase position deviated from the initial value stored in the controller. a. The gripper main body was replaced. b. The finger with the setting on the origin close side was replaced. c. The CPU board in the YRC controller was replaced. d. The CPU software version for the YRC controller was changed. e. Struck an obstacle while returning to the origin point. f. The encoder Z-phase had faulty wiring or malfunctioned. g. The gripper drive section or transmission section malfunctioned.
Action	1. Perform the return-to-origin again. 2. Remove the obstacle and perform the return-to-origin again. 3. Replace the gripper main body.

26.4 : Gripper Power supply voltage low

Code : &H1A04

Meaning/Cause	The DC power voltage dropped to 80% or less of the rated value.
Action	Check the power capacity. If the power capacity is insufficient, adjust the power voltage to its correct range.

26.6 : Gripper P.E. Counter over

Code : &H1A06

Meaning/Cause	a. Mechanical lock occurred in the gripper drive part. b. The motor cable had faulty wiring or incorrect wiring. c. The parameter was faulty.
Action	1. Check the gripper drive part for mechanical lock. 2. Check the motor and encoder cable connections. 3. Initialize the parameters.

26.7 : Gripper Internal fault

Code : &H1A07

Meaning/Cause	Error occurred inside the gripper control board.
Action	Contact your distributor with details of this problem.

26.8 : Gripper 24V Power off

Code : &H1A08

Meaning/Cause	a. 24VDC power cable was not connected. b. 24VDC power was not supplied. c. 24VDC power cable had faulty wiring.
Action	1. Check the 24VDC power cable connection. 2. Check the 24VDC power. 3. Check the 24VDC power cable.

26.9 : Gripper System fault 1

Code : &H1A09

Meaning/Cause	The software entered the runaway status due to external noise.
Action	Contact your distributor with details of this problem.

26.10 : Gripper Feedback error 1

Code : &H1A0A

Meaning/Cause	a. The finger overrun the software limit due to external force. b. The encoder counting was incorrect due to external noise.
Action	1. Turn on the power to check that no external force is applied. After that, perform the return-to-origin. 2. Contact your distributor with details of this problem.

26.11 : Gripper Feedback error 2

Code : &H1A0B

Meaning/Cause	a. The encoder cable has faulty wiring. b. The guide block was locked.
Action	1. Check the encoder cable connections. 2. Unlock the guide block.

26.12 : Gripper Abnormal voltage

Code : &H1A0C

Meaning/Cause	a. The power voltage increased by regeneration. b. The 24VDC power voltage was incorrect.
Action	1. Decrease the duty of the mechanism part. 2. Check the capacity of the 24VDC power supply. If the capacity is insufficient, adjust the power voltage to its correct range.

26.13 : Gripper System fault 2

Code : &H1A0D

Meaning/Cause	The software entered the runaway status due to external noise.
Action	Contact your distributor with details of this problem.

26.14 : Gripper Feedback error 3

Code : &H1A0E

Meaning/Cause	The motor cable had faulty wiring or incorrect wiring.
Action	Check the motor cable connections.

[27] Error messages occurred in electric gripper main body

27.32 : Gripper Soft limit over

Code : &H1B20

Meaning/Cause	The operation position exceeded the software limit set by the parameter.
Action	1. Change the operation position to put it within a software limit area. 2. Change the software limit value. 3. Change the limit width.

27.35 : Gripper Origin incomplete

Code : &H1B23

Meaning/Cause	The return-to-origin was not performed.
Action	Perform the return-to-origin to put the gripper in the return-to-origin completion status.

27.36 : Gripper Servo off

Code : &H1B24

Meaning/Cause	A movement command was executed in the servo OFF status.
Action	Turn on the servo.

27.37 : Gripper Interlock

Code : &H1B25

Meaning/Cause	It was attempted to execute a program or move an axis in the interlock status.
Action	Reset the interlock and execute the program or move the axis.

27.50 : Gripper Data error

Code : &H1B32

Meaning/Cause	The option data, such as movement command to be sent to the gripper control board exceeded the input range.
Action	Restart the system generation.

27.51 : Gripper type error

Code : &H1B33

Meaning/Cause	It was attempted to initialize with an unspecified actuator type.
Action	Enter a correct value for the gripper axis number.

27.52 : Gripper Internal failure

Code : &H1B34

Meaning/Cause	a. The 24VDC power was not turned on. b. An error occurred in the gripper control board.
Action	1. Check the 24VDC power. 2. Contact your distributor with details of this problem.

1.2 Programming box error messages

When a hardware error or a software error occurs in the programming box, the following messages are highlighted (shown with reversed background) on the guideline of the lowest line of the screen.

PB TRAP !!

Contents : Undefined operation code was executed.
Cause : A hardware error occurred.
Action : Replace the programming box.

PB Receive Error!! (Data Register Full)

Contents : Data receive register is full.
Cause : A hardware error occurred.
Action : Replace the programming box.

PB Receive Error!! (Over Run Error)

Contents : An overrun occurred while receiving data.
Cause : a. Malfunction occurred due to noise.
b. The cable is broken or disconnected.
c. The connector is not making contact.
Action : 1. Separate equipment away from noise source.
2. Replace the PB cable.
3. Replace the programming box.

PB Receive Error!! (Parity Error)

Contents : Parity error occurred during communication.
Cause : a. Malfunction occurred due to noise.
b. The cable is broken or disconnected.
c. The connector is not making contact.
Action : 1. Separate equipment away from noise source.
2. Replace the PB cable.

PB Receive Error!! (Framing Error)

Contents : Framing error occurred during communication.
Cause : Malfunction occurred due to noise.
Action : Separate equipment away from noise source.

PB Receive Error!! (Buffer Overflow)

Contents : Remaining area in receive buffer fell below 1% during communications.
Cause : a. Large amount of data was sent from the controller.
b. Communication control error.
Action : 1. Replace the programming box.
2. Replace the controller.

PB Transmit Error!! (Time Out Error)

Contents : Transmitting to controller is impossible.
Cause : a. The cable is broken or disconnected.
b. No response from controller due to problem in CPU unit.
Action : 1. Replace PB cable.
2. Replace the programming box.
3. Replace the controller.

PB Device Not Ready!! (Time Out Error)

Contents : Cannot control the controller.
Cause : a. The cable is broken or disconnected.
b. Handshake with controller is defective due to problem with controller.
Action : 1. Replace PB cable.
2. Replace the programming box.
3. Replace the controller.

PB RS-422 Error!! (RTS/CTS LINE Error)

Contents : Cannot control the controller.
Cause : a. The cable is broken or disconnected.
b. Controller operation is abnormal.
c. The connector is not making contact.
Action : 1. Replace the PB cable.
2. Replace the controller.

PB RS-422 Error!! (DATA LINE Error)

Contents : Data communication with controllers is defective.
Cause : a. The cable is broken or disconnected.
b. The connector is not making contact.
Action : 1. Replace the PB cable.
2. Replace the controller.

PB Memory Error!! (DATA Write Error)

Contents : Internal memory is defective.
Cause : Internal memory circuit is defective.
Action : Replace the programming box.

PB Receive Error!! (Buffer Overflow)

Contents : Remaining capacity of data receive data buffer fell below 1 percent.
Cause : a. Massive amount of data was sent from controller.
b. Communication control error.
Action : 1. Replace the programming box.
2. Replace the controller.

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:YRC + regenerative unit • Robot model name + serial No. example:R6YXGL250 • Controller version No. example:V10.01 R1001
When	• Date of purchase example:June 2008 • 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 error information

Error history (log) information is stored inside the robot controller. The following 2 methods are available for checking this information.

2.2.1 Acquiring information from the programming box

1 ***Enter DIAGNOS mode.***

Press the F5 (DIAGNOS) key in SYSTEM mode.

2 ***Check the error status or error history.***

Pressing F1 (CHECK) shows the controller error status.

A maximum of 12 errors are displayed.

Pressing F2 (HISTORY) shows a list of errors.

A maximum of 500 error histories can be checked.

2.2.2 Acquiring information from the RS-232C

1 ***Connect the controller to the PC.***

Use an RS-232C cable to connect the controller to the PC and set the communication conditions.

2 ***Check the error log.***

Send a command "@READ LOG" from the PC to receive the internal error history in the controller.
A maximum of 500 error histories can be checked.

2.3 Troubleshooting checkpoints

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 power input terminal correctly. • Supply rated power supply 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 "ERR" LED on front panel lights up.	• Now in emergency stop.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check the DI00 (Emergency stop input) status on the programming box display screen.	• Release programming box emergency stop button. • Insert PB connector. • Connect the emergency stop terminal of SAFETY connector.
		• Error of error group No. 17 occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information.	• Check the axis from the error information. • Check the cause from the error information. • Eliminate the cause of the error.
		• Error of error group No. 21, 22 occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information.	• Check the cause from the error information. • Eliminate the cause of the error.

2. Robot operation

	Symptom	Possible cause	Check items	Corrective action
1	Controller turns on but can't execute program and manual movement.	• Interlock signal.	• Check standard I/O interface connector (for interlock signal) and check if 24VDC is supplied. • Check the DI11 (Interlock) status on the programming box display screen.	• Connect the standard I/O interface connector for interlock signal. • Connect the 24VDC power supply. • Disable interlock signal with the parameter.
		• Robot is in emergency stop.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check the DI00 (Emergency stop input) status on the programming box display screen.	• Release programming box emergency stop button. • Plug in PB connector. • Connect emergency stop terminal of SAFETY connector.
		• Error occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED on front panel is lit.	• Check the cause from the error information. • Eliminate the cause of the error.
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/ acceleration settings are incorrect.	• Check tip weight parameter setting in SYSTEM mode. • Check "Accel. Coefficient" parameter setting in SYSTEM mode. • Check AXWGHT/ACCEL commands in program language.	• Set a correct tip weight parameter. • Set a correct "Accel. Coefficient" 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 if warped or damaged guides or ball screws are found.
		• Controller is defective.	• Replace with another controller and check operation.	• If operation is normal use the substitute controller.
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.	• If operation is normal use the substitute controller.

* 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 absolute reset and return to original position. In case 2, you cannot return to original position.

3. I/O operation

	Symptom	Possible cause	Check items	Corrective action
1	Won't operate even when dedicated input signal is supplied.	• No 24VDC supply.	• Check that 24VDC is supplied from standard I/O interface connector. • Check DI04 on programming box screen.	• Supply 24VDC.
		• Problem in signal connection.	• Check wiring on standard I/O interface connector.	• Make the correct wiring on standard I/O interface connector.
		• Error has occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED is lit on front of controller.	• Check the cause from the error information. • Eliminate the cause of the error.
2	No output of dedicated output signal.	• No 24VDC supply.	• Check that 24VDC is supplied from standard I/O interface connector. • Check DI04 on programming box screen.	• Supply 24VDC.
		• Problem in signal connection.	• Check wiring on standard I/O interface connector.	• Make the correct wiring on standard I/O interface connector.
		• Error has occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED is lit on front of controller.	• Check the cause from the error information. • Eliminate the cause of the error.
3	No output of general-purpose I/O signal.	• No 24VDC supply.	• Check that 24VDC is supplied from standard. I/O interface connector. • Check DI04 on programming box screen. • Check that 24VDC is supplied for option I/O interface.	• Supply 24VDC.
		• Problem in signal connection.	• Check wiring on standard I/O interface connector. • Check wiring on option I/O interface connector.	• Make the correct wiring on standard I/O interface connector. • Make the correct wiring on option I/O interface connector.
		• Error in option I/O interface setting.	• Check the option I/O interface setting on the DIP switch.	• Make the correct option I/O interface setting.
		• Error has occurred.	• Connect the programming box and run self-diagnosis in SYSTEM mode to check the error information. • Check if "ERR" LED is lit on front of controller.	• Check the cause from the error information. • Eliminate the cause of the error.

Revision history

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

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

Revision code	Date	Description
01	February 2010	Original production
02	January 2013	New robot models The information related to the operation mode has been removed from the version 01 and included in the new Operation Manual (I138E-EN)
03	January 2014	New robot models Chapter 1 "2.2 Overload error reset" was added. The "limitless motion" axis parameter item was added. Troubleshooting items were added. Text errors were corrected.
03A	December 2014	Small correction
03B	August 2015	Schaffner filter was added

OMRON

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Note: Specifications subject to change without notice.

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