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YAMAHA

YAMAHA 4-AXIS ROBOT CONTROLLER

RCX240

User's Manual

Ver. 2.06

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Introduction

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

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

Refer to the "Programming Manual" that comes with the robot controller for detailed information on robot programs.

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.

Reference

Refer to "4. Connecting to the power" in Chapter 3, "INSTALLATION".

[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 be sure to connect the absolute batteries while referring to "9. 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.

Reference

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 "11.9 Absolute reset" in Chapter 4, "OPERATION".
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 achieve maximum service life for the single-axis robots, the robot must be operated within the allowable duty (50%).
The duty is calculated as follows:

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

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

Overview of the RCX series

The YAMAHA RCX series robot controllers were developed based on years of YAMAHA experience and proven achievements in robotics and electronics. These controllers are specifically designed to operate YAMAHA industrial robots efficiently and accurately.
Despite their compact size, the RCX series controllers operate efficiently as multi-axis controllers with a variety of functions.
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 the programming manual for more details on multi-tasking.)

2. Robot language

The RCX series controller comes with a BASIC-like high-level robot language that conforms to the industrial robot programming language SLIM *[1]. This robot language allows easy programming even of complex movements such as multi-task operations and uses a compiling method *[2] for rapid execution of programs.
(*[1]: Standard Language for Industrial Manipulators)
(*[2]: 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.
- **Three-dimensional CP control**
  Allows three-dimensional interpolation control of linear and circular movements.

4. Maintenance

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

5. CE marking *

As a YAMAHA robot series product, the RCX series robot controller is designed to conform to machinery directives, low-voltage directives and EMC (Electromagnetic compatibility) directives. In this case, the robot controller is set to operate under "SAFE" mode. (* For CE marking compliance, see the CE marking supplement manual.)

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

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1. Safety information

Before using the YAMAHA robot controller, be sure to read this manual and related manuals, and follow their instructions to use the robot controller safely and correctly.
Warnings and cautions listed in this manual relate to YAMAHA robot controllers. To ensure safety of the user's final system that includes YAMAHA robots and controllers, please take appropriate safety measures as required by the user's individual system.

Industrial robots are highly programmable machines that provide a large degree of freedom in movement. To use YAMAHA robots and controllers safely and correctly, be sure to comply with the safety instructions and precautions described in this chapter. 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).

This manual describes safety precautions and operating points using the following symbols and signal words.

DANGER

"DANGER" INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

WARNING

"WARNING" INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.

CAUTION

"CAUTION" indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or damage to the equipment or loss of data.

NOTE

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

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

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

To use YAMAHA robots and controllers safely and correctly, always comply with the safety rules and instructions.
Please note, however, this user's 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.

2. Particularly important cautions

Particularly important cautions for handling and operating the robot and controller are described below. Additional cautions are also described in each chapter. Be sure to comply with those instructions to ensure safety.

2.1 System design safety points

DANGER

- **YAMAHA ROBOT CONTROLLERS AND ROBOTS ARE DESIGNED AND MANUFACTURED FOR GENERAL-PURPOSE INDUSTRIAL EQUIPMENT. THEY SHOULD NOT BE USED IN THE FOLLOWING APPLICATIONS:**
  - **MEDICAL EQUIPMENT OR SYSTEMS WHICH WILL AFFECT HUMAN LIFE**
  - **EQUIPMENT DESIGNED TO CARRY OR TRANSPORT PERSONS**
  - **EQUIPMENT OR SYSTEMS WHICH WILL SERIOUSLY AFFECT SOCIETY OR PUBLIC POLICY**
  - **USE IN ENVIRONMENTS SUBJECT TO VIBRATION, SUCH AS VEHICLES AND SHIPS**
- **EACH ROBOT CONTROLLER HAS AN EMERGENCY STOP INPUT TERMINAL TO TRIGGER EMERGENCY STOP. USING THIS TERMINAL, CONFIGURE A SAFETY CIRCUIT SO THAT THE SYSTEM INCLUDING THE ROBOT CONTROLLER WILL WORK SAFELY.**

WARNING

- **TO CHECK THE OPERATING STATUS OF THE ROBOT CONTROLLER, REFER TO THIS MANUAL AND RELATED USER'S MANUAL. BUILD THE SYSTEM INCLUDING THE ROBOT CONTROLLER SO THAT IT WILL ALWAYS WORK SAFELY.**
- **INSTALL A SIGNAL LIGHT (SIGNAL TOWER, ETC.) AT AN EASY-TO-SEE POSITION SO THAT THE OPERATOR WILL KNOW THE STOP STATUS OF THE ROBOT (TEMPORARY STOP, EMERGENCY STOP, ERROR STOP, ETC.).**

CAUTION

- **Do not bundle control lines or communication cables together or in close contact with the main power supply circuit or power lines. As a general rule, separate them by at least 100mm. Failure to follow this instruction may cause malfunctions due to noise.**

2.2 Installation safety points

WARNING

- ALWAYS GROUND THE GROUND TERMINAL OF THE POWER TERMINAL BLOCK TO AVOID ELECTRICAL SHOCK.
- 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 MANUFACTURER.
- ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE STARTING INSTALLATION OR WIRING WORK. FAILURE TO SHUT OFF ALL PHASES MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE.
- YAMAHA ROBOTS AND ROBOT CONTROLLERS ARE NOT DESIGNED TO BE EXPLOSION-PROOF. DO NOT USE THEM IN LOCATIONS EXPOSED TO INFLAMMABLE GASES, GASOLINE OR SOLVENT THAT COULD CAUSE EXPLOSION OR FIRE. FAILURE TO OBSERVE THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH, OR LEAD TO FIRE.
- USE THE ROBOT CONTROLLER WITHIN THE ENVIRONMENT SPECIFICATIONS LISTED IN THIS MANUAL.
  USING THE CONTROLLER IN AN ENVIRONMENT OUTSIDE THE SPECIFICATION RANGE MAY CAUSE ELECTRICAL SHOCK, MALFUNCTIONS, PRODUCT DAMAGE OR DETERIORATED PERFORMANCE.
- INSTALL THE ROBOT CONTROLLER AND PROGRAMMING BOX AT A LOCATION OUTSIDE THE ROBOT'S WORKING ENVELOPE YET WHERE IT IS EASY TO OPERATE THE ROBOT AND VIEW ITS MOTION.
- INSTALL THE 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 BE A CAUSE OF INJURY.
- INSTALL THE ROBOT CONTROLLER IN A STABLE, LEVEL LOCATION AND SECURE IT FIRMLY. AVOID INSTALLING THE ROBOT CONTROLLER UPSIDE DOWN OR IN A TILTED POSITION.
- PROVIDE SUFFICIENT CLEARANCE AROUND THE ROBOT CONTROLLER FOR GOOD VENTILATION. POOR VENTILATION MAY CAUSE MALFUNCTION, BREAKDOWN OR FIRE.
- NEVER DIRECTLY TOUCH THE CONDUCTIVE SECTIONS AND ELECTRONIC PARTS OTHER THAN THE CONNECTORS, ROTARY SWITCHES, AND DIP SWITCHES ON THE OUTSIDE PANEL OF THE ROBOT CONTROLLER.
- SECURELY TIGHTEN THE SCREWS ON THE L-SHAPED BRACKETS TO INSTALL THE ROBOT CONTROLLER. IF NOT SECURELY TIGHTENED, THE SCREWS MAY BECOME LOOSE CAUSING THE CONTROLLER TO DROP.
- SECURELY INSTALL EACH CONNECTION CABLE CONNECTOR INTO THE RECEPTACLES OR SOCKETS. POOR CONNECTIONS MAY CAUSE EQUIPMENT MALFUNCTIONS.

2.3 Wiring safety points

WARNING

- **ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE STARTING INSTALLATION OR WIRING WORK. FAILURE TO SHUT OFF ALL PHASES MAY CAUSE ELECTRICAL SHOCK OR PRODUCT DAMAGE.**

CAUTION

- **Make sure that no foreign matter such as cutting chips or wire scraps enter the robot controller. Malfunctions, breakdown or fire may result if they have entered.**
- **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 may cause equipment malfunctions.**
- **Do not modify the cables and do not place any heavy object on them. Handle them carefully to avoid damage. Damaged cables may cause malfunction or electrical shock.**
- **If there is a possibility that the cables connected to the robot controller may be damaged, protect them with a cover, etc.**
- **Do not apply excessive loads or impacts to the connectors when making cable connections. The connector pins may become bent or the internal PC board may be damaged.**
- **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. Detaching by pulling on the cable itself may damage the connector or cables, and poor cable contact may cause equipment malfunctions.**

2.4 Start-up and maintenance safety points

DANGER

- NEVER ENTER THE ROBOT'S WORKING ENVELOPE WHILE THE ROBOT IS OPERATING OR THE MAIN POWER IS TURNED ON. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH. INSTALL A SAFEGUARD (SAFETY ENCLOSURE) OR A GATE INTERLOCK WITH AN AREA SENSOR TO KEEP ALL PERSONS AWAY FROM THE ROBOT'S WORKING ENVELOPE.
- WHEN IT IS NECESSARY TO OPERATE THE ROBOT WHILE YOU ARE WITHIN THE ROBOT'S WORKING ENVELOPE, SUCH AS FOR TEACHING OR MAINTENANCE/ INSPECTION, ALWAYS CARRY THE PROGRAMMING BOX WITH YOU SO THAT YOU CAN IMMEDIATELY STOP THE ROBOT OPERATION IN CASE OF AN ABNORMAL CONDITION. ALSO SET THE ROBOT OPERATING SPEED TO 3% OR LESS. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH.
- CHECK THE FOLLOWING POINTS BEFORE OPERATING THE ROBOT.
  - NO ONE IS WITHIN THE ROBOT'S WORKING ENVELOPE.
  - THE PROGRAMMING BOX IS AT THE SPECIFIED POSITION.
  - THERE IS NO ABNORMAL STATE IN THE ROBOT AND RELATED DEVICES.

WARNING

- ONLY PERSONNEL TRAINED IN SAFETY AND ROBOT OPERATION MAY OPERATE THE ROBOT. OPERATION BY ANY PERSON WHO HAS NOT RECEIVED THE PROPER TRAINING IS VERY DANGEROUS AND MUST BE AVOIDED.
- THE ROBOT AND ROBOT CONTROLLER ARE NOT DESIGNED TO BE EXPLOSION-PROOF. DO NOT USE THEM IN LOCATIONS EXPOSED TO INFLAMMABLE GASES, GASOLINE OR SOLVENT THAT COULD CAUSE EXPLOSION OR FIRE. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH, OR LEAD TO FIRE.
- DO NOT TOUCH ANY ELECTRICAL TERMINAL OF THE ROBOT CONTROLLER. DOING SO MAY CAUSE ELECTRICAL SHOCK OR EQUIPMENT MALFUNCTIONS.
- ALWAYS CONNECT THE ROBOT AND ROBOT CONTROLLER IN THE CORRECT COMBINATION. USING THEM IN AN INCORRECT COMBINATION MAY CAUSE FIRE OR BREAKDOWN.
- ALWAYS SHUT OFF ALL PHASES OF THE POWER SUPPLY EXTERNALLY BEFORE CLEANING OR TIGHTENING THE TERMINAL SCREWS. FAILURE TO SHUT OFF ALL PHASES MAY CAUSE ELECTRICAL SHOCK, PRODUCT DAMAGE OR MALFUNCTIONS.
- DO NOT TOUCH THE ROBOT CONTROLLER AND ROBOT DURING OPERATION. SOME PARTS IN THE ROBOT CONTROLLER OR ROBOT ARE HOT DURING OPERATION. TOUCHING THEM MAY CAUSE BURNS.
- DO NOT HANDLE OR OPERATE THE ROBOT CONTROLLER OR PROGRAMMING BOX WITH WET HANDS. TOUCHING THEM WITH WET HANDS MAY RESULT IN ELECTRICAL SHOCK OR BREAKDOWN.
- IMMEDIATELY TURN OFF POWER IF UNUSUAL ODORS, NOISE OR SMOKE ARE NOTICED DURING OPERATION. CONTINUOUS OPERATION UNDER SUCH A CONDITION MAY RESULT IN ELECTRICAL SHOCK, FIRE OR BREAKDOWN. STOP USING AND CONTACT OUR SALES OFFICE OR SALES REPRESENTATIVE.

- DO NOT DISASSEMBLE OR MODIFY ANY PART IN THE ROBOT CONTROLLER AND PROGRAMMING BOX. DO NOT OPEN ANY COVER. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE ELECTRICAL SHOCK, BREAKDOWN, MALFUNCTION, INJURY, OR FIRE.
- IF A COMPONENT USED IN THE ROBOT OR CONTROLLER NEEDS TO BE REPLACED OR REPAIRED, ALWAYS FOLLOW THE INSTRUCTIONS FROM YAMAHA. INSPECTION AND MAINTENANCE OF THE CONTROLLER OR ROBOT BY ANY PERSON WHO DOES NOT HAVE THE REQUIRED KNOWLEDGE AND EXPERTISE IS DANGEROUS AND MUST BE AVOIDED.
- WHEN PERFORMING MAINTENANCE OR INSPECTION OF THE ROBOT CONTROLLER UNDER OUR INSTRUCTIONS, WAIT AT LEAST 30 MINUTES AFTER TURNING THE POWER OFF. SOME COMPONENTS IN THE ROBOT CONTROLLER MAY BE HOT OR STILL RETAIN A HIGH VOLTAGE SHORTLY AFTER OPERATION, SO BURNS OR ELECTRICAL SHOCK MAY OCCUR IF THOSE PARTS ARE TOUCHED.
- DURING STARTUP OR MAINTENANCE WORK, DISPLAY AN EASY TO UNDERSTAND SIGN OR MESSAGE ON THE PROGRAMMING UNIT OR OPERATION PANEL TO PREVENT ANYONE OTHER THAN PERSONNEL FOR THAT WORK FROM MISTAKENLY OPERATING A START OR SELECTOR SWITCH. IF NEEDED, TAKE OTHER MEASURES SUCH AS LOCKING THE COVER ON THE OPERATION PANEL.
- DECIDE ON "WORK INSTRUCTIONS" IN CASES WHERE PERSONNEL MUST WORK WITHIN THE ROBOT'S WORKING ENVELOPE TO PERFORM STARTUP OR MAINTENANCE WORK. MAKE SURE THE WORKERS KNOW THESE "WORK INSTRUCTIONS" WELL.

CAUTION

- When using ferrite cores for noise elimination, fit them to the power cable as close to the robot controller and/or the robot as possible, to prevent malfunctions due to noise.
- Back up the robot controller internal data in 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 the internal data.
- Do not use thinner, benzene, and alcohol to wipe clean the surface of the programming box. The surface sheet may be damaged or printed letters or marks might be erased. Use a soft, dry cloth and gently wipe the surface.
- Do not use a hard or pointed object to operate 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 of the programming box. Malfunction or breakdown may result if a wrong memory card is used.

2.5 Safety precautions during robot operation

DANGER

- NEVER ENTER THE ROBOT'S WORKING ENVELOPE WHILE THE ROBOT IS OPERATING OR THE MAIN POWER IS TURNED ON. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH. INSTALL A SAFEGUARD (SAFETY ENCLOSURE) OR A GATE INTERLOCK WITH AN AREA SENSOR TO KEEP ALL PERSONS AWAY FROM THE ROBOT'S WORKING ENVELOPE.
- WHEN IT IS NECESSARY TO OPERATE THE ROBOT WHILE YOU ARE WITHIN THE ROBOT'S WORKING ENVELOPE, SUCH AS FOR TEACHING OR MAINTENANCE/ INSPECTION, ALWAYS CARRY THE PROGRAMMING BOX WITH YOU SO THAT YOU CAN IMMEDIATELY STOP THE ROBOT OPERATION IN CASE OF AN ABNORMAL CONDITION. ALSO SET THE ROBOT OPERATING SPEED TO 3% OR LESS. FAILURE TO FOLLOW THIS INSTRUCTION MAY CAUSE SERIOUS ACCIDENTS INVOLVING INJURY OR DEATH.

WARNING

- ONLY PERSONNEL TRAINED IN SAFETY AND ROBOT OPERATION MAY OPERATE THE ROBOT. OPERATION BY ANY PERSON WHO HAS NOT RECEIVED THE PROPER TRAINING IS VERY DANGEROUS AND MUST BE AVOIDED.

2.6 Precautions for disposal

CAUTION

- **When disposing of this product discard it as industrial waste.** Take appropriate measures in compliance with legal regulations in your country or entrust its proper disposal to a company authorized to handle industrial waste.

3. Safety measures for robots

3.1 Safety measures for SCARA type robots

(1) Safty measures during transportation:

To ensure safety, use the eyebolts that come with the robot.
Refer to the robot user's manual for details.

(2) Protective measures against electrical shock:

Use the protective ground terminal to ensure safety.
Refer to the robot user's manual for details.

3.2 Safety measures for single-axis robots, Cartesian robots, and pick & place robots

(1) Protective measures against electrical shock:

Use the protective ground terminal to ensure safety.
Refer to the robot user's manual for details.

4. Motor overload precautions

Since abnormal operation (such as overload) of the motor is detected by software, the controller parameters must be set correctly to match the motor type used in the robot connected to the controller.
Prior to shipping, the controller parameters are preset to match the robot model to be used. However, please check the robot model again when connecting it to the controller.

5. Warning labels and marks

5.1 Warning labels

The warning labels shown below are affixed to the controller. To use the YAMAHA robot and controller safely and correctly, be sure to observe the instructions and caution on the labels.

(1) "Read Instruction Manual" label



This label means that important information you must know is described in the manual.
Before using the controller, be sure to read this manual carefully.
When in particular configuring an external safety circuit or connecting a power supply to the controller, read this manual carefully and follow the instructions.
Connectors have a particular orientation, so insert each connector in the correct direction.

5.2 Warning marks

The following warning marks are shown on the controller. To use the YAMAHA robot and controller safely and correctly, be sure to observe the instructions and caution of the marks.

(1) "Electric Hazard" mark



This mark indicates that a high voltage is present.
This mark warns you of possible electrical shock. Do not touch the terminal block and connectors to avoid electrical shock.

(2) "CAUTION" mark



This label means that important information you must know is described in the manual.
Before using the controller, be sure to read this manual carefully.
When in particular configuring an external safety circuit or connecting a power supply to the controller, read this manual carefully and follow the instructions.
Connectors have a particular orientation, so insert each connector in the correct direction.

(3) "High Temperature Hazard" mark



Indicates that the area around this mark may become very hot.
Heatsinks and regenerative unit become hot during and shortly after operation. Do not touch them to avoid burns.

6. Industrial robot operating and maintenance personnel

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 user's manual carefully to understand its contents before attempting the robot operation.

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.

7. Make daily and periodic inspections

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

8. 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

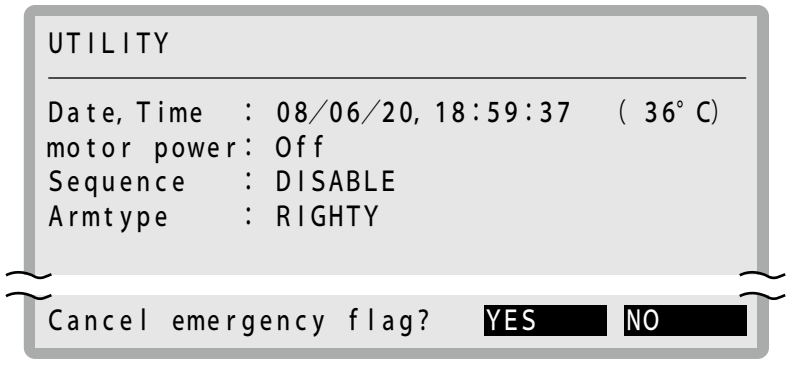
THE VERTICAL AXIS OF THE VERTICAL USE ROBOT WILL SLIDE DOWN WHEN THE BRAKE IS RELEASED, CAUSING A HAZARDOUS SITUATION.

- **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.**

Step 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.)

Emergency stop screen



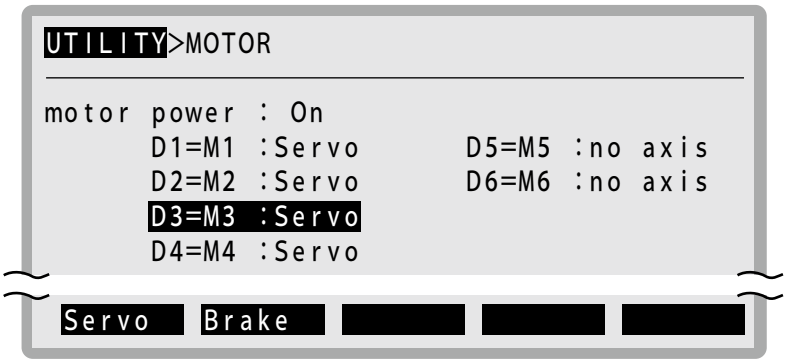
Step 2 *Press the* F4 *(Yes) key to cancel the internal emergency stop flag.*

It is not necessary to release the emergency stop button on the RPB and the external emergency stop before this operation.

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

Step4 *Use the cursor keys (▲/▼) to select the axis for the target brake.*

Selecting axis



Step5 *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.

9. Warranty

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

■ This warranty does not cover any failure caused by:

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

■ The following cases are not covered under the warranty:

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

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

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10. Operating environment

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 cooled housing 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, high-output 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

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1. System overview

The RCX series controllers are designed for use with a SCARA robot or Cartesian 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.

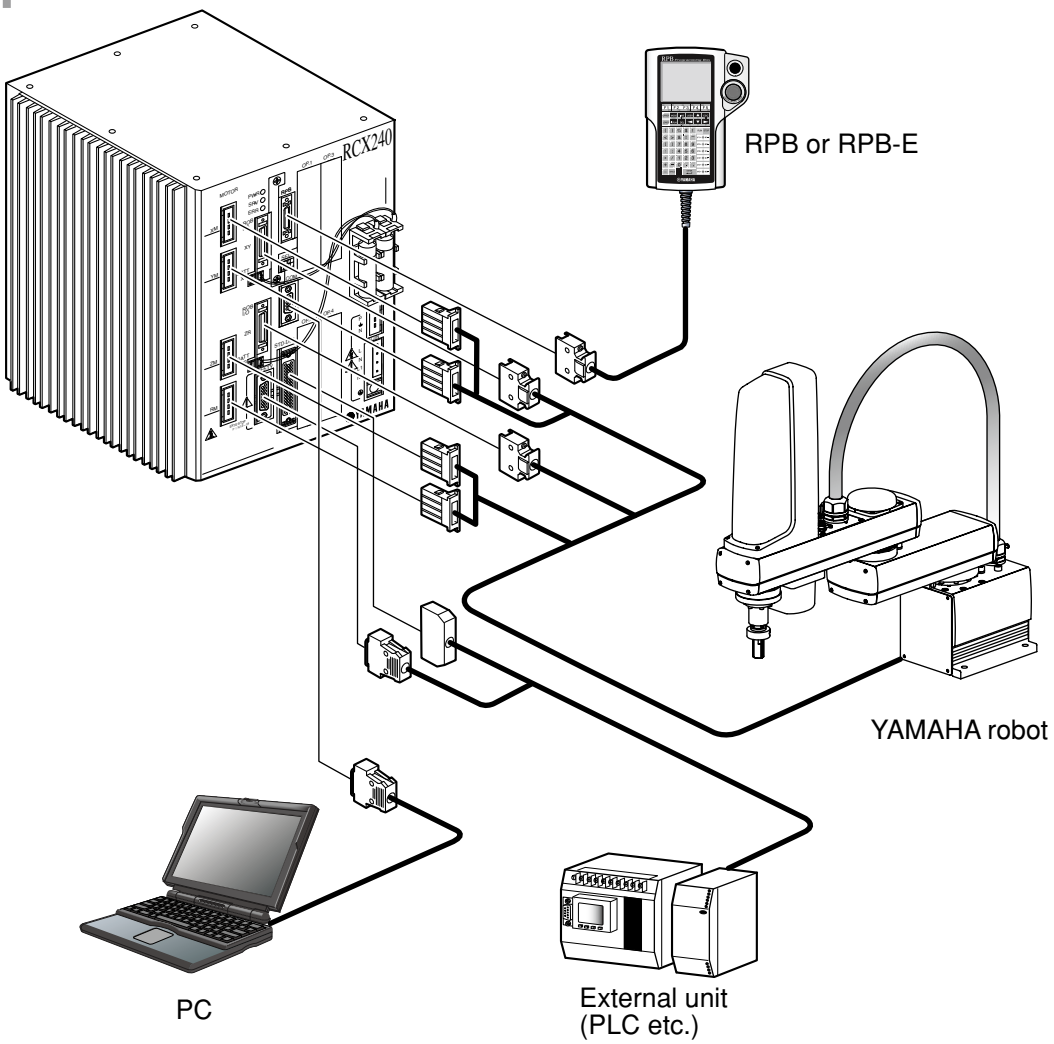
1.1 Main system configuration

Configuration 1 : System for controlling one robot

Example : YK500XG

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

System for controlling one robot

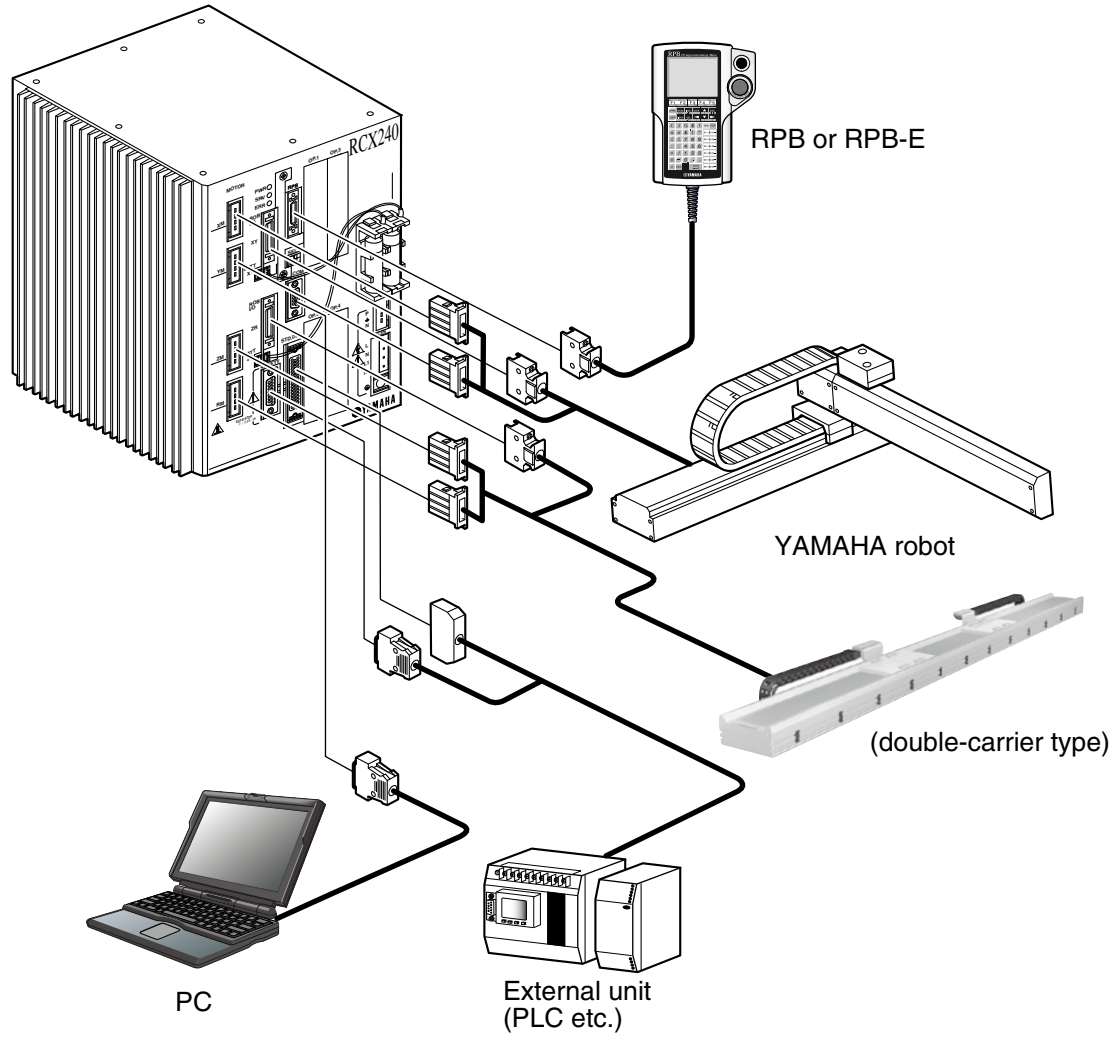


Configuration 2 : System for controlling two robot

Example: Main robot : MXYx
Sub robot : MF50 double-carrier type

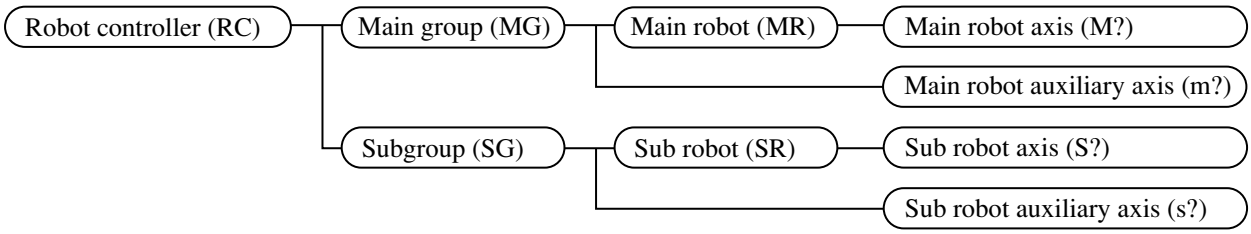
Axes 1 and 2 on the robot controller are used as the main robot axes and axes 3 and 4 are used as the Sub robot axes.

System for controlling two robot



1.2 Axis definition for the RCX240

Axis definitions for the YAMAHA RCX240 robot controller are shown below.



Robot controller	Indicates the entire robot controller and controls a maximum of 4 axes. The letters "RC" are displayed on the RPB.
Main group	Indicates the main robot and main auxiliary axes and has a maximum of 4 axes. The letters "MG" are displayed on the RPB.
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 RPB.
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 RPB. (?=1 to 4)
Main auxiliary axes	Are 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 RPB. (?=1 to 4)
Sub group	Indicates the sub robot and sub auxiliary axes, and has a maximum of 2 axes. The letters "SG" are displayed on the RPB.
Sub robot	Indicates the robot name specified as a sub robot, and includes all axes of the sub robot. The letters "SR" are displayed on the RPB.
Sub robot axes	Indicate the axes composing the sub robot. These can be moved with the robot language MOVE2 command. The letters "S?" are displayed on the RPB. (?=1 to 2)
Sub auxiliary axes	Are the single axes composing the sub group. These cannot be moved with the robot language MOVE2 command. Use the DRIVE2 command to move these axes. The letters "s?" are displayed on the RPB. (?=1 to 2)

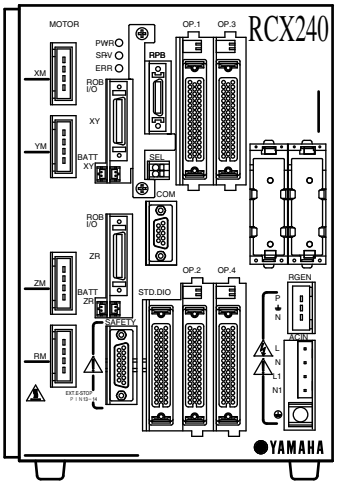
Only the main robot axes are usually specified. Auxiliary axes and sub group settings are for options made at the time of shipment.

2. External view and control system

The RCX240 external view and the control system basic diagram are shown below.

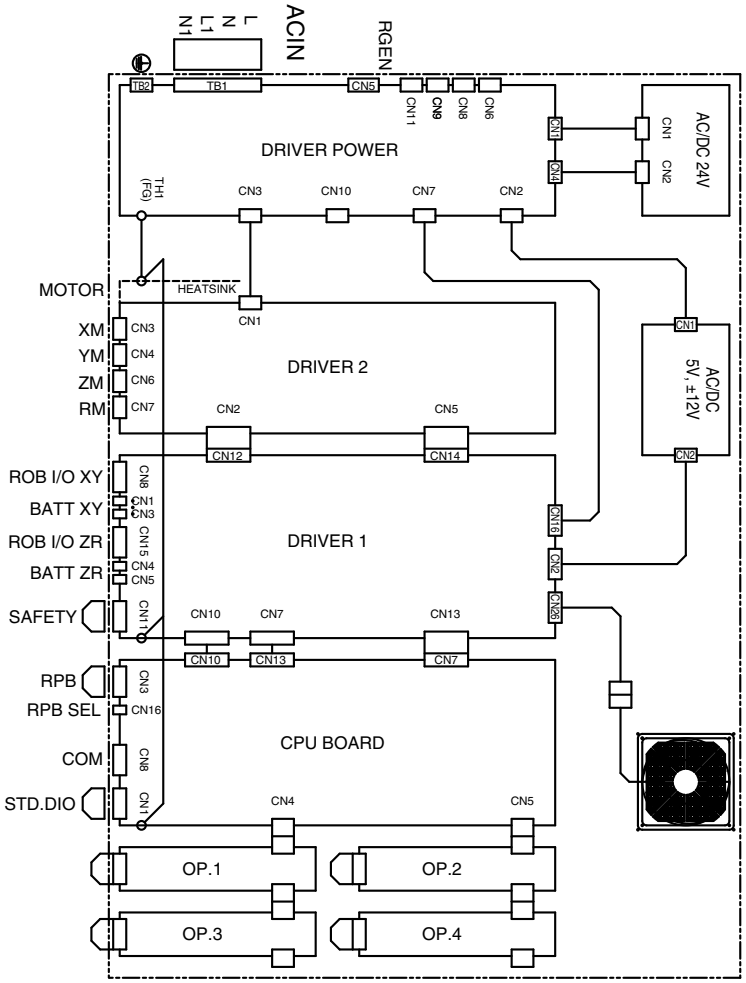
2.1 RCX240 external view

RCX240 external view



2.2 Controller system

Basic block diagram



3. Optional devices

3.1 RPB programming box

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

RPB programming box



3.2 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.

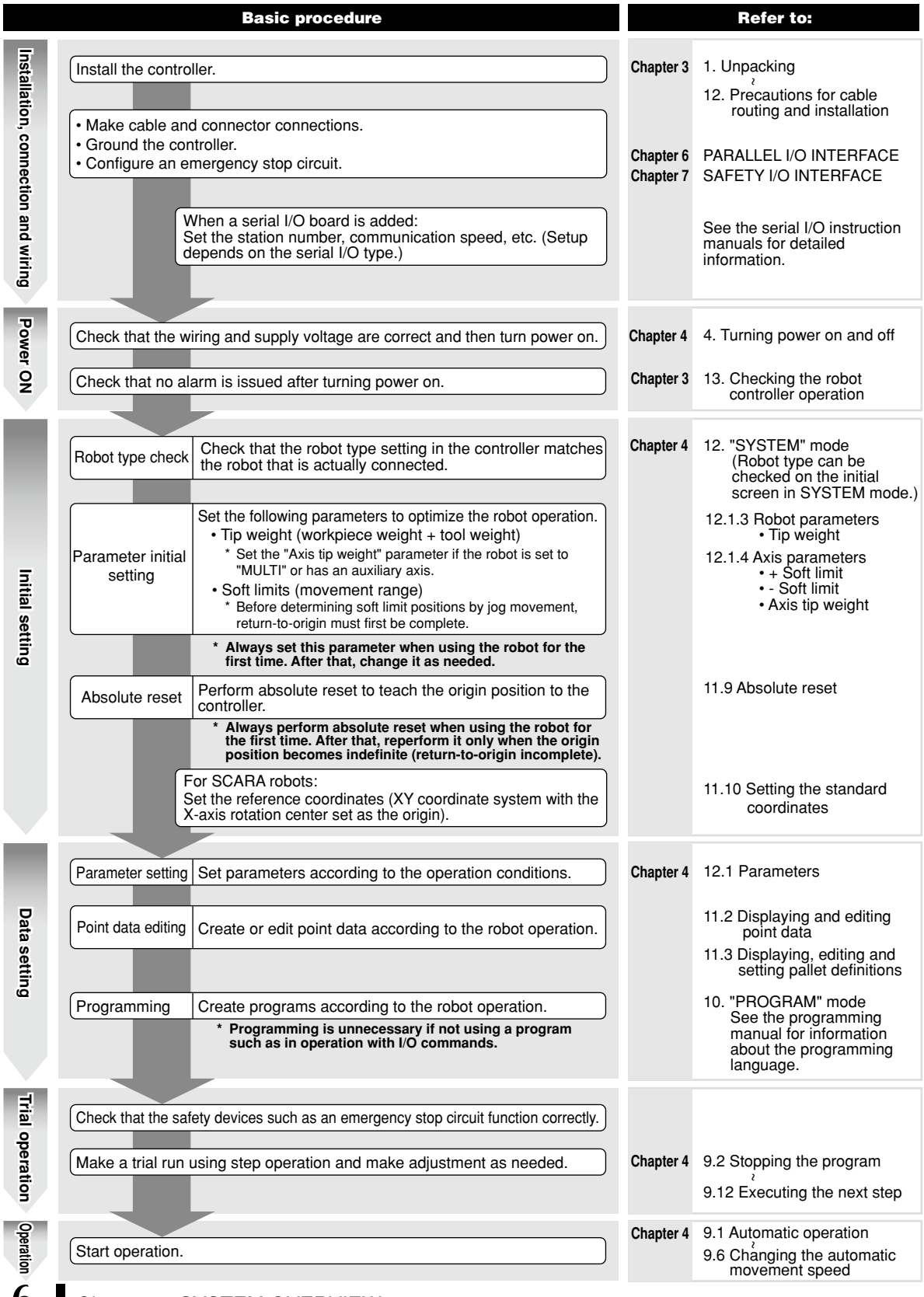
3.3 Regenerative unit

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

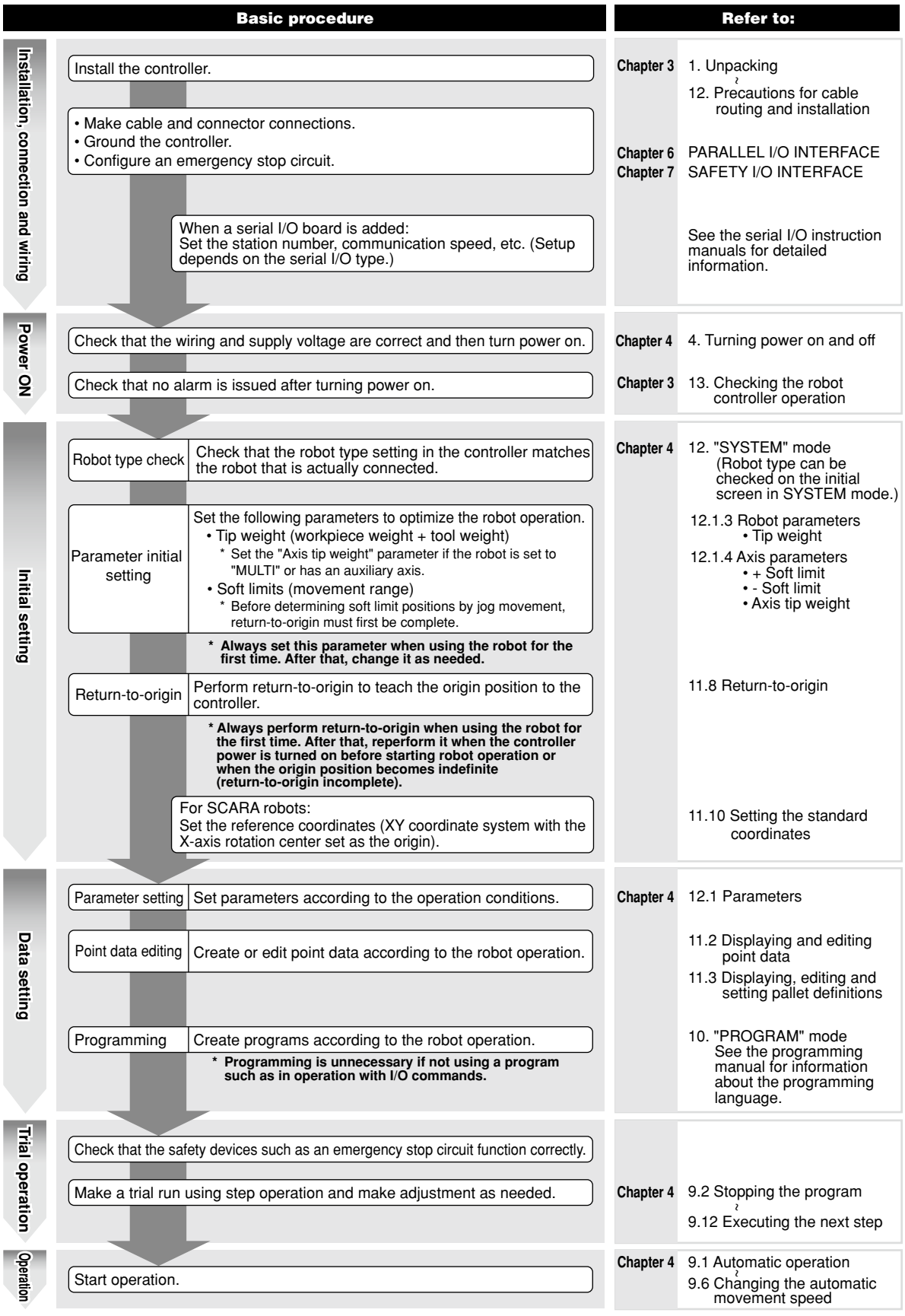
4. Basic sequence from installation to operation

The basic sequence from installation to actual operation is shown below. Refer to this sequence to use the RCX240 safely, correctly and effectively. Before beginning the work, read this user's manual thoroughly.

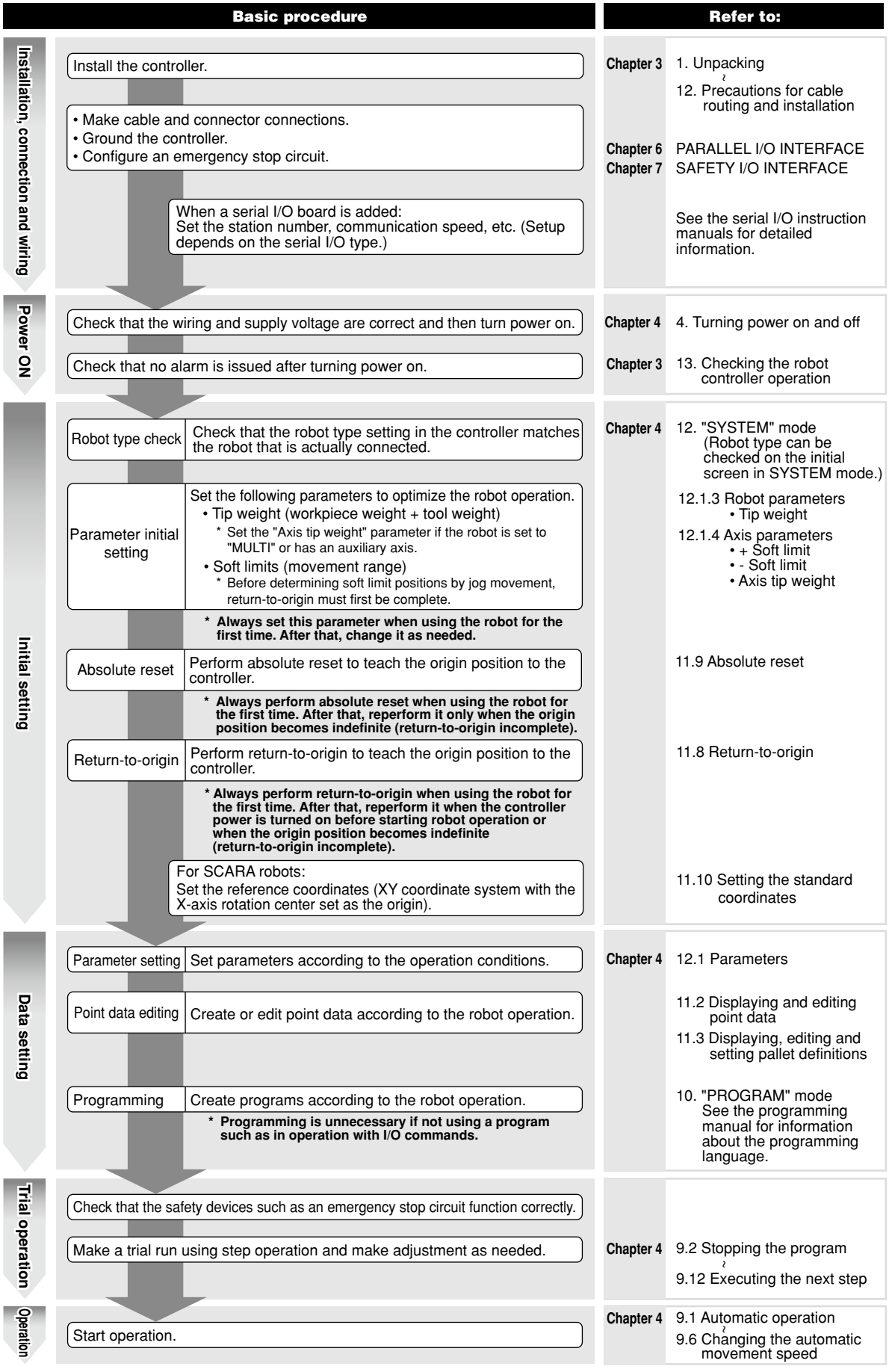
4.1 When using absolute type axes only



4.2 When using incremental type axes only



4.3 When using both absolute and incremental type axes



Chapter 3 INSTALLATION

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1. 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 there is any serious damage or dents on the packing box, please notify your YAMAHA sales dealer without unpacking the box.

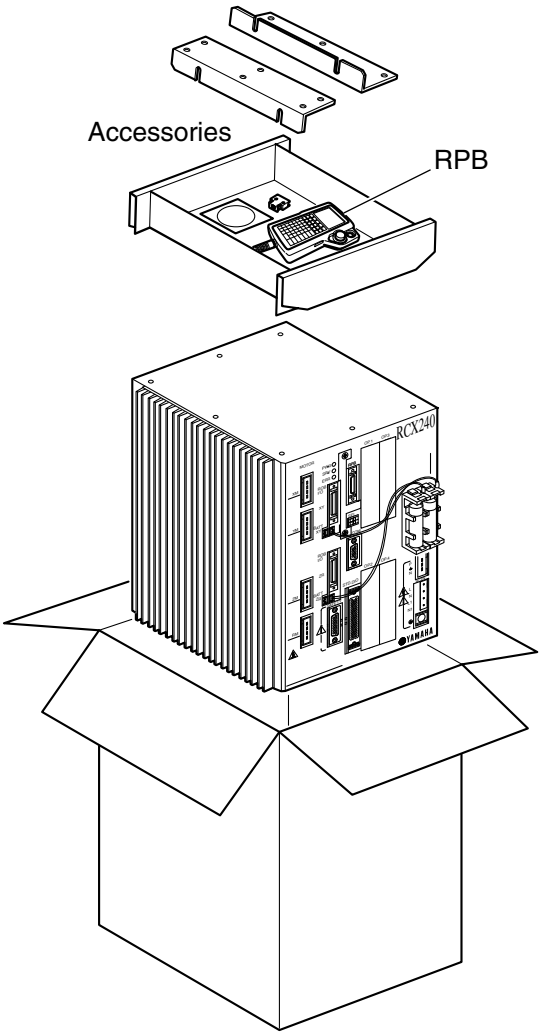
1.2 Unpacking

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	STD. DIO connector	1
	RPB terminator	1
	L-type bracket set for front and rear panels	1
	SAFETY connector	1
	Connector guard for COM connector	1
	CD-ROM manual	1
Option	RPB programming box	1
	L-type brackets for side panel	2
	OPT. DIO connectors	4 Max.
	Connector labels	4 Max.
	RGU-2 connection cable	1

2. Installing the robot controller

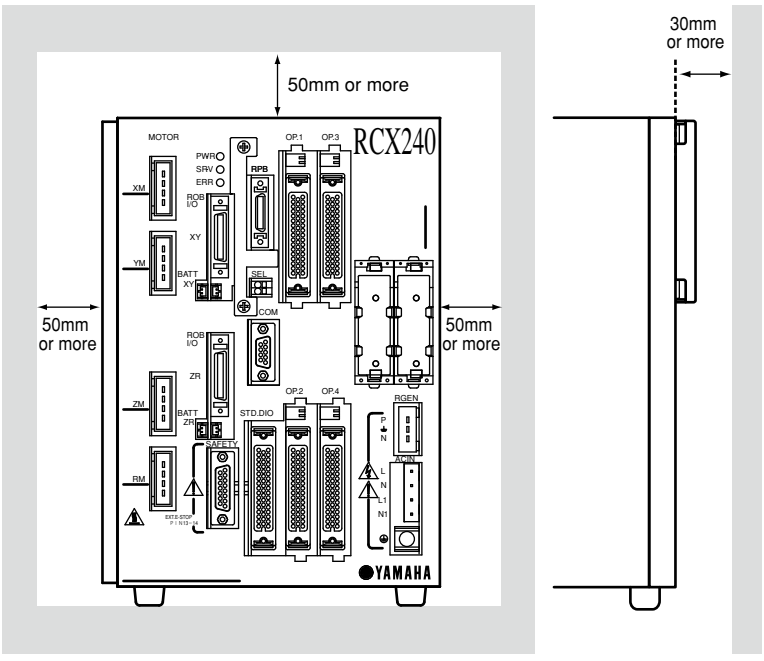
When installing, choose a proper place for your robot controller, taking into account your system layout, accessibility for maintenance, etc.

2.1 Installation conditions

CAUTION

1. **When carrying the robot controller, use a dolly or similar hand truck and move it carefully to avoid dropping and resultant damage.**
2. **Take care not to allow the connectors on the front of the robot controller to be hit or bumped. Shocks received by the connectors may damage the PC boards in the controller.**
3. **Be sure to give the cables used to connect the controller enough extra length to avoid strain and pulling at the connectors.**
4. **Install the controller inside the control panel.**
5. **Keep the controller away from oil and water. If the controller is to be used under such adverse conditions, put it in a watertight box equipped with a cooling device.**
6. **Install the controller on a flat, level surface. Do not stand the controller on its side or end, and do not install in an inverted position.**
   Do not install in locations subject to excessive vibrations.
7. **Do not install the controller in locations where the ambient temperature may rise higher than the rated temperature.**
8. **Do not block the fan vents in the rear panel. If blocked, temperature inside the controller will rise leading to malfunctions, breakdowns or deterioration of electric components. Always provide a clearance of at least 30mm from the rear panel so that the fan works properly.**

Installation clearance



When installing the robot controller, follow the precautions below.

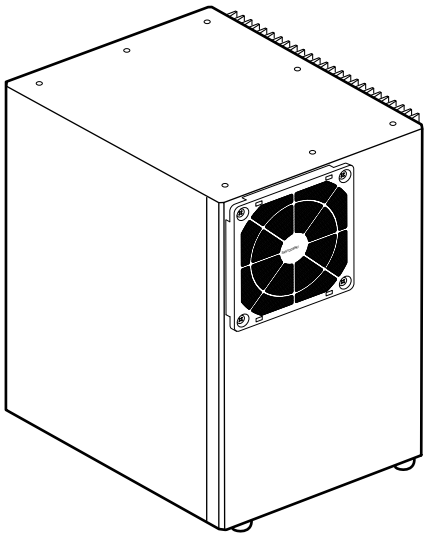
1. Provide a clearance of at least 50mm from the top or side panel of the controller.
2. Do not block the heat-sink on the side panel.
3. Do not block the fan on the rear panel of the controller.
4. Provide a clearance of at least 30mm from the rear panel of the controller.

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

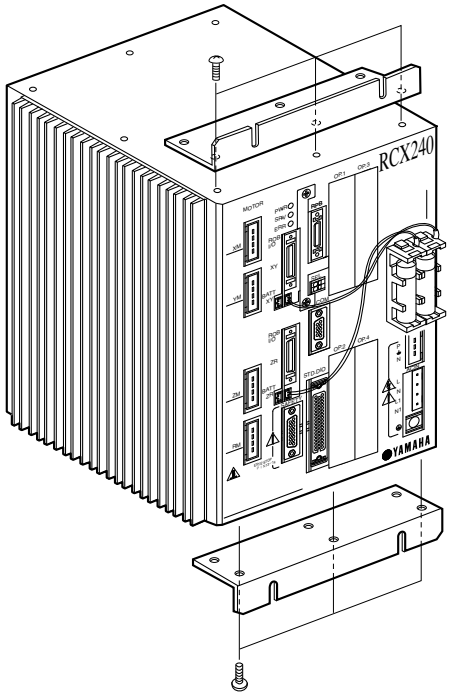


2) Attaching the L-type brackets (supplied as standard accessories) to the front

CAUTION

The L-type brackets have mounting holes in two different position. Use the holes that best match the equipment layout.

Attaching the L-type brackets to the front

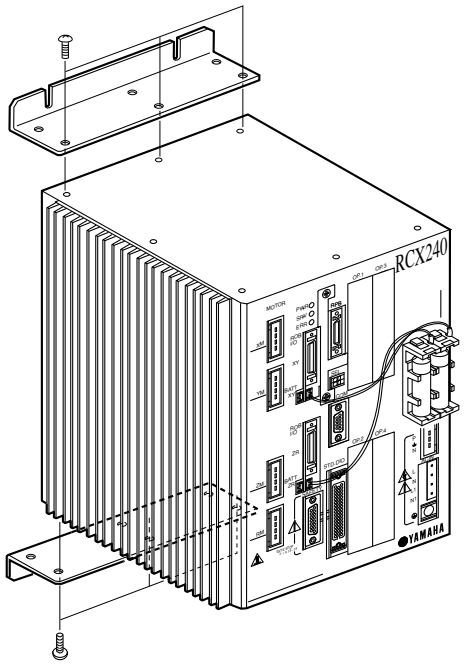


3) Attaching the L-type brackets (supplied as standard accessories) to the rear

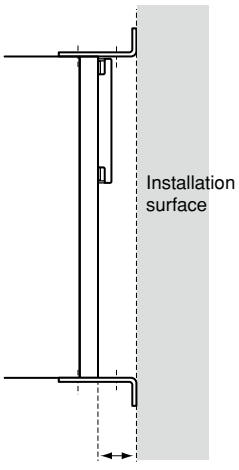
CAUTION

- **Provide a clearance of at least 30 mm 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 30 mm will be secured between the controller rear panel and the installation surface.**

Attaching the L-type brackets to the rear

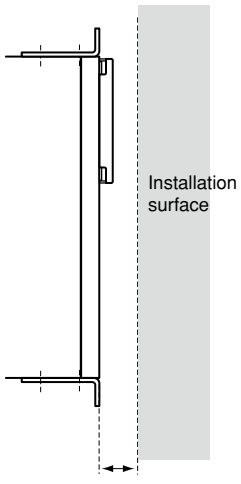


Installation example 1



30mm

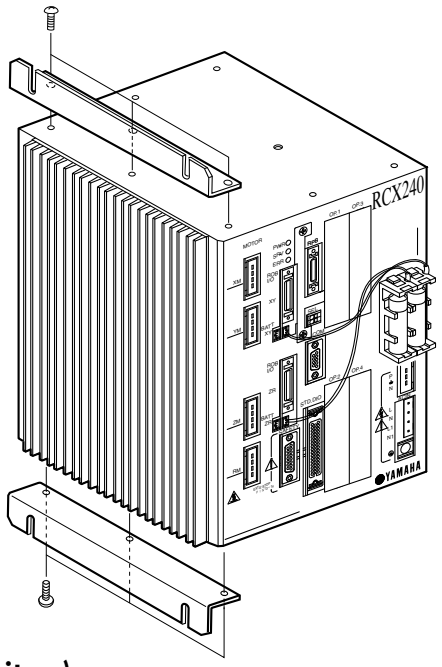
Installation example 2



Keep a clearance of
30mm or more

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

Attaching the L-type brackets to the side



L-type bracket part No. (single item)

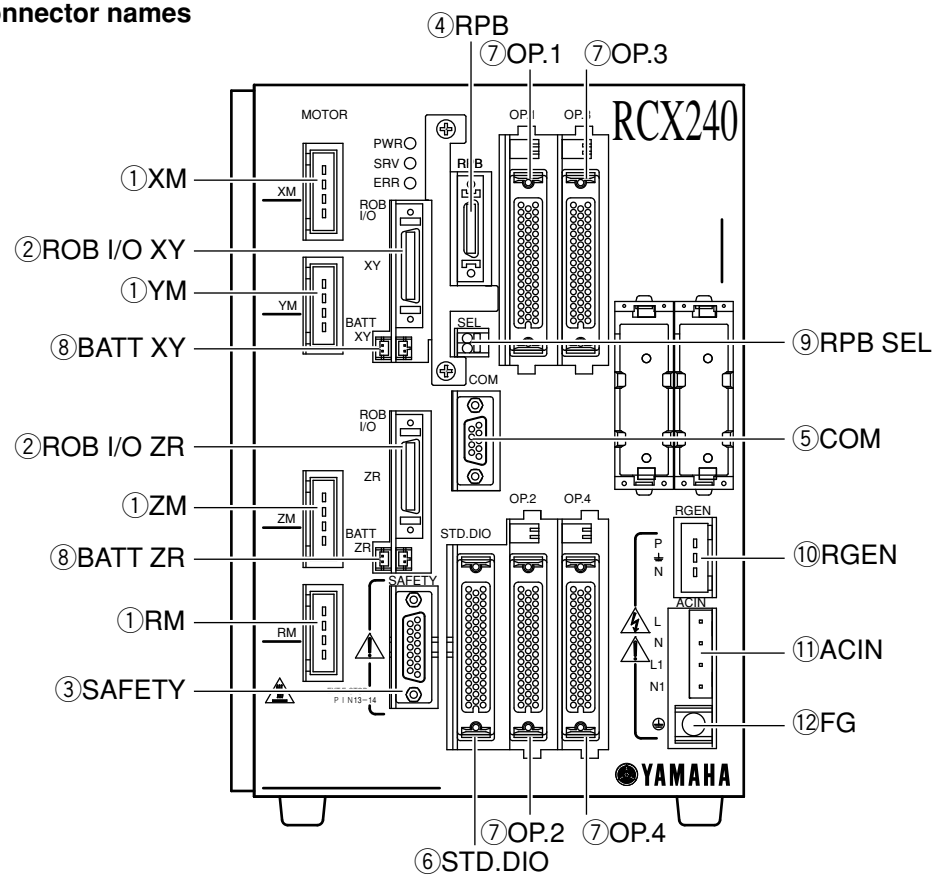
1	Standard (for front and rear)	KX0-M410H-003
2	Option (for side)	KX0-M410H-102

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

3. Connector names

Connector names, locations and functions are shown below.

Connector names



	Connector name	Function
①	XM/YM/ZM/RM	Connectors for servomotor drive
②	ROB I/O [XY/ZR]	Connectors for servomotor feedback and sensor signals
③	SAFETY	Input/output connector for safety function such as emergency stop
④	RPB	Connector for RPB
⑤	COM	RS-232C interface connector.
⑥	STD.DIO	Connector for dedicated input/output and standard general-purpose input/output
⑦	OP. 1, 2, 3, 4	Connectors attached to optional expansion I/O boards
⑧	BATT [XY/ZR]	Battery connector for absolute backup
⑨	RPB SEL	RPB selector switch contact
⑩	REGN [P/ ⏚ /N]	Connector for regenerative unit
⑪	AC IN [L/N/L1/N1]	Terminal block for power cable. Use ring-tongue terminals to make connections.
⑫	FG	Ground terminal (⏚). Provide Class D grounding (100 ohms or less).

WARNING

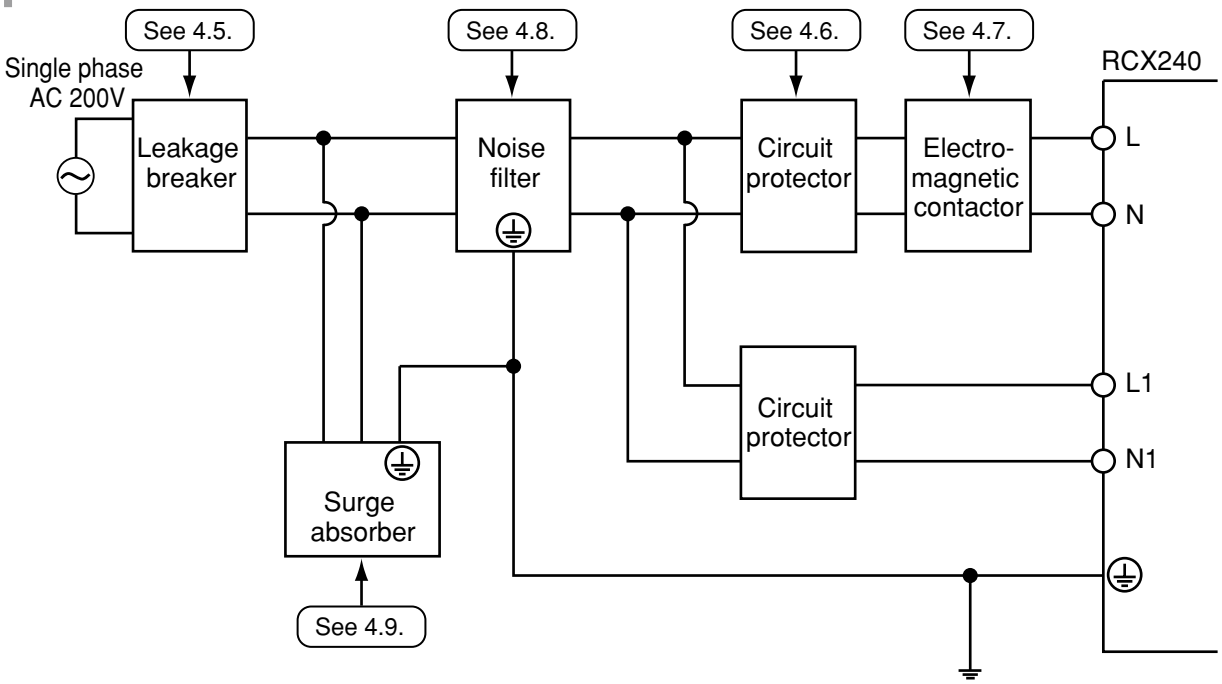
TO PREVENT ELECTRICAL SHOCKS, NEVER TOUCH THE RGEN AND AC IN TERMINALS WHEN POWER IS SUPPLIED TO THE ROBOT CONTROLLER.

4. 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.

4.1 Power supply connection example

Connection example



CAUTION

Do not make incorrect terminal connections. Incorrect connections may cause malfunction.

4.2 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.

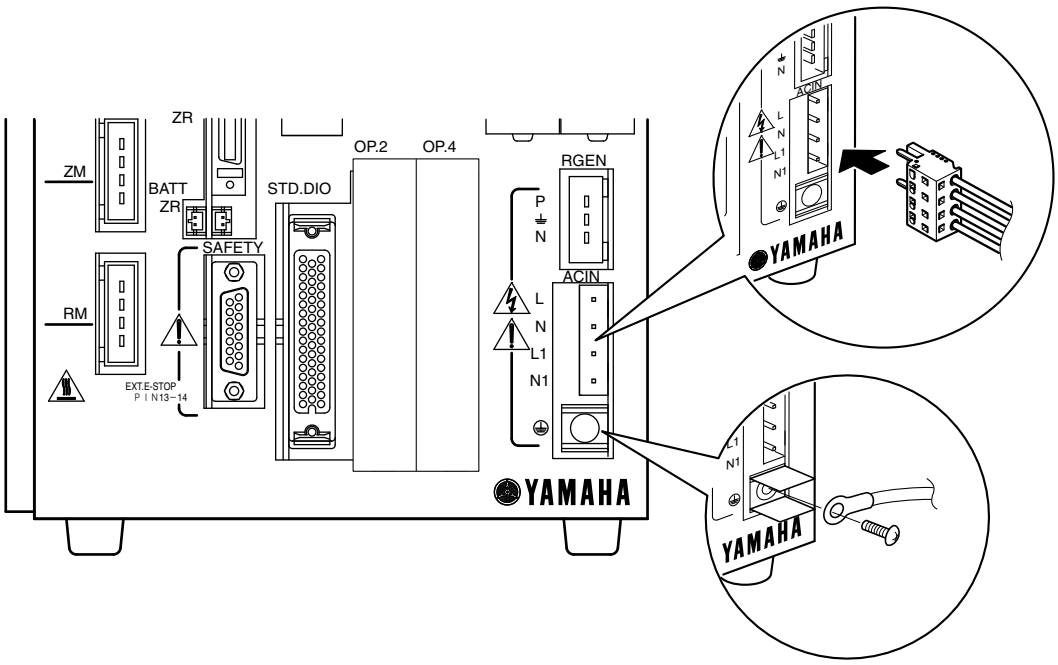
Symbol	Wiring	Remarks		
L	200 to 230V	Live	Main power supply (for motor power)	Wire cross-section 2.0 sq mm or more
N	200 to 230V	Neutral		
L1	200 to 230V	Live	Power for control	Wire cross-section 1.25 sq mm or more
N1	200 to 230V	Neutral		

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

WARNING

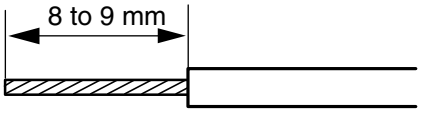
- TO PREVENT ELECTRICAL SHOCKS OR FAULTY OPERATION CAUSED BY NOISE, THE EARTH TERMINAL (PROTECTIVE CONDUCTOR) MUST BE GROUNDED PROPERLY.
- TO PREVENT ELECTRICAL SHOCKS, NEVER TOUCH THE AC IN TERMINALS WHEN POWER IS SUPPLIED TO THE ROBOT CONTROLLER.

AC IN and ground terminals



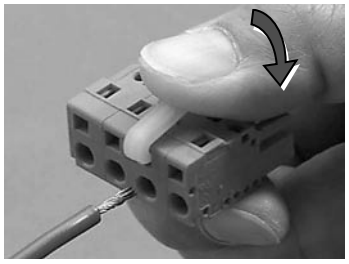
4.3 AC power connector wiring

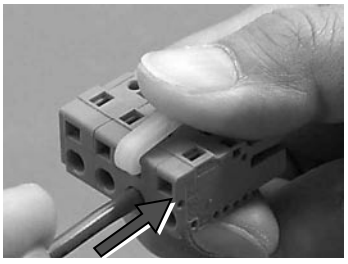
Strip the wire to expose 8 to 9 mm of bare lead.

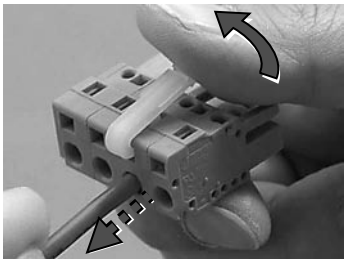


Lever







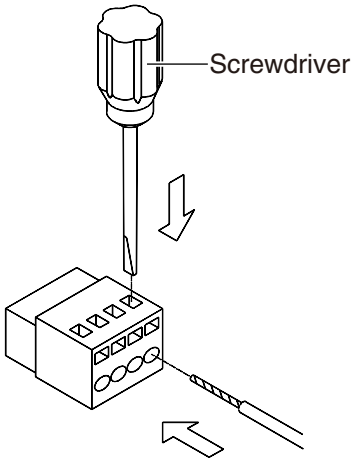


(1) Attach the lever to the upper slot as shown and press down on it with your finger to depress the internal spring.

(2) Insert the wire lead all the way into the opening while still holding the lever down.

(3) Release the lever to make the wiring connection. Pull gently on the wire to make sure it is securely attached. (Do not pull strongly on the wire.)

You may insert the wire into the opening while pressing down the internal spring with a flat-blade screwdriver.



CAUTION

Basically only one wire can be inserted into one wire hole.

4.4 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: RCX240

(1) When connected to SCARA robot

Robot model				Power capacity (VA)	Generated heat amount (W)
Standard type	Clean type	Dust-proof & drip-proof type	Ceiling-hanging/ inverse type		
YK120XG, 150XG				300	58
YK180XG, 180X, 220X	YK180XC, 220XC			500	63
YK250XH, 350XH, 400XH	YK250XCH, 350XCH, 400XCH	YK250XP, 350XP, 400XP	YK300XHS, 400XHS	1000	75
	YK500XC, 600XC	YK500XP, 600XP	YK500XS, 600XS	1500	88
YK500XG, 600XG				1700	93
	YK700XC, 800XC, 1000XC	YK700XP, 800XP, 1000XP	YK700XS, 800XS, 1000XS	2000	100
YK600XGH, 700XG, 800XG, 900XG, 1000XG, 1200X				2500	113

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

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

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

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

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

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

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

4.5 Installing an external leakage 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
RCX240 control power supply (L1, N1)	4mA(MAX)
RCX240 main power supply (L, N)	

4.6 Installing 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
RCX240 control power supply (L1, N1)	5A	Slow type with inertia delay
RCX240 main power supply (L, N)	15A	

4.7 Installing an electromagnetic contactor

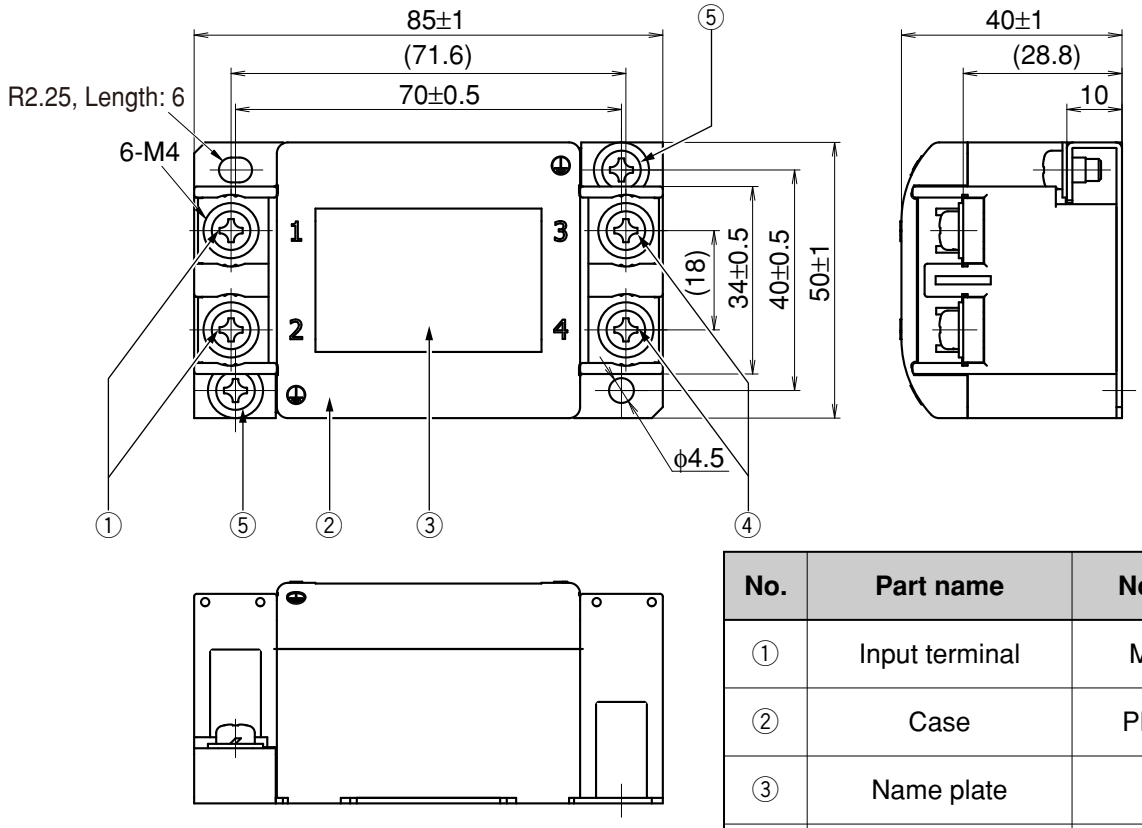
When controlling the power on/off operation of the robot controller using an external unit such as a PLC, an electromagnetic contactor should be installed on the AC power supply line for the controller. Select an electromagnetic contactor that falls under the required safety category and control the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

4.8 Installing a noise filter

To comply with CE marking requirements, use a noise filter to suppress the noise on the power supply line.

Dimensional outlines of recommended noise filter

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



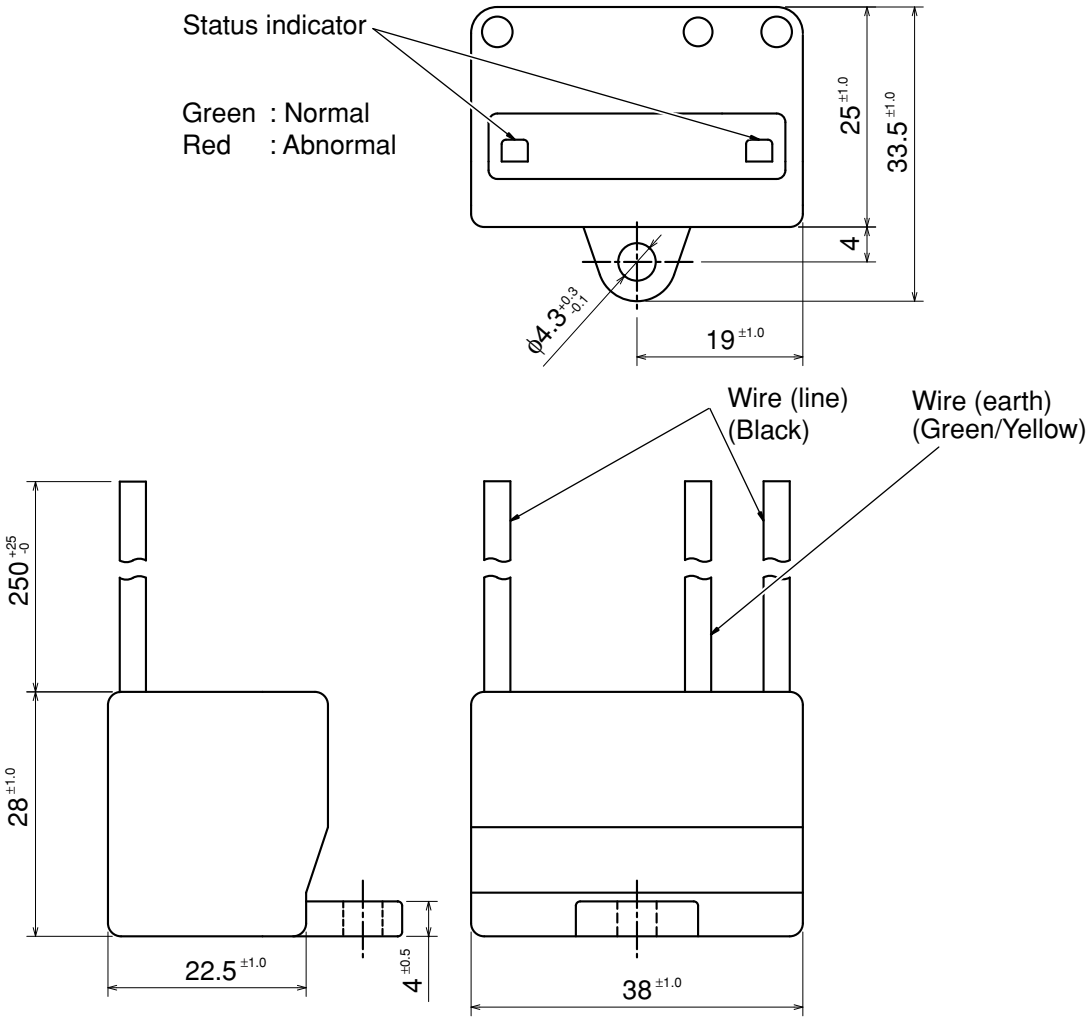
No.	Part name	Note
①	Input terminal	M4
②	Case	PBT
③	Name plate	
④	Output terminal	M4
⑤	Earth terminal	M4

4.9 Installing a surge absorber

The controller contains a protection circuit to protect the internal components from surge noise that may be generated by lightning. The controller therefore conforms to CE marking without using an external surge absorber. To further enhance the surge immunity, install an external surge absorber.

Dimensional outlines of recommended surge absorber

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



5. 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 user's manual for details.

NOTE

Check robot cables for bent pins, kinks, and other damage before connecting.

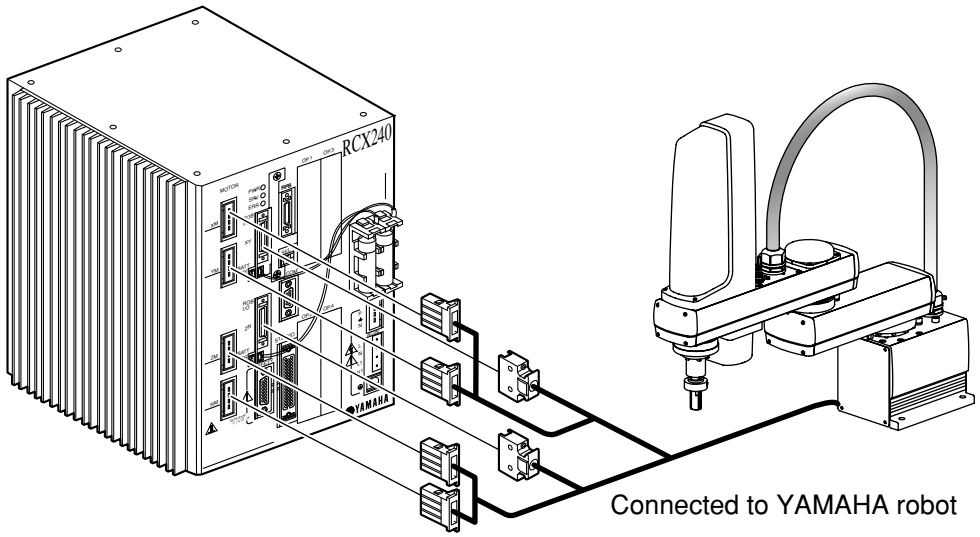
WARNING

- **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.**
- **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.
Also make sure that the robot is properly grounded. For details on the grounding method, refer to the robot user's manual.

Robot cable connection to controller



Connected to YAMAHA robot

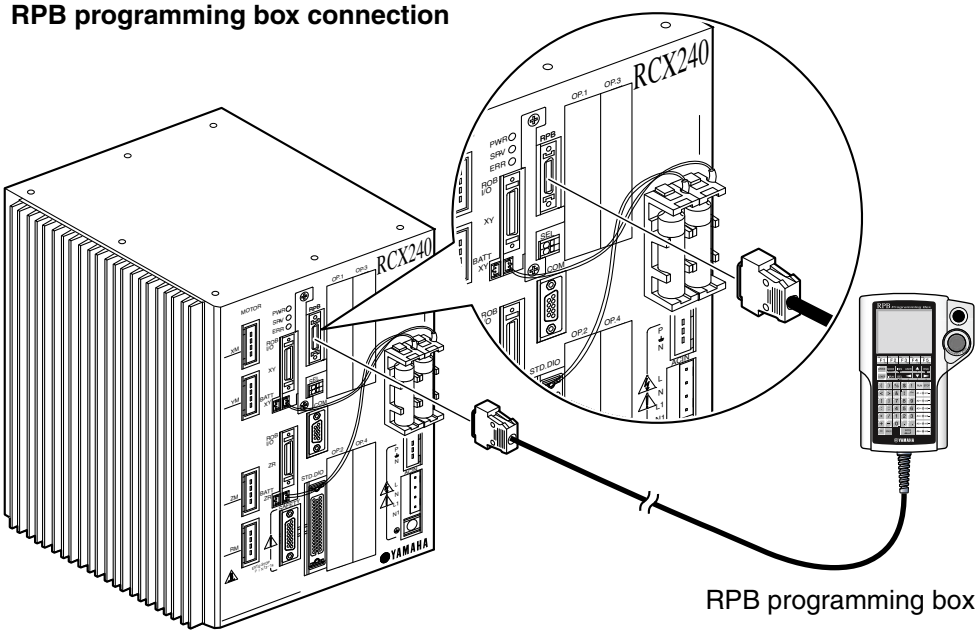
6. Connecting the RPB programming box

As shown in the figure below, the RPB should be connected to the RPB connector on the front panel of the robot controller.

CAUTION

Use caution since the RPB connector must be connected in the correct direction. Connecting in the wrong direction may cause faulty operation or breakdowns.

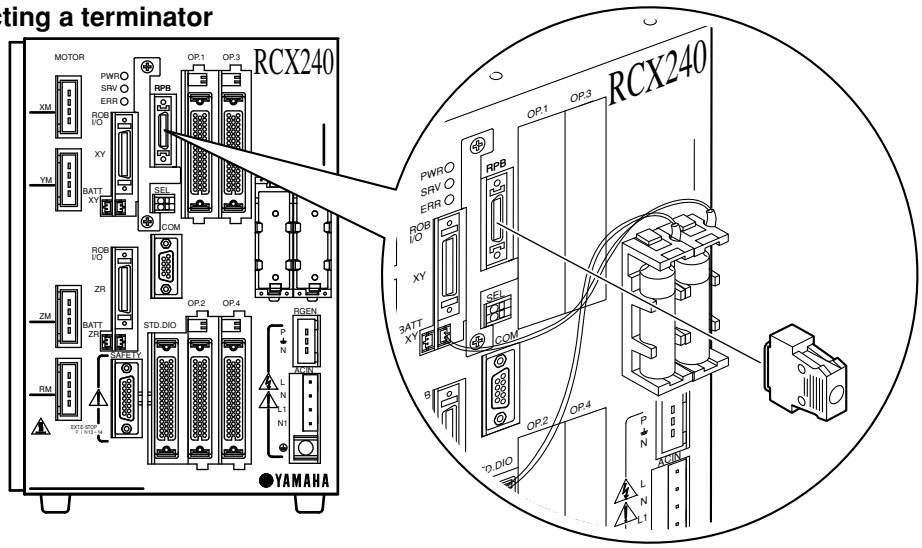
RPB programming box connection



● Connecting a terminator

If not connecting the RPB, plug the terminator (supplied) into the RPB connector.

Connecting a terminator



CAUTION

If not connecting the RPB, always be sure to plug the terminator (supplied) into the RPB connector.
Emergency stop in the robot controller is triggered when the RPB is disconnected from the robot controller, because a B-contact (normally closed) type emergency stop button is provided on the RPB. Plug the RPB terminator into the RPB connector to avoid such an emergency stop.

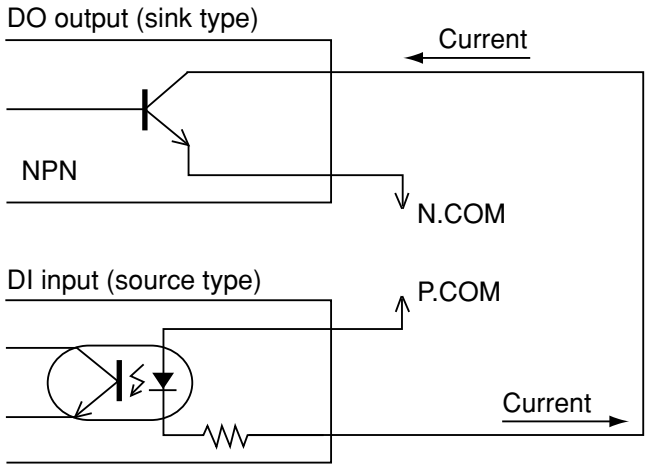
7. I/O connections

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, see Chapter 6, "PARALLEL I/O INTERFACE" or see Chapter 7, "SAFETY I/O INTERFACE".
The following describes terms used in the manual.

- **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).

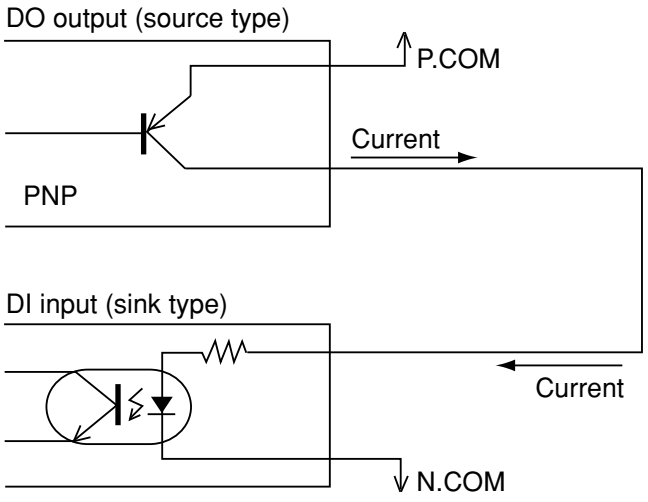
Connection for NPN specifications



- **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



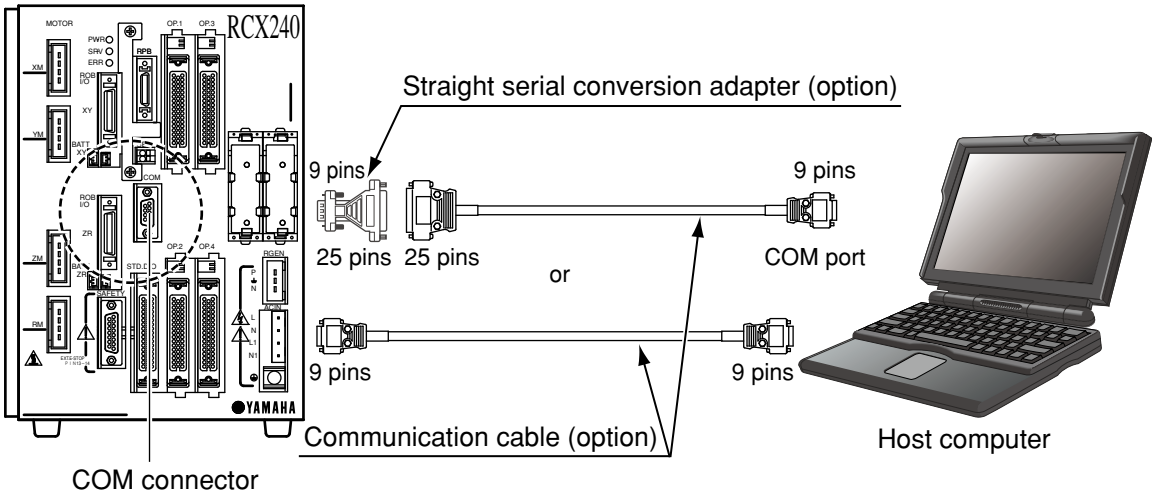
8. Connecting a host computer

As a standard feature, the robot controller has an RS-232C interface port for data communication with a host computer. Most computer models having an RS-232C port can be interfaced to the robot controller, by connecting the COM connector on the front of the robot controller to the RS-232C port of the computer using a communication cable.
For more detailed information on the RS-232C interface, see "RS-232C INTERFACE" in Chapter 8.

NOTE

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

Host computer connection

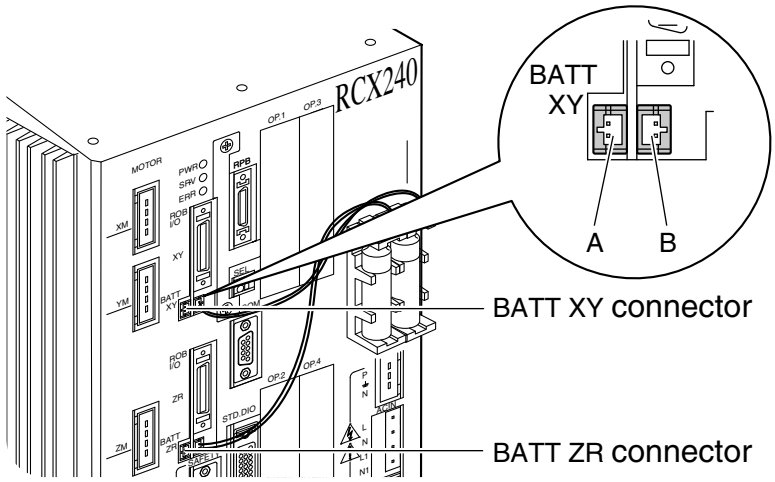


9. Connecting the absolute battery

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.

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 1 year	Standard (2 batteries)
BATT XY/ZR A or B	About half a year	1 battery

CAUTION

When connecting the absolute batteries in parallel, use the same batteries.

WARNING

DO NOT MODIFY THE WIRING OR ATTEMPT TO EXTEND IT. THIS COULD CAUSE EQUIPMENT MALFUNCTIONS AND BREAKDOWNS.

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.

NOTE

- Return-to-origin is incomplete if an absolute battery connector is unplugged from the BATT connector while the controller power is turned off. When shipped to the customer, the absolute batteries are not connected to the controller, so an error message is always issued when the power is first turned on. Please note that this is not an abnormal condition.
- The batteries must be connected when using the controller for the first time or must be replaced when the backup time was exceeded while the controller power was off.
- Unplug the absolute battery connectors when you are going to store the controller for a period of time that is much longer than the backup time.

10. 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 one year after being connected to the controller.
Always charge the new battery after it is installed.

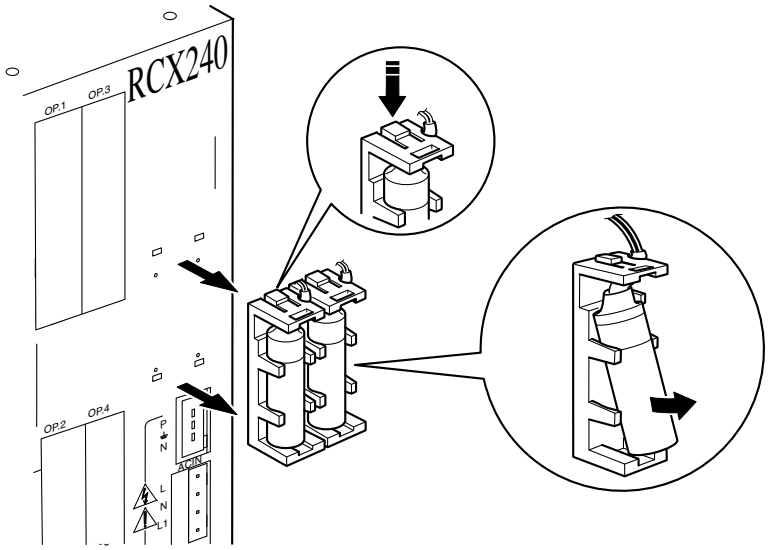
Battery type	3.6V, 2700mAH
Battery part No.	KAS-M53G0-100

Battery case part No.	KBG-M5395-000

● Replacing the absolute battery

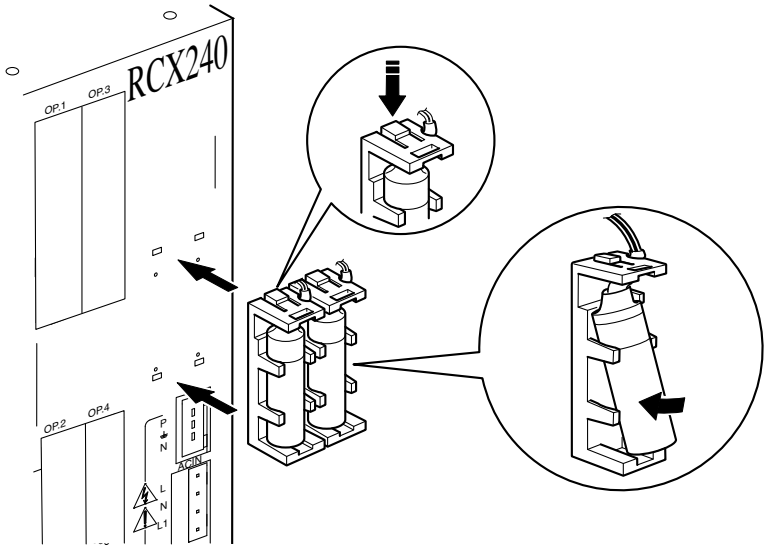
1) Remove the battery from the battery holder.

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



11. 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 RCX240 may require a regenerative unit depending on the robot type to be connected.
- Check the cable and connectors for bent pins, kinks, and other 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

12. Precautions for cable routing and installation

12.1 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.

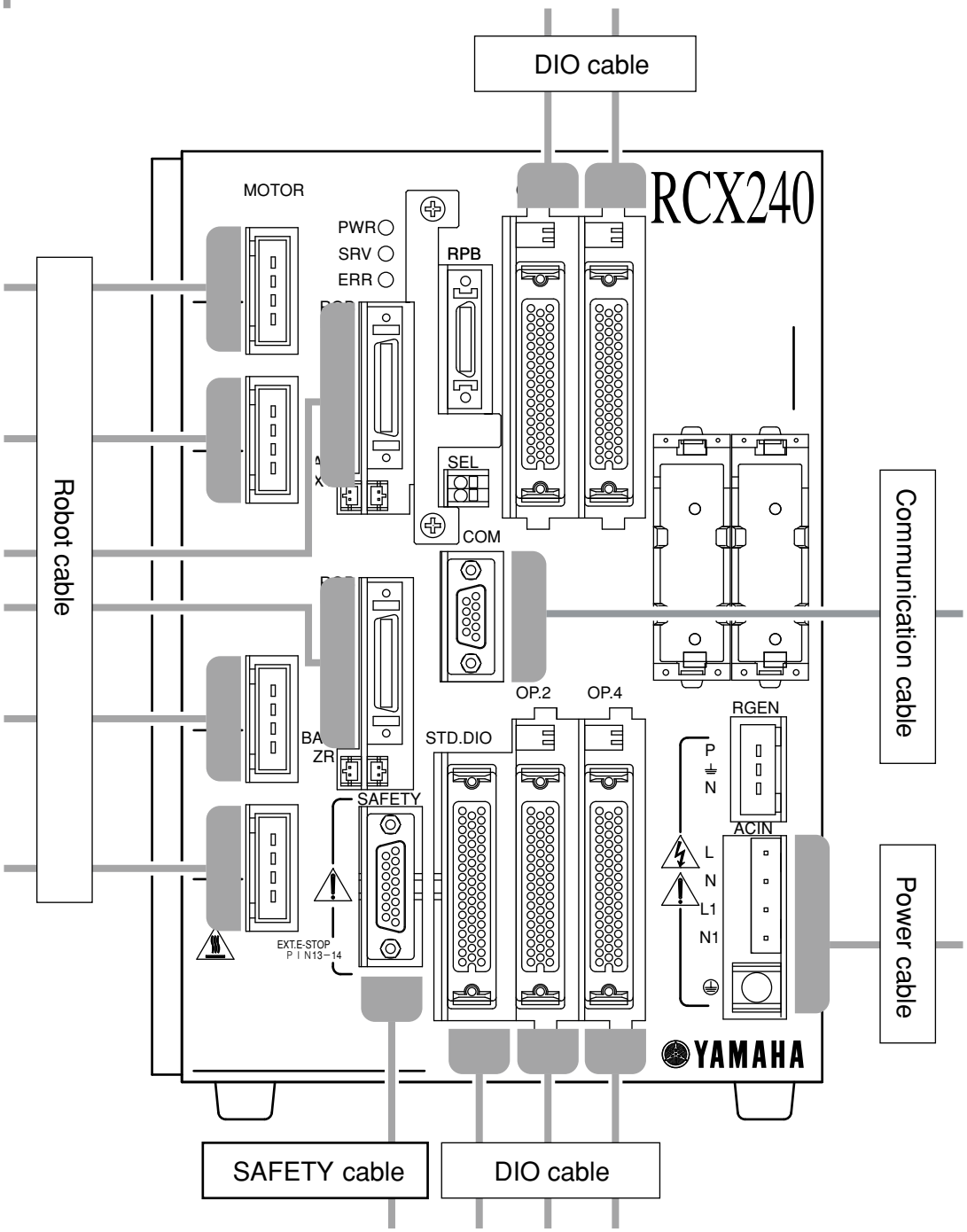
4) Keep robot cables away from other equipment power lines. Never bundle them together.

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



12.2 Precautions for installation

This robot controller is not designed with an explosion-proof, dust-proof or drip-proof structure. Do not install it in the following locations or environments

(1) where exposed to flammable gases or liquids.

(2) where conductive debris such as metal cutting chips are spread.

(3) where to corrosive gases such as acid gases and alkaline gases.

(4) where exposed to cutting oil, grinding fluids and machining mist.

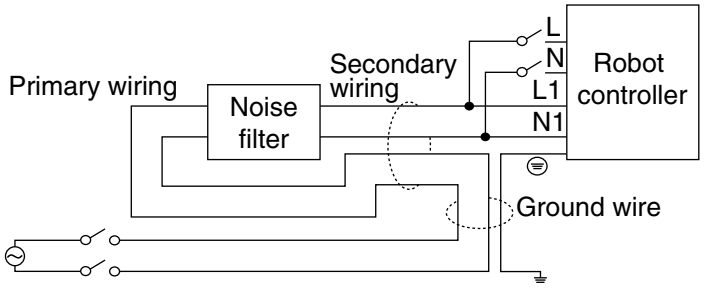
(5) near sources of electrical noise, such as large inverters, high-power high-frequency generators, large switching equipment, and welding machines.

12.3 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.

Bad example

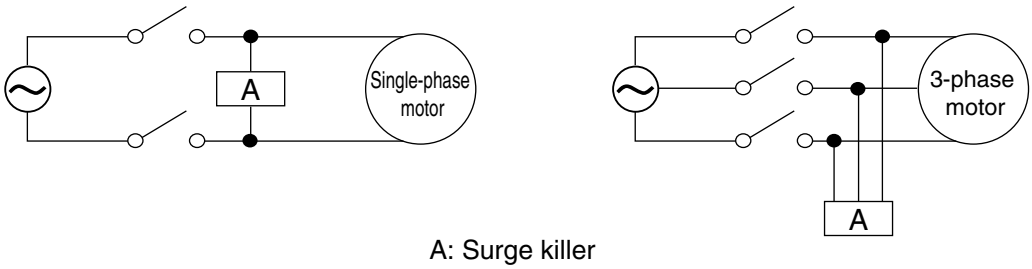


• Primary wiring and secondary wiring of the noise filter are bundled together.
• Ground wire is bundled with primary wiring of the noise filter.

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

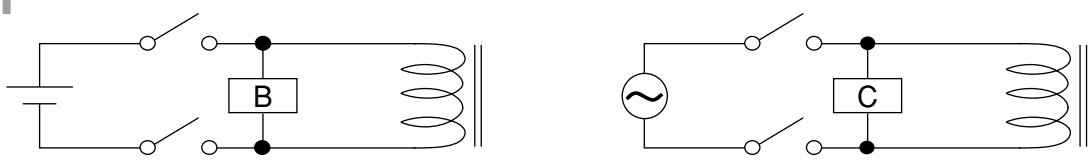
Example of surge absorber

For inductive motor



A: Surge killer

For solenoid valve, solenoid



DC type

B: Diode, varistor, CR elements

AC type

C: Varistor, CR elements

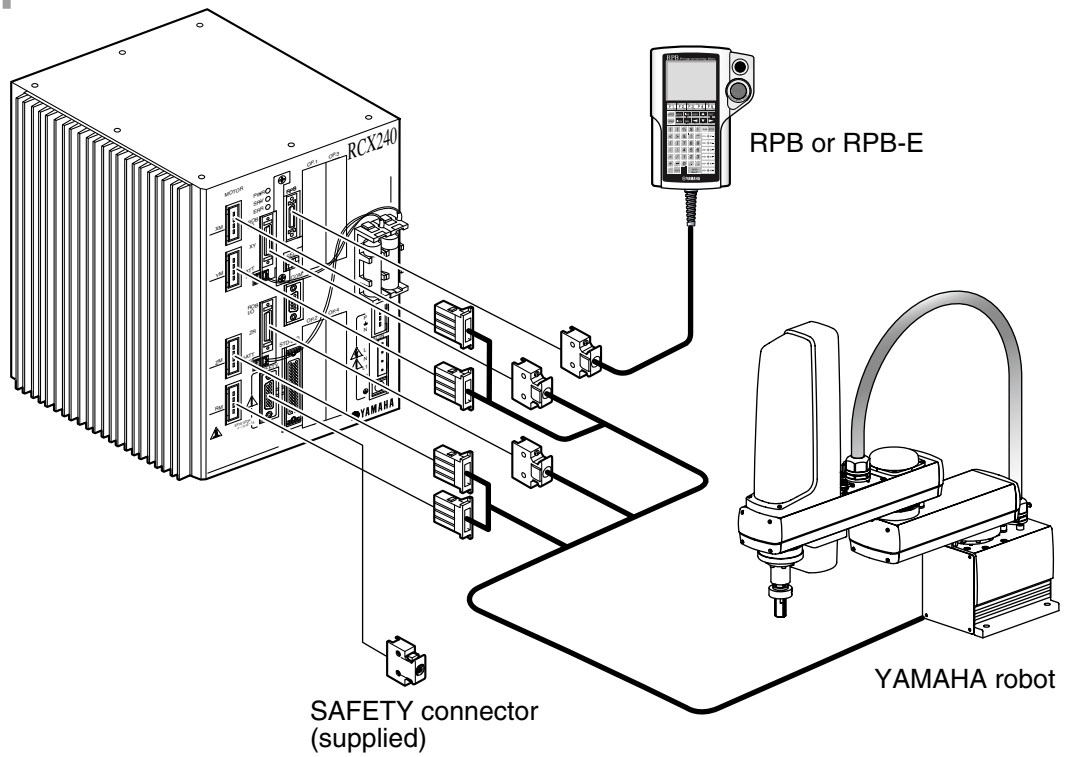
13. Checking the robot controller operation

This section explains how to check the controller operation using a special connector that comes with the controller and an applicable robot. Before beginning this check, finish making connections to the following items.

- Power supply (Do not supply power until you actually begin the operation check.)
- Robot cable
- RPB 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.)

13.1 Cable connection

Cable connection

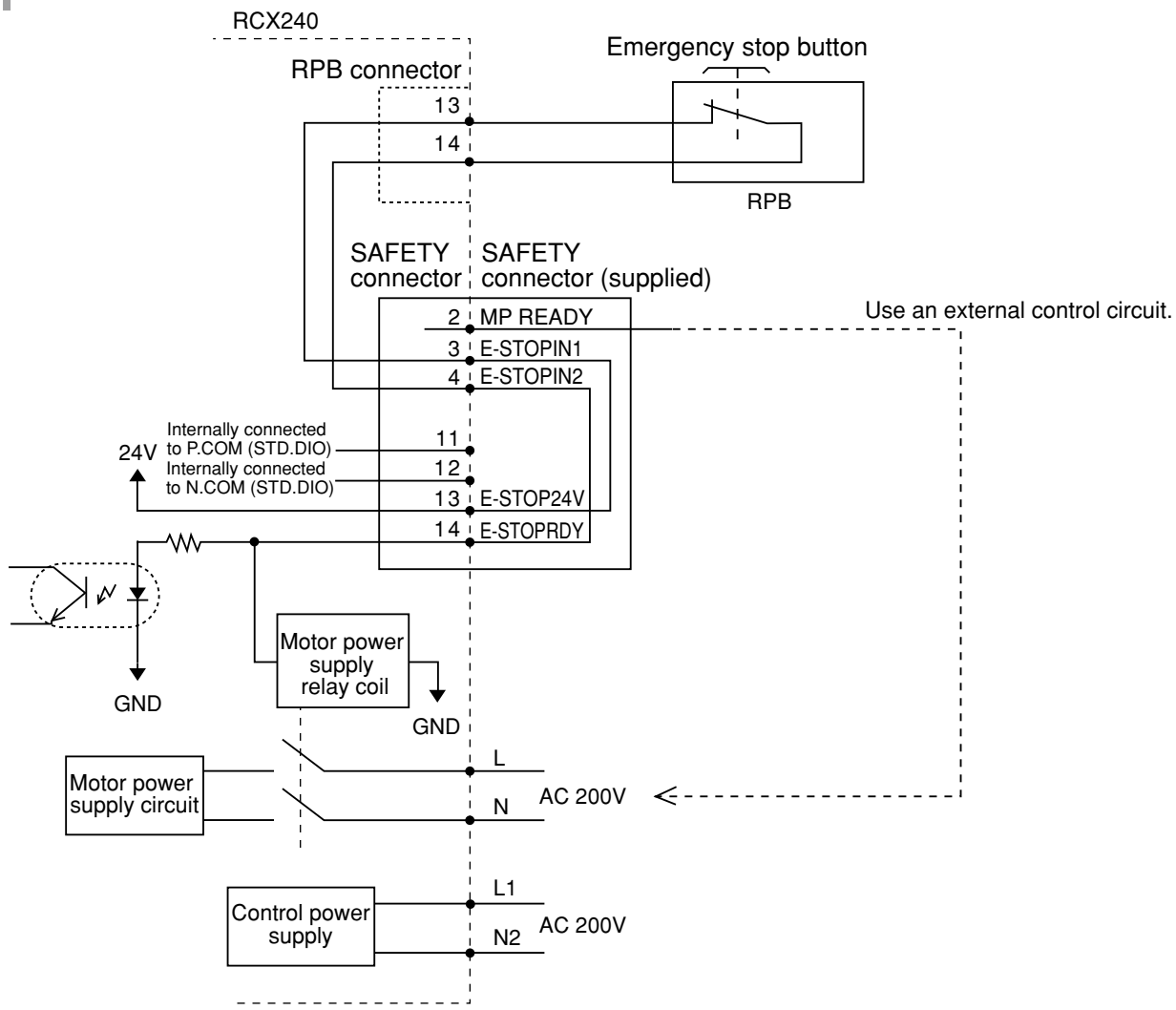


13.2 Emergency stop input signal connection

CAUTION

- **External emergency stop and the RPB 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.**
- **A 24 V supply is required to operate MP READY. Supply a 24 V to pins 47 to 50 of the STD.DIO. As long as the 24 V is supplied to those pins, the "Watch on STD.DIO DC24V" parameter cannot be set to "INVALID".**

Emergency stop input signal connection



- The emergency stop button on the RPB is connected to the controller through the SAFETY connector.

CAUTION

Pin 11 of the SAFETY connector, pin 12 of the P.COM SAFETY connector of the STD. DIO, and N.COM of the STD.DIO are internally connected in the controller.
Do not connect the SAFETY connector and STD.DIO connector to different power supplies. Doing so may cause malfunction

13.3 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

An interlock signal always appears because no connection is made to the STD. DIO. This can be cancelled using a software parameter.

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 RPB and take corrective action according to the description given in Chapter 10, "TROUBLESHOOTING".

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1. Operation overview

The controller configuration and main functions are shown below.
Set up the equipment as needed according to the operation to be performed.

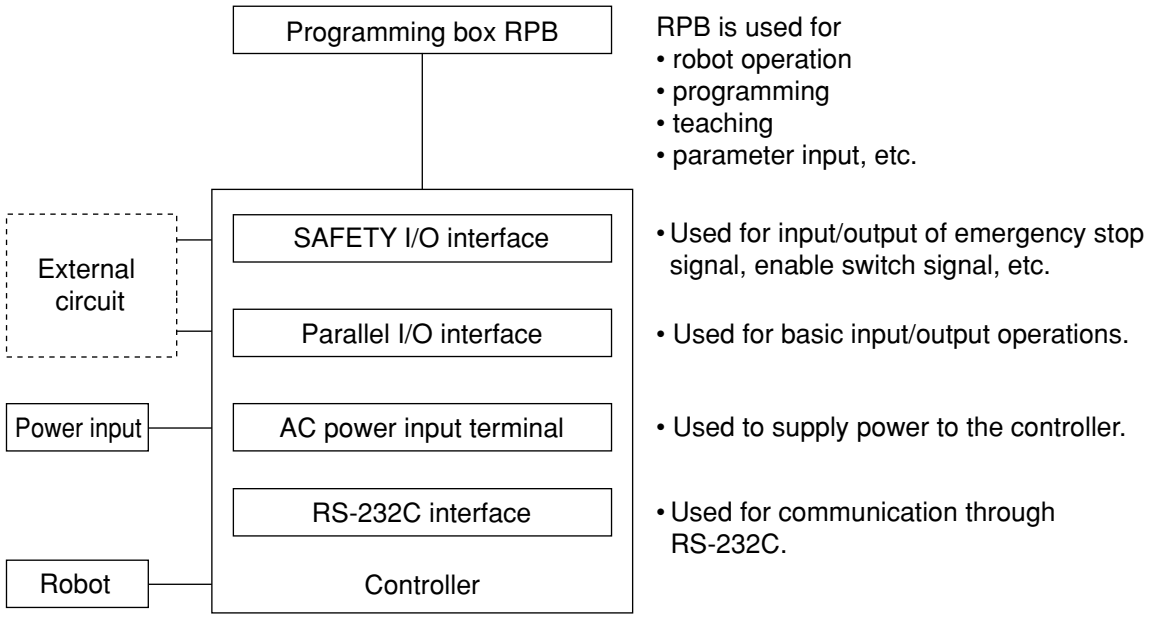
CAUTION

The external circuit connected to the robot controller should be prepared by the user.

NOTE

- Refer to Chapter 6 for PARALLEL I/O INTERFACE.
- Refer to Chapter 7 for SAFETY I/O INTERFACE.
- Refer to Chapter 8 for RS-232C INTERFACE.

Operation overview



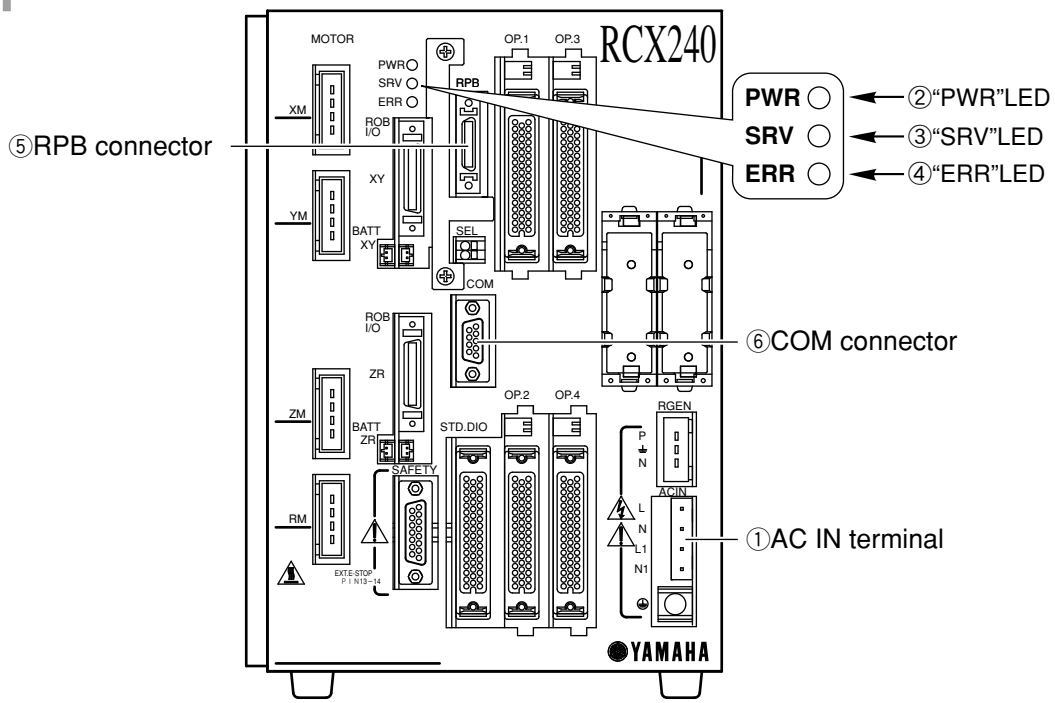
This chapter mainly explains how to operate the RPB programming box.

2. The RCX robot controller

2.1 Part names

● **Controller front panel**

Part names and layout



2.2 Main functions

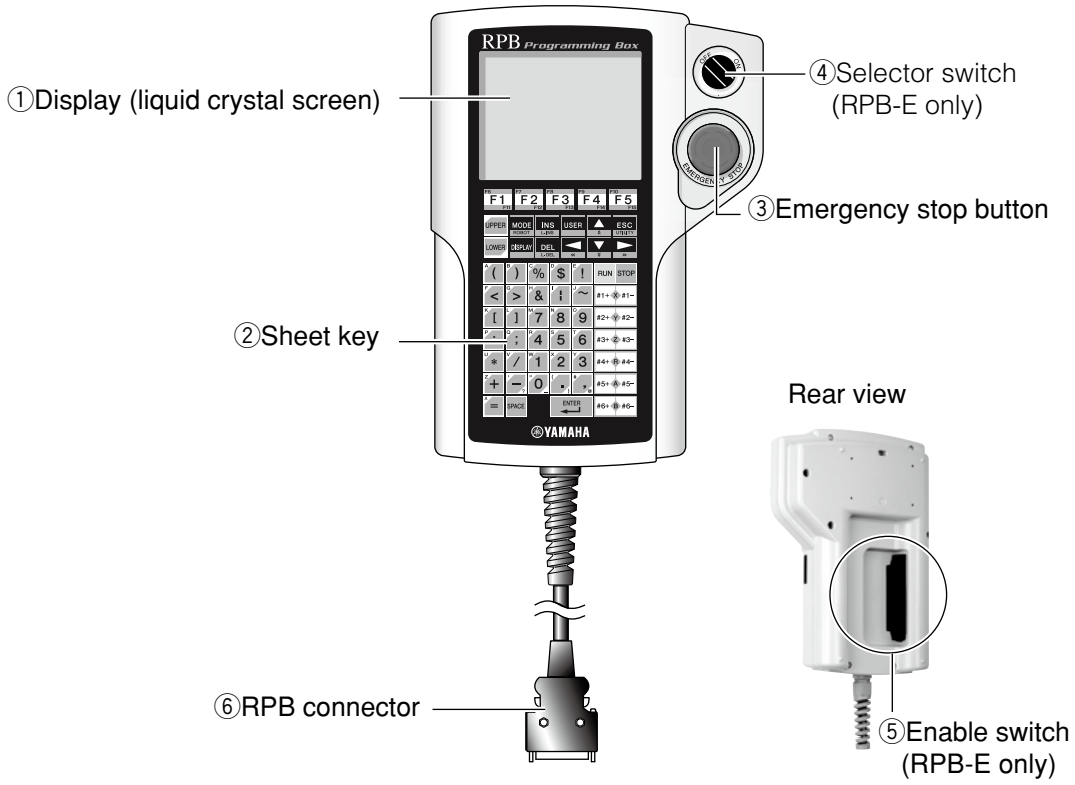
① **AC IN terminal**	: Supplies power to the controller.
② **"PWR" LED**	: Lights up when the controller is turned on.
③ **"SRV" LED**	: Lights up when the robot servo is on and turns off when the servo power is off.
④ **"ERR" LED**	: Lights up when a serious error occurs.
⑤ **RPB connector**	: Connects to the RPB programming box.
⑥ **COM connector**	: Connects to an external device via the RS-232C interface. (D-SUB 9P female connector)

3. RPB programming box

The RPB programming box connects to the robot controller and is used to edit and execute robot programs.

3.1 Part names

RPB programming box



3.2 Main functions

① **Display (liquid crystal screen)**
This is a liquid crystal display (LCD) with 40 characters × 15 lines, showing various types of information. The screen contrast is adjustable.

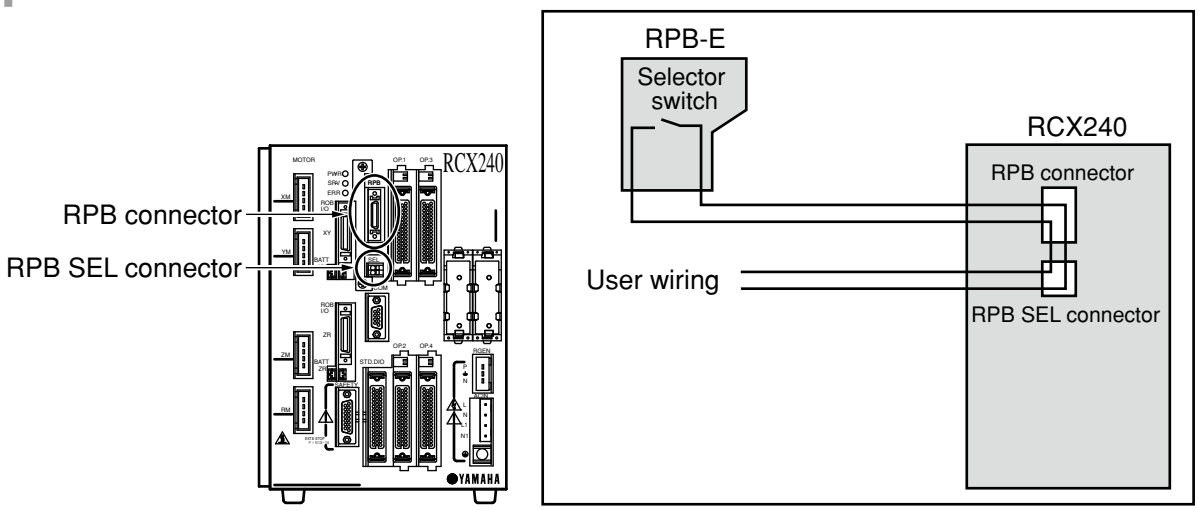
② **Sheet keys**
Use these keys to operate the robot or edit programs.
The sheet keys are grouped into three main types: function keys, control keys and data keys.

③ **Emergency stop button**
Pressing this button during operation immediately stops robot operation. This is a B-contact (normally closed) type switch.

④ **Selector switch (RPB-E only)**

This switch can be used as needed by wiring to the RPB SEL connector by the user.
The switch ON/OFF function is disabled if not wired correctly.

Selector switch



⑤ **3-position enable switch (RPB-E only)**

This switch is provided for safety. Pressing it to mid-position only allows robot operation.
This switch does not function unless pins 1 to 4 (for enable switch) of the SAFETY connector are correctly wired.

Switch is released	: Emergency stop.
Switch is pressed to mid position	: Operation possible
Switch is fully pressed	: Emergency stop

Configure the external safety circuit so that this enable switch functions as described above.

⑥ **RPB connector**

Use this connector to connect the RPB programming box to the robot controller.

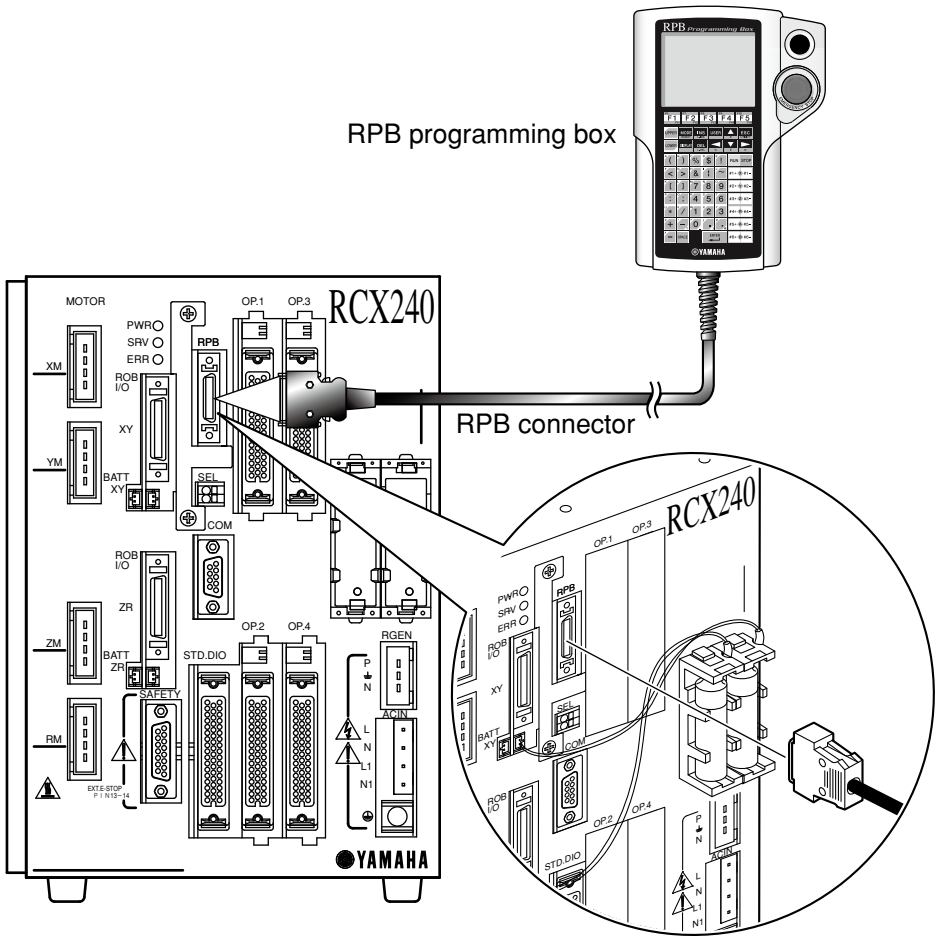
3.3 Connection to the robot controller

Connect the RPB programming box to the RPB connector on the front panel of the robot controller. Connect the cable securely since poor connections might cause malfunctions or breakdowns.

NOTE

Emergency stop is triggered when the RPB is connected to or disconnected from the robot controller while the power is on. If this happens, emergency stop must be cancelled to continue operation.

Robot controller connection



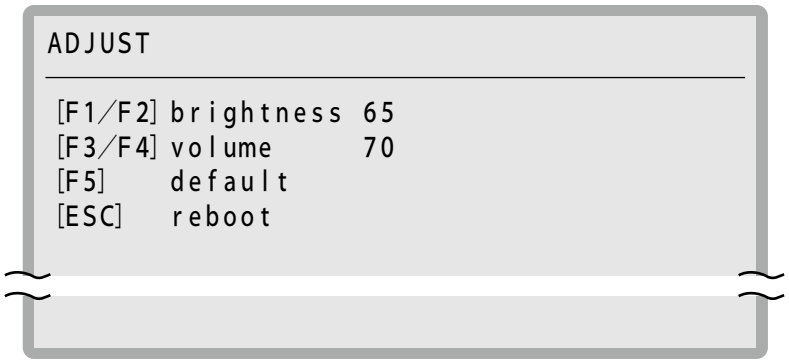
3.4 Changing the RPB screen settings

The RPB screen contrast can be adjusted, and the key-press volume can be changed as needed.

Step 1 ***Turn on the power while holding down DISPLAY on the RPB.***

The RPB setting screen ("ADJUST" mode) appears.

"ADJUST" mode for changing RPB screen settings



Step 2 ***Use the following procedure to make adjustments.***

• To adjust the screen contrast **(Setting range: 0% (bright) to 100% (dark))**

1. Press F1 (brightness + 5%) or F2 (brightness – 5%) to make adjustments.
2. Press ESC to end the setting.
   The screen returns to the normal menu screen.

• To change the key-press volume **(Setting range: 0% (off) to 100% (maximum))**

1. Press F3 (volume + 5%) or F4 (volume – 5%) to make adjustments.
2. Press ESC to end the setting.
   The screen returns to the normal menu screen.

• To initialize the settings

1. Press F5 (default).
   The screen contrast and key-press volume return to the default settings.
   (contract: 65%, key volume: 70%)

4. Turning power on and off

This section explains how to turn power on and off, assuming that the external emergency stop circuit and other necessary units are connected according to the instructions in Chapter 3, "INSTALLATION", and also that the robot controller operates correctly.

Step1 *Connect the RPB to the controller.*

Connect the RPB connector to the RPB connector (RPB) on the front panel of the robot controller.

CAUTION

When connecting the RPB to the robot controller, always use the dedicated cable and connector attached to the RPB. Do not modify this cable or extend it by using a relay unit, etc.

Step2 *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.)

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 "12. "SYSTEM" mode" in this chapter for detailed information.
- 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.

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.

Step3 *Turn on the servo.*

When SAFE mode or serial I/O setting is enabled, the controller always starts with the robot servo turned off. To turn on the servo, refer to "14. "UTILITY" mode" in this chapter.

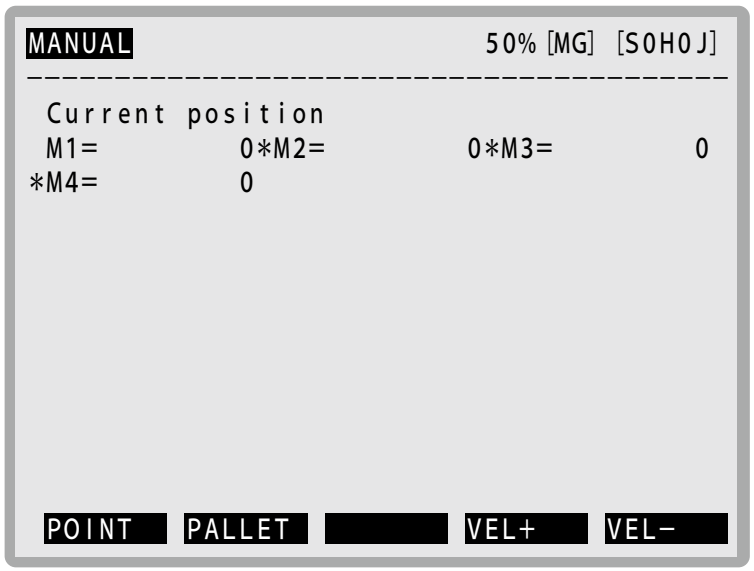
NOTE

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. For more details, refer to "12.1.5 Other parameters" in this chapter.

Step4 *Check that return-to-origin has been completed.*

If return-to-origin is incomplete, eliminate the problem and perform absolute reset or return-to-origin, or perform both operations when absolute type axes and incremental type axes exist. Then start the robot operation. (Refer to "11.9 Absolute reset" in this chapter for how to perform absolute reset and refer to "11.8 Return-to-origin" for how to perform return-to-origin.

"MANUAL" mode screen

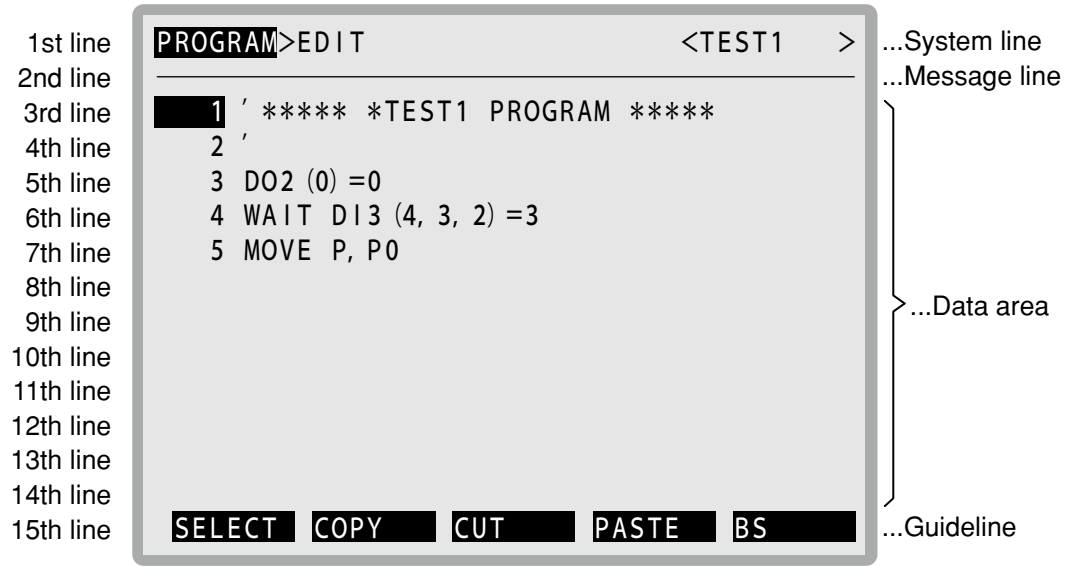


5. Operation keys

5.1 RPB screen

The RPB screen display is composed of 4 areas as shown below.

RPB screen example



NOTE

From now on in this manual, the RPB screen is shown with a portion of the data area cut out by a ≈ mark.

1) System line (1st line)

The current mode and its hierarchy are displayed on the 1st line at the top left of the screen. The above screen example shows that you are in "PROGRAM>EDIT" mode.
When the mode name is highlighted, it shows that the motor power is turned on. If the motor power is turned off for example by pressing the emergency stop, the highlighted display for the mode name is cancelled.

2) Message line (2nd line)

If an error occurs, the error message appears on the 2nd line. Other displays on this line indicate the following status.

Dashed line	Return-to-origin incomplete.
Solid line	Return-to-origin complete.
Double-solid line	Program is being executed.
"@" mark in 2nd column	Online command is being executed through RS-232C interface. Changes to a dot "." when the command ends.
"s" mark in 1st column	Sequence program is being executed.

3) Data area (3rd to 14th lines)

Various types of data and editing information are displayed on the 3rd to 14th lines. These lines scroll to the right and left to show up to 80 characters per line.

4) Guideline (Bottom line)

The bottom line (15th line) mainly shows the contents assigned to function keys in highlighted display.

5) Pointer

The line number and item currently selected are highlighted by the pointer cursor.

Use the cursor (▲ / ▼) keys to move the pointer up and down.

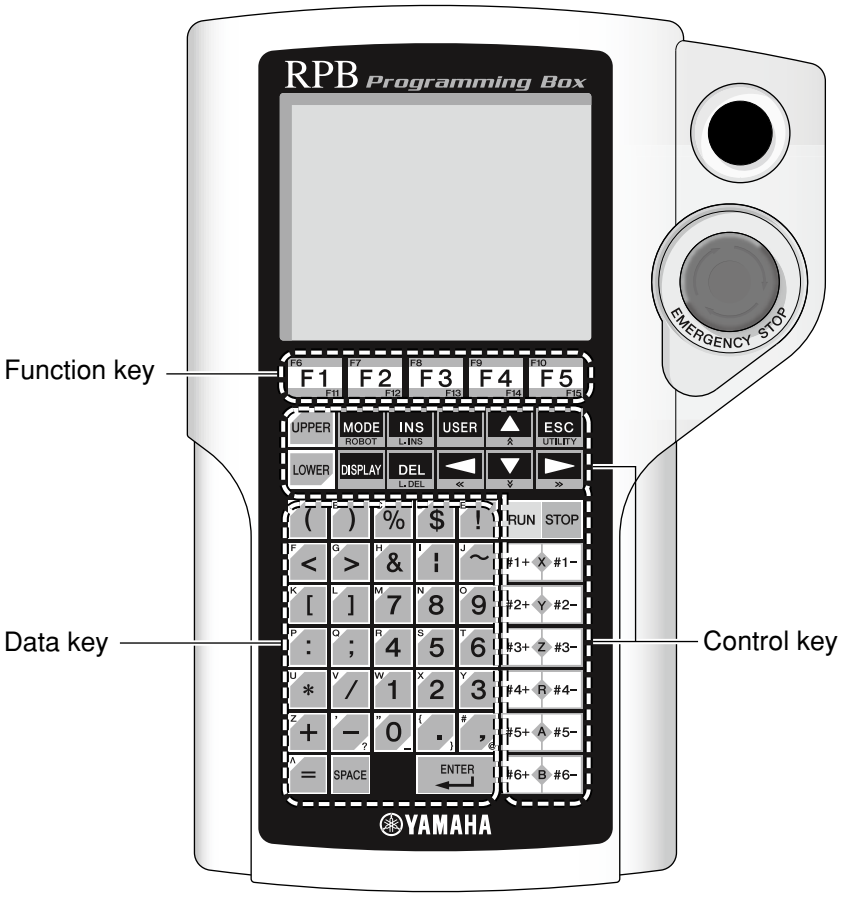
Use the cursor (◄ / ►) keys to move the pointer right and left.

5.2 Operation key layout

The operation keys are covered with a plastic sheet to prevent dust. There are 3 main kinds of keys.

1) Function keys
2) Control keys
3) Data keys

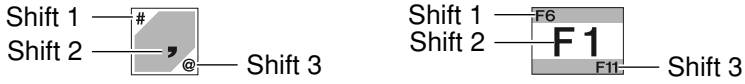
Sheet key layout



5.3 Basic key operation

1) Each operation key has 3 different functions as shown below.
Use UPPER or LOWER as needed to enable various functions.

Key configuration



2) There are 3 ways (shift 1 to shift 3) to use each operation key.

Shift	Example of key input	Input data
1	UPPER + # , @ Shift 1: Use a key while holding down UPPER.	"#"
2	# , @ Shift 2: Use a key without holding down UPPER and LOWER.	","
3	LOWER + # , @ Shift 3: Use a key while holding down LOWER.	"@"

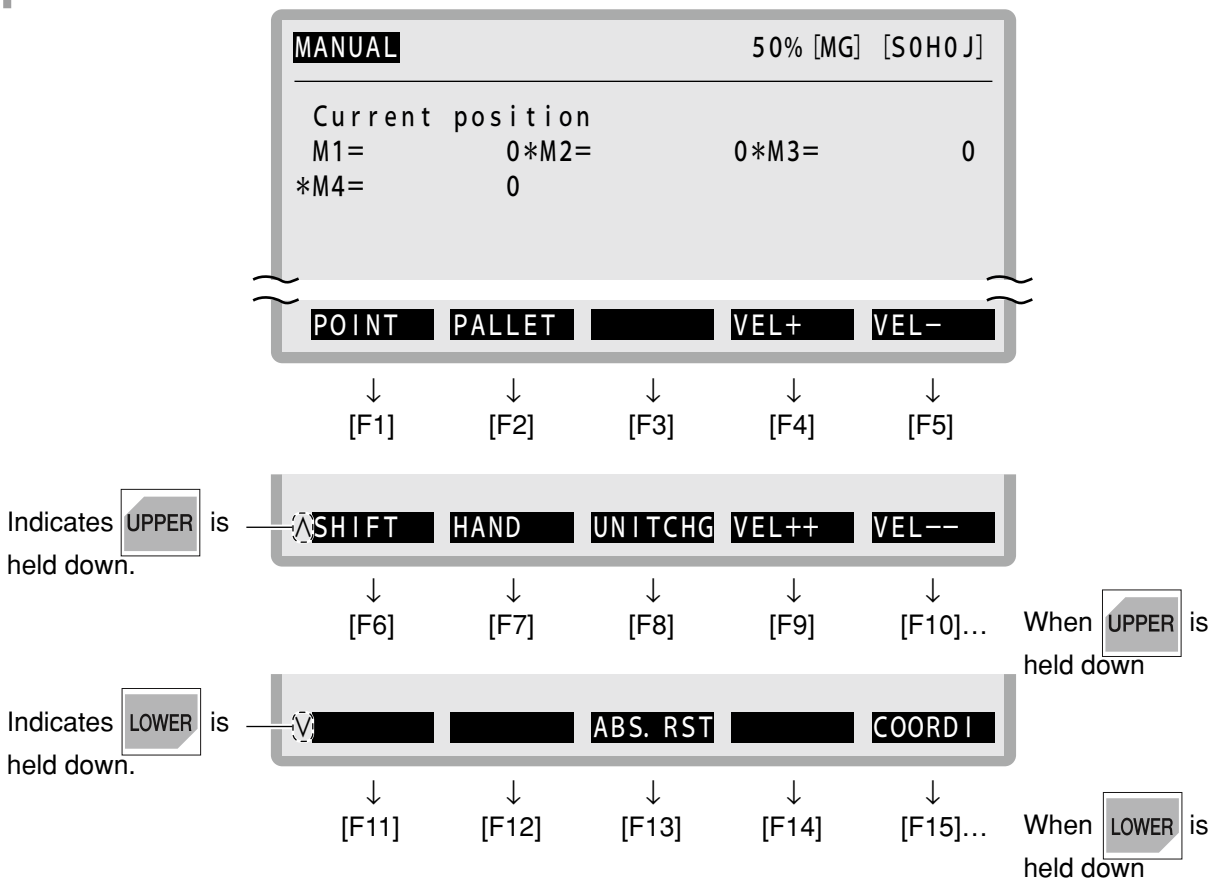
5.4 Function keys

To operate the RPB, select the menus by pressing the function keys.
The relation of the function keys to their menus in "MANUAL" mode is shown below.

Function key		Selected menu
F6 F1 F11	(F1)	POINT
F7 F2 F12	(F2)	PALLET
F9 F4 F14	(F4)	VEL +
F10 F5 F15	(F5)	VEL -
UPPER + F6 F1 F11	(F6)	SHIFT
UPPER + F7 F2 F12	(F7)	HAND
UPPER + F8 F3 F13	(F8)	UNITCHG
UPPER + F9 F4 F14	(F9)	VEL ++
UPPER + F10 F5 F15	(F10)	VEL --
LOWER + F8 F3 F13	(F13)	ABS.RST
LOWER + F10 F5 F15	(F15)	COORDI

Relation of function keys to menus

Function keys and menus



Function keys F1 to F5 (sheet keys on the RPB) correspond to the function key menus on the screen from the left.

Pressing UPPER switches to function keys F6 to F10, and pressing LOWER switches to function keys F11 to F15.

NOTE

From hereon, when F6 to F10 are mentioned, it means to press F6 F1 F11 to F10 F5 F15 while holding down UPPER on the side of the RPB.

Likewise, when F11 to F15 are mentioned, it means to press F6 F1 F11 to F10 F5 F15 while holding down LOWER on the side of the RPB.

5.5 Control keys

There are 6 kinds of control keys: (1) Mode selection keys, (2) Extended function keys, (3) Cursor keys, (4) Page keys, (5) Edit keys, (6) Jog keys.
The functions of each key are explained below.

(1) Mode selection keys

MODE : Displays the mode menu (highest hierarchy).

DISPLAY : Selects the robot I/O monitor screen.

UTILITY : Selects "UTILITY" mode. (This key is shown as UTILITY from now on.)

(2) Extended function keys

USER : Calls up the function key assigned by the user.

ROBOT : Switches robots. (This key is shown as ROBOT from now on.)

ESC : Returns to the previous screen (upper hierarchy).

(3) Cursor keys

▲ : Moves the cursor up.
Moves the pointer (highlighted line number display) up when not editing on the screen.

▼ : Moves the cursor down.
Moves the pointer (highlighted line number display) down when not editing on the screen.

◀ : Moves the cursor to the left. (Screen scrolls to the right when the cursor reaches the left end.)
Scrolls the screen to the right when not edited.

▶ : Moves the cursor to the right. (Screen scrolls to the left when the cursor reaches the right end.)
Scrolls the screen to the left when not edited.

(4) Page keys

» : Returns to the previous screen. (This key is shown as » from now on.)

» : Switches to the next screen. (This key is shown as » from now on.)

« : Switches to the left-hand screen. (This key is shown as « from now on.)

» : Switches to the right-hand screen. (This key is shown as » from now on.)

(5) Edit keys

These keys are enabled when the editing cursor is displayed.

INS : Toggles between "Insert" and "Overwrite" modes.
The cursor "_" appears in "Overwrite" mode and " ■ " appears in "Insert" mode.

DEL : Deletes one character at the cursor position.

L. INS : Inserts one line at the cursor position. (This key is shown as L. INS from now on.)

L. DEL : Deletes one line at the cursor position. (This key is shown as L. DEL from now on.)

(6) Jog keys

RUN : Starts operation.
This key is valid only during "AUTO" mode or point trace.

STOP : Stops operation.
After RUN has been pressed in "AUTO" mode, STOP is valid during program execution, direct command execution, point trace execution and return-to-origin operation.

#1+ X : Moves axis 1 in the + direction or the robot in the +X direction on the XY coordinates.

X #1− : Moves axis 1 in the – direction or the robot in the -X direction on the XY coordinates.

#2+ Y : Moves axis 2 in the + direction or the robot in the +Y direction on the XY coordinates.

Y #2− : Moves axis 2 in the - direction or the robot in the -Y direction on the XY coordinates.

#3+ Z : Moves axis 3 in the + direction.

Z #3− : Moves axis 3 in the - direction.

#4+ R : Moves axis 4 in the + direction.

R #4− : Moves axis 4 in the - direction.

#5+ A : Moves axis 5 in the + direction.

A #5− : Moves axis 5 in the - direction.

#6+ B : Moves axis 6 in the + direction.

B #6− : Moves axis 6 in the - direction.

NOTE

The #1+ X to B #6− keys are hereafter called the Jog keys.
The Jog keys are enabled in "MANUAL" mode.

5.6 Data keys

The data keys are used for data input, programming and data editing.
There are 2 kinds of data keys.

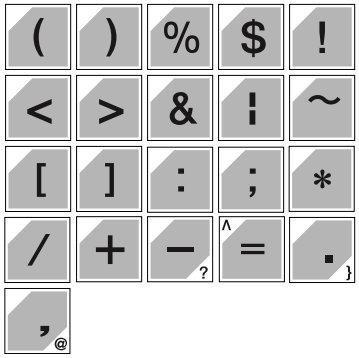
(1) Alphanumeric keys

0 to 9 : Enters numbers.

A to Z : Enters alphabetic characters.

SPACE : Inserts spaces.

(2) Symbol keys



5.7 Other keys

(1) Enter key

ENTER : Pressing this key executes a direct command when in "AUTO>DIRECT" mode. When the cursor is displayed, pressing this key completes the data input on the cursor line.

(2) Shift keys

UPPER : Selects shift 1 for key operation.

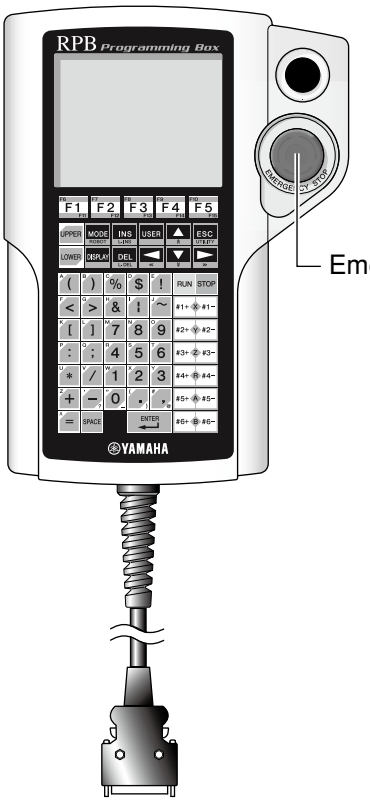
LOWER : Selects shift 3 for key operation

6. Emergency stop

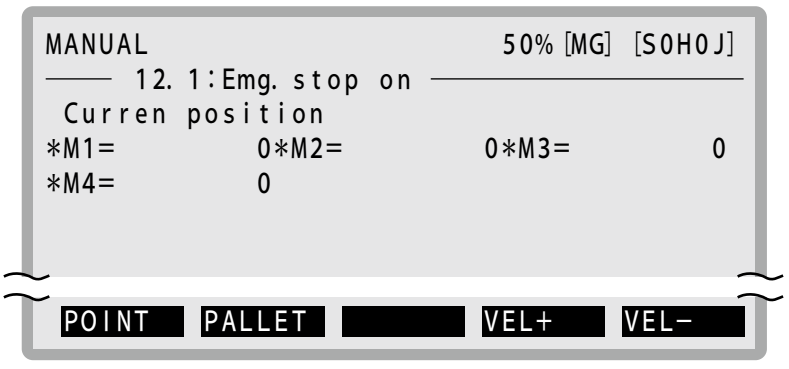
If for some reason you want to stop the robot immediately during operation, press the emergency stop button on the RPB. Pressing the emergency stop button cuts off power to the robot to stop operation. A message appears on the RPB screen as shown below. The highlighted display for the mode name is cancelled during emergency stop.

Emergency stop

RPB programming box



Emergency stop button



NOTE

Besides the emergency stop button on the RPB, an external dedicated input (emergency stop) terminal is provided in the SAFETY connector. Refer to Chapter 7 for details.

6.1 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 7.
- Origin positions are retained even when emergency stop is triggered, so the robot can be operated the same as before emergency stop just by canceling emergency stop without absolute reset or return-to-origin.

Step 1 ***Cancel the emergency stop button on the RPB.***

Turning the emergency stop button clockwise releases the emergency stop.

Step 2 ***Press the*** UTILITY ***while holding down the*** LOWER**.**

The screen switches to "UTILITY" mode and the following message appears.

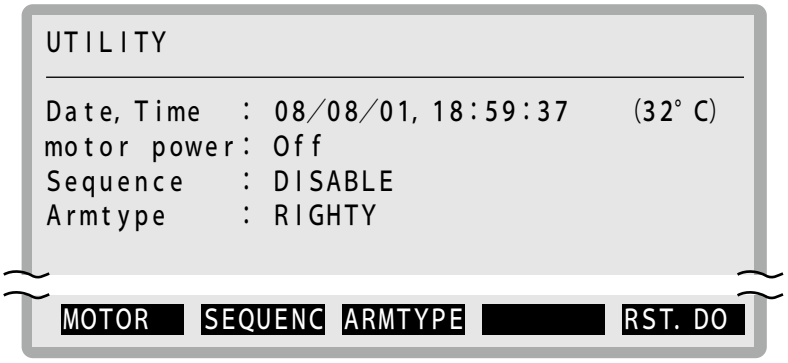
Emergency stop reset (1)



Step 3 ***Press*** F4 ***(YES).***

The following screen appears.

Emergency stop reset (2)

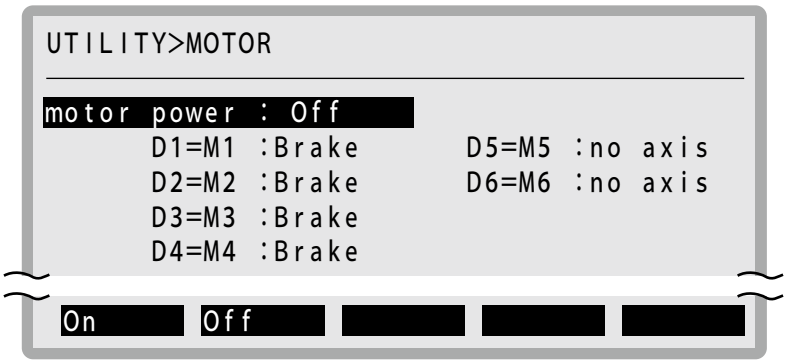


At this time, pressing ESC *returns to the previous mode with the motor power still turned off. To turn on the motor power, continue the following operations.*

Step4 ***Press F1 (MOTOR).***

The following screen appears.

"UTILITY>MOTOR" mode (1)



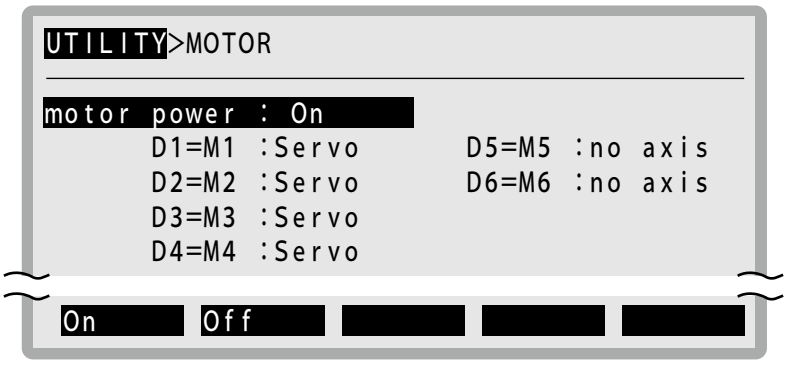
Step5 ***Press F1 (On) to turn on the motor power.***

At the same time, the servomotor sets to HOLD status.
The mode name "UTILITY" on the system line (1st line) 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.

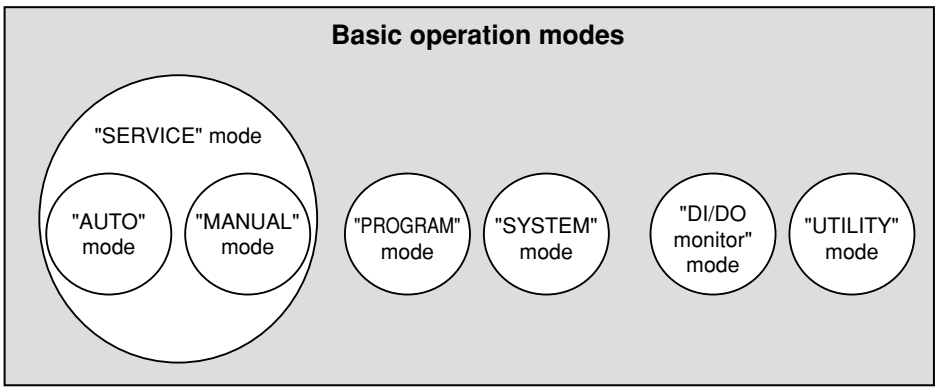
"UTILITY>MOTOR" mode (2)



Step6 ***Press the ESC to return to the previous mode.***

7. Mode configuration

The robot operation mode consists of the following modes.



"SERVICE" mode can be used only when "SAFE" mode is enabled.

7.1 Basic operation modes

Robot operation is classified into 5 basic modes as follows.

(1) "SERVICE" mode (only when "SAFE" mode is enabled)

(2) "AUTO" mode

(3) "PROGRAM" mode

(4) "MANUAL" mode

(5) "SYSTEM" mode

Among these modes, "SERVICE" mode can be selected with DI02 (SERVICE mode input) and other modes with the function keys.

(1) "SERVICE" mode

"SERVICE" mode is used to perform maintenance work using the RPB safely within the safety enclosure of the robot system. This mode includes "AUTO" and "MANUAL" modes in the basic operation mode, and can be selected by turning DI02 (SERVICE mode input) OFF. The following functions are selected in "SERVICE" mode.

1. Robot is controlled only by RPB operation.
2. Automatic operation is prohibited.
3. Robot operating speed is set to below 3% of the maximum speed.
4. Robot operation is possible only by hold-to-run control.

CAUTION

The "SYSTEM" mode is used to select the "SERVICE" mode functions. (Refer to "12.3.2 Setting the "SERVICE" mode" in this chapter.)

(2) "AUTO" mode

Select this mode to execute robot programs. Robot programs can be executed only in this mode. Operable tasks in this mode differ depending on the parameter settings in "SERVICE" mode.

(3) "PROGRAM" mode

Select this mode to create and edit robot programs. Robot programs can be edited on the RPB screen.

(4) "MANUAL" mode

Select this mode to move the robot manually or perform point teaching. Return-toorigin and manual movement can be executed only in this mode.
Operable tasks in this mode differ depending on the parameter settings in "SERVICE" mode.


NOTE

- Absolute reset and return-to-origin operation can be performed only in "MANUAL" mode.
- "AUTO" mode may be selected depending on the execution level when the robot controller is turned on

(5) "SYSTEM" mode

Select this mode to perform maintenance and adjustment of the YAMAHA robots such as robot parameter and axis parameter settings.

7.2 Other operation modes

Other than the basic operation modes the following two modes are also available.

(1) "DI/DO Monitor" mode

(2) "UTILITY" modeThese modes can be selected with the control keys.

These modes can be selected with the control keys.

(1) "DI/DO Monitor" mode

Use this mode to monitor the robot controller I/O status or task status on the RPB screen. Use DISPLAY to select this mode.

(2) "UTILITY" mode

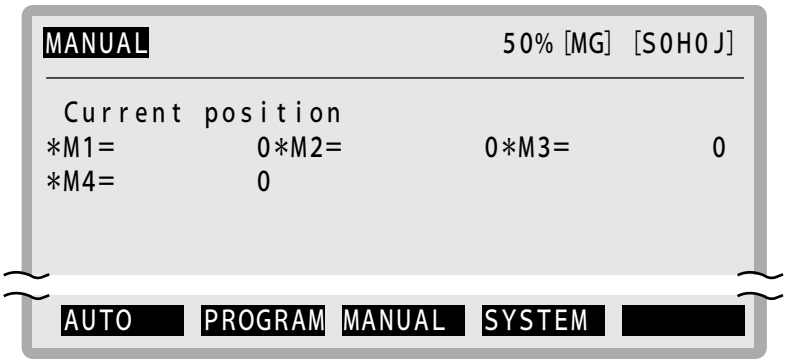
Use this mode to perform maintenance of the YAMAHA robots such as recovery from emergency stop and motor servo on/off switching. Use UTILITY to select this mode.

7.3 Mode hierarchy

Robot operation is mainly performed by selecting the desired mode from the hierarchy menu. (Refer to the "Mode hierarchy diagram" described later.) To select a menu, press the corresponding function key.

Pressing MODE displays the 4 basic modes on the guideline (bottom line) of the screen as shown below.

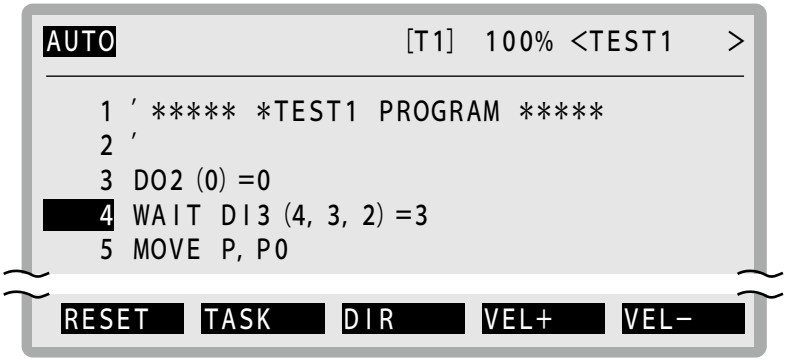
Mode menu



These are basic modes at the highest hierarchy on the menu. The display position for each mode name corresponds to each function key of F1, F2, F3 and F4 from the left.

For example, when F1 (AUTO) is pressed, "AUTO" mode is entered.

"AUTO" mode menu



When "AUTO" mode is entered, the submenu for the "AUTO" mode operation appears on the guideline.

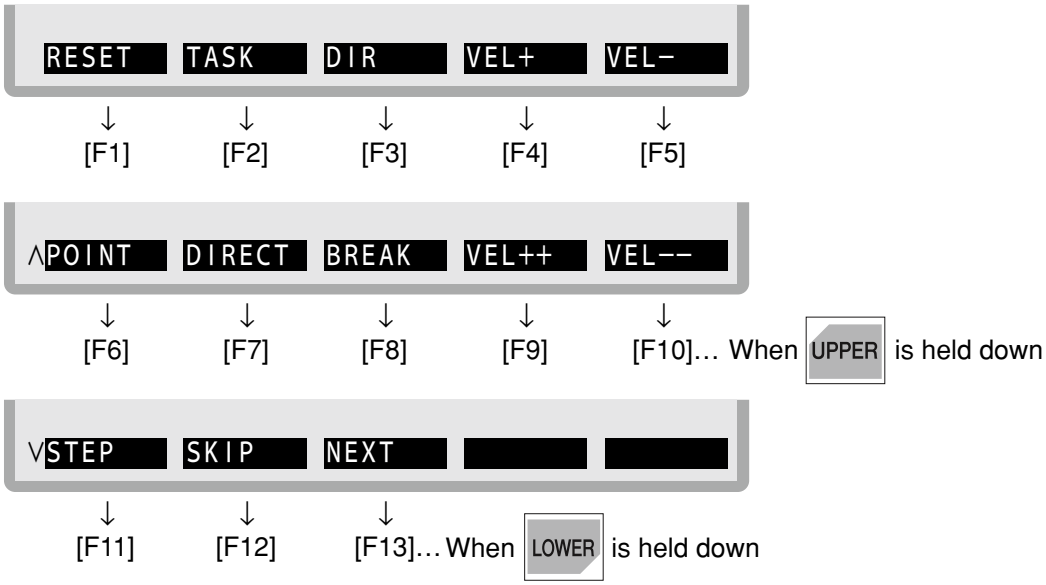
The submenu also corresponds to the function keys from F1 to F15. (See the figure titled "Function switching" on the next page.)

When there are 6 or more submenus, press the UPPER or LOWER shift key. The menu display changes while the shift key is pressed.

Shift keys



Function switching



The "∧" mark at the left end on the guideline shows that UPPER is pressed, while the "∨" mark shows that LOWER is pressed.

Some submenus have other menus for accessing the next hierarchical mode.
For example, pressing F8 in "AUTO" mode while holding down UPPER, switches to "BREAK" mode. Submenus relating to "BREAK" mode then appear.

As explained above, operation can proceed through each hierarchy by selecting the menu items with the function keys. To return to the previous mode hierarchy, press ESC.
To return to a highest mode press MODE. The basic modes are then displayed on the guideline, so select the desired basic mode by pressing the corresponding function key.

NOTE

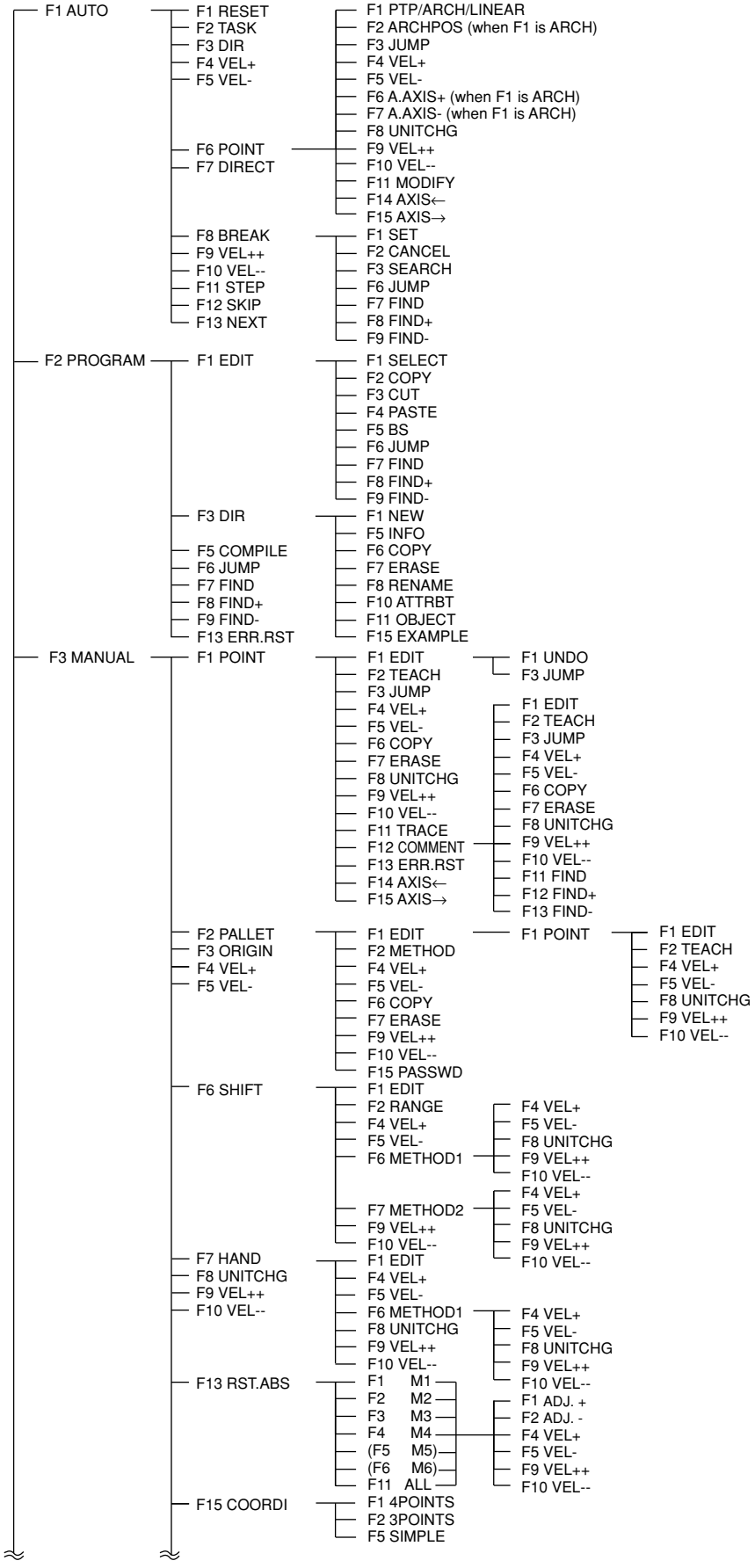
- When the data is being edited such as in "EDIT" mode, MODE is inoperative. After pressing ESC to return the mode hierarchy, press MODE.
- From here in this user's manual the mode hierarchy status is stated in the order as shown below.

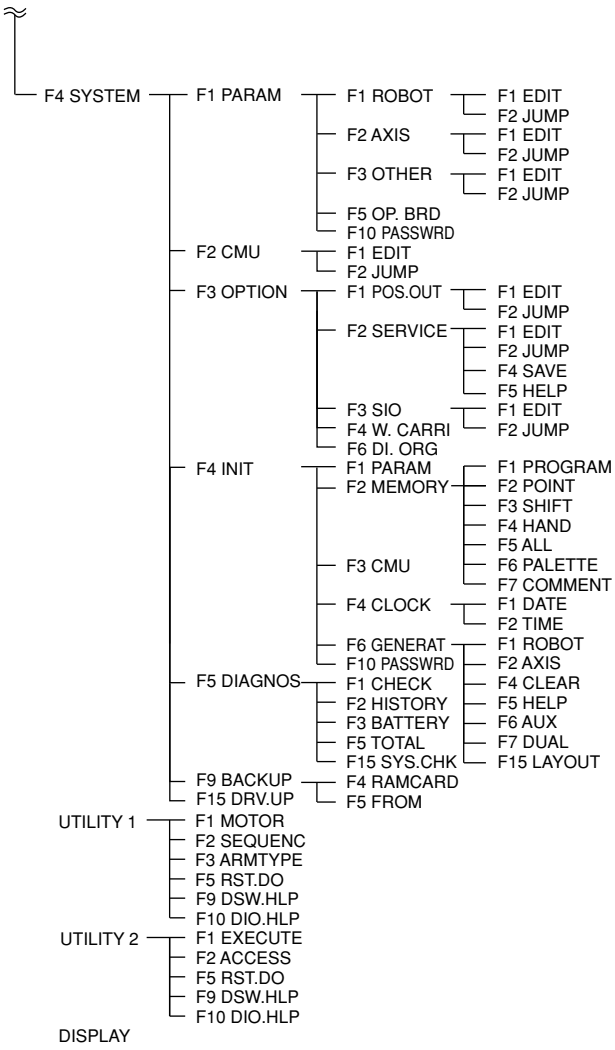
  First (highest) hierarchy>Second hierarchy>Third hierarchy>Fourth hierarchy
  Example: PROGRAM>DIR>ERASE

The above example shows that the current mode is entered by selecting F2 (PROGRAM) from the first hierarchy menu, F3 (DIR) from the second hierarchy menu and F7 (ERASE) from the third hierarchy menu.

See the figure titled "Mode hierarchy diagram" on the next page for the entire mode hierarchy.

Mode hierarchy diagram




F4 SYSTEM
F1 PARAM
F1 ROBOT
F1 EDIT
F2 JUMP
F2 AXIS
F1 EDIT
F2 JUMP
F3 OTHER
F1 EDIT
F2 JUMP
F5 OP. BRD
F10 PASSWRD
F2 CMU
F1 EDIT
F2 JUMP
F3 OPTION
F1 POS.OUT
F1 EDIT
F2 JUMP
F2 SERVICE
F1 EDIT
F2 JUMP
F4 SAVE
F5 HELP
F3 SIO
F1 EDIT
F2 JUMP
F4 W. CARRI
F6 DI. ORG
F4 INIT
F1 PARAM
F1 PROGRAM
F2 MEMORY
F2 POINT
F3 SHIFT
F4 HAND
F5 ALL
F3 CMU
F6 PALETTE
F7 COMMENT
F4 CLOCK
F1 DATE
F2 TIME
F6 GENERAT
F1 ROBOT
F10 PASSWRD
F2 AXIS
F5 DIAGNOS
F1 CHECK
F4 CLEAR
F2 HISTORY
F5 HELP
F3 BATTERY
F6 AUX
F5 TOTAL
F7 DUAL
F15 SYS.CHK
F15 LAYOUT
F9 BACKUP
F4 RAMCARD
F15 DRV.UP
F5 FROM
UTILITY 1
F1 MOTOR
F2 SEQUENC
F3 ARMTYPE
F5 RST.DO
F9 DSW.HLP
F10 DIO.HLP
UTILITY 2
F1 EXECUTE
F2 ACCESS
F5 RST.DO
F9 DSW.HLP
F10 DIO.HLP
DISPLAY

8. "SERVICE" mode

"SERVICE" mode can be used only when "SAFE" mode is enabled.
Use "SERVICE" mode to perform safe maintenance work with the RPB while within the safety enclosure of the robot system. This mode can be selected by turning DI02 (SERVICE mode input) OFF.

CAUTION

- **Use "SYSTEM" mode to select the functions in "SERVICE" mode. (Refer to "12.3.2 Setting the "SERVICE" mode" in this chapter.)**
- **Basically, RPB operation is only allowed in "SERVICE" mode, so application software (VIP/WIN, etc.) that executes on-line commands through the RS-232C interface cannot be used, except for cases where other operating devices are enabled by on-line commands made via the RS-232C.**

8.1 Operation device

If operation from a device other than the RPB is permitted, the operator using the RPB may be exposed to hazardous situations. For example:

1. When a dedicated input start signal is turned ON without the RPB operator knowing about it.
2. When an external device runs a robot operation command through the RS-232C interface without the RPB operator knowing about it.

To prevent this kind of accident in "SERVICE" mode, only the RPB can be used to operate the robot and other operation devices are disabled. However, you may add other operation devices provided you take responsibility for your own safety.

8.2 Prohibition of "AUTO" mode operation

A major purpose for robot operation while the operator is working within the safety enclosure is maintenance and adjustment of the robot. If a robot program is executed in "AUTO" mode during maintenance work, the robot might move on its own with no warning to the operator. Therefore, "AUTO" mode operation is basically prohibited in "SERVICE" mode. However, if robot movement in a program must be checked while the operator stays within the safety enclosure, then "AUTO" mode can be selected provided you take responsibility for your own safety.

8.3 Hold-to-Run function

If the robot operator using the RPB should trip or fall during maintenance work, he (she) might be exposed to a dangerous situation. To prevent this kind of accident, the Hold-to-Run function allows the robot to move only during the time that the RPB key is kept pressed (like a deadman switch.). However, the Hold-to-Run function can be turned OFF provided you take responsibility for your own safety.

8.4 Limitations on robot operating speed

A major purpose of robot operation while the operator is working within the safety enclosure is maintenance and adjustment of the robot. If a dangerous situation should occur, the operator can easily avoid it if the robot operating speed is maintained within 250mm/sec.
The robot operating speed in "SERVICE" mode is therefore basically limited to below 3% of maximum speed. However, if the robot operating speed has to be set higher than the safety range while the operator is still within the safety enclosure, this speed limitation can be cancelled provided you take responsibility for your own safety.

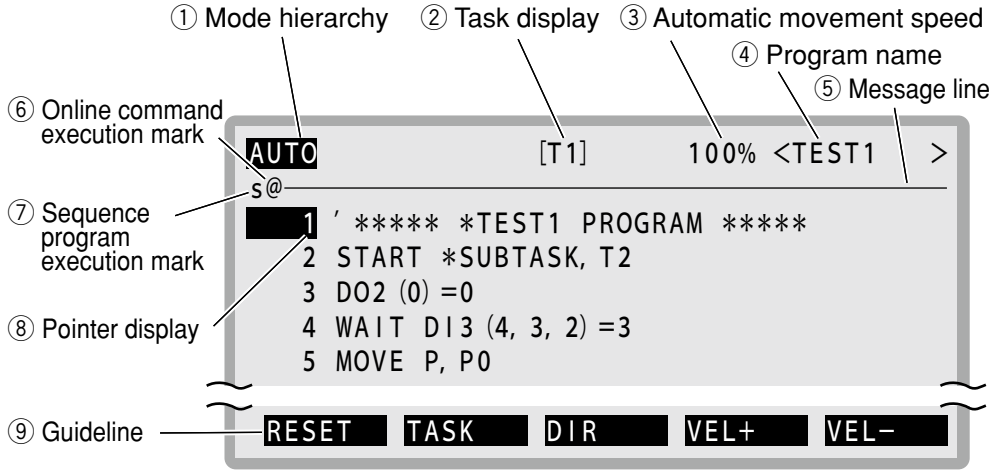
CAUTION

When operating the robot without using the safety functions explained in sections 8.2, 8.3 and 8.4 while the operator is still within the safety enclosure, it is important to take even more stringent safety precautions.

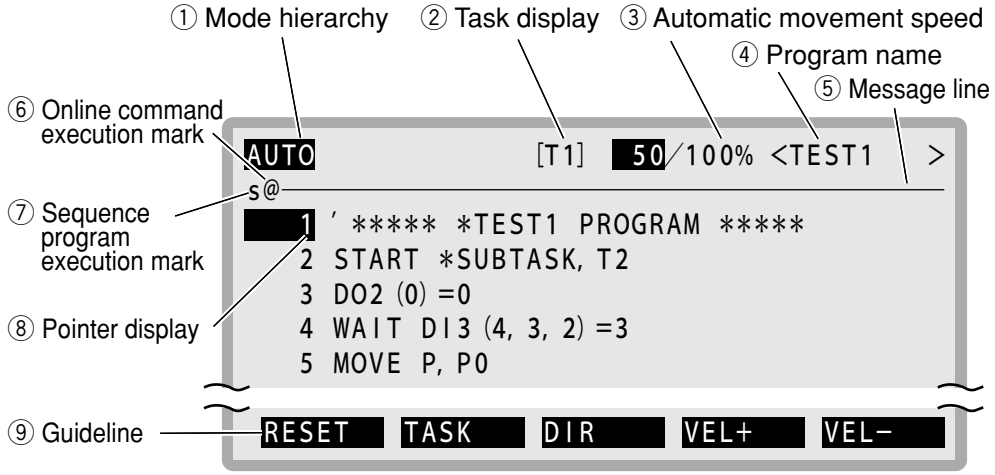
9. "AUTO" mode

"AUTO" mode executes robot language programs and related tasks.
The initial "AUTO" mode screen is shown below.

"AUTO" mode (one-robot setting)



"AUTO" mode (two-robot setting)



① **Mode hierarchy**
Shows the current mode hierarchy. When the highest mode ("AUTO" in this case) is not highlighted, it means the servomotor power is off. When highlighted, it means the servomotor power is on.

② **Task display**
Shows the task number for the program listing being displayed.

③ **Automatic movement speed**
Robot movement speed is displayed during automatic operation.
This is the speed at which the robot moves during automatic operation.
When two robots are specified, two speeds are displayed for " Main group speeds / Sub group speeds ", with the currently selected group highlighted.

④ **Program name**
Shows the program name currently selected.

⑤ **Message line**
If an error occurs, the error message appears here. A dashed line means return-to-origin is incomplete. A solid line means return-to-origin return is complete. A double-solid line means automatic operation is in progress.

⑥ **Online command execution mark**
When an online command is being executed, an "@" mark is displayed in the second column on the second line. This mark changes to a dot (.) when the online command ends.

⑦ **Sequence program execution mark**
When a sequence program is being executed, an "s" mark is displayed in the first column on the second line.

⑧ **Pointer display**
The program line number to be executed next is shown highlighted in the program listing.

⑨ **Guideline**
The contents assigned to function keys are shown highlighted. A message on what to do next also appears here in some operation steps.

Upon entering "AUTO" mode, the specified program is compiled and an object file is created to execute automatic operation.
When the same object file already exists, no compiling is executed.
If an error is found in a command statement during compiling, the error message and the program listing after the command line where the error occurred are displayed.
If the compiling ends normally, the program listing is displayed from the top command line.


NOTE

Usually, return-to-origin must be completed before starting "AUTO" mode. If return-to-origin is not complete, the message "Origin incomplete" appears. In such a case, refer to "11.8 Return-to-origin" and "11.9 Absolute reset" later in this chapter.
However, the program can be executed depending on the command execution level even if return-to-origin has not been completed. For further information, see the execution level explained in section 14.5, "Changing the execution level" later in this chapter.

Valid keys and submenu descriptions in "AUTO" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Scrolls the program listing.
⏫ / ⏬ *1		Switches to other screens.
F1	RESET	Resets the program.
F2	TASK	Changes the program listing according to each task.
F3	DIR	Changes the current program.
F4	VEL+	Increases automatic movement speed for the selected robot group in steps.(1→5→20→50→100%)
F5	VEL-	Decreases automatic movement speed for the selected robot group in steps.(100→50→20→5→1%)
F6 *2	POINT	Moves to the specified point number position.
F7 *2	DIRECT	Executes a command statement written on one line.
F8 *2	BREAK	Sets a break point.
F9 *2	VEL++	Increases automatic movement speed for the selected robot group in 1% increments.
F10 *2	VEL--	Decreases automatic movement speed for the selected robot group in 1% decrements.
F11 *3	STEP	Executes one line of the command statement.
F12 *3	SKIP	Advances to the next line without executing the current command statement.
F13 *3	NEXT	Executes one line of the command statement. (Sub-routines are executed at a time.)
ROBOT *4		Switches the selected robot group.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6 to F10, press F1 to F5 while holding down UPPER.

*3: To use F11 to F13, press F1 to F3 while holding down LOWER.

*4: To use ROBOT, press MODE while holding down LOWER.

9.1 Automatic operation

Program commands are executed continuously during automatic operation. Before starting automatic operation, make sure that return-to-origin, program debugging, I/O signal connections and point data teaching have already been completed. When the execution level is set to other than level 0, automatic operation is possible even if return-to-origin is incomplete.

NOTE

Regardless of the execution level, some commands such as the robot movement commands cannot be executed if return-to-origin is incomplete.
When the execution level 5, 6 or 8 is selected, the program will always be executed from the beginning.

Step 1 *Enter "AUTO" mode.*

On the highest mode screen, press F1 *(AUTO) to enter "AUTO" mode.*

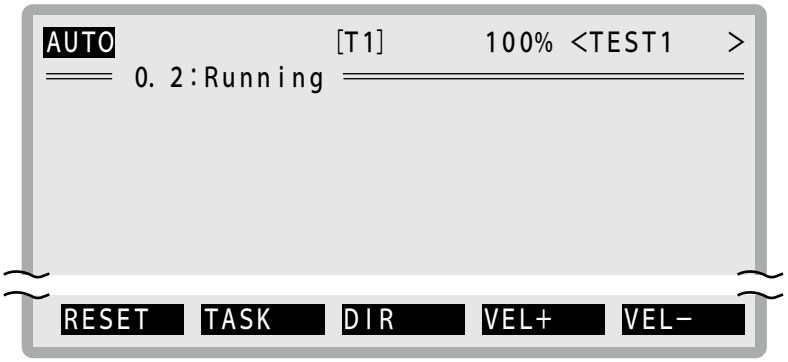
Step 2 *Press* RUN.

Command statements are executed in order from the line number where the pointer is displayed.
The program listing disappears during automatic operation and the message "Running" appears on the message line (the second line).
The message line changes from a single solid line to a double-solid line when automatic operation starts.

WARNING

- **UPON PRESSING RUN, THE ROBOT STARTS TO MOVE. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.**
- **WHEN CHANGING THE AUTOMATIC MOVEMENT SPEED DURING AUTOMATIC OPERATION, CHECK SAFETY FOR SURROUNDING AREAS.**

Automatic operation in progress



The following keys are enabled during automatic operation.

Valid keys		Menu	Function
F9	*1	VEL++	Increases automatic movement speed for the selected robot group in 5% increments.
F10	*1	VEL- -	Decreases automatic movement speed for the selected robot group in 5% decrements.
ROBOT	*2		Switches the selected robot group.

*1: To use F9 or F10, press F4 (F9) or F5 (F10) while holding down UPPER.

*2: To use ROBOT, press MODE (ROBOT) while holding down LOWER.

NOTE

When automatic movement speed was changed during automatic operation, it is enabled after the automatic operation is complete.

9.2 Stopping the program

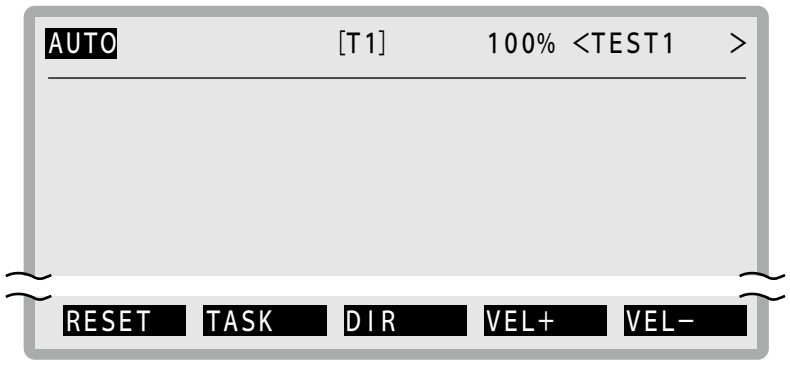
Step1 ***Press STOP during program execution.***

Program execution temporarily stops.

CAUTION

Do not turn off the robot controller during program execution. If turned off, an error may occur in the internal system data and the program might not restart normally when the power is again turned on. Always be sure to terminate or stop the program before turning the power off.

Program stop screen



Step2 ***Press ESC to display the program listing.***

The pointer indicates the next command line number to be executed in the program.

Step3 ***Press RUN to re-execute the program.***

9.3 Resetting the program

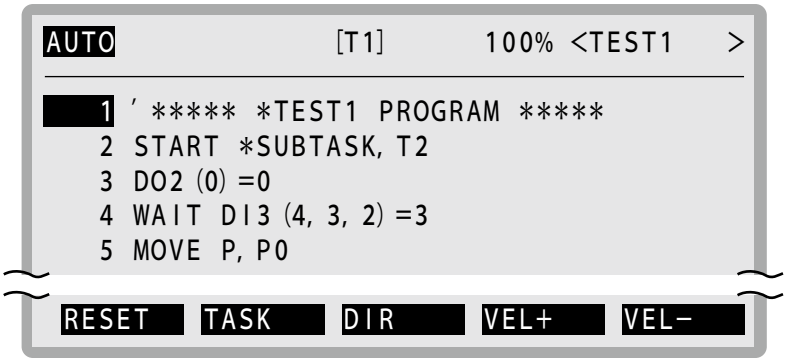
To restart a program stopped with STOP from the beginning, reset the program.

NOTE

The output is also reset when the program is reset. However, the output will not be reset in the following cases:

1. "DO cond. on PGM reset / RESCDO" in Other parameters is set to "HOLD". (For details, See "12.1.5 Other parameters" in Chapter 4.)
2. A sequence program is being executed without enabling the DO reset in the sequence execution flag setting.

Program reset



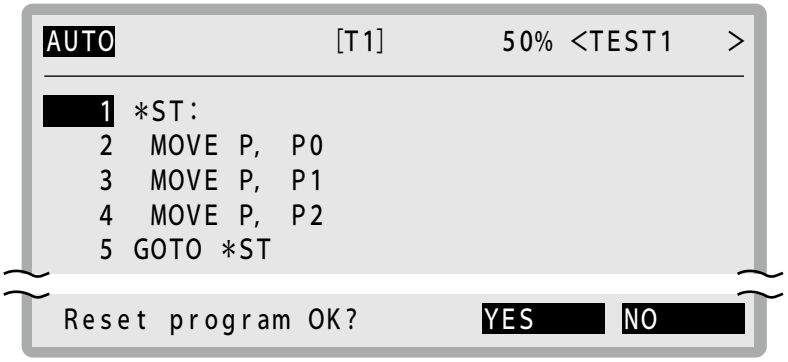
1. When the program "_SELECT" does not exist:

Step 1 ***Press*** F1 ***(RESET) in "AUTO" mode.***

Step 2 ***Press*** F4 ***(YES).***

The program listing appears from the first line. (A pointer also appears on the first line number of the program.)

Program reset

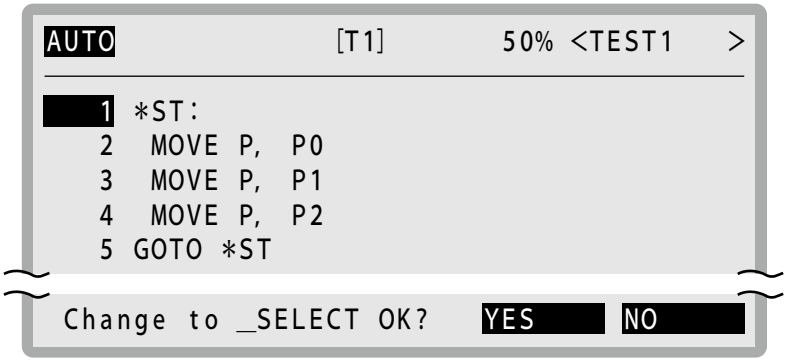


2. When the program "_SELECT" exists:

Step1 ***Press F1 (RESET) in "AUTO" mode.***

The following confirmation message appears on the guideline when "_SELECT" exists in the programs.

Program reset



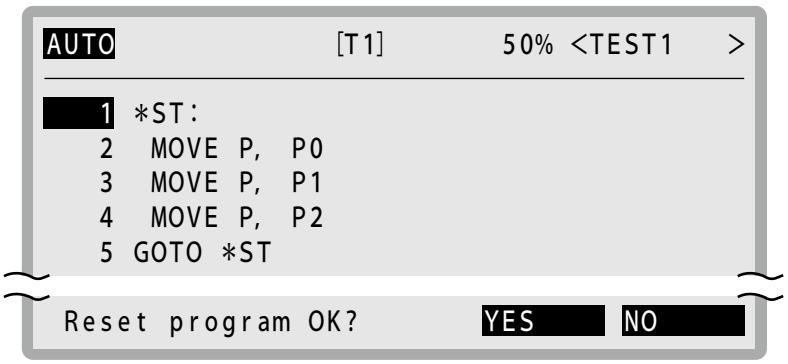
Step2 ***Select the program reset method.***

The following message appears on the guideline when "_SELECT" exists among the programs. Press F4 (YES) to reset the selected program by switching it to "_SELECT", or press F5 (NO) to just reset the current program.

Step3 ***Another confirmation message appears when F5 (NO) was pressed in step 2.***

Press F4 (YES) to reset the current program, or press F5 (NO) to cancel the reset.

Program reset



NOTE

The output is also reset when the program is reset. However, the output will not be reset in the following cases:

1. "DO cond. on PGM reset / RESCDO" in Other parameters is set to "HOLD". (For details, See "12.1.5 Other parameters" in Chapter 4.)
2. A sequence program is being executed without enabling the DO reset in the sequence execution flag setting.

9.4 Switching task display

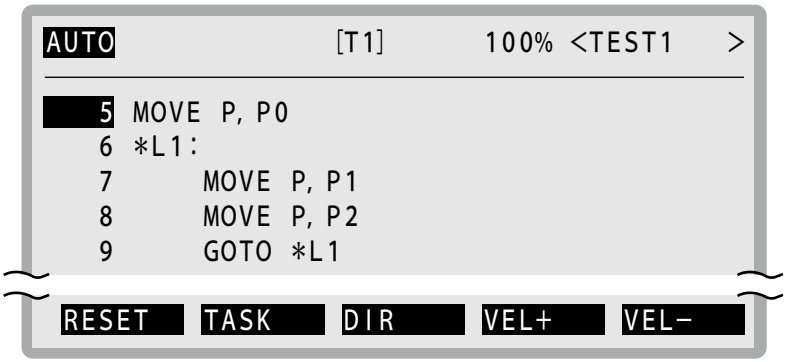
When a program executing multiple tasks is stopped, the program listing for each task can be displayed.

Step1 ***Press*** STOP ***during program execution to stop the program.***

Step2 ***Press*** ESC ***to display the program listing.***

The pointer indicates the next command line number to be executed in the current task.

Main task (T1) display

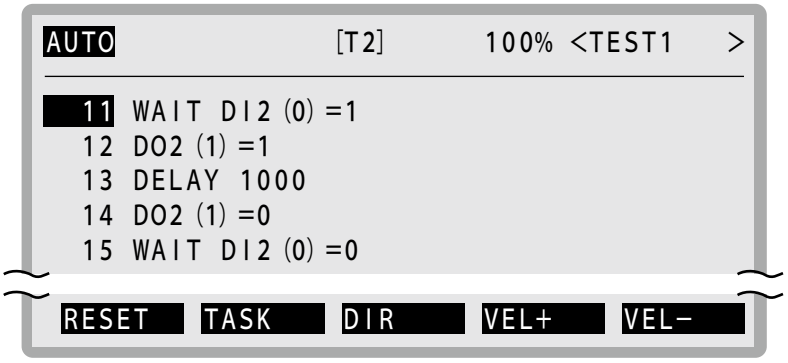


Step3 ***Switch the task.***

Press F2 *(TASK) to select a lower-order task program.*

Each time F2 *(TASK) is pressed, lower-order task programs (T2→T3→...T8) are displayed.*
At this time, the pointer indicates the next command line number to be executed in each task.

Sub task (T2 to T8) display



9.5 Switching the program

If the program displayed on the screen is not the one you want to execute, it can be switched to another program.

NOTE

The output is reset when the program is switched. However, the output will not be reset in the following cases:

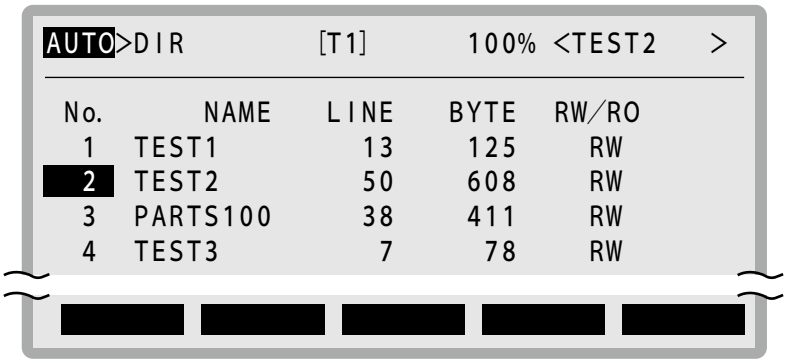
1. "DO cond. on PGM reset / RESCDO" in Other parameters is set to "HOLD". (For details, See "12.1.5 Other parameters" in Chapter 4.)
2. A sequence program is being executed without enabling the DO reset in the sequence execution flag setting.

Step 1 ***Press F3 (DIR) in "AUTO" mode.***

Program information appears. A pointer is displayed on the line number of the program which is currently selected.

Step 2 ***Select the desired program using the cursor (▲ / ▼) keys.***

Switching programs



Step 3 ***Press ESC.***

The selected program will be automatically complied, and an abject file created.

9.6 Changing the automatic movement speed

Automatic movement speed for the selected robot group can be set within the range of 1 to 100%.



NOTE

When two robots are specified, two speeds are displayed for " Main group speeds / Sub group speeds ". The speed shown highlighted can be set. To switch the robot group, use ROBOT (LOWER + MODE).



NOTE

Automatic movement speeds once set here are stored in the internal memory even when the power is turned off.
If the speed is set with the program command statement (SPEED statement), the actual robot operating speed will be the product of that speed and the automatic movement speed.
For example, if the automatic movement speed is 80% and the speed specified by the SPEED statement is 50%, then the robot movement speed is set as follows.
Operating speed = 80% × 50% = 40%

- Press F4 (VEL+) or F5 (VEL-) in "AUTO" mode to change the speed in steps.
  Each time the F4 (VEL+) or F5 (VEL-) is pressed, the speed changes in steps of 1← →5← →20← →50← →100%.
  The maximum motor speed is set at 100%.

- Press F9 (VEL++) or F10 (VEL--) to change the speed gradually.
  Each time the F9 (VEL++) or F10 (VEL--) is pressed, the speed changes in units of 1%.
  Holding down the key changes the speed continuously.

9.7 Executing the point trace

Point data positions can be checked by actually moving the robot arm in the following modes.

- PTP motion mode
- Arch motion mode
- Linear interpolation motion mode

NOTE

- When two robots are specified, check the currently selected robot group on the RPB screen. "(MG)" indicates the main robot group and "(SG)" the sub robot group. To switch the robot group, use ROBOT (LOWER + MODE).
- Point trace cannot be performed unless return-to-origin is complete.

To enter "AUTO>POINT" mode, press F6 (POINT) in "AUTO" mode.

Point data is displayed on the screen as shown below.

Point trace screen (with no auxiliary axis)

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
              x          y          z          r
P3    =  150.50    64.53    21.78   -45.14
P4    =   96.65  -224.89    43.31    28.79
P5    =  -63432     19735     6243     22642

COMNT:                              [LEFTY]
 [POS]         0         0         0         0
 PTP             JUMP      VEL+      VEL-
```

* The "[RIGHTY]" message on the first line appears only when a SCARA robot is selected.

* The "[LEFTY]" message on the 13th line appears only when a SCARA robot is selected, and a hand system flag is set for the point data.

Valid keys and submenu descriptions in "AUTO>POINT" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Switches the point number and scrolls the screen.
⏫ / ⏬ *1		Switches to other screens.
F1	PTP/ ARCH/ LINEAR	Switches the trace movement mode.
F2	A.POS	Specifies the arch position during ARCH motion mode.
F3	JUMP	Displays the specified point data.
F4	VEL+	Increases automatic movement speed for the selected robot group in steps.(1→5→20→50→100 %)
F5	VEL-	Decreases automatic movement speed for the selected robot group in steps.(100→50→20→5→1 %)
F6 *2	A.AXIS+	Moves the arch axis to the right during ARCH motion mode.
F7 *2	A.AXIS-	Moves the arch axis to the left during ARCH motion mode.
F8 *2	UNITCHG	Switches the units for indicating the current position to "mm/pulse".
F9 *2	VEL++	Increases automatic movement speed for the selected robot group in 1% increments.
F10 *2	VEL- -	Decreases automatic movement speed for the selected robot group in 1% decrements.
F11 *3	MODIFY	Switches to the point data editing screen in "MANUAL" mode.
F14 *3	AXIS←	Moves the cursor to the left to select another axis.
F15 *3	AXIS→	Moves the cursor to the right to select another axis.
ROBOT *4		Switches the selected robot group.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6 to F10, press F1 to F5 while holding down UPPER.

*3: To use F11 to F15, press F1 to F5 while holding down LOWER.

*4: To use ROBOT, press MODE while holding down LOWER.

● F11 (MODIFY)

Pressing F11 (MODIFY) switches to the point data edit screen and allows you to correct the point data while checking the point trace position.

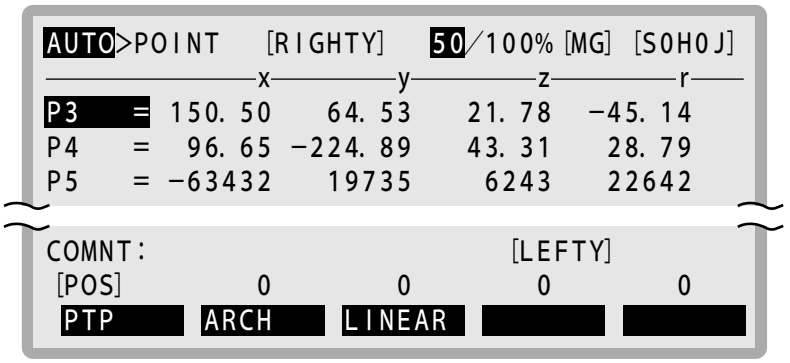
To return to the trace mode, press F11 (TRACE) again.

9.7.1 PTP motion mode

1. When no auxiliary axis is specified:

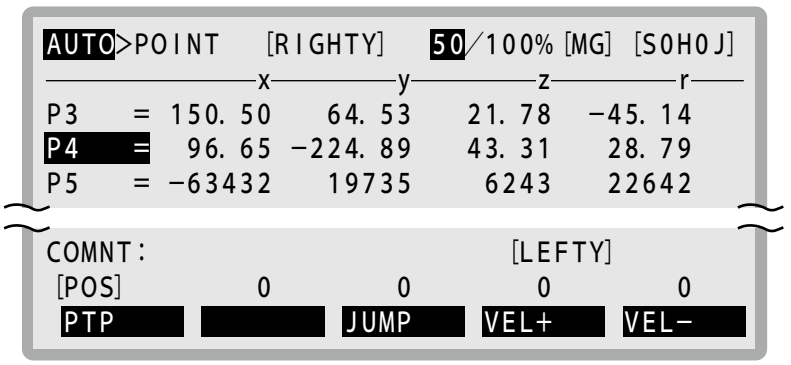
Step1 ***In "AUTO>POINT" mode, press F1 (PTP) to select PTP motion mode.***

Point trace screen in PTP motion mode (with no auxiliary axis)



Step2 ***Use the cursor (▲ / ▼) keys to select the point number to be checked.***

Point trace screen in PTP motion mode (with no auxiliary axis)



NOTE

If the SCARA robot is selected and the hand system flag is set for the point data, this hand system will have priority over the current arm type.

Step3 ***Press RUN to perform trace.***

Press RUN, and the robot moves by PTP motion to the specified point position. The trace speed is 1/5th of the automatic movement speed. If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority. To stop the trace, press STOP.

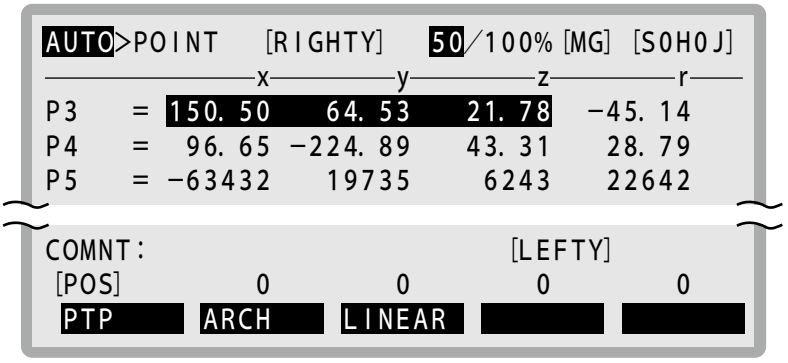
WARNING

UPON PRESSING RUN, THE ROBOT STARTS TO MOVE. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

2. When auxiliary axis is specified:

Step 1 *Press F1 (PTP) in "AUTO>POINT" mode.*

Point trace screen in PTP motion mode (with auxiliary axis)

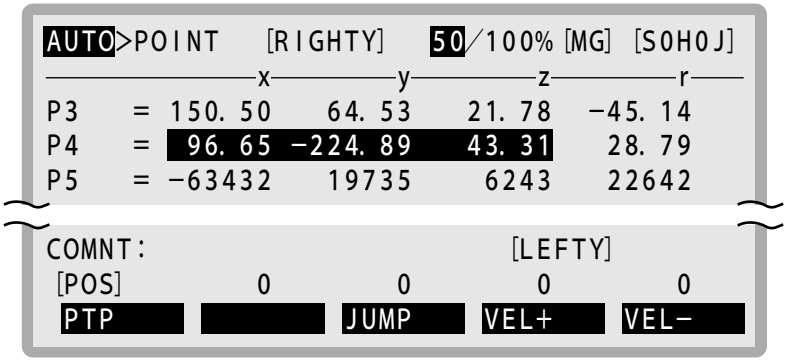


Step 2 *Select the point to be checked.*

Use the cursor (▲ / ▼) keys and F14 (AXIS←) or F15 (AXIS→) so that the point value of the robot axis to be checked is highlighted.

To perform trace for the robot main axes:

Point trace screen in PTP motion mode (with auxiliary axis)

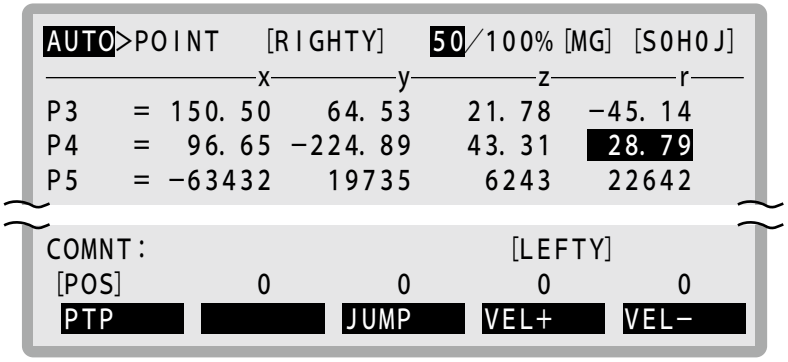


NOTE

If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority over the current arm type.

To perform trace for the auxiliary axis:

Point trace screen in PTP motion mode (with auxiliary axis)



Step3 Press RUN to perform trace.

Press RUN, and the robot moves by PTP motion to the specified point position. The trace speed is 1/5th of the automatic movement speed. If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority. To stop the trace, press STOP.

WARNING

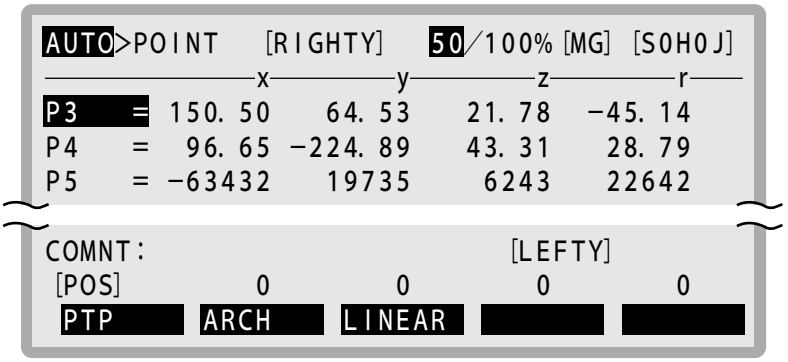
UPON PRESSING RUN, the robot starts to move. To avoid danger, do not enter the robot movement range.

9.7.2 ARCH motion mode

1. When no auxiliary axis is specified:

Step 1 *Press* F2 *(ARCH) in "AUTO>POINT" mode.*

Point trace screen in ARCH motion mode (with no auxiliary axis)

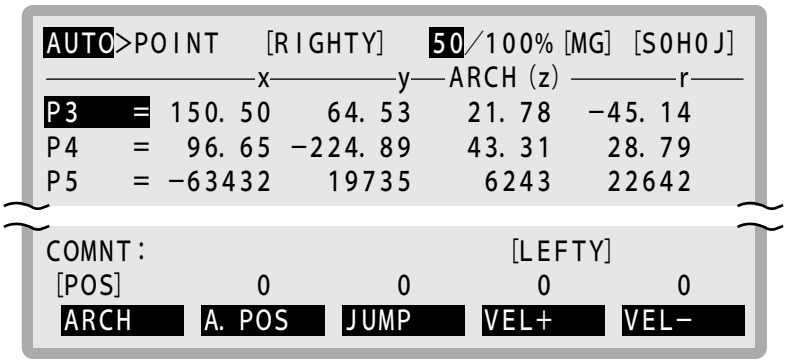


Step 2 *Select the axis to move by arch motion.*

Select F6 *(A.AXIS+) or* F7 *(A.AXIS-) to select the axis.*

The selected axis is indicated on the message line as in "ARCH(z)".

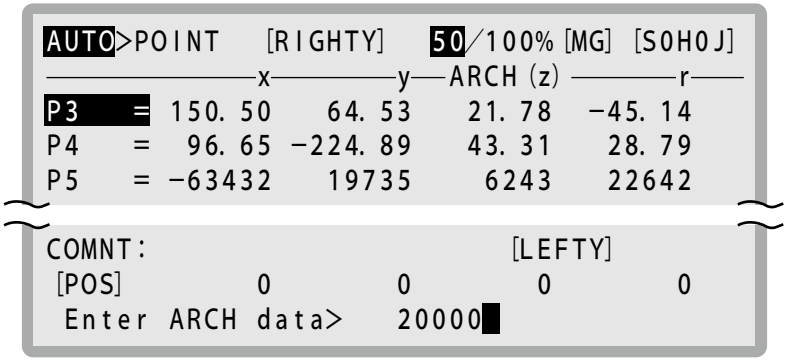
Point trace screen in ARCH motion mode (with no auxiliary axis)



Step3 *Set the arch motion position.*

Press F2 *(A.POS) and enter the arch motion position.*

Point trace screen in ARCH motion mode (with no auxiliary axis)



NOTE

If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority over the current arm type.

Step4 *Select the point number to be checked.*

Use the cursor (▲ / ▼ *) keys.*

Step5 *Press* RUN *to perform trace.*

Press RUN *to move the robot by arch motion to the specified point position. The trace speed is 1/5th of the automatic movement speed. If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority. To stop the trace, press* STOP.

WARNING

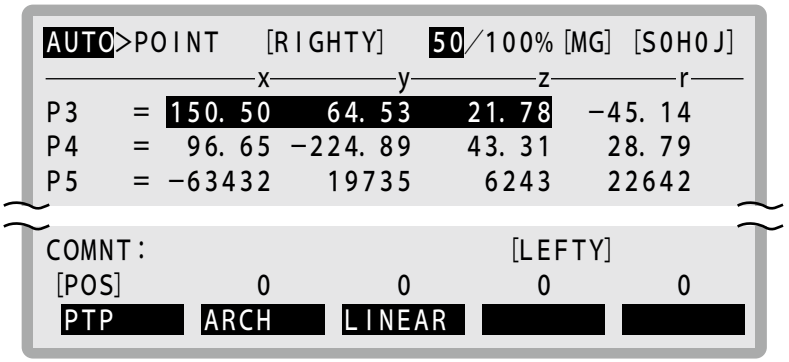
UPON PRESSING RUN, THE ROBOT STARTS TO MOVE. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

2. When auxiliary axis is specified:

Step 1 *Press* F2 *(ARCH) in "AUTO>POINT" mode.*

When performing point trace using an auxiliary axis, skip steps 2 and 3.

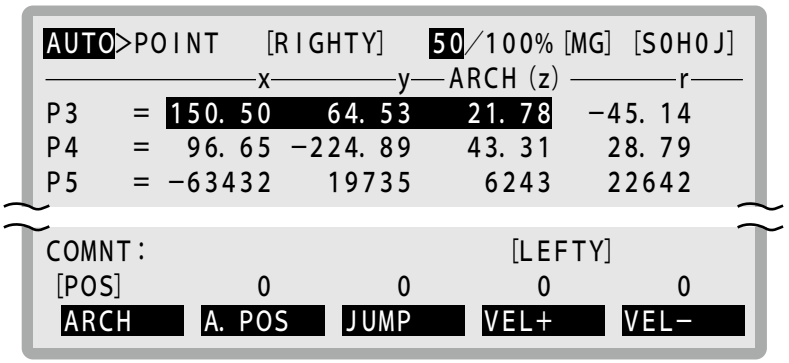
Point trace screen in ARCH motion mode (with auxiliary axis)



Step 2 *Select the axis to move by arch motion.*

Select F6 *(A.AXIS+) or* F7 *(A.AXIS-) to select the axis.*

Point trace screen in ARCH motion mode (with auxiliary axis)



Step3 *Set the arch motion position.*

Press F2 *(A.POS) and enter the arch motion position.*

Point trace screen in ARCH motion mode (with auxiliary axis)

```
AUTO>POINT   [RIGHTY]   50/100% [MG] [S0H0J]
              x         y    ARCH (z)      r
P3    = 150.50    64.53    21.78   -45.14
P4    =  96.65  -224.89    43.31    28.79
P5    = -63432    19735     6243    22642

COMNT:                            [LEFTY]
 [POS]         0         0         0         0
  Enter ARCH data>    20000
```

NOTE

If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have a priority over the current arm type.

Step4 *Select the point to be checked.*

Use the cursor (▲ */* ▼ *) keys and* F14 *(AXIS←) or* F15 *(AXIS→) so that the point value of the robot axis to be checked is highlighted.*

Step5 *Press* RUN *to perform trace.*

Press RUN *to move the robot by arch motion to the specified point position. (The auxiliary axis moves by PTP.) The trace speed is 1/5th of the automatic movement speed. If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority. To stop the trace, press* STOP.

WARNING

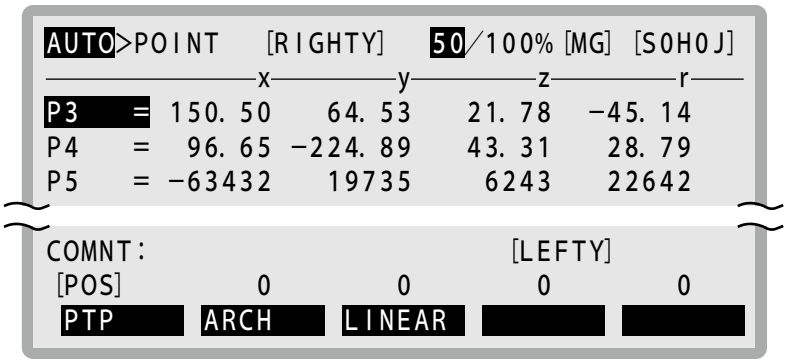
UPON PRESSING RUN, THE ROBOT STARTS TO MOVE. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

9.7.3 Linear interpolation motion mode

1. When no auxiliary axis is specified:

Step 1 *Press* F3 *(LINEAR) in "AUTO>POINT" mode.*

Point trace screen in linear interpolation motion mode (with no auxiliary axis)

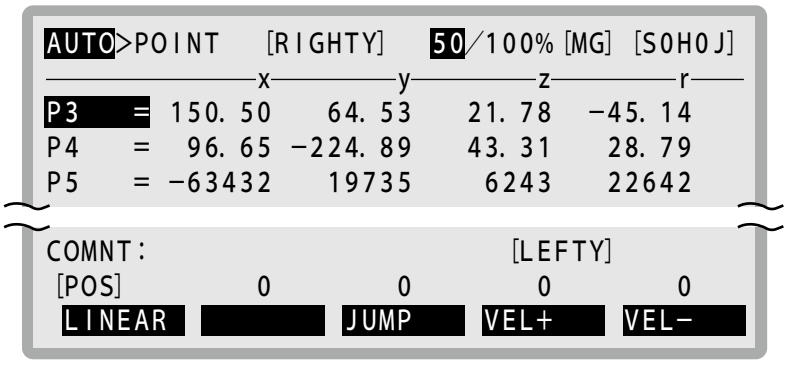


Step 2 *Use the cursor (* ▲ */* ▼ *) keys to select the point number to be checked.*

NOTE

If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority over the current arm type.

Point trace screen in linear interpolation motion mode (with no auxiliary axis)



Step 3 *Press* RUN *to perform trace.*

Press RUN *to move the robot by linear interpolation motion to the specified point position. The trace speed is 1/5th of the automatic movement speed. If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority. To stop the trace, press* STOP.

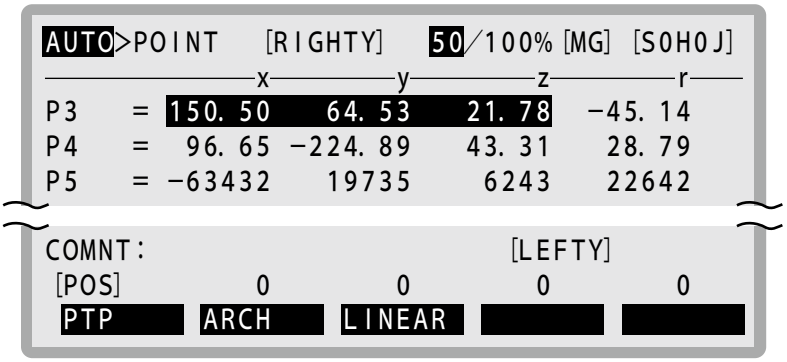
WARNING

UPON PRESSING RUN, THE ROBOT STARTS TO MOVE. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

2. When auxiliary axis is specified:

Step 1 *Press* F3 *(LINEAR) in "AUTO>POINT" mode.*

Point trace screen in linear interpolation motion mode (with auxiliary axis)

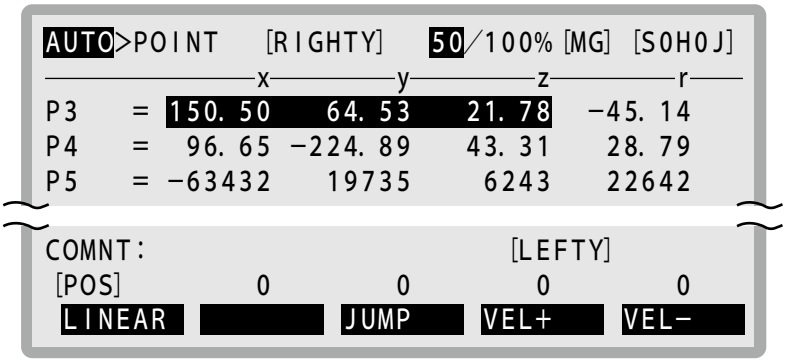


Step 2 *Select the point to be checked.*

Use the cursor (▲ / ▼ *) keys and* F14 *(AXIS←) or* F15 *(AXIS→) so that the point value of the robot axis to be checked is highlighted.*

To perform trace for the robot main axes:

Point trace screen in linear interpolation motion mode (with auxiliary axis)

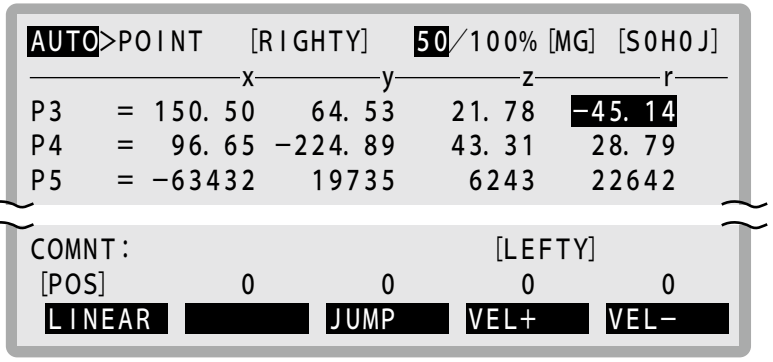


NOTE

If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority over the current arm type.

To perform trace for the auxiliary axis:

Point trace screen in linear interpolation motion mode (with auxiliary axis)



Step3 Press RUN to perform trace.

Press RUN to move the robot by linear interpolation motion to the specified point position. (The auxiliary axis moves by PTP.) The trace speed is 1/5th of the automatic movement speed. If the SCARA robot is selected and the hand system flag is set for the point data, then this hand system will have priority. To stop the trace, press STOP.

WARNING

UPON PRESSING RUN, THE ROBOT STARTS TO MOVE. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

9.8 Direct command execution

In "AUTO>DIRECT" mode, one line of the command statement can be executed just after you have entered it.

Step1 ***Press F7 (DIRECT) in "AUTO" mode.***

The screen switches to "AUTO>DIRECT" mode and the cursor appears on the screen. The prompt (>) also appears on the bottom line of the screen.

Direct command execution

```
AUTO                [T1]       100% <TEST1    >
   1 ' ***** TEST1 PROGRAM *****
   2 START *SUBTASK, T2
   3 DO2 (0) =0
   4 WAIT DI3 (4, 3, 2) =3
   5 MOVE P, P0
≈                                                ≈
≈                                                ≈
>DO (25) =1_
```

Step2 ***Enter one line of the command statement.***

Step3 ***Press ENTER to execute the command you have just entered.***

NOTE

Main command statements that can be executed directly are assignment statements, movement commands, SET statements, RESET statements, etc.

- Before executing a movement command, return-to-origin must have been completed.
- The STOP ON option cannot be used with a movement command.
- A movement command ends after positioning on the axis is complete.

9.9 Break point

An ongoing program can be stopped if a break point is set in the program. This is useful when debugging the program.
The program execution pauses on the line just prior to a break point. The program execution will restart from the break point when RUN is pressed.

Valid keys and submenu contents in "AUTO>BREAK" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the break point and scrolls the screen.
⏫ / ⏬ *1		Switches the page display.
F1	SET	Sets the break point.
F2	CANCEL	Deletes the break point.
F3	SEARCH	Searches for the line set with the break point.
F6 *2	JUMP	Shows the program listing from specified line.
F7 *2	FIND	Specifies the character string to be found.
F8 *2	FIND+	Finds the specified character string searching backwards from the cursor position.
F9 *2	FIND-	Finds the specified character string searching forwards from the cursor position.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6 to F9, press F1 (F6 + F11) to F4 (F9 + F14) while holding down UPPER.

NOTE

- Up to 4 break points can be set in one program.
- The F6 to F9 keys have the same functions as edit operation in "PROGRAM" mode. Refer to "10.2.10 Line jump" and "10.2.11 Searching a character string" later in this chapter.

9.9.1 Setting break points

To make program debugging easy, the program execution can be stopped on the line where a break point is set.

Step 1 ***Press F8 (BREAK) in "AUTO" mode.***

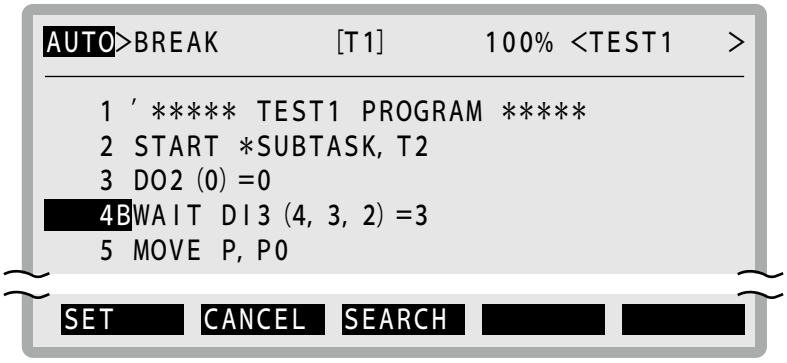
"AUTO>BREAK" mode is then entered.

Step2 ***Use the cursor keys to select the line number on which a break point is to be set.***

Step3 ***Press*** F1 ***(SET).***

A " B *" mark appears to the left of the command statement and a break point is set on* that line.

Break point setting



9.9.2 Deleting break points

To delete a break point, follow these steps.

Step1 ***Select the break point to be deleted.***

Use the cursor (▲ */* ▼ *) keys to select the line number where the break point is set.*

Reference

To find the line number on which another break point was set, press F3 (SEARCH). This function makes it easier to find a break point that you want to delete.

Step2 ***Press*** F2 ***(CANCEL).***

The " B *" mark disappears and the break point is canceled.*

NOTE

- Up to 4 break points can be set in one program. These 4 break points cannot set in different programs. However, when there is "COMMON" program, 4 break points can be set including the main program. (For more information on the COMMON program, refer to the programming manual.)
- If the program is compiled or edited, all the break points are deleted.
- Break points are ignored during execution of STEP or NEXT. However, break points set in sub-routines are enabled when executing NEXT.

9.10 Executing a step

WARNING

THE ROBOT MAY BEGIN TO MOVE WHEN STEP IS EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Step1 *Press F11 (STEP) in "AUTO" mode.*

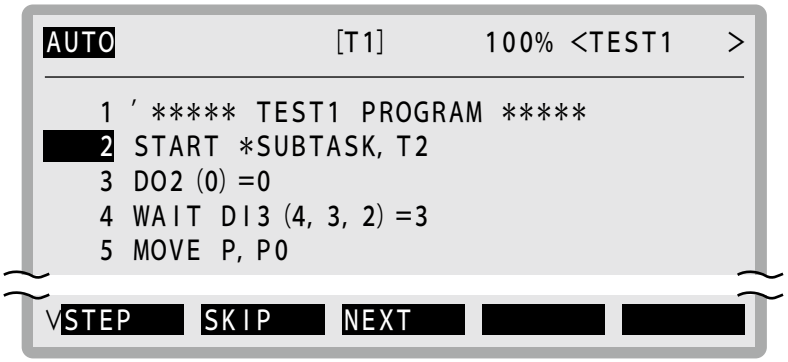
The command statement of the line number indicated by the pointer is executed. After execution, the pointer moves to the next line.

Step2 *Execute the next step.*

Each time F11 is pressed, the command statement of the line number indicated by the pointer is executed.

If the command statement is a sub-routine or sub-procedure, its top line is executed.

STEP execution



NOTE

During STEP, SKIP and NEXT execution, the message "Running" is displayed on the screen. After execution is complete, the pointer moves to the line number of the next command statement.

9.11 Skipping a step

Step 1 ***Press F12 (SKIP) in "AUTO" mode.***

The pointer skips to the next line without executing the command statement of the line number the pointer is on.

Step 2 ***To skip the next step, press F12 (SKIP) again.***

Each time F12 is pressed, the pointer skips to the next line without executing the command statement of the line number the pointer is on.

9.12 Executing the next step

WARNING

THE ROBOT MAY BEGIN TO MOVE WHEN NEXT IS EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Step 1 ***Press F13 (NEXT) in "AUTO" mode.***

The command statement of the line number indicated by the pointer is executed. After execution, the pointer moves to the next line.

Step 2 ***Execute the next step.***

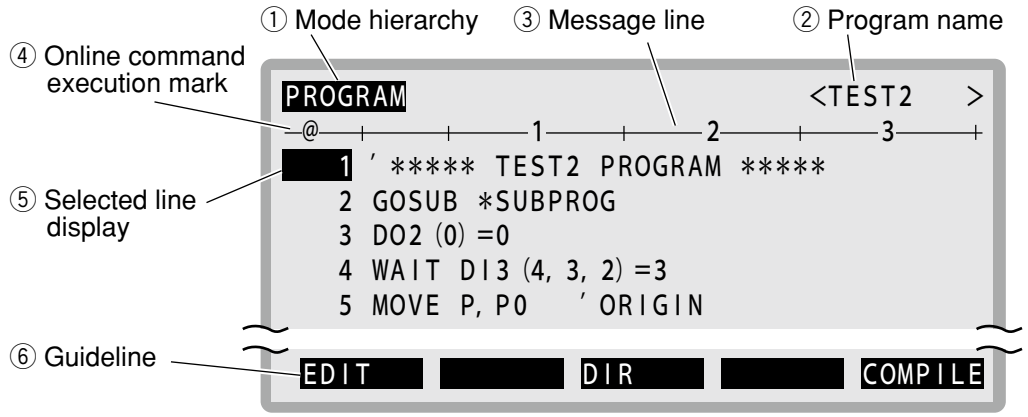
Each time F13 is pressed, the command statement of the line number indicated by the pointer is executed.
If the command statement is a sub-routine or sub-procedure, its top line is executed.

10. "PROGRAM" mode

Robot language programs can be edited, deleted and managed in "PROGRAM" mode.

The initial "PROGRAM" mode screen is shown below.
When "PROGRAM" mode is entered, the currently selected program appears on the screen.

"PROGRAM" mode



① Mode hierarchy

Shows the current mode hierarchy. When the highest mode ("PROGRAM" in this case) is highlighted it means the servomotor power is on. When not highlighted, it means the servomotor power is off.

② Program name

Shows the program name currently selected.

③ Message line

This line shows the number of digits of the program. If an error occurs, the error message also appears here.

④ Online command execution mark

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

⑤ Selected line display

In the program listing, the line number to be edited is highlighted.

⑥ Guideline

The contents assigned to function keys are shown highlighted. A message on what to do next also appears here in some operation steps.

Valid keys and submenu descriptions in "PROGRAM" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Selects the program and scrolls the screen.
⇈ / ⇊ *1		Switches the page display.
F1	EDIT	Edits the program.
F3	DIR	Displays the program data.
F5	COMPILE	Compiles the program.
F6 *2	JUMP	Displays the program listing from a specified line.
F7 *2	FIND	Specifies the character string to be found.
F8 *2	FIND+	Finds the specified character string searching backwards from the cursor position.
F9 *2	FIND-	Finds the specified character string searching forwards from the cursor position.
F13 *3	ERR.RST	Allows editing if the selected program is destroyed.

*1: To use ⇈ / ⇊, press ▲ / ▼ while holding down LOWER.

*2: To use F6 to F9, press F1 to F4 while holding down UPPER.

*3: To use F13, press F3 while holding down LOWER.

NOTE

Refer to the separate "Programming Manual" for details on the programming language.

10.1 Scrolling a program listing

- Pressing the cursor (▲ / ▼) keys in "PROGRAM" mode scrolls up or down through a program listing one line at a time.
  Pressing the cursor (◄ / ►) keys scrolls right or left through a program listing one character at a time.
  Holding down the cursor key continuously scrolls through the screen.

- Pressing the page (≪ , ≫ , ⇊ , ⇈) keys scrolls one page screen at a time.

10.2 Program editing

Step 1 ***Press F1 (EDIT) in "PROGRAM" mode.***

A cursor appears on the top line of a program listing as shown on the "PROGRAM>EDIT" mode screen below, allowing program editing.

Step 2 ***Enter a program.***

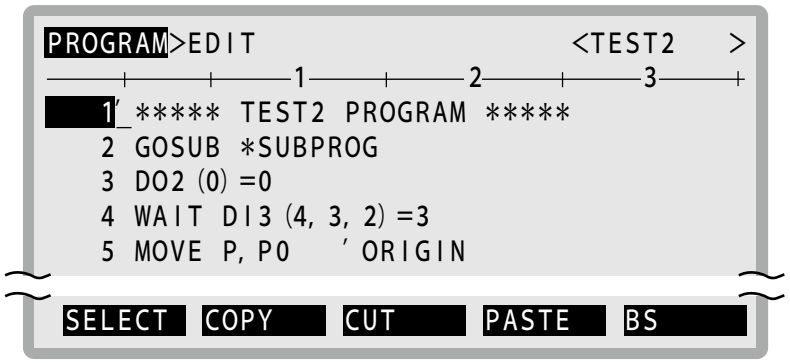
Use the cursor keys to move the cursor to the position to be edited and enter a program command with the RPB.
A maximum of 75 characters can be entered on one line.

NOTE

Program editing is finished when any of ENTER, up/down cursor (▲ / ▼) keys, page up/down (⇈ / ⇊) keys, or ESC is pressed during program editing.

A maximum of 9999 lines can be written in one program as long as the program size is within about 98 Kbytes.

"PROGRAM>EDIT" mode



Step 3 ***After entering the program for one line, press ENTER.***

This finishes the program entry for that line and moves the cursor to the beginning of the next line. Use the same method to edit other positions in the program.

Step 4 ***When program editing is complete, press ESC.***

Valid keys and submenu descriptions in "PROGRAM>EDIT" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor and scrolls the screen.
⇈ / ⇊ *1		Switches the page display.
INS		Switches between Insert and Overtype modes.
L. INS *2		Inserts one blank line.
DEL		Deletes one character.
L. DEL *3		Deletes one line.
USER		Displays the user function key.
ESC		Ends program editing.
ENTER		Finishes the program input for one line and moves the cursor to the beginning of the next line.
F1	SELECT	Selects the starting line for copy or cut.
F2	COPY	Copies the selected line and temporarily stores it in a buffer.
F3	CUT	Cuts the selected lines and temporarily stores it in a buffer.
F4	PASTE	Inserts the buffer data directly prior to the cursor line.
F5	BS	Backs the cursor and deletes the preceding character.
F6 *4	JUMP	Displays the program listing from the specified line.
F7 *4	FIND	Specifies the character string to be found.
F8 *4	FIND+	Finds the specified character string searching backwards from the cursor position.
F9 *4	FIND-	Finds the specified character string searching forwards from the cursor position.

*1: To use ⇈ / ⇊, press ▲ / ▼ while holding down LOWER.

*2: To use L. INS, press INS while holding down LOWER.

*3: To use L. DEL, press DEL while holding down LOWER.

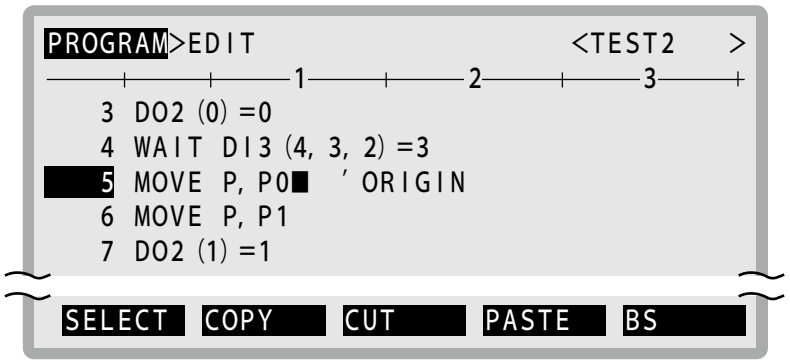
*4: To use F6 to F9, press F1 (F6) to F4 (F9) while holding down UPPER.

10.2.1 Cursor movement

- Pressing the cursor (▲ / ▼) keys in "PROGRAM>EDIT" mode moves the cursor up or down one line at a time.
  Pressing the cursor (◄ / ►) keys moves the cursor right or left one character at a time.

- Pressing the page (« , » , ⌄ , ⌃) keys moves the cursor one page screen at a time.

Cursor movement

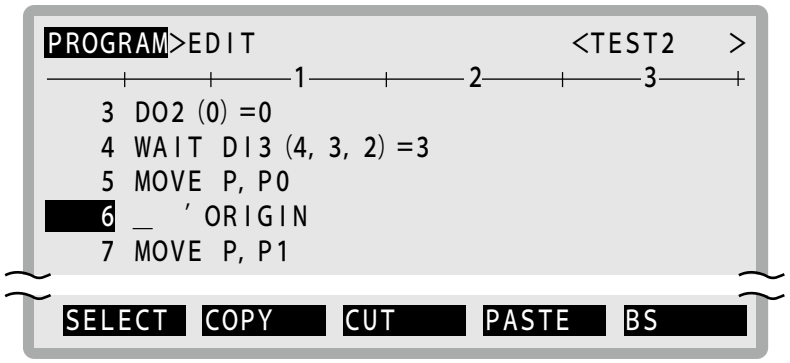


10.2.2 Insert/Overwrite mode switching

- Pressing INS in "PROGRAM>EDIT" mode switches to Insert mode.

  The edit cursor becomes a thin line (_), and the input character is inserted just previous to the cursor position.

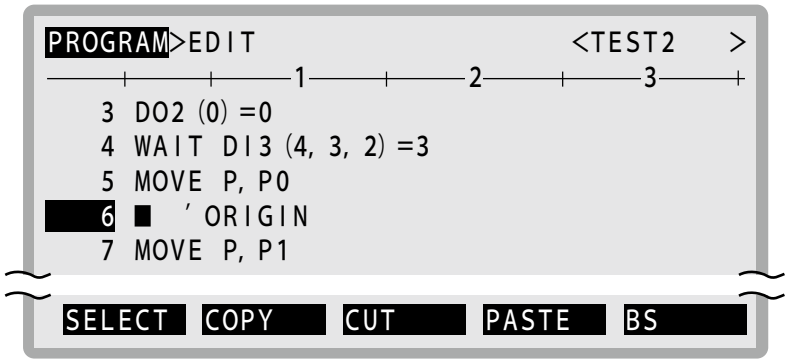
Insert mode



- Pressing INS in Insert mode returns to Overwrite mode.

  The edit cursor changes back to a thick line (■), and the input character replaces the character at the cursor position.

Overwrite mode



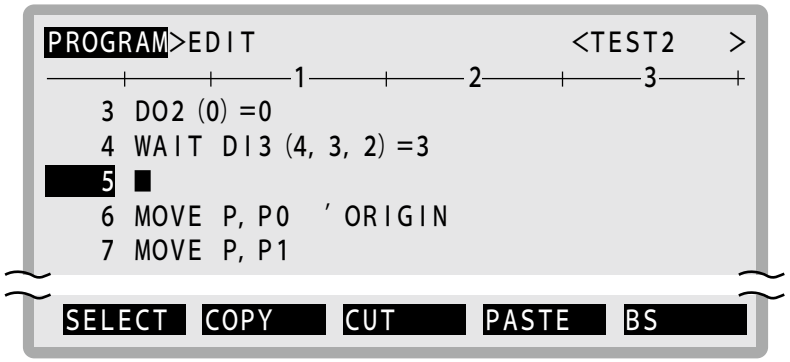
10.2.3 Inserting a line

Step 1 ***In "PROGRAM>EDIT" mode, move the cursor to the position where you want to insert a line.***

Step 2 ***Press*** L-INS ***(*** LOWER ***+*** INS ***).***

A blank line is inserted at the cursor position.

Inserting a line



10.2.4 Deleting a character

Step 1 ***In "PROGRAM>EDIT" mode, move the cursor to the character you want to delete.***

Step 2 ***Press*** DEL ***.***

One character at the cursor position is deleted.

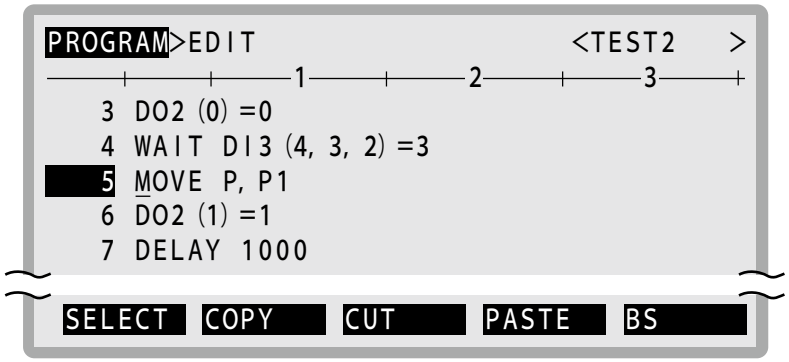
10.2.5 Deleting a line

Step1 ***In "PROGRAM>EDIT" mode, move the cursor to the line you want to delete.***

Step2 ***Press*** L-DEL ***(*** LOWER ***+*** DEL ***).***

One line at the cursor position is deleted, and the program lines after the cursor position moves upward.
For example, deleting one line on the screen shown in 10.2.3 changes to the following screen.

Deleting a line



10.2.6 User function key display

User function keys make it easier to enter programs. Programs can be easily created by pressing the function keys that correspond to the character strings you want to enter.

NOTE

When using this function, it is necessary to make a program named "FUNCTION" and then write command statements for registering functions.
For information on how to register the function keys, refer to "10.3.9 Creating a sample program automatically" and "10.6 Registering user function keys" later in this chapter.

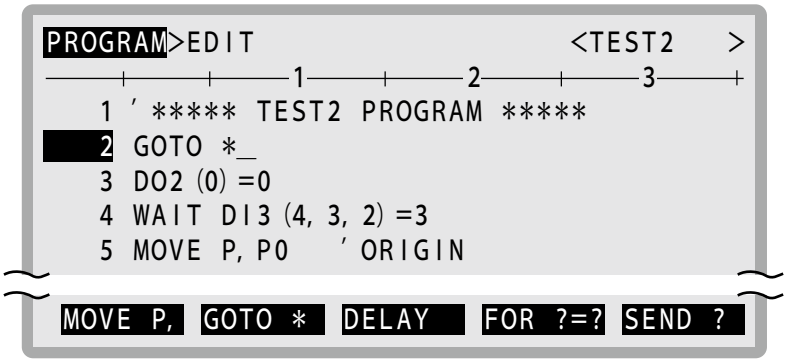
Step1 ***Press*** USER ***in "PROGRAM>EDIT" mode.***

The character strings are displayed on the guideline, which are preassigned to function keys F1 *to* F15*. Each character string is displayed in up to 7 characters from the beginning.*

Step2 ***Press the function key matching the character string you want to enter.***

For example, when F2 *(GOTO *) is pressed on the following screen, the character string for "GOTO *" is entered at the cursor position.*

User function keys



10.2.7 Quitting program editing

Press ESC to quit program editing in "PROGRAM>EDIT" mode.

10.2.8 Copying or cutting lines

Specified lines can be copied or cut in "PROGRAM>EDIT" mode.

Step1 ***Move the cursor to the line you want copy or cut.***

Step2 ***Press F1 (SELECT).***

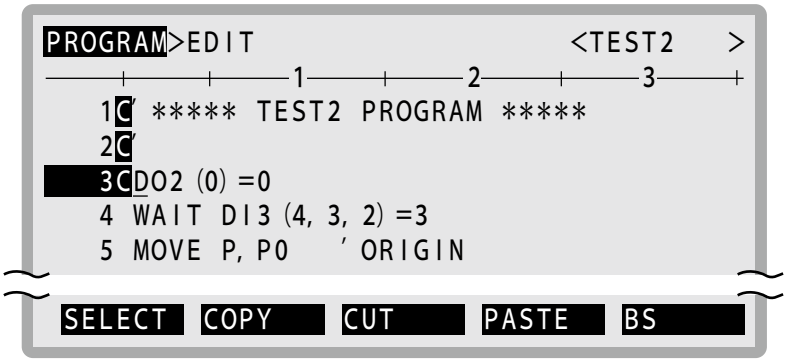
Line select mode is entered.

Step3 ***Use the cursor (▼) keys to specify the copy/cut range.***

A "C" mark appears on each line which was specified.

Press ESC if you want to cancel this operation.

Specifying the copy/cut lines



NOTE

When selecting a line range, the maximum number of characters is 200. If the number of characters exceeds 200, the selected line range must be reduced. The number of characters on one line is the count from the top to the last characters (excluding blanks) plus 1.

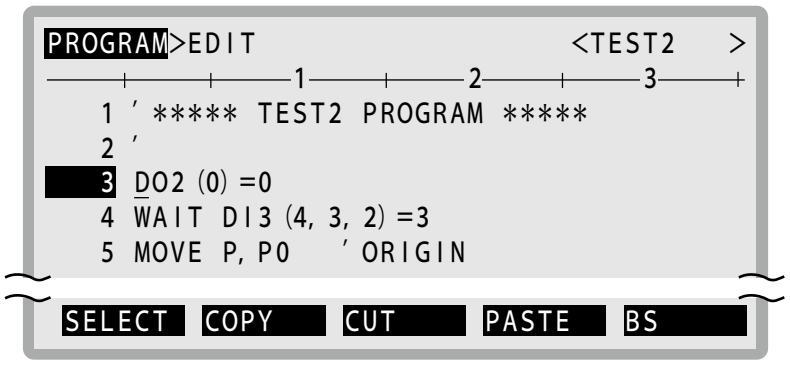
Step4 *Copy or cut the specified lines.*

Press F2 *(COPY) or* F3 *(CUT).*

Pressing F2 *(COPY) copies the data on the selected lines into the buffer.*

The " C *" marks then disappear.*

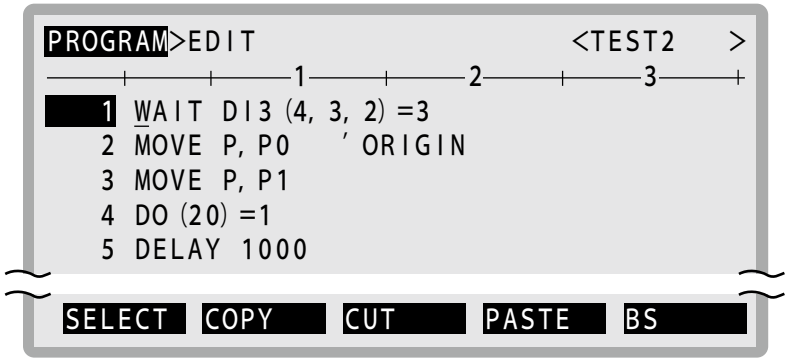
Copying the selected lines



Pressing F3 *(CUT) deletes the data on the selected lines and moves it into the buffer.*

The " C *" marks then disappear.*

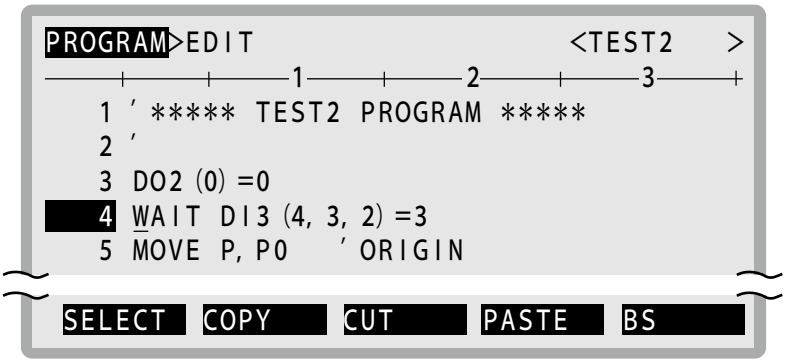
Cutting the selected lines



Step5 *Press* F4 *(PASTE) to paste the specified lines.*

The data stored into the buffer by copy/cut operation is inserted just before the cursor line.

Pasting the data



NOTE

The data stored in the buffer can be pasted repeatedly until you exit "PROGRAM" mode.
However, if another copy/cut operation is performed, then the data within the buffer is rewritten.

10.2.9 Backspace

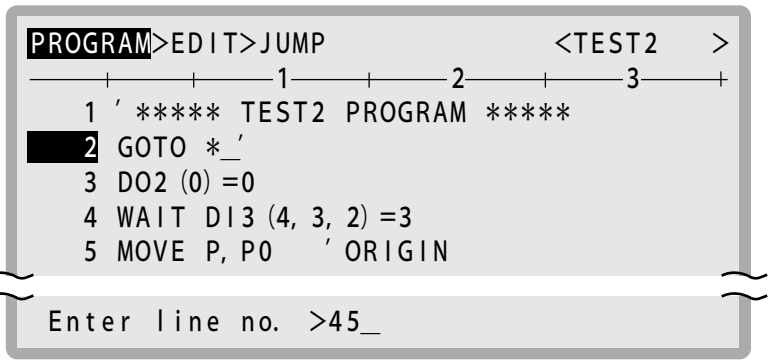
Pressing F5 (BS) in "PROGRAM>EDIT" mode backs the cursor and deletes the preceding character.
When the cursor is at the beginning of a line, it connects to the end of the previous line. However, nothing is changed if the number of characters on the connected line exceeds 75 characters.

10.2.10 Line jump

Step 1 ***Press F6 (JUMP) in "PROGRAM>EDIT" mode.***

"PROGRAM>EDIT>JUMP" mode is entered, and the message "Enter line no. > " appears on the guideline.

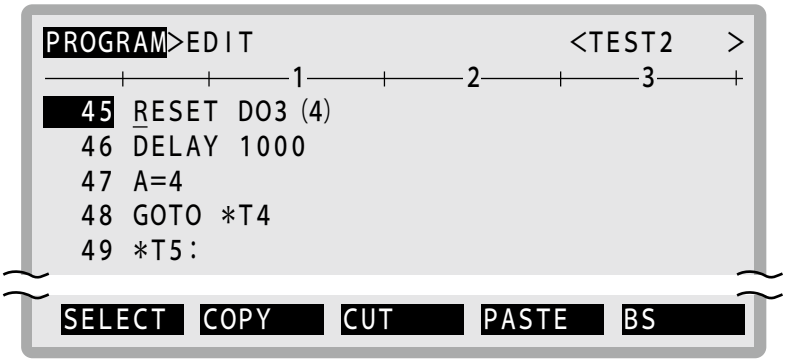
Line jump



Step2 ***Enter the line number to jump to and press*** [ENTER].

The program is then displayed from the specified line.

Performing line jump



10.2.11 Searching a character string

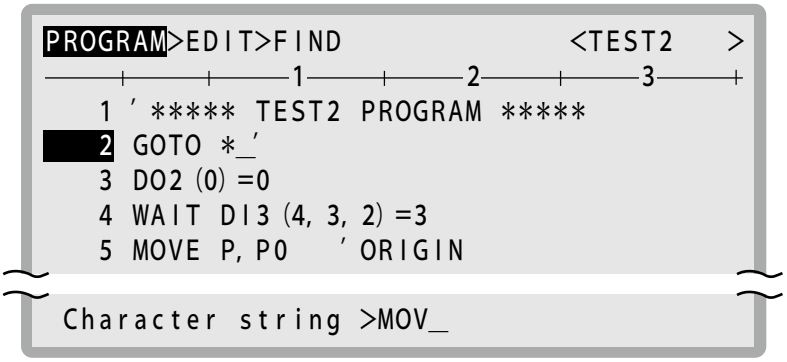
Step1 ***Press*** [F7] ***(FIND) in "PROGRAM>EDIT" mode.***

"PROGRAM>EDIT>FIND" mode is entered, and the message "Character string > " appears on the guideline.

Step2 ***Enter the character string you want to search for and press*** [ENTER].

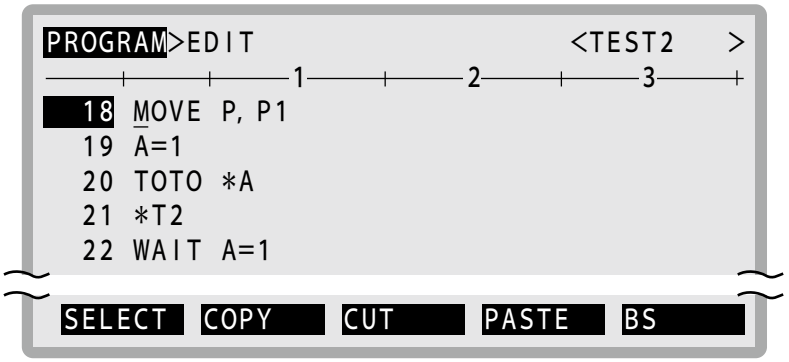
A maximum of 20 characters can be used.

Character string search



Search starts from the cursor position towards the end of the program and stops at the first matching character string.

Character string search



Step3 ***To continuously search for another character string, press*** F8 ***(FIND+) or*** F9 ***(FIND-).***

Pressing F8 *(FIND+) restarts the search from the current cursor position towards the end of the program.*

Pressing F9 *(FIND-) restarts the search from the current cursor position towards the top of the program.*

In either case, the search stops at the first matching character string.

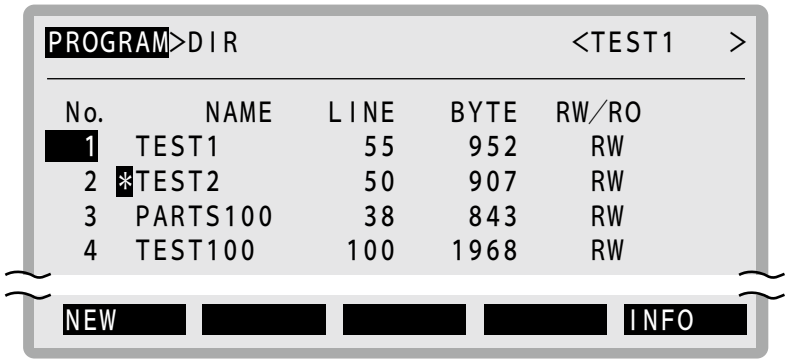
10.3 Directory

When F3 (DIR) is pressed in "PROGRAM" mode, information on each program appears as shown below.

NOTE

A maximum of 100 programs can be stored.

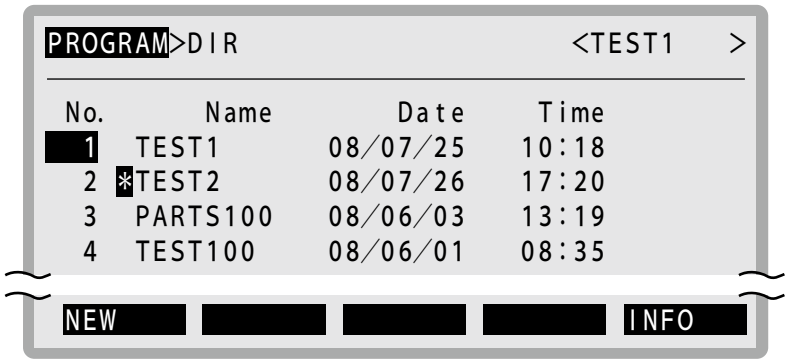
Program information (1)



Pressing ► on the above screen displays the "DATE" and "TIME" data.

(Press ◄ to return to the previous display.)

Program data (2)



NOTE

The date and time are updated when the program is created or edited.

Contents of each item are shown below.

Item	Description
No.	Indicates the serial number of the program. The number of the program which is currently selected is highlighted (reversed background).
Name	Indicates the program name. The "*" mark (reversed background) shows this program is compiled and the object program exists. The " s " mark (reverse background) shows an object exists in the sequence program.
Line	Shows the number of lines in the program.
Byte	Shows how many bytes of memory the program uses.
RW/RO	Indicates the program attribute. RW : Reading or writing enabled. RO : Reading only enabled; writing inhibited.
Date	Shows the date when the program was made or edited.
Time	Shows the time when the program was made or edited.

Valid keys and submenu descriptions in "PROGRAM >DIR" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Selects the program or scrolls the screen vertically.
◀ / ▶		Switches between the program information display and the date/time display.
⏫ / ⏬ *1		Switches to other screens.
F1	NEW	Registers a new program name.
F5	INFO	Shows the number of bytes used for the entire program.
F6 *2	COPY	Copies the program.
F7 *2	ERASE	Erases the program.
F8 *2	RENAME	Renames the program.
F10 *2	ATTRBT	Changes the program attribute.
F11 *3	OBJECT	Shows the object program information.
F15 *3	EXAMPLE	Automatically creates the program name "FUNCTION".

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6 to F8, or F10, press F1 to F3, or F5 while holding down UPPER.

*3: To use F11 or F15, press F1 or F5 while holding down LOWER.

10.3.1 Cursor movement

To select the program, use the cursor (▲ / ▼) keys in "PROGRAM>DIR" mode.
The pointer cursor moves to the selected program number.
The program name is displayed at the right end on the system line (1st line).

10.3.2 Registering a new program name

When creating a new program, you must first register the program name.

Step1 ***In "PROGRAM>DIR" mode, press F1 (NEW) to enter "PROGRAM>DIR>NEW" mode.***

The message "Enter program name>" appears on the guideline.

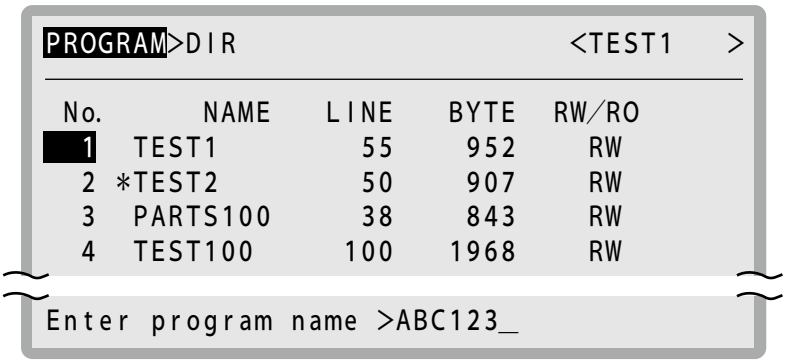
Step2 ***Enter a program name.***

Use 0 to 9 , A to Z , or _ to enter a program. A maximum of 8 characters can be used. (Press ESC if you want to cancel the data input.)

NOTE

Program names can be up to 8 characters consisting of a combination of alphanumeric characters (0 to 9, A to Z) and underscores (_).

Registering a new program



Step3 ***Press ENTER .***

The program name you entered is now registered.

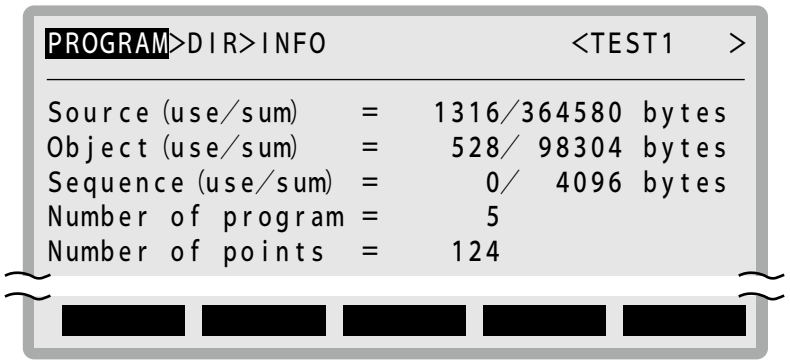
NOTE

The following program names have special meanings.
"FUNCTION"
"SEQUENCE"
"_SELECT"
"COMMON"
(Refer to "Programming Manual" for these programs.)

10.3.3 Directory information display

In "PROGRAM>DIR" mode, press F5 (INFO) to enter "PROGRAM>DIR>INFO" mode. The following information on the selected program appears.

Program information



Item	Description
Source (use/sum)	Displays a count of used bytes and bytes available for source program and point data.
Object (use/sum)	Displays a count of used bytes and bytes available for object program.
Sequence (use/sum)	Displays a count of used bytes and bytes available for sequence object program. (8 bytes are used for one circuit of sequence program.)
Number of program	Displays the number of programs.
Number of points	Displays the number of points that have been set. (28 bytes are used for one point.)

10.3.4 Copying a program

In "PROGRAM>DIR" mode, a program in the directory can be copied under a different name.

Step1 ***Select the program you want to copy with the cursor (▲ / ▼) keys.***

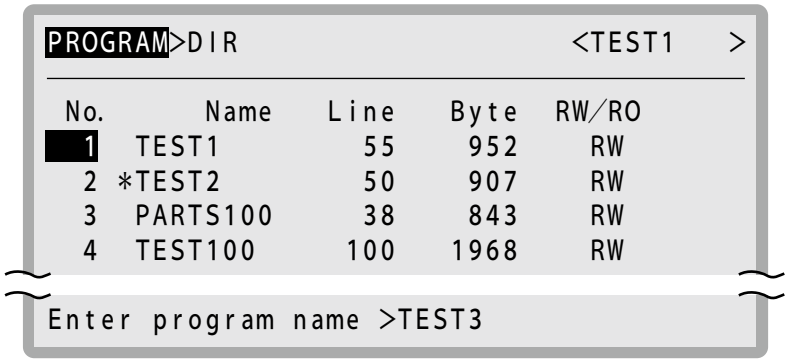
Step2 ***Press F6 (COPY).***

"PROGRAM>DIR>COPY" mode is entered, and the message "Enter program name >" appears on the guideline along with an edit cursor.

Step3 ***Enter a new program name.***

Press ESC if you want to cancel this operation.

Copying a program



NOTE

Program names can be up to 8 characters and consist of a combination of alphanumeric characters (0 to 9, A to Z) and underscores (_).

Step4 ***Press ENTER to make a copy.***

10.3.5 Erasing a program

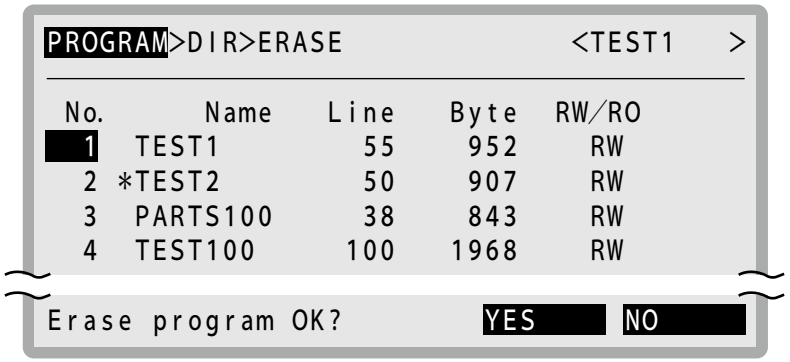
In "PROGRAM>DIR" mode, unnecessary programs in the directory can be erased.

Step 1 ***Select the program you want to erase with the cursor (▲ / ▼) keys.***

Step 2 ***Press F7 (ERASE).***

"PROGRAM>DIR>ERASE" mode is entered, and the message "Erase program OK?" appears on the guideline.

Erasing a program

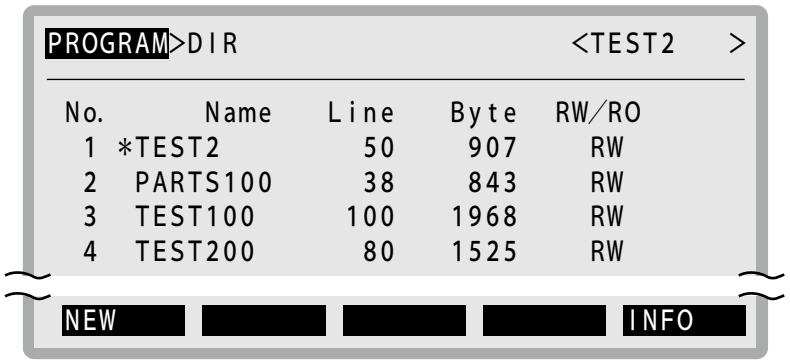


Step 3 ***Press F4 (YES) to erase the selected program.***

Press F5 (NO) if you want to cancel erasure.

After the program is erased, the lower program names move upward.

After erasing a progra



CAUTION

- **Programs with an "RO (read only)" attribute cannot be erased. When these programs must be erased, change the attribute.**
- **To change the program attribute, refer to "10.3.7 Changing the program attribute".**

10.3.6 Renaming a program

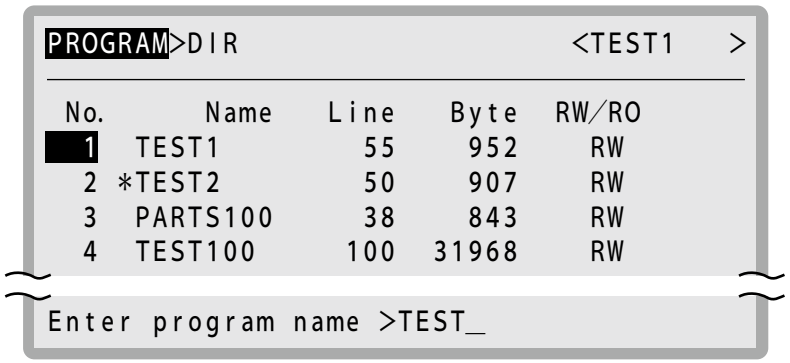
In "PROGRAM>DIR" mode, the names of programs in the directory can be changed.

Step1 ***Select the program you want to rename with the cursor (▲ / ▼) keys.***

Step2 ***Press F8 (RENAME).***

"PROGRAM>DIR>RENAME" mode is entered, and the message "Enter program name >" appears on the guideline along with the original program name.

Renaming a program



Step3 ***Enter a new program name.***

Press ESC if you want to cancel this operation.

NOTE

Program names can be up to 8 characters and consist of a combination of alphanumeric characters (0 to 9, A to Z) and underscores (_).

Step4 ***Press ENTER to rename the program.***

10.3.7 Changing the program attribute

Editing and erasing the programs can be prohibited by specifying the program attribute in "PROGRAM>DIR" mode.

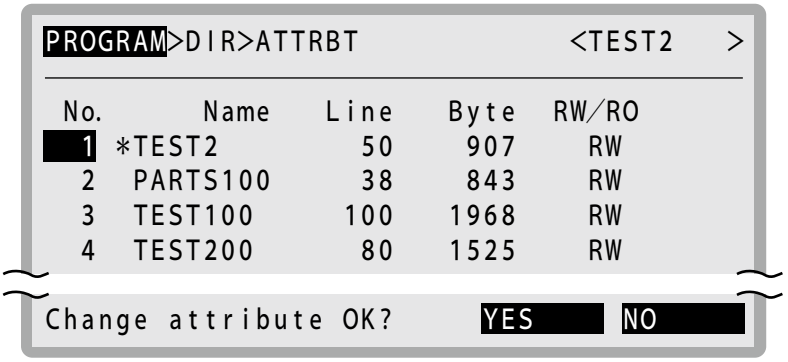
1. **RW (read or write)**
   Program contents can be edited and erased.
   This is automatically specified as a default when a program name is registered.
2. **RO (read only)**
   Program contents cannot be edited or erased.

Step 1 ***Select the program whose attribute you want to change with the cursor (▲ / ▼) keys.***

Step 2 ***Press F10 (ATTRBT).***

"PROGRAM>DIR>ATTRBT" mode is entered, and a confirmation message appears on the guideline.

Changing a program attribute



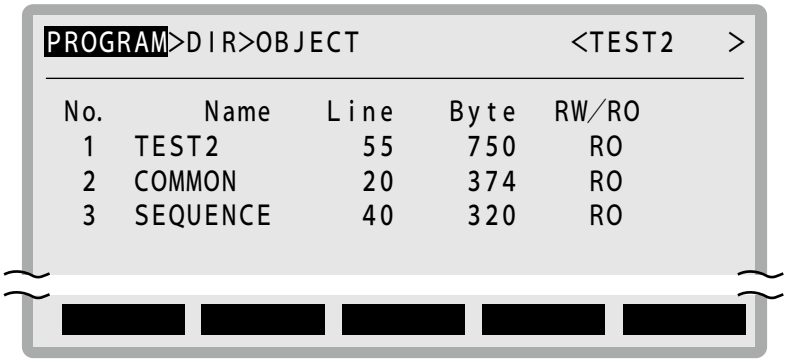
Step 3 ***Press F4 (YES) to change the program attribute.***

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

10.3.8 Displaying object program information

In "PROGRAM>DIR" mode, press F11 (OBJECT) to enter "PROGRAM>DIR>OBJECT" mode. Object information appears as shown below.

Object program information



10.3.9 Creating a sample program automatically

This section explains the procedure of automatically creating a sample program for defining user function keys which can be used in "MANUAL" and "PROGRAM" modes.

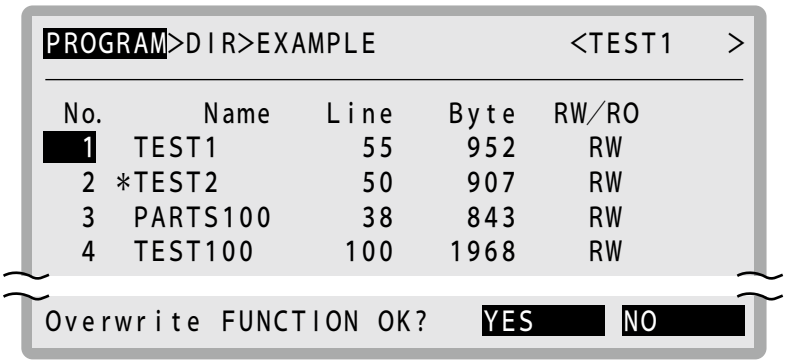
NOTE

Use caution when creating a sample program automatically, since previously defined user function data will be rewritten.

Step1 *Press F15 (EXAMPLE) in "PROGRAM>DIR" mode.*

"PROGRAM>DIR>EXAMPLE" mode is entered, and a confirmation message appears on the guideline.

Loading a sample program



Step2 *Press F4 (YES) to perform this operation.*

A sample program will be automatically created under the program name "FUNCTION".

Press F5 (NO) if you want to cancel this operation.

Step3 *Rewrite the contents of this created program as needed.*

User function keys can be customized with this program.

NOTE

Refer to "10.2.6 User function key display" for details on user function keys. Refer to "10.6 Registering user function keys" when registering user function keys.

[Sample program listing]

```
*** <FUNCTION> SAMPLE PROGRAM ****
'*You can change any statements          *
'*as you like.                            *
'*<FUNCTION> will help you in             *
'*MANUAL and PROGRAM mode.                *
'*****************************************************
*M_F1:'DO(20)ALTERNATE
      DO(20)=~DO(20)
*M_F2:'DO(21)ALTERNATE
      DO(21)=~DO(21)
*M_F3:'DO(22)ALTERNATE
      DO(22)=~DO(22)
*M_F4:'DO(23)ALTERNATE
      DO(23)=~DO(23)
*M_F5:'DO(24)ALTERNATE
      DO(24)=~DO(24)
*M_F6:'DO(25)MOMENTARY
      DO(25)=1
      DO(25)=0
*M_F7:'DO(26)MOMENTARY
      DO(26)=1
      DO(26)=0
*M_F8:'DO(27)MOMENTARY
      DO(27)=1
      DO(27)=0
*M_F9:'DO2()ON
      DO2()=255
*M_F10:'DO2()OFF
      DO2()=0
*M_F11:'OPEN
      DO3(0)=&B1
*M_F12:'CLOSE
      DO3(0)=O
*M_F13:'AND
      DO3(1)=1 & DO3(0)
*M_F14:'DI4 –> DO4
      DO4()=DI4()
*M_F15:'DO5INC
      DO5()=DO5()+1
'*********************************
*P_F1:'MOVE P,P
*P_F2:'MOVE L,P
*P_F3:'GOTO *
*P_F4:'DELAY
*P_F5:'WAIT
*P_F6:'GOSUB *
*P_F7:'RETURN
*P_F8:'PRINT
*P_F9:'SPEED
*P_F10:'HALT
*P_F11:'IF    THEN
*P_F12:'ELSE
*P_F13:'ENDIF
*P_F14:'FOR   =   TO
*P_F15:'NEXT
```

10.4 Compiling

To compile the program and create an executable object program, follow the procedure below. The object program allows you to check input errors or bugs after program editing.

Step 1 ***In "PROGRAM>DIR" mode, select the program to compile.***

Use the cursor (▲ / ▼) keys to select the program, then press ESC.

Step 2 ***In "PROGRAM" mode, press F5 (COMPILE).***

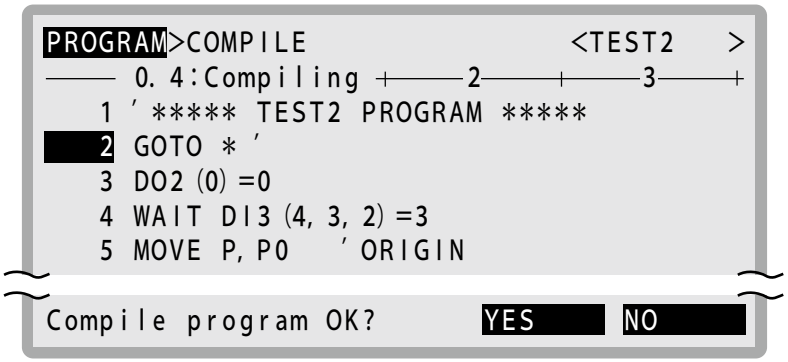
"PROGRAM>COMPILE" mode is entered, and a confirmation message appears on the guideline.

Step 3 ***Press F4 (YES) to compile the program.***

The message "Compiling" is displayed during compiling.

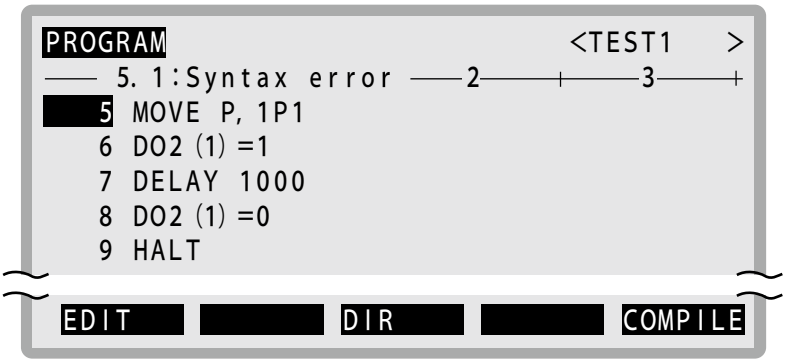
Press F5 (NO) if you want to cancel the compiling.

Compiling



If an error is found in the command statements, the program listing for that line appears along with an error message, and the compiling stops. When the compiling ends normally, an object program has been made. The previous object program was deleted.

Compile error



NOTE

Even if the specified program is yet not compiled, it is compiled automatically when you move to "AUTO" mode.

10.5 Line jump and character string search

The F6 (JUMP), F7 (FIND), F8 (FIND+) and F9 (FIND-) can be used in the same way as in "PROGRAM>EDIT" mode.
Refer to "10.2.10 Line jump" and "10.2.11 Searching a character string" earlier in this chapter.)

10.6 Registering user function keys

To register the user function keys which are used in "PROGRAM" and "MANUAL" modes, make a program named "FUNCTION", and enter the command statements for registering the user function keys.
The robot controller recognizes a program named "FUNCTION" as a special program for registering the user function keys. Therefore, do not use this name for normal programs.

Step1 ***Press F3 (DIR) in "PROGRAM" mode.***

"PROGRAM>DIR" mode is entered.

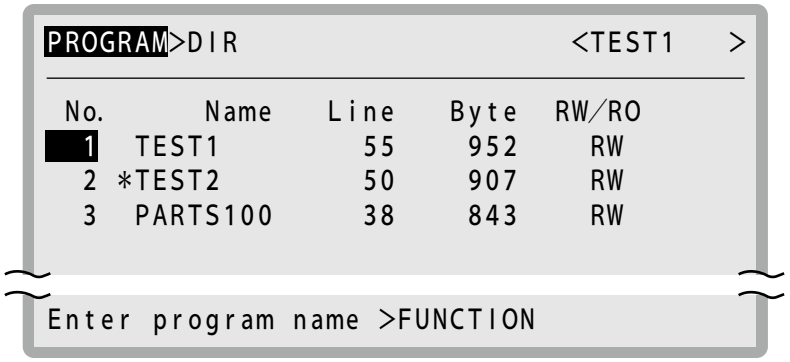
Step2 ***Press F1 (NEW).***

The message "Enter program name >" appears on the guideline.

Step3 ***Enter the program name.***

Enter "FUNCTION" following this message on the guideline.

Registering "FUNCTION" program (1)



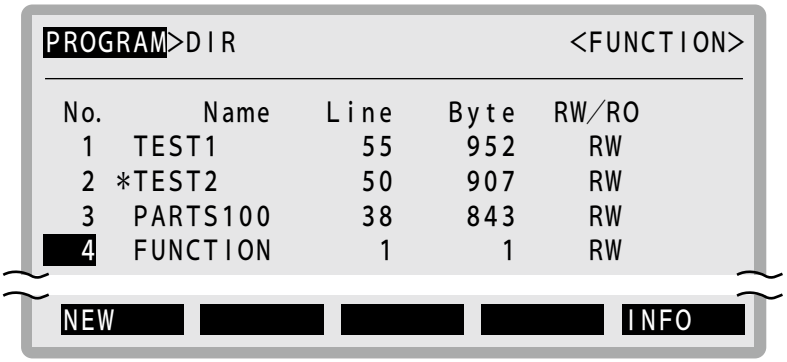
Step4 ***Press ENTER.***

The program name "FUNCTION" is now created.

Press ESC to return to "PROGRAM" mode.

At the same time, the program name "FUNCTION" appears on the system line as the current program.

Registering "FUNCTION" program (2)



Step5 *Press F1 (EDIT).*

"PROGRAM>EDIT" mode is entered, and the cursor appears on the first line.

Step6 *Enter a command statement for registering function keys.*

The command statement format differs between the "PROGRAM" mode and "MANUAL" mode. Refer to the examples below.

1. When registering function keys for editing in "PROGRAM" mode

```
*P_F<n>:'<character string>
```

<n> .....Function key number to be registered (n=1 to15)

<character string> .....Character string to be assigned to the function key (displayed on the screen).

Example) *P_F2:'MOVE, P.... Character string "MOVE, P" is assigned to F2.

*P_F8:'DELAY ..... Character string "DELAY" is assigned to F8.

2. When registering function keys for I/O commands in "MANUAL" mode

```
*M_F<n>:'<character string>
<I/O statement 1>
<I/O statement 2>
```

<n> .....Function key number to be registered (n=1 to 15)

<character string> .....Character string to be assigned to the function key (displayed on the screen).

<I/O statement 1> .....Command statement to be executed when the key is pressed.

<I/O statement 2> .....Command statement to be executed when the key is released.

NOTE

<I/O statement 2> may be omitted. If omitted the <I/O statement 1>will be executed when the key is pressed, but nothing will be executed when released.

Example) *M_F2:'MOMENT. Character string "MOMENT" is assigned to F2.

DO (20) =1 ..... DO (20) is turned ON when F2 is pressed.

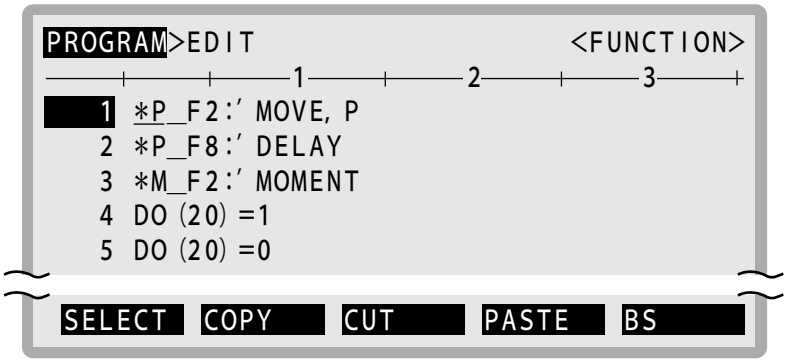
DO (20) =0 ..... DO (20) is turned OFF when F2 is released.

*M_F14:'ALTER .... Character string "ALTER" is assigned to F14.

DO (20) =˜DO (20)DO (20) is highlighted when F14 is pressed.

In the above example, "ALTER" defines an "alternate" type function, and "MOMENT" a "momentary" type function.
A <character string> of up to 65 characters can entered. However, up to 7 characters following the colon (:) are displayed on the function key menu.

Registering user functions



NOTE

- In one "FUNCTION" program, functions for program edit and I/O functions in "MANUAL" mode can be used together and defined.
- Besides the above method, user functions can also be defined by the next method.
  1) "FUNCTION" can be made automatically according to the user function-defined sample program registered in the unit. (Refer to "10.3.9 Creating a sample program automatically")
  2) Rewrite the contents of the "FUNCTION" program in the "PROGRAM>EDIT" mode to create desired user functions.
- When assignment was made to a function key that has already been assigned, the new assignment will be valid.

Step 7 When the registration is complete, press ESC.

10.7 Resetting an error in the selected program

If an error "9.1:Program destroyed" occurs in the selected program data, this function resets the error and allows you to continue editing.

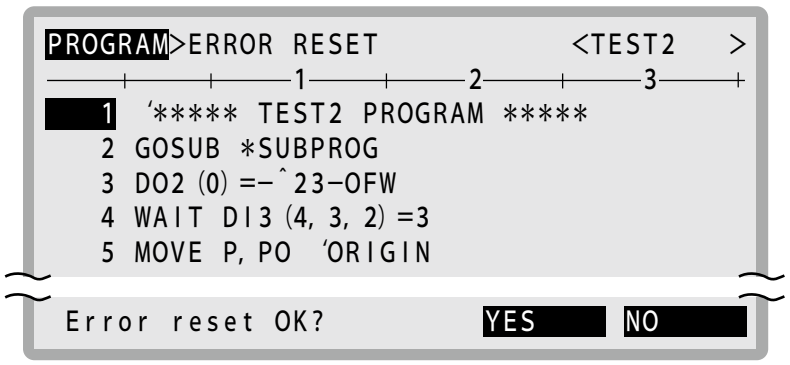
CAUTION

This function resets an error, but does not restore the program data. A problem is probably occurring in the program, so check and correct the program in "PROGRAM>EDIT" mode.

Step 1 ***Press F13 (ERR. RST) in "PROGRAM" mode.***

A confirmation message appears on the guideline.

Resetting an error in the selected program



Step 2 ***Press F4 (YES) to reset the error.***

The program can be edited after resetting the error.

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

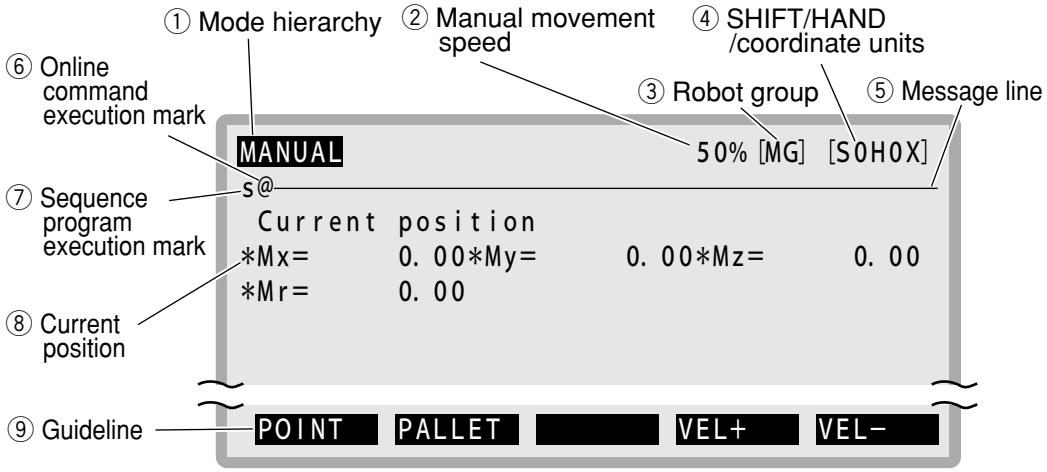
NOTE

- This function is enabled for each program.
- This reset function does not work if an error "9.3:Memory destroyed" occurs. In this case, initialize the memory.

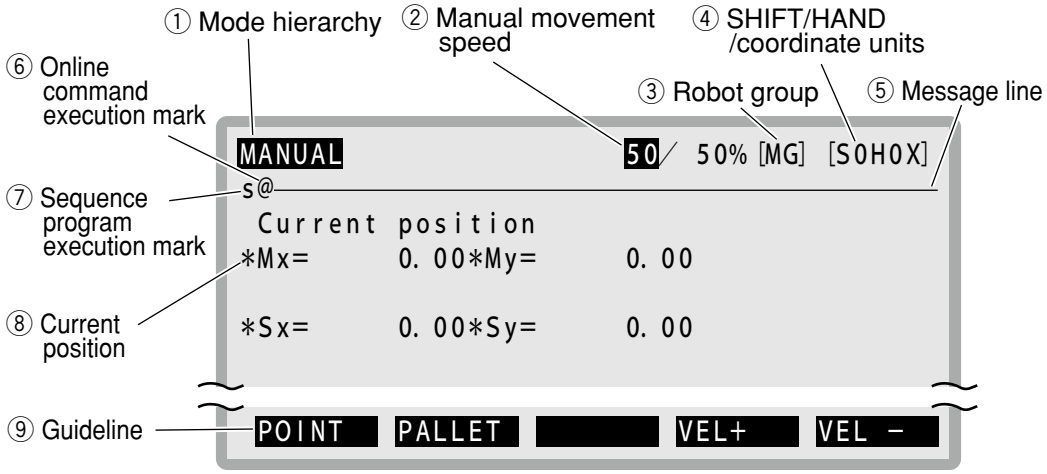
11. "MANUAL" mode

Point data and shift data coordinates can be defined and edited in "MANUAL" mode.
The initial "MANUAL" mode screen is shown below.

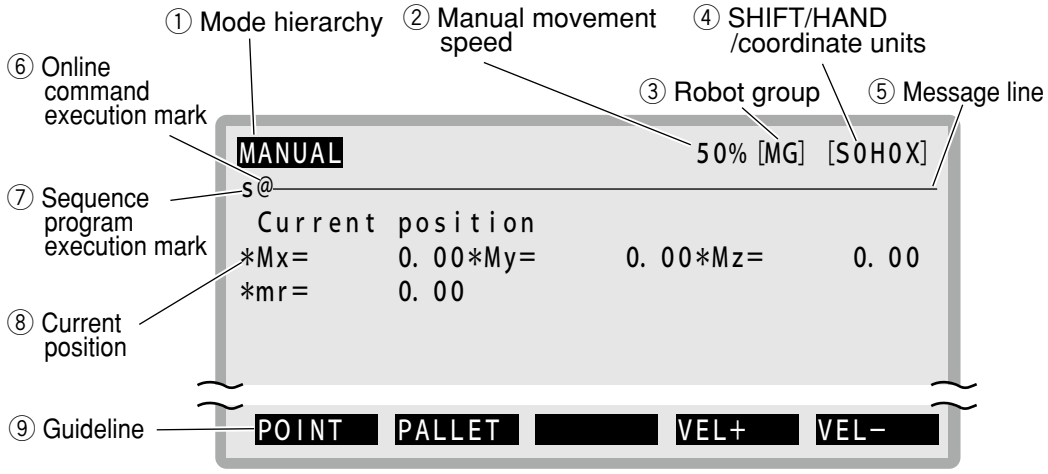
"MANUAL" mode (one-robot setting)



"MANUAL" mode (two-robot setting)



"MANUAL" mode (with auxiliary axis)



① Mode hierarchy

Shows the current mode hierarchy. When the highest mode ("MANUAL" in this case) is highlighted it means the servomotor power is on. When not highlighted it means the servomotor power is off.

② Manual movement speed

Shows the robot movement speed selected for manual operation.
When two robots (main and sub robots) are specified, two speeds are displayed for " Main group speeds / Sub group speeds ", with the currently selected group highlighted.

③ Robot group

This shows the robot group currently selected for manual movement.
When one robot is specified, only "[MG]" (main group) appears.
When two robots are specified, the "[MG]" (main group) or "[SG]" (sub group) appears, which can be switched with the ROBOT (LOWER + MODE).

④ SHIFT/HAND/coordinate units

Shows the shift coordinate number, hand definition number and coordinate units. When two robots are specified, the main group or sub group number and coordinate units appear, which can be switched with the ROBOT (LOWER + MODE).

⑤ Message line

If an error occurs, the error message appears here. A dashed line means return-to-origin is incomplete. A solid line means return-to-origin return is complete.

⑥ Online command execution mark

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

⑦ Sequence program execution mark

When a sequence program is being executed, an "s" mark is displayed in the first column on the second line.

⑧ Current position

This shows the current position of the robot. When an "M" or "S" letter is followed by a number it indicates the position in "pulse" units (integer display) and when an "x" to "a" letter follows, it indicates "mm" units (decimal point display). When an asterisk (*) appears at the left of the "M" and "S" letters, it indicates the origin sensor is on. An asterisk also appears when no origin sensor is used.

An "M" letter means the main robot axis, and an "S" letter means the sub robot axis. When auxiliary axes are specified, the lower-case letters "m" and "s" appear instead of upper-case letters.

⑨ Guideline

The contents assigned to function keys are shown highlighted. A message on what to do next also appears here in some operation steps.

Valid keys and submenu descriptions in "MANUAL" mode are shown below.

Valid keys		Menu	Function
#1+ X to B #6−			Moves the robot manually.
F1		POINT	Switches to the point data processing screen.
F2		PALLET	Switches to the pallet data processing screen.
F3		ORIGIN	Performs return-to-origin.
F4		VEL+	Increases manual movement speed for the selected robot group in steps.(1→5→20→50→100 %)
F5		VEL-	Decreases automatic movement speed for the selected robot group in steps.(100→50→20→5→1 %)
F6	*1	SHIFT	Switches to the shift data processing screen.
F7	*1	HAND	Switches to the hand data processing screen.
F8	*1	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9	*1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	*1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.
F13	*2	RST.ABS	Resets the absolute position sensor.
F15	*2	COORDI	Sets the standard coordinates.
ROBOT	*3		Switches the robot group.

*1: To use F6 to F10, press F6 F1 F11 to F10 F5 F15 while holding down UPPER.

*2: To use F13 or F15, press F8 F3 F13 or F10 F5 F15 while holding down LOWER.

*3: To use ROBOT, press MODE ROBOT while holding down LOWER.

11.1 Manual movement

In "MANUAL" mode, you can manually move the robot with the Jog keys as explained below.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

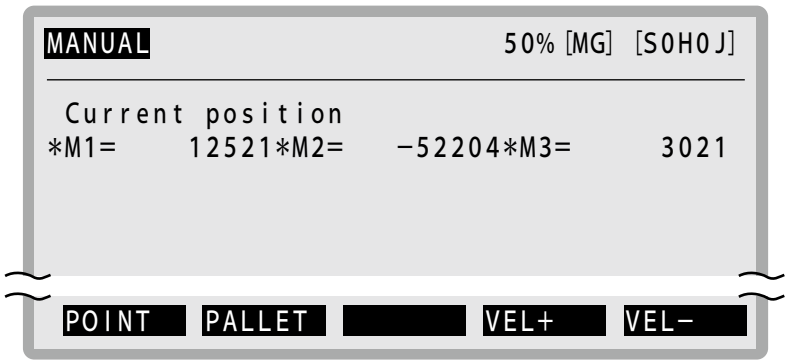
- When two robots (main and sub robots) are specified, check the currently selected robot group on the RPB before performing manual movement. If the selected robot group is wrong, press ROBOT (LOWER + MODE) to change the robot group.
- For details on the soft limits, refer to "12.1.4 Axis parameters" in this chapter.
- When the current position is displayed in "pulse" units, the robot can be moved manually along the axes whose servos are on, even if the servos of the other axes are off.
- When the current position is displayed in "mm" units, the robot can be moved manually only when the servos of all axes are on.
- The maximum jog movement time for one movement command is 300 seconds. So if the software limits are set too large and the movement time exceeds 300 seconds at the specified speed, the robot movement will stop in 300 seconds. To move the robot further, use jog movement once again.

1. Manual movement when return-to-origin has been completed

(1) When the current position is displayed in "pulse" units:

A letter "J" is displayed on the upper right of the RPB screen.

Display shown in "pulse" units (J)



Each time a Jog key is pressed, the robot moves a specified distance (inching distance) along the corresponding axis. When the Jog key is held down, the robot keeps moving towards the soft limit of the axis. The robot stops when the Jog key is released or the soft limit is reached. The movement distance (inching distance) is equal to the manual movement speed setting value.

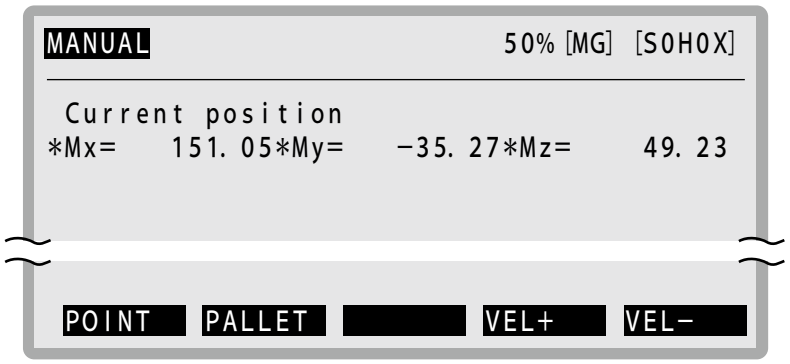
[Example] When manual movement speed is 20%:
Inching distance in "pulse" units = 20 pulses

If robot movement beyond the +/- soft limits is attempted with the Jog keys, the error message "2.1: Over soft limit" appears and the robot does not move.

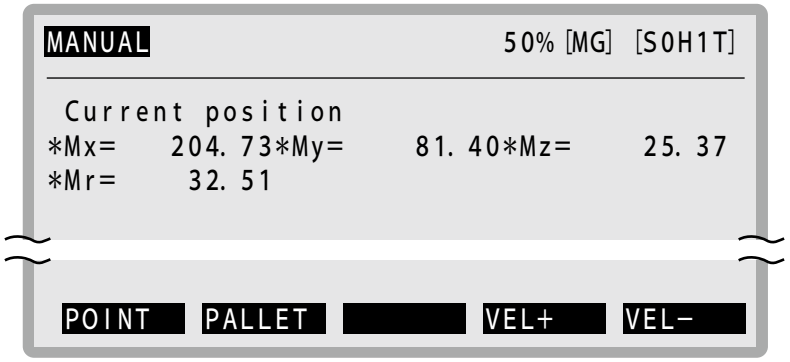
(2) When the current position is displayed in "mm" units:

A letter "X" is displayed on the upper right of the RPB screen. If "Tool coordinate" mode is selected, a letter "T" is displayed.

Display shown in "mm" units (X)



Display shown in "mm" units (Tool coordinate mode: T)



1) When "X" is displayed (When not in "Tool coordinate" mode)
When a Jog key is pressed, the robot arm tip moves in the corresponding direction on the Cartesian coordinates. If auxiliary axis setting is made, then the robot moves only along the corresponding axis.

2) When "T" is displayed (When in "Tool coordinate" mode)
"Tool coordinate" mode can be used only when hand data for the R-axis of a Cartesian robot or SCARA robot is selected (hand definition is made).

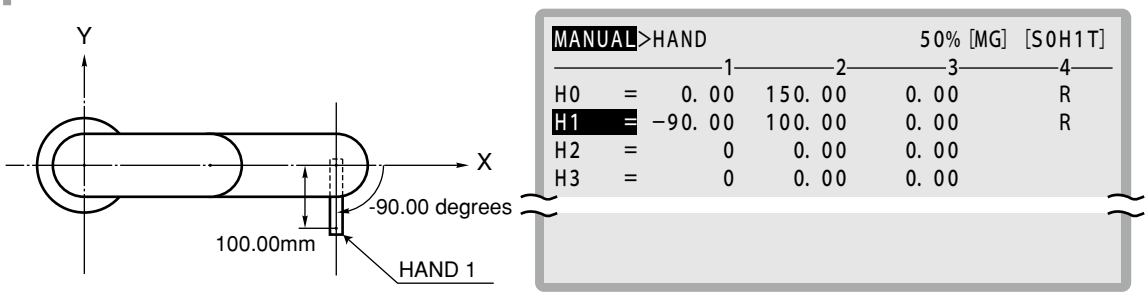
Pressing the #1+ X or X #1- key moves the hand forwards or backwards.

Pressing the #2+ Y or Y #2- key moves the hand to the left or right.

Pressing the #4+ R or R #4- key rotates the end of the hand around its center.

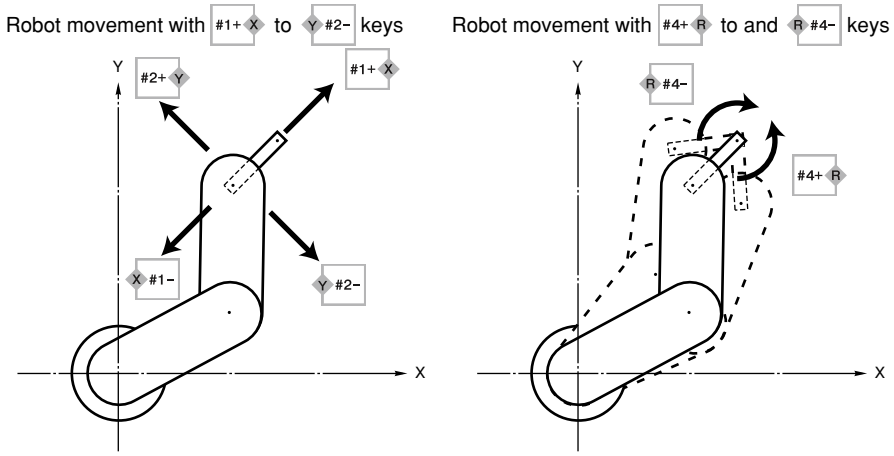
When the other Jog keys are pressed, the robot moves the same way as when "X" is displayed.

Robot movement in "Tool coordinate" mode (example) (1)



If the above hand is defined, the robot moves with Jog keys as illustrated below.

Robot movement in "Tool coordinate" mode (example) (2)



Each time a Jog key is pressed, the robot moves a specified distance (inching movement). When the Jog key is held down, the robot keeps moving. The robot stops when the Jog key is released or either of the soft limit or shift coordinate range is reached.

The robot stops when the Jog key is released or the soft limit is reached.

The movement distance (inching distance) is equal to the manual movement speed setting (%) multiplied by 0.01mm or 0.01 deg.

[Example] When manual movement speed is 20%:
Inching distance in "mm" units = 0.20mm

If robot movement beyond the +/- soft limits is attempted with the Jog keys, the error message "2.1: Over soft limit" appears and the robot does not move. Likewise, if robot movement beyond the shift coordinate range is attempted, the error message "2.11: Exceeded shift coord. range" appears and the robot does not move.

If the current position is outside the soft limits, the error message "2.1: Over soft limit" also appears and the robot does not move.

2. When return-to-origin is not complete

CAUTION

- **If return-to-origin is incomplete, the soft limits do not work correctly.**
- **On the PHASER series robots, operating the robot while return-to-origin is still incomplete may cause an alarm or abnormal movement because the thrust required for operation cannot be obtained. Always perform return-to-origin before operating the robot.**

(1) When the current position is displayed in "pulse" units:

Robot movement with the Jog keys is possible the same as when return-to-origin is complete. However, the message "0.1: Origin incomplete" appears when a Jog key is pressed.

(2) When the current position is displayed in "mm" units:

The robot does not move with the Jog keys. The current position display switches automatically to "pulse" units and the error message "0.1: Origin incomplete" appears. Perform absolute reset or return-to-origin at this point.

NOTE

If return-to-origin is incomplete, the current position always appears as "pulse" units when the controller is turned on.

11.2 Displaying and editing point data

Press F1 (POINT) in "MANUAL" mode to enter "MANUAL>POINT" mode. This mode allows you to display and edit the point data.
One point is made up of data from 6 axes (x, y, z, r, a, b).
Note that the hand system flag can be set as an extended function for the point data set with the Cartesian coordinates ("mm" units). The hand system flag is valid only for the SCARA robot.
Point numbers can be specified in the range of 0 to 9999.

NOTE

When two robots (main and sub robots) are specified, the point data can be shared between them.

The axis data for three points is displayed on the screen along with a point comment on the selected point number. To see the other data, scroll the screen with the cursor keys or page keys.

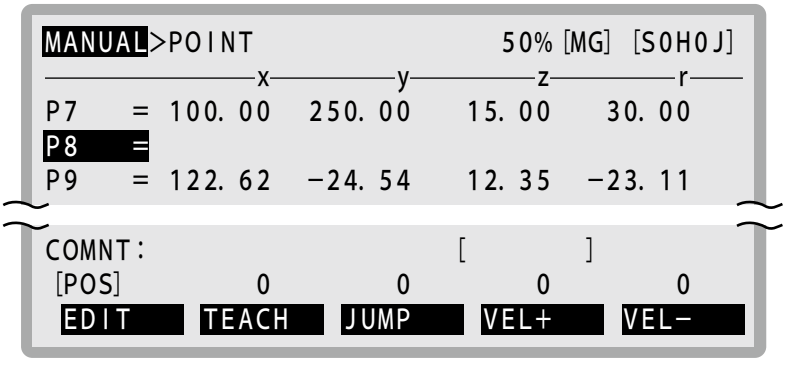
- ▲ ▼ Scrolls up or down one line at a time.
- ◄ ► Scrolls right or left one character at a time.
- ⇈ ⇊ Scrolls up or down three lines at a time.
- « » Scrolls right or left one page at a time.

CAUTION

In the case of SCARA robots, it cannot be guaranteed that the robots will move to the same position if a different hand system is used to move to a point data on the Cartesian coordinates (millimeter units).

The 5-digit area on the left side shows the point numbers, with the point number for editing shown highlighted.
The hand system will appear in the sixth line when the SCARA robot is selected and a hand system flag of the extended setting is set.

Point data



Valid keys and submenu descriptions in "MANUAL>POINT" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the point data and scrolls the screen.
⏫ / ⏬ *1		Switches to other screens.
F1	EDIT	Enters point data with keys.
F2	TEACH	Enters point data by teaching.
F3	JUMP	Shows the specified point data.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases automatic movement speed for the selected robot group in steps.(100→50→20→5→1 %)
F6 *2	COPY	Copies point data.
F7 *2	ERASE	Deletes point data.
F8 *2	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9 *2	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *2	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.
F11 *3	TRACE	Moves the arm to the specified point.
F12 *3	COMMENT	Switches to the point comment edit screen.
F13 *3	ERR.RST	Allows editing even if the point data is destroyed.
F14 *3	AXIS←	Moves the cursor to the left to select another axis. (Enabled only when auxiliary axis is added.)
F15 *3	AXIS→	Moves the cursor to the right to select another axis. (Enabled only when auxiliary axis is added.)
ROBOT *4		Switches the robot group.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6 to F10, press F1 to F5 while holding down UPPER.

*3: To use F11 to F15, press F1 to F5 while holding down LOWER.

*4: To use ROBOT, press MODE while holding down LOWER.

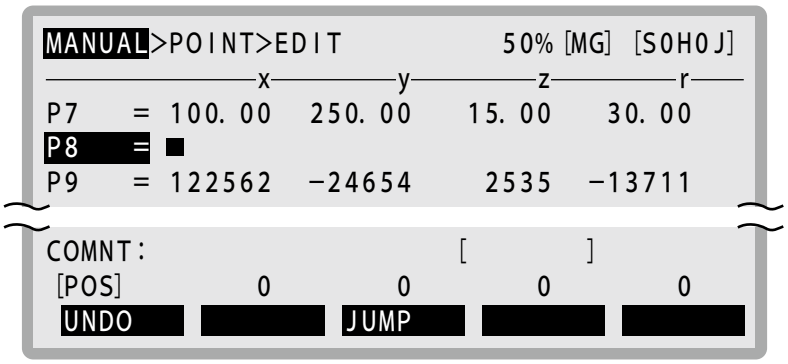
11.2.1 Point data input and editing

Step1 ***In "MANUAL>POINT" mode, use the cursor (▲ / ▼) keys to select the point to edit.***

Step2 ***Press F1 (EDIT).***

An edit cursor appears at the left end of the point line data that was selected.

Editing point data



Step3 ***Use 0 to 9 , + , − , . and SPACE to enter the point data.***

Enter a space to separate between the data for x and y. The data input formats are as follows.

• To enter the data in joint coordinates ("pulse" units)

Enter an integer of up to 8 digits.
(Even if the input data is less than 8 digits, it will be displayed in 8 digits when the number of display digits is set to 8 in "SYSTEM>PARAM" mode.)
: ±######
(±########)

NOTE

- Enter all point data for the X-axis to b-axis. If omitted, "0" will be automatically entered for that axis.
- The error message "Digit number error" appears when the data format is wrong. Enter it in the correct format.

• To enter the data in Cartesian coordinates ("mm" units)

Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point.
(Even if the input data is less than 8 digits, it will be displayed in 8 digits when the number of display digits is set to 8 in "SYSTEM>PARAM" mode.)
: ±###.##,±####.#,±#####.
(±#####.##,±#####.#,±#######.)

To set the SCARA robot and set a hand system flag of the extended setting, set 1 or 2 at the end of the b axis data. If a value other than 1 or 2 is set, or if no value is designated, then 0 will be set to indicate that no hand system flag was set.

1: Indicates that point has been set with RIGHTY (right-handed system).
2: Indicates that point has been set with LEFTY (left-handed system).

NOTE

To set the SCARA robot and set the hand system flag in the point data, set 1 (RIGHTY: right-handed system) or 2 (LEFTY: left-handed system) at the end of the b axis data setting.

Step4 *Finish the point data input.*

Press ENTER*, cursor up/down (* ▲ / ▼ *) keys or page up/down (* ⏫ , ⏬ *) keys to finish the point data input.*

Press ESC *if you want to cancel the point data input.*

Valid keys and submenu descriptions in "MANUAL>POINT>EDIT" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Moves the cursor and scrolls the screen.
⏫ / ⏬ *1		Switches to other screen.
INS		Toggles between Insert mode and Overwrite mode.
DEL		Deletes one character on the cursor position.
F1	UNDO	Restores the point data.
F3	JUMP	Jumps to the specified point number.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

11.2.1.1 Restoring point data

During point data editing, pressing F1 (UNDO) reverses the last data input and restores the preceding data.
This function is enabled only on lines that are not yet complete.

11.2.2 Point data input by teaching

In "MANUAL>POINT" mode, the current position of the robot can be obtained as point data by teaching.

NOTE

Point data teaching cannot be performed when return-to-origin is incomplete. Perform point teaching after performing absolute reset or return-to-origin.

NOTE

When two robots (main and sub robots) are specified, check the currently selected robot group on the RPB before performing point teaching.
"(MG)" indicates the main robot group is selected, and "(SG)" indicates the sub robot group is selected. To change the robot group, use ROBOT (LOWER + MODE).

1. When no auxiliary axis is used:

Step1 ***Select the point number to obtain point data with the cursor (▲ / ▼) keys.***

Point data teaching (with no auxiliary axis [1])

When teaching at P8

```
MANUAL>POINT                          50% [MG] [S0H0X]
                    x          y          z          r
P7    = 100.00   250.00    15.00    30.00
P8    =
P9    = 122.62   -24.54    12.35   -23.11
COMNT:                          [         ]
 [POS]    10.00   100.00     5.00    10.00
 EDIT    TEACH    JUMP     VEL+     VEL-
```

Step2 ***Use the Jog keys to move the robot arm.***

As the arm moves, the current position data on the 7th line on the screen changes.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

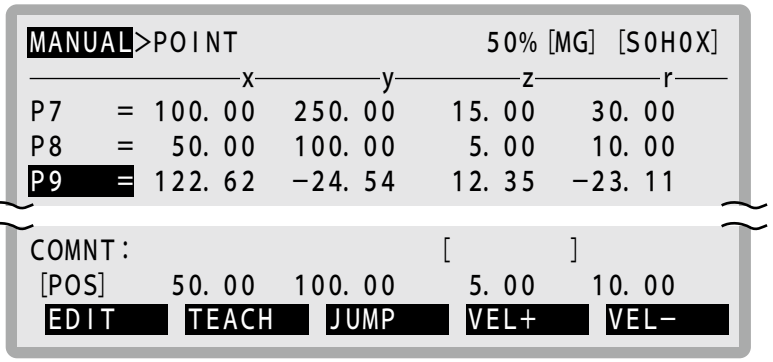
Step3 ***When the arm arrives at the target point, press F2 (TEACH).***

Teaching is performed so that the current robot position data is allotted to the currently selected point number.
After teaching, the pointer cursor moves down to the next line automatically.
The format for point data input by teaching is set to the currently selected coordinate system.

CAUTION

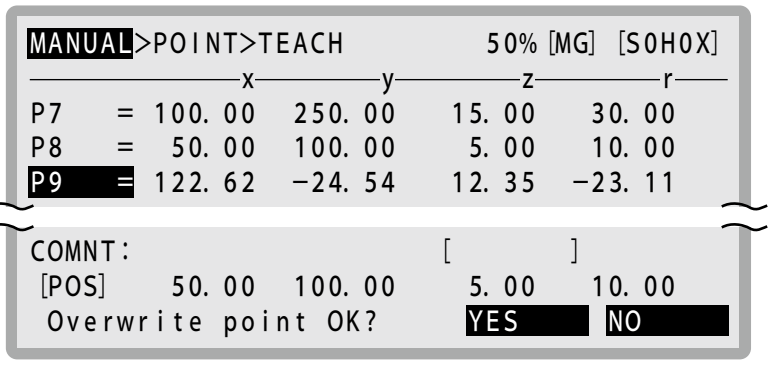
To perform teaching at a point on the Cartesian coordinates (millimeter units) with a SCARA robot, always use the correct hand system that should actually be moved. The robot cannot be guaranteed to move to the same position if moving with a hand system different from that used for teaching.

Point data teaching (with no auxiliary axis [2])



When point data is already allotted to the currently selected point number, a confirmation message appears on the guideline when F2 *(TEACH) is pressed.*

Point data teaching (with no auxiliary axis [3])



Press F4 *(YES) to perform the teaching. The specified point number data is rewritten.*

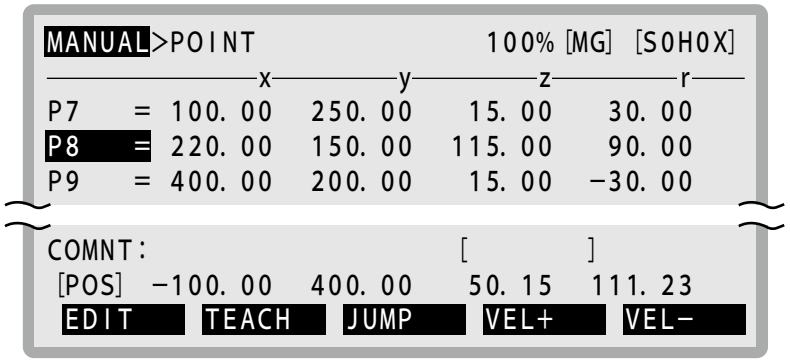
Press F5 *(NO) if you want to cancel the teaching input.*

2. When an auxiliary axis is used:

Step 1 ***Select the point number to obtain point data with the cursor (▲ / ▼) keys.***

Point data teaching (with auxiliary axis [1])

When teaching at P8



Step2 *Select the points.*

Use the cursor (▲ / ▼) keys, F14 (AXIS ←) or F15 (AXIS →) to select the axes to perform point teaching.
As shown below, the point number at the left end should be highlighted when teaching on all axes. When teaching on the standard axes, their point data values should be highlighted. When teaching on the auxiliary its point data value should be highlighted. Note that an undefined point cannot be specified except for point numbers.

Point data teaching (with auxiliary axis [2])

When teaching on all axes

```
MANUAL>POINT                    100% [MG] [S0H0X]
                  x         y         z         r
P7    = 100.00   250.00    15.00    30.00
P8    = 220.00   150.00   115.00    90.00
P9    = 400.00   200.00    15.00   -30.00

COMNT:                          [        ]
 [POS]    50.00   100.00     0.00     0.00
 EDIT     TEACH    JUMP     VEL+     VEL-
```

Point data teaching (with auxiliary axis [3])

When teaching on standard axes

```
MANUAL>POINT                    100% [MG] [S0H0X]
                  x         y         z         r
P7    = 100.00   250.00    15.00    30.00
P8    = 220.00   150.00   115.00    90.00
P9    = 400.00   200.00    15.00   -30.00

COMNT:                          [        ]
 [POS] -100.00   400.00    50.15   111.23
 EDIT     TEACH    JUMP     VEL+     VEL-
```

Point data teaching (with auxiliary axis [4])

When teaching on auxiliary axis

```
MANUAL>POINT                    100% [MG] [S0H0X]
                  x         y         z         r
P7    = 100.00   250.00    15.00    30.00
P8    = 220.00   150.00   115.00    90.00
P9    = 400.00   200.00    15.00   -30.00

COMNT:                          [        ]
 [POS] -100.00   400.00    50.15   111.23
 EDIT     TEACH    JUMP     VEL+     VEL-
```

Step3 *Use the Jog keys to move the robot axis for teaching.*

As the arm moves, the current position data on the 7th line on the screen changes.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Step4 *When the axis arrives at the target point, press* F2 *(TEACH).*

Teaching is performed so that the current robot position data is allotted to the currently selected point. The format for point data input by teaching is set to the currently selected coordinate system. However, when teaching is performed on different axes, they must use the same coordinates as the teach points. Therefore, if the point data is in "mm" units, then the current position must also be in "mm" units.
When point data is already allotted to the currently selected point, a confirmation message "Overwrite point OK?" appears on the guideline when F2 *(TEACH) is pressed.*

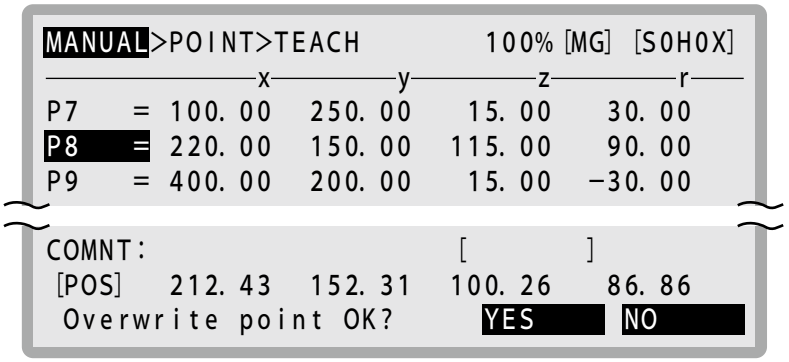
Press F4 *(YES) to perform the teaching.*

Press F5 *(NO) if you want to cancel the teaching,*

CAUTION

To perform teaching at a point on the Cartesian coordinates (millimeter units) with a SCARA robot, always use the correct hand system that should actually be moved. The robot cannot be guaranteed to move to the same position if moving with a hand system different from that used for teaching.

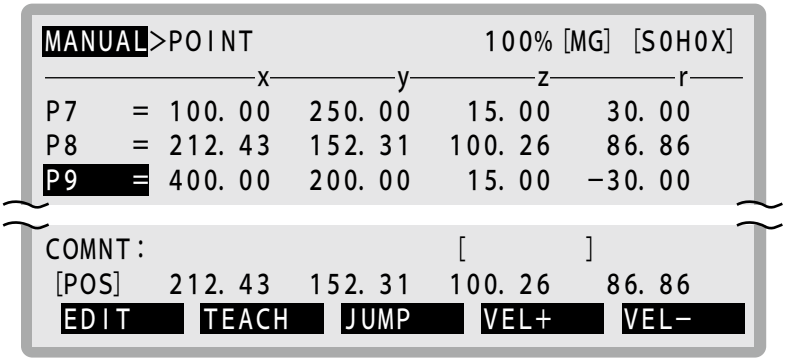
Point data teaching (with auxiliary axis [5])



After teaching, the specified point number moves to the next line automatically.

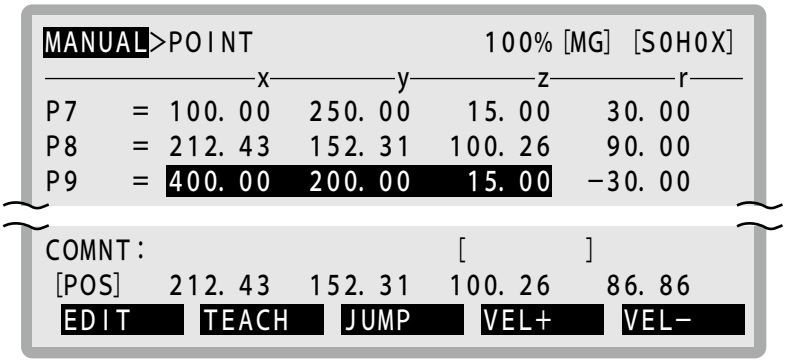
Point data teaching (with auxiliary axis [6])

When teaching on all axes



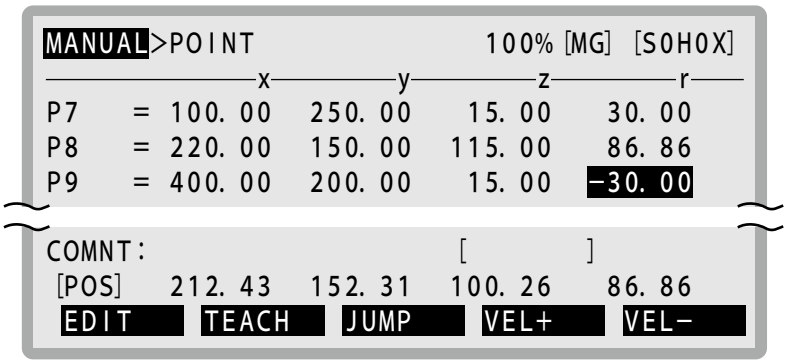
Point data teaching (with auxiliary axis [7])

When teaching on standard axes



Point data teaching (with auxiliary axis [8])

When teaching on auxiliary axis



NOTE

Point data teaching cannot be performed if return-to-origin is incomplete.

11.2.3 Point data input by direct teaching

Point data can also be obtained by direct teaching (moving the robot by hand to the target point while the robot servo is off).

WARNING

WHEN YOU PERFORM DIRECT TEACHING, MAKE SURE THAT THE EMERGENCY STOP BUTTON IS PRESSED SO THAT THE SERVO WILL NOT TURN ON.

Step 1 ***Activate emergency stop.***

Press the emergency stop button on the RPB.

Step 2 ***In "MANUAL>POINT" mode, move the robot by hand to the target point and perform point teaching.***

For point data teaching methods, refer to the previous section "11.2.2 Point data input by teaching". (In this procedure you move the robot by hand since the Jog keys cannot be used.)

NOTE

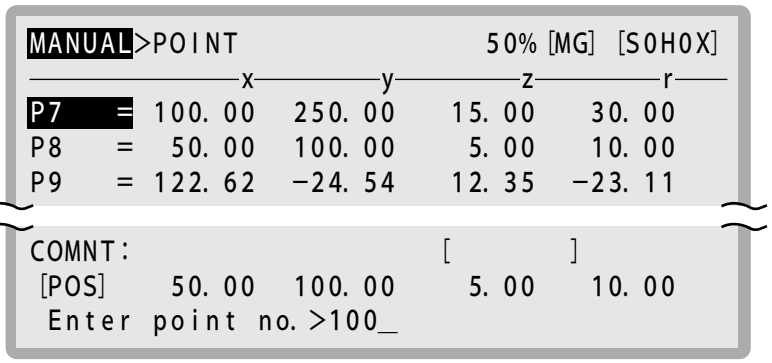
When the robot servo is off, automatic and manual operation cannot be performed. There are two methods for turning on the robot servo: One is to use the RPB and the other is to use the dedicated input.
Refer to "14. "UTILITY" mode" in this chapter, or refer to "1. Standard I/O interface overview" in Chapter 6.

11.2.4 Point jump display

Step 1 ***Press F3 (JUMP) in "MANUAL>POINT" mode.***

The message "Enter point no.>" appears on the guideline.

Point jump (1)



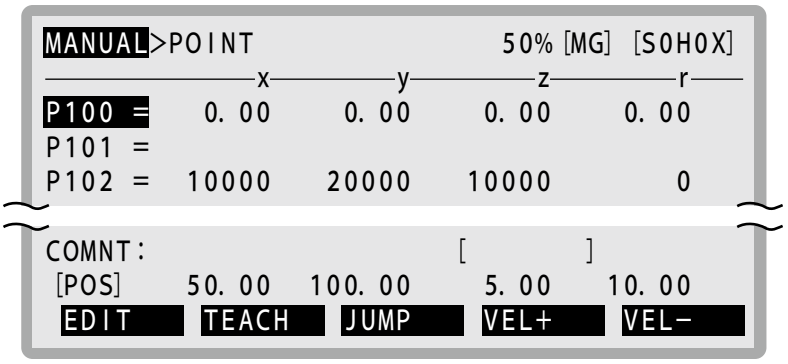
Step2 ***Enter the point number to jump to, and press*** ENTER.

A jump is made so that the point data is displayed from the designated point number.

NOTE

Valid point numbers are from 0 to 9999.

Point jump (2)



11.2.5 Copying point data

Point data can be copied under another point number.

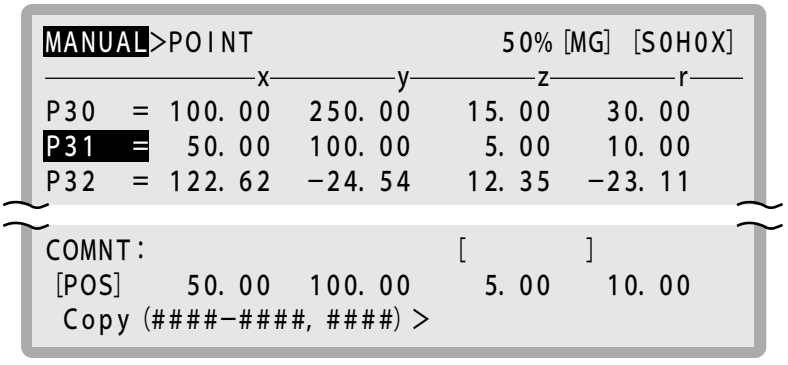
NOTE

If a hand system flag is set in the point data, the hand system flag will also be copied.

Step1 ***Press*** F6 ***(COPY) in "MANUAL>POINT" mode.***

The message "Copy(####-####,####)>" appears on the guideline.

Copying point data (1)



Step2 ***Enter the point number range.***

Use 0 *to* 9, − *and* , *to enter the point number range for the copy source and the point number for the copy destination in the following format.*

"(copy start number) – (copy end number), (copy destination number)"

For example, to copy the data between P30 and P34 onto the lines after P50, enter "30 - 34, 50".

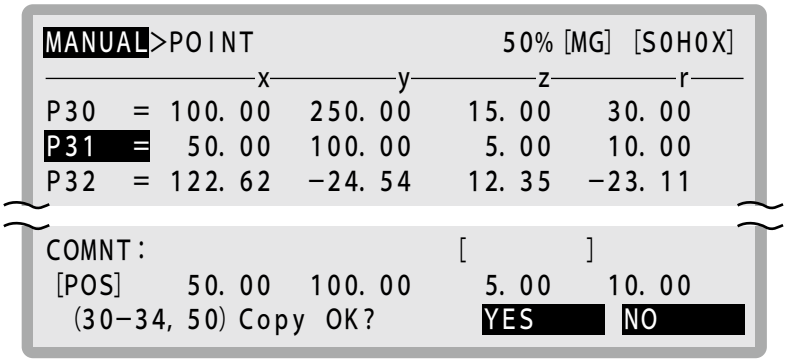
NOTE

Valid point numbers are from 0 to 9999.

Step3 ***Press*** ENTER.

A confirmation message appears on the guideline.

Copying point data (2)



Step4 ***Press*** F4 ***(YES) to make a copy.***

The point data in the selected range is copied onto the data lines starting from the specified copy destination number.

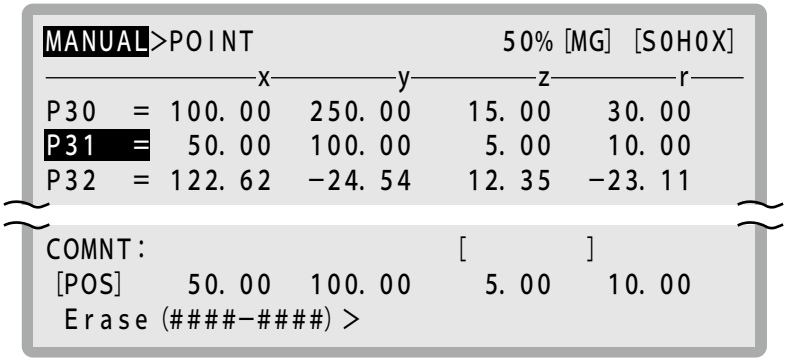
Press F5 *(NO) if you want to cancel the copy.*

11.2.6 Erasing point data

Step1 ***Press*** F7 ***(ERASE) in "MANUAL>POINT" mode.***

The message "Erase (####-####)>" appears on the guideline.

Erasing point data (1)



Step2 ***Enter the point number range.***

Use 0 *to* 9*, and* − *to enter the point number range to delete in the following format.*

"(erase start number) - (erase end number)"

For example, to erase the data between P30 and P34, enter "30 - 34".

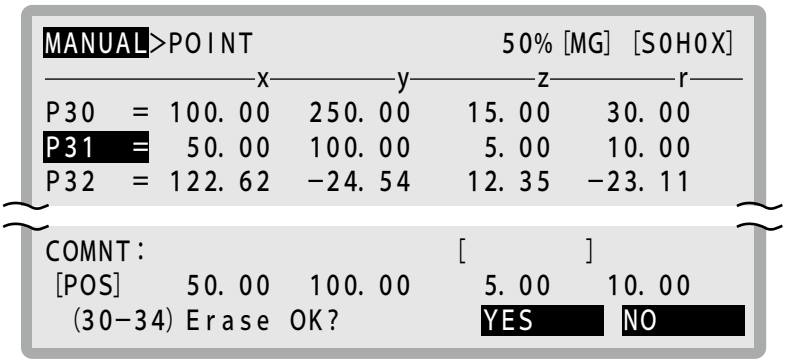
Step3 ***Press*** ENTER.

A confirmation message appears on the guideline.

NOTE

Valid point numbers are from 0 to 9999.

Erasing point data (2)



Step4 ***Press*** F4 ***(YES) to erase the point data.***

The point data in the specified range is erased.

Press F5 *(NO) if you want to cancel erasure.*

11.2.7 Point data trace

Point data positions can be checked by actually moving the robot.

To execute point trace, enter "AUTO>POINT" mode by pressing F11 (TRACE) in "MANUAL>POINT" mode. Then use the point trace function to execute point trace.

Refer to "9.7 Executing the point trace" earlier in this chapter for details.

NOTE

- In "AUTO>POINT" mode, pressing F11 (MODIFY) returns to "MANUAL>POINT" mode that was active before trace.
- When "AUTO>POINT" mode was entered from "MANUAL>POINT" mode, pressing ESC also returns to "MANUAL>POINT" mode.

11.2.8 Point comment input and editing

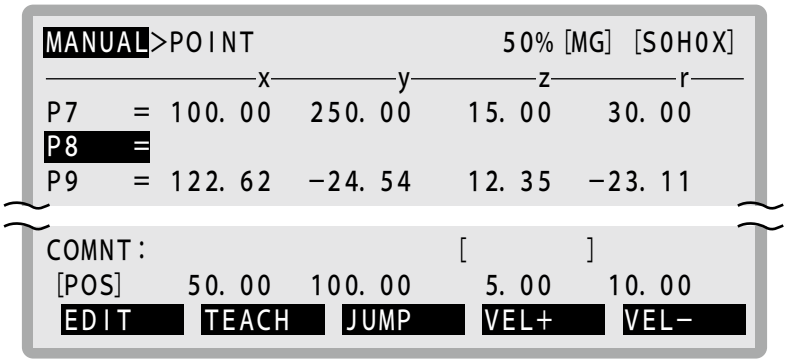
Press F12 (COMMENT) in "MANUAL>POINT" mode.

The data display on the screen does not change (same as "MANUAL>POINT" mode).
The 5-digit area on the left shows point numbers, with the currently selected point number highlighted.

NOTE

- Point comments can be entered for point numbers having no data.
- A point comment can be up to 15 characters.

Entering a point comment (1)



Valid keys and submenu descriptions in "MANUAL>POINT" comment mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies point data or scrolls the screen vertically.
⏫ / ⏬ *1		Switches to other screens.
F1	EDIT	Edits point comments.
F2	TEACH	Enters point data by teaching.
F3	JUMP	Displays the specified (jumped) data.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6 *2	COPY	Copies point comments.
F7 *2	ERASE	Deletes point comments.
F8 *2	UNITCHG	Changes the current position display units to "mm" or "pulse".
F9 *2	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *2	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.
F11 *3	FIND	Enters the character string to be found.
F12 *3	FIND+	Starts searching for a comment containing the specified character string towards the end of the program.
F13 *3	FIND-	Starts searching for a comment containing the specified character string towards the top of the program.
ROBOT *4		Switches the robot group.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6 to F10, press F1 (F6) to F5 (F10) while holding down UPPER.

*3: To use F11 to F13, press F1 (F6) to F3 (F8) while holding down LOWER.

*4: To use ROBOT, press MODE (ROBOT) while holding down LOWER.

11.2.8.1 Point comment input and editing

Point comments can be entered and edited in "MANUAL>POINT>COMMENT" mode.

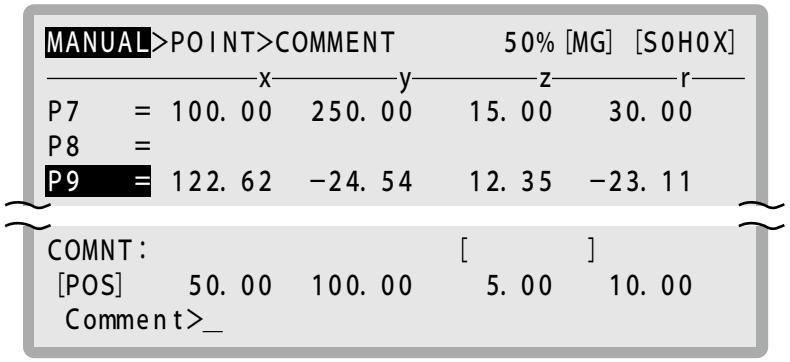
NOTE

- For point comments, it is advisable to enter a character string that is easy to understand.
- A point comment can be up to 15 characters.

Step 1 ***Select the point number to edit or enter a comment using the cursor (▲ / ▼) keys.***

Step 2 ***Press F1 (EDIT).***

Entering a point comment (2)



Step 3 ***Enter a comment.***

Enter a point comment with the data keys.
Up to 15 characters can be entered as a comment.

Step 4 ***Press ENTER.***

The comment you have entered is now registered and displayed.
Press ESC if you want to cancel the comment input.

11.2.8.2 Point data input by teaching

For point data teaching methods, use the same procedure as explained in "11.2.2 Point data input by teaching".

11.2.8.3 Jump to a point comment

Step1 ***Press F3 (JUMP) in "MANUAL>POINT>COMMENT" mode.***

The message "Enter point no. >" appears on the guideline.

Jumping to a point comment display (1)

```
MANUAL>POINT>COMMENT          50% [MG] [S0H0X]
                  x          y          z          r
P7    = 100.00   250.00    15.00    30.00
P8    =
P9    = 122.62   -24.54    12.35   -23.11
COMNT:                        [        ]
 [POS]    50.00   100.00     5.00    10.00
  Enter point no.>107_
```

Step2 ***Enter the point comment to jump to, and press ENTER.***

A jump is made to the designated point and its comment is then displayed.

Jumping to a point comment display (2)

```
MANUAL>POINT>COMMENT          50% [MG] [S0H0X]
                  x          y          z          r
P107 = 340.05   250.03   115.00    34.54
P108 = 340.05   200.05   115.00    34.54
P109 = 122.62   -24.54    12.35   -23.11
COMNT: WAIT_POS 08            [        ]
 [POS]    50.00   100.00     5.00    10.00
 EDIT    TEACH    JUMP      VEL+      VEL-
```

NOTE

Valid point numbers are from 0 to 9999.

11.2.8.4 Copying a point comment

Point comments can be copied under another point number.

Step 1 ***Press F6 (COPY) in "MANUAL>POINT>COMMENT" mode.***

The message "Copy(####-####,####)>" appears on the guideline.

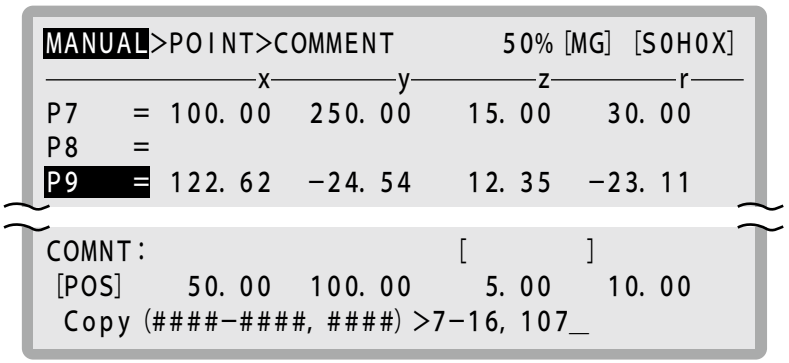
Step 2 ***Enter the point number range.***

Use 0 to 9, − and . to enter the point number range for the copy source and the point number for the copy destination in the following format.

"(copy start number) – (copy end number), (copy destination number)"

For example, to copy the point comments between P7 and P16 onto the lines after P107, enter "7 - 16, 107".

Copying a point comment (1)



NOTE

Valid point numbers are from 0 to 9999.

Step 3 ***Press ENTER.***

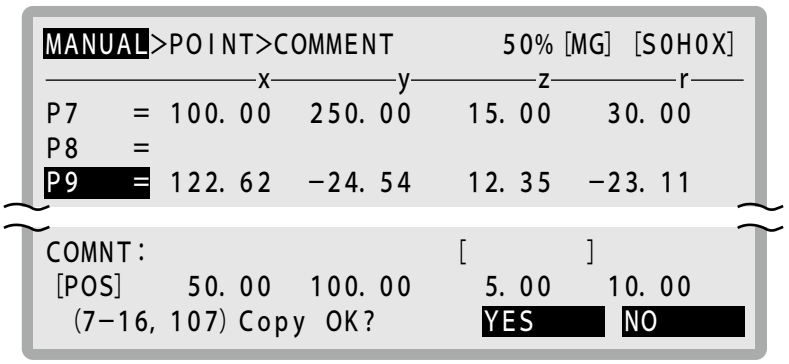
A confirmation message appears on the guideline.

Step 4 ***Press F4 (YES) to copy the point comments.***

The point data in the specified range is copied.

Press F5 (NO) if you want to cancel copy.

Copying a point comment (2)



11.2.8.5 Erasing point comments

Point comments already entered can be deleted.

Step1 ***Press F7 (ERASE) in "MANUAL>POINT>COMMENT" mode.***

The message "Erase(####-####)>" appears on the guideline.

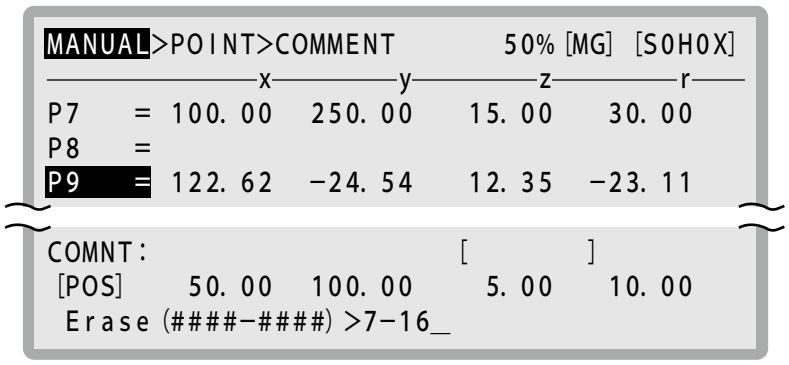
Step2 ***Enter the point number range.***

Use 0 to 9 and − to specify the point number range in the following format and press ENTER.

"(erase start number) - (erase end number)"

For example, to erase the point comments between P7 and P16, enter "7 - 16".

Deleting a point comment (1)



NOTE

Valid point numbers are from 0 to 9999.

Step3 ***Press ENTER.***

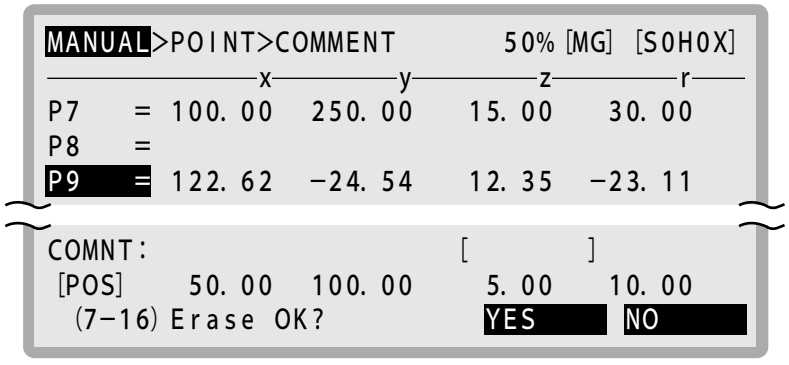
A confirmation message appears on the guideline.

Step4 ***Press F4 (YES) to erase the point comments.***

The point comments in the specified range are erased.

Press F5 (NO) if you want to cancel erasure.

Deleting a point comment (2)



11.2.8.6 Point comment search

Point comments already entered can be located.

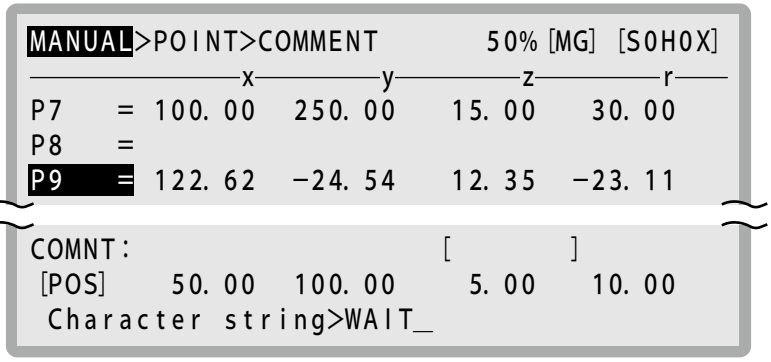
Step1 ***Press F11 (FIND) in "MANUAL>POINT>COMMENT" mode.***

The message "Character string >" appears on the guideline.

Step2 ***Enter a point comment to find using the data keys.***

Up to 15 characters can be entered to find a comment.

Searching for a point comment (1)



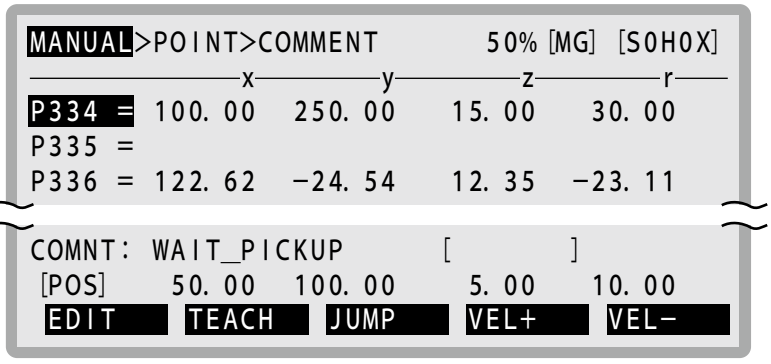
NOTE

A point comment can be up to 15 characters.

Step3 ***Press ENTER.***

Search starts from the cursor position towards the end of the program and stops at the first matching character string.

Searching for a point comment (2)



Step4 ***To continuously search for another character string, press F12 (FIND+) or F13 (FIND-).***

Pressing the F12 (FIND+) restarts the search from the current cursor position towards the end of the program and stops at the first matching character string.

Pressing the F13 (FIND-) restarts the search from the current cursor position towards the top of the program and stops at the first matching character string.

11.2.9 Point data error reset

If an error "9.2:Point data destroyed" occurs in the point data, this function resets the error and allows you to continue editing.

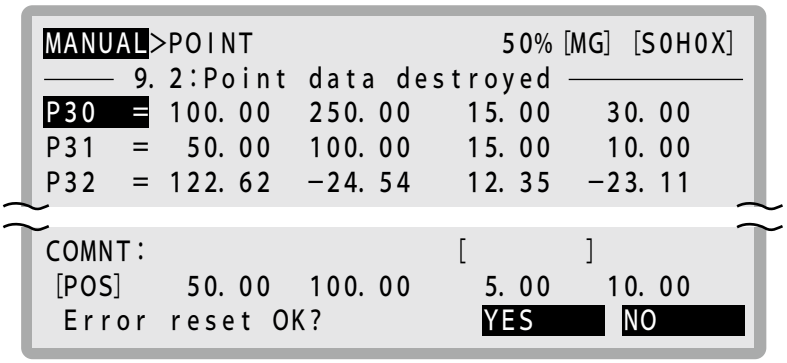
CAUTION

This function resets an error, but does not restore the point data. A problem is probably occurring in the point data, so check and correct the point data in "MANUAL>POINT>EDIT" mode.

Step 1 ***Press F13 (ERR. RST) in "MANUAL>POINT" mode.***

A confirmation message appears on the guideline.

Resetting a point data error



Step 2 ***Press F4 (YES) to reset the error.***

Point data can be edited after resetting the error.

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

NOTE

This reset function does not work if an error "9.3:Memory destroyed" occurs. In this case, initialize the memory.

11.3 Displaying, editing and setting pallet definitions

Press F2 (PALLET) in "MANUAL" mode to enter "MANUAL>PALLET" mode.

This mode allows you to display, edit and set pallet definitions.

This mode allows you to display, edit and set pallet definitions. However, the standard coordinates must be set when a SCARA robot is used. Refer to "11.10 Setting the standard coordinates" for details.

A total of 20 pallets (definition numbers 0 to 19) can be defined to assign a point data area to each pallet. Each pallet is generated (outlined) by using 5 points (P[1] to P[5] as shown below). The maximum number of points that can be defined in one pallet is 32767 (=NX*NY*NZ).

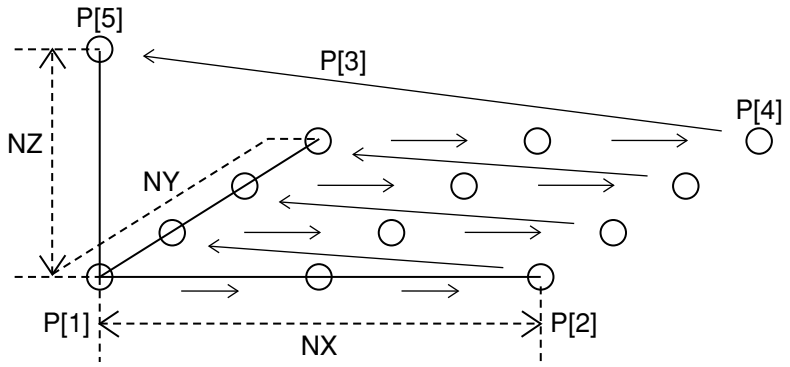
NOTE

- A total of 20 pallets can be defined.
- The maximum number of points that can be defined in one pallet is 32767.
- Data in the point data area is used for pallet definition.

NOTE

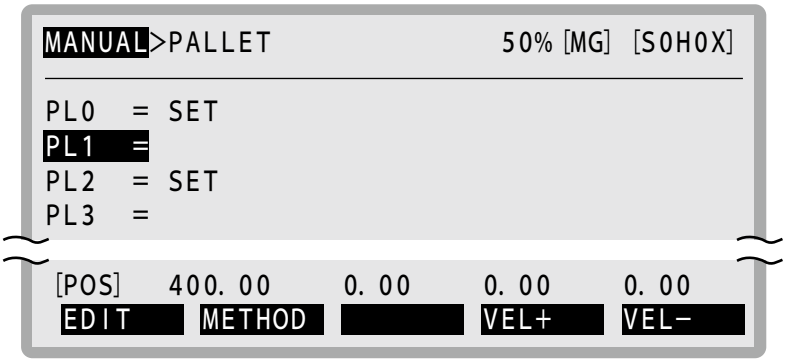
When two robots (main and sub robots) are specified, pallet definitions can be shared between them.

Pallet definition (1)



Pallet number	Point number used	Pallet number	Point number used
PL0	P3996 to P4000	PL10	P3946 to P3950
PL1	P3991 to P3995	PL11	P3941 to P3945
PL2	P3986 to P3990	PL12	P3936 to P3940
PL3	P3981 to P3985	PL13	P3931 to P3935
PL4	P3976 to P3980	PL14	P3926 to P3930
PL5	P3971 to P3975	PL15	P3921 to P3925
PL6	P3966 to P3970	PL16	P3916 to P3920
PL7	P3961 to P3965	PL17	P3911 to P3915
PL8	P3956 to P3960	PL18	P3906 to P3910
PL9	P3951 to P3955	PL19	P3901 to P3905

Pallet definition (2)



Pallet definition numbers marked "SET" mean that they have already been defined.

Valid keys and submenu descriptions in "MANUAL>PALLET" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the pallet definition number.
⏫ / ⏬ *1		Switches to other screens.
F1	EDIT	Edits pallet definitions.
F2	METHOD	Sets the pallet definition point by teaching.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6 *2	COPY	Copies pallet definitions.
F7 *2	ERASE	Deletes pallet definitions.
F9 *2	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *2	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.
F15 *3	PASSWD	Does not function.
ROBOT *4		Switches the robot group.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6, F7, F9 or F10, press F1, F2, F4 or F5 while holding down UPPER.

*3: To use F15, press F5 while holding down LOWER.

*4: To use ROBOT, press MODE while holding down LOWER.

11.3.1 Editing pallet definitions

Step1 ***In "MANUAL>PALLET" mode, select the pallet number with the cursor (▲ / ▼) keys.***

Step2 ***Press F1 (EDIT).***

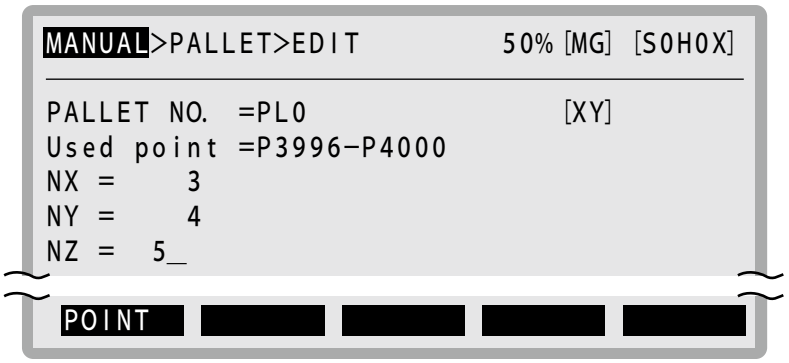
"MANUAL>PALLET>EDIT" is entered.

Step3 ***Use the cursor (▲ / ▼) keys to move the cursor to the position you want edit.***

Step4 ***Use 0 to 9 to enter the desired value.***

*The maximum number of points per pallet must be within 32767 (=NX*NY*NZ).*

Editing pallet definitions



NOTE

The maximum number of points per pallet is 32767 (=NX*NY*NZ).

Step5 ***Press ENTER to determine the input value.***

Step6 ***To continue editing, repeat steps 3 to 5.***

Step7 ***Press ESC to quit editing and return to "MANUAL>PALLET" mode.***

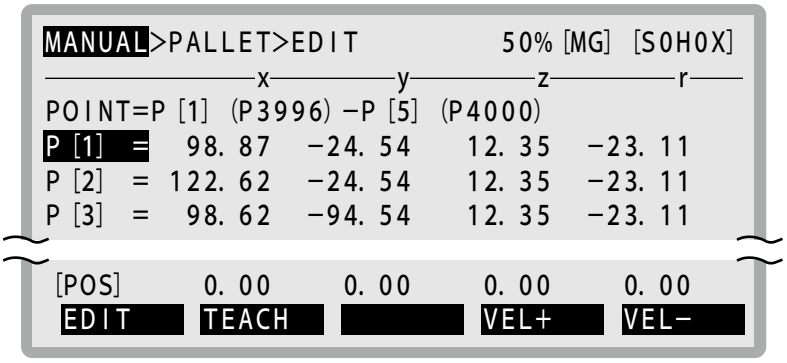
Valid keys and submenu descriptions in "MANUAL>PALLET>EDIT" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Move cursors.
F1	POINT	Set point data in the pallet definitions.

11.3.1.1 Point setting in pallet definition

In "MANUAL>PALLET>EDIT" mode, a screen like that shown below is displayed.

Point editing in pallet definition



The 3rd line shows the point numbers and point data in the pallet definition.

NOTE

- Each pallet is generated with 5 points for pallet definition.
- These 5 points should be defined in order from P(1) to P(5). See "11.3 Displaying, editing and setting pallet definitions".

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

Valid keys	Menu	Function
▲ / ▼		Specifies the point data or scrolls the screen.
F1	EDIT	Edits the point in pallet definition.
F2	TEACH	Sets the point in pallet definition by teaching.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8 *1	UNITCHG	Switches the current position display units.
F9 *1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.
ROBOT *2		Switches the robot group.

*1: To use F8 to F10, press F8 F3 F13 to F10 F5 F15 while holding down UPPER.

*2: To use ROBOT, press MODE ROBOT while holding down LOWER.

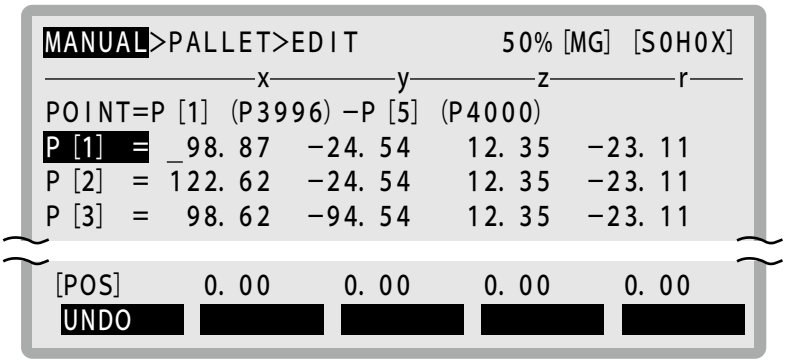
11.3.1.1.1 Editing the point in pallet definition

NOTE

- Each pallet is generated (outlined) with 5 points, so always specify these 5 points for pallet definition.
- Point data in the pallet definition must be entered in "mm" units.
- The 5 points should be defined in order from P(1) to P(5). See "11.3 Displaying, editing and setting pallet definitions".

Step 1 *In "MANUAL>PALLET" mode, press* F1 *(EDIT).*

Point editing in pallet definition



Step 2 *Use the cursor (◄ / ► / ▲ / ▼) keys to move the cursor to the position you want edit.*

Step 3 *Use* 0 *to* 9 *,* + *,* − *,* . *and* SPACE *to enter the point data.*

Step 4 *Press* ENTER *or cursor up/down (▲ / ▼) keys to finish the point data input.*

Pressing ESC *aborts the input.*

Step 5 *To continue editing, repeat steps 2 to 4.*

Step 6 *Press* ESC *to quit editing and return to "MANUAL>PALLET" mode.*

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

Valid keys	Menu	Function
▲ / ▼		Moves the cursor.
F1	UNDO	Reverses the last data input and restores the preceding data.

11.3.1.1.2 Setting the point in pallet definition by teaching

For point data teaching methods, refer to "11.2.2 Point data input by teaching".

11.3.2 Pallet definition by teaching

NOTE

Pallets cannot be defined by teaching if return-to-origin is incomplete. Perform teaching after performing absolute reset or return-to-origin.

Step1 ***In "MANUAL>PALLET" mode, select the pallet number with the cursor (▲ / ▼) keys.***

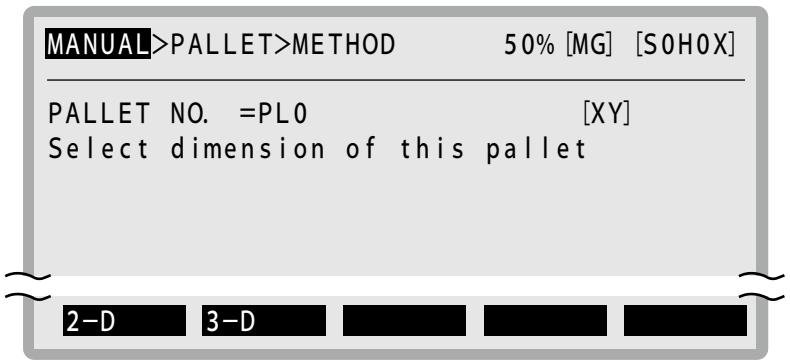
Step2 ***Press F2 (METHOD).***

"MANUAL>PALLET>METHOD" mode is entered.

Step3 ***Select the pallet to define.***

Select "2-D" (plane) or "3-D" (solid).

Pallet definition by teaching (1)



Step4 ***Teach point [P1].***

Move the robot work point to P(1) used in the pallet definition, and perform teaching by pressing ENTER.

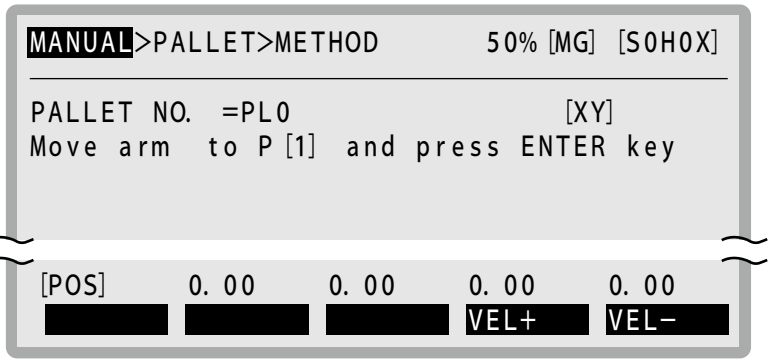
WARNING

TO AVOID HAZARDOUS SITUATIONS DO NOT ENTER THE ROBOT MOVEMENT RANGE WHEN MANIPULATING THE ROBOT.

NOTE

- Each pallet is generated (outlined) with 5 points for pallet definition.
- Point data in the pallet definition must be entered in "mm" units.
- The 5 points should be defined in order from P(1) to P(5). See "11.3 Displaying, editing and setting pallet definitions".

Pallet definition by teaching (2)

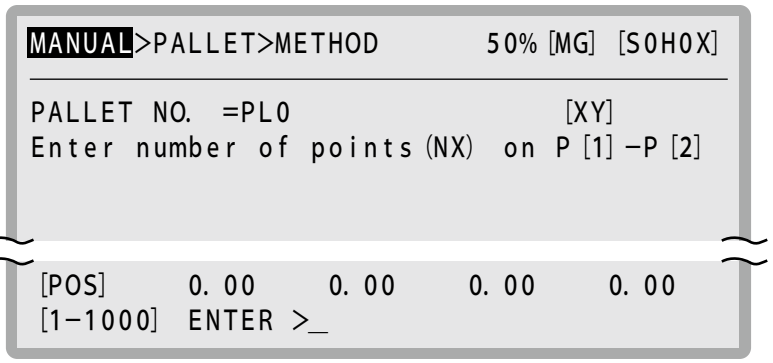


Step5 ***Teach other points.***

Perform teaching at P(2), P(3), P(4) and P(5) (only when "3-D" is selected) as in step 4).

Step6 ***Enter the number of points NX between P[1] and P[2] on the pallet with a positive integer.***

Pallet definition by teaching (3)



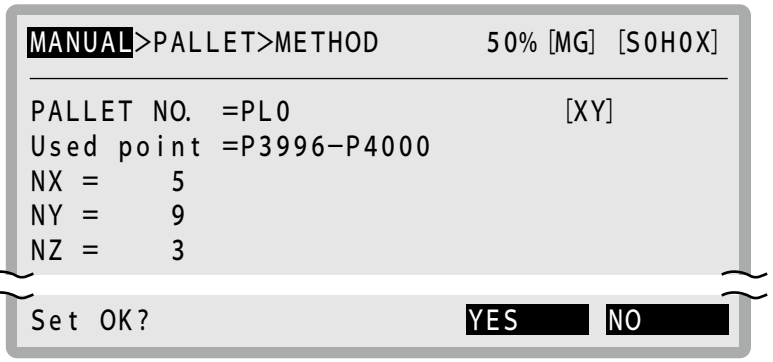
Step7 ***Enter the number of points NY and NZ (only when "3-D" is selected) as in step 6.***

Step8 ***When a confirmation message appears, determine whether to make the setting.***

Press F4 *(YES) to determine the setting.*

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

Pallet definition by teaching (4)



NOTE

- Each pallet is generated with 5 points for pallet definition.
- The 5 points should be defined in order from P(1) to P(5). See "11.3 Displaying, editing and setting pallet definitions".

Valid keys and submenu descriptions in "MANUAL>PALLET>METHOD" mode are shown below.

Valid keys		Menu	Function
F4		VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5		VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	*1	UNITCHG	Switches between the current display units (mm or pulses).
F9	*1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	*1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.

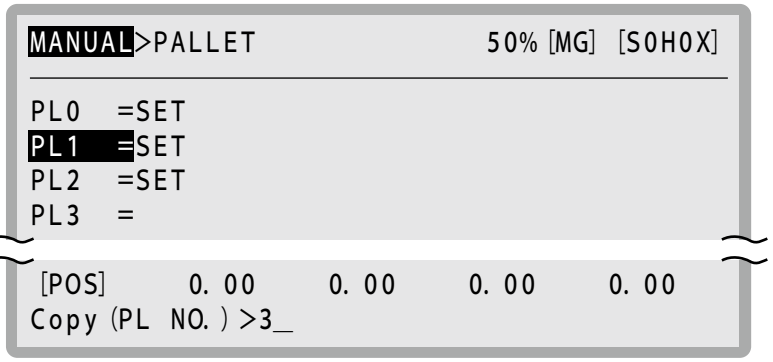
*1: To use F8 to F10, press F8 F3 F13 to F10 F5 F15 while holding down UPPER.

11.3.3 Copying a pallet definition

Step 1 ***In "MANUAL>PALLET" mode, select the pallet number with the cursor (▲ / ▼) keys.***

Step 2 ***Press F6 (COPY) and then enter the pallet number where you want to copy the currently selected pallet definition.***

Copying a pallet definition (1)



NOTE

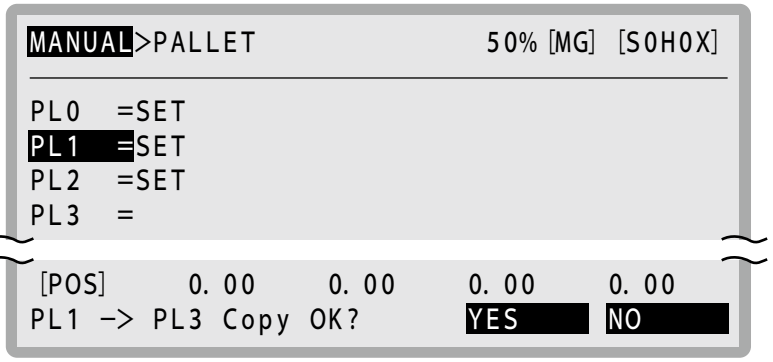
- Valid pallet numbers are from 0 to 19.
- Pallet definition cannot be copied if the currently selected pallet is undefined.

Step 3 ***When a confirmation message appears, determine whether to copy the pallet definition.***

Press F4 (YES) to make a copy.

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

Copying a pallet definition (2)



11.3.4 Deleting a pallet definition

NOTE

Pallet definition cannot be deleted if the currently selected pallet is undefined.

Step 1 ***In "MANUAL>PALLET" mode, select the pallet number with the cursor (▲ / ▼) keys.***

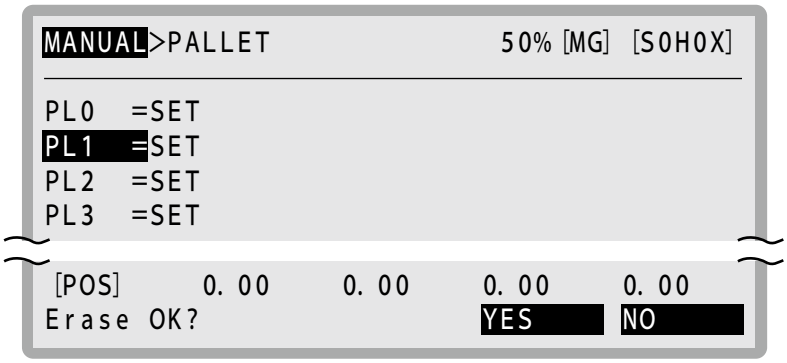
Step 2 ***Press F7 (ERASE).***

A confirmation message then appears asking whether to delete the currently selected pallet definition.

Press F4 (YES) to delete it.

Press F5 (NO) if you want to cancel.

Deleting a pallet definition



11.4 Changing the manual movement speed

Manual movement speed of the selected robot group can be set anywhere within the range from 1 to 100%. Movement speed in "MANUAL" mode is set separately from the "AUTO" mode movement speed. One-fifth of the maximum speed in "AUTO" mode is equal to the maximum movement speed in "MANUAL" mode.

- Press F4 (VEL+) or F5 (VEL-) to change the manual movement speed in steps.
  Each time this key is pressed, the speed changes in steps of 1 ← → 5 ← → 20 ← → 50 ← → 100%. The maximum motor speed is set at 100%.

- Press F9 (VEL++) or F10 (VEL--) to change the manual movement speed gradually.
  Each time this key is pressed, the speed changes in units of 1%.
  Holding down the key changes the speed continuously.

NOTE

When two robots (main and sub robots) are specified, two speeds are displayed for " Main group speeds / Sub group speeds ", with the currently selected robot group highlighted. To switch the robot group, use ROBOT (LOWER + MODE).

11.5 Displaying, editing and setting shift coordinates

Press F6 (SHIFT) in "MANUAL" mode to enter "MANUAL>SHIFT" mode.

This mode allows you to display, edit and set shift coordinates. However, the standard coordinates must be set when a SCARA robot is used. Refer to "11.10 Setting the standard coordinates" for details.

Shift coordinates cannot be used with MULTI type robots.

NOTE

Shift coordinates cannot be used with MULTI type robots since the SHIFT/HAND selection display on the 1st line on the RPB screen appears blank.

By setting shift coordinates, the point data on the Cartesian coordinates ("mm" units) can be shifted to any desired position within the robot work area. The work area can also be restricted in each direction.

Up to 10 shift coordinates (shift coordinate numbers 0 to 9) can be set to shift the standard coordinates in the X, Y, Z and R (XY plane rotation) directions. Each shift coordinate can specify the robot operating area.

NOTE

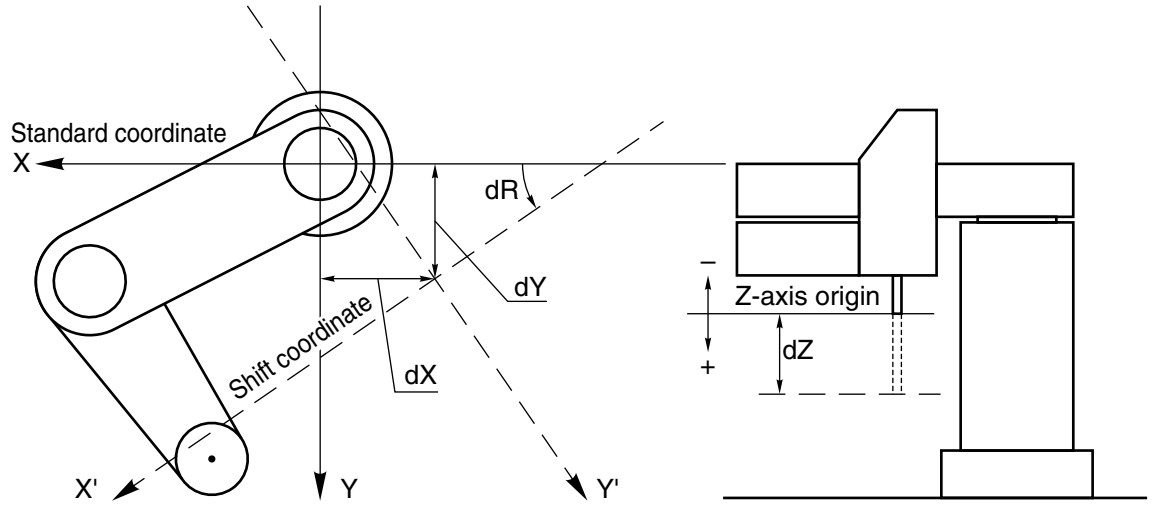
- When two robots (main and sub robots) are specified, the shift data can be shared between them. Shift coordinate numbers can be set for each robot separately.
- A maximum of 10 shift coordinates can be set per robot.

Shift coordinate data format

Sn= ±###.## ±###.## ±###.## ±###.##
dX (mm) dY (mm) dZ (mm) dR (degrees)
(n=0 to 9)

When the shift amount is dX=0.00, dY=0.00, dZ=0.00, dR=0.00, the shift coordinates equal the standard coordinates.

Standard coordinates and shift coordinates



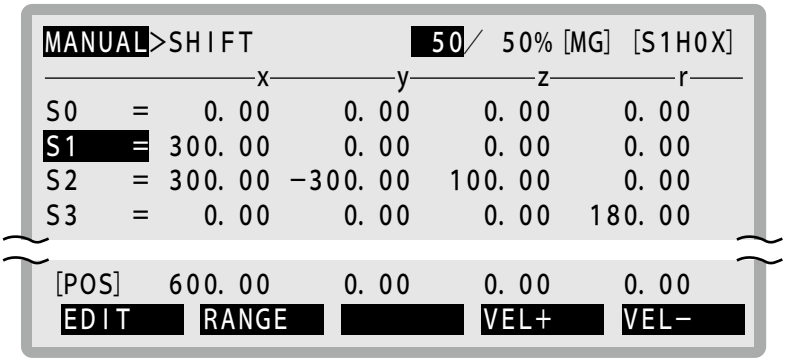
When "MANUAL>SHIFT" mode is entered, a screen like that shown below appears.

The currently selected shift coordinate number is highlighted.

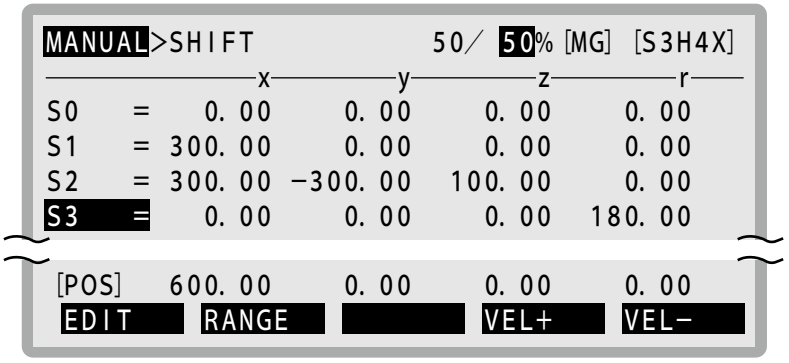
"MANUAL>SHIFT" mode (one-robot setting)



"MANUAL>SHIFT" mode (two-robot setting [1])
Main robot group is selected:



"MANUAL>SHIFT" mode (two-robot setting [2])
Sub robot group is selected:



Valid keys and submenu descriptions in "MANUAL>SHIFT" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the shift coordinate number.
⏫ / ⏬ *1		Switches to other screens.
F1	EDIT	Edits the shift coordinates.
F2	RANGE	Sets the shift coordinates range.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6 *2	METHOD1	Makes setting 1 for shift coordinates.
F7 *2	METHOD2	Makes setting 2 for shift coordinates.
F9 *2	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *2	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.
ROBOT *3		Switches the robot group.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

*2: To use F6, F7, F9 or F10, press F1 (F11), F2 (F12), F4 (F14) or F5 (F15) while holding down UPPER.

*3: To use ROBOT, press MODE (ROBOT) while holding down LOWER.

11.5.1 Editing shift coordinates

Step 1 ***In the "MANUAL>SHIFT" mode, select a shift coordinate number with the cursor (▲ / ▼) keys.***

Step 2 ***Press F1 (EDIT).***

"MANUAL>SHIFT>EDIT" is entered.

Step 3 ***Use the cursor (◄ / ►) keys to move the cursor to the position you want to change.***

Step 4 ***Use 0 to 9 , + , − , . and SPACE to enter the shift coordinate data.***

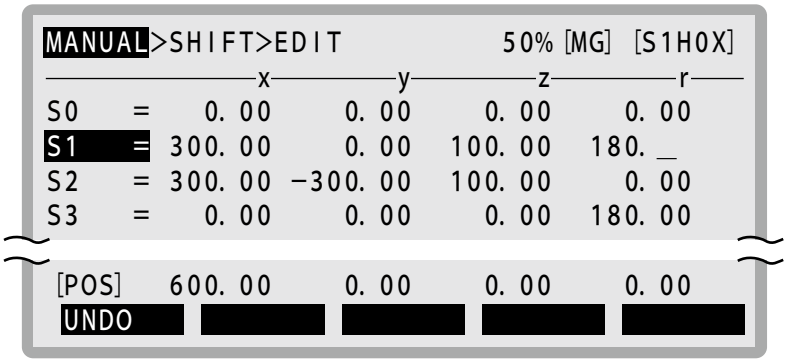
Enter a space to separate between the data for x, y, z, r. The data input formats are as follows.

- **To enter the data in Cartesian coordinates ("mm" units)**
  Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point. :± ###.##, ±####.#, ±#####.

NOTE

Enter all shift data for x, y, z and r. If omitted, "0" will be automatically entered for that axis.

Editing shift coordinate data



Step 5 ***Finish the point data input.***

Press ENTER , cursor up/down (▲ / ▼) keys or page up/down (⏫ , ⏬) keys to finish the point data input.

Press ESC if you want to cancel the point data input.

Step 6 ***To continue the editing, repeat steps 3 to 5.***

Step7 Press ESC to quit editing and return to "MANUAL>SHIFT" mode.

NOTE

The shift coordinate data on which the cursor was positioned when returning to "MANUAL>SHIFT" mode is used as the shift coordinates for the currently selected robot group.

Valid keys and submenu descriptions in "MANUAL>SHIFT>EDIT" mode are shown below.

Valid keys	Menu	Function
F1	UNDO	Reverses the last data input and restores the preceding data.

11.5.1.1 Restoring shift coordinates

During shift coordinate data editing, pressing F1 (UNDO) reverses the last data input and restores the preceding data.
This function is enabled only on lines that are not yet complete.

11.5.2 Editing the shift coordinate range

By setting the shift coordinate range, the robot operating area can be restricted to the desired range on each shift coordinate. Moreover, setting the soft limit parameters allows you to specify the robot work area more precisely.

Shift coordinate range data format

- Plus side

  SP n= ±###.## ±###.## ±###.## ±###.##
  dPX (mm) dPY (mm) dPZ (mm) dPR (degrees)
  (n=0 to 9)

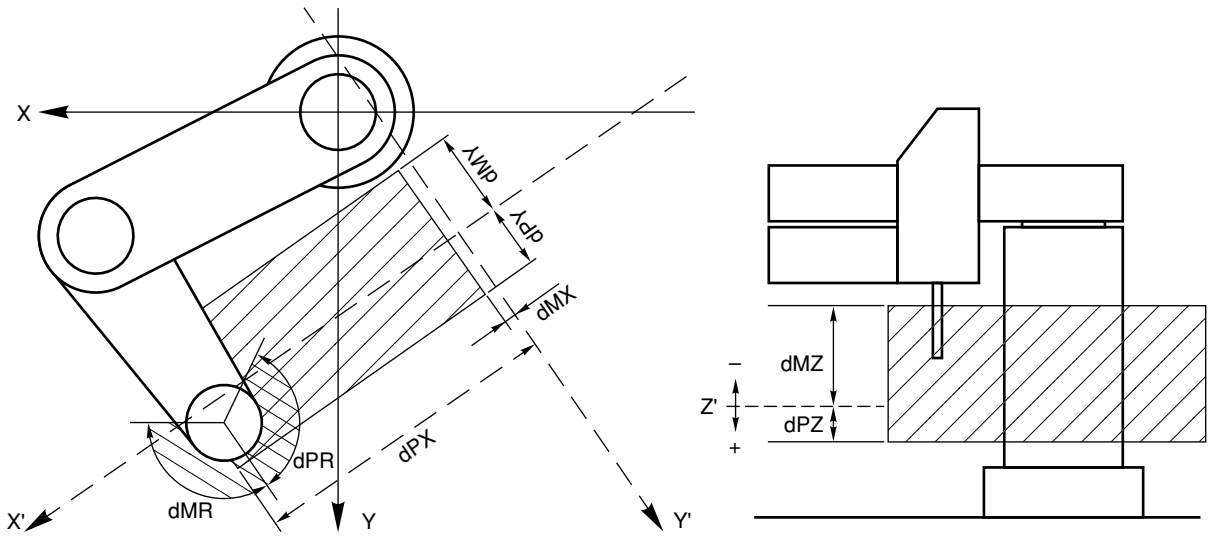
- Minus side

  SMn= ±###.## ±###.## ±###.## ±###.##
  dMX (mm) dMY (mm) dMZ (mm) dMR (degrees)
  (n=0 to 9)

NOTE

- "n" is a shift coordinate number.
  [Example]
  SP1 ..... Plus side work area of shift coordinate S1
  SM 2.... Minus side work area of shift coordinate S2
- When the plus and minus sides on an axis (x, y, z, r) are both at 0.00, the work area on that axis is not be restricted.

Shift coordinate range



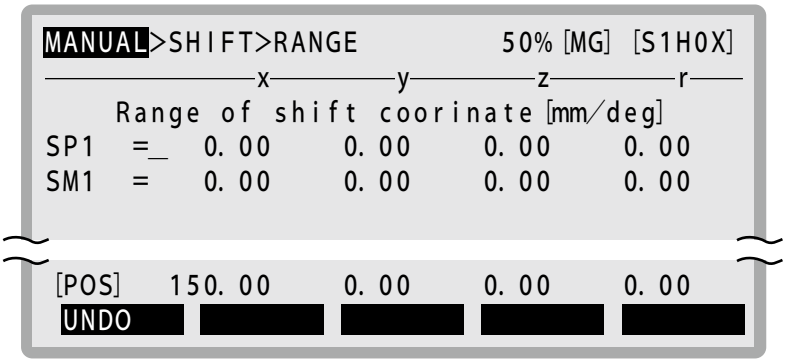
To edit a shift coordinate range, use the procedure below.

Step 1 ***In "MANUAL>SHIFT" mode, use the cursor (▲ / ▼) keys to select the shift coordinate number you want to edit.***

Step2 ***Press F2 (RANGE).***

"MANUAL>SHIFT>RANGE" mode is entered.
A cursor for editing the shift coordinate range appears.

Editing shift coordinate range (1)



Step3 ***Use the cursor (◄ / ►) keys to move the cursor to the position you want to change.***

Step4 ***Use 0 to 9 , + , − , . and SPACE to enter the point data.***

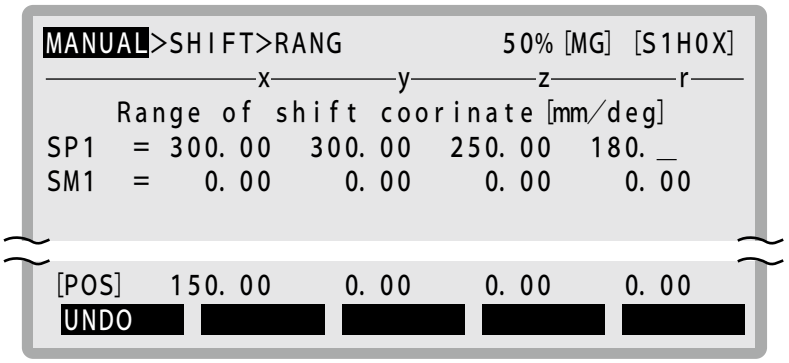
Enter a space to separate between the data for x and y. The data input formats are as follows.

- **To enter the data in Cartesian coordinates ("mm" units)**
  Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point. :±###.##, ±####.#, ±#####.

NOTE

Enter all shift range data for x, y, z and r. If omitted, "0" will be automatically entered for that axis.

Editing shift coordinate range (2)



Step5 ***Finish the point data input.***

Press ENTER , cursor up/down (▲ / ▼) keys or page up/down (⇈ , ⇊) keys to finish the point data input.

Press ESC if you want to cancel the point data input.

Step6 ***Edit the shift coordinate range on the minus side.***

Edit the range using the procedure in steps 3 to 5.

Step7 ***Press ESC to quit editing and return to "MANUAL>SHIFT" mode.***

NOTE

The shift coordinate number selected when returning to "MANUAL>SHIFT" mode is used as the shift coordinates for the currently selected robot group.

Valid keys and submenu descriptions for editing shift coordinates range are shown below.

Valid keys	Menu	Function
F1	UNDO	Reverses the last data input and restores the preceding data.

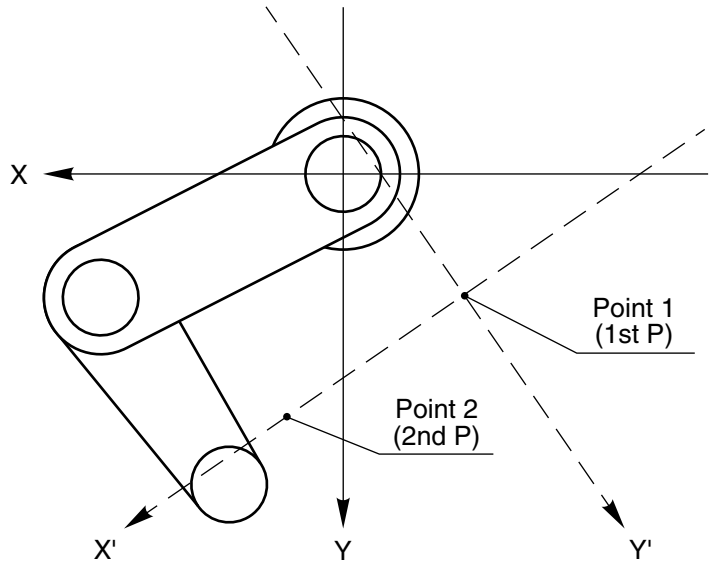
11.5.2.1 Restoring a shift coordinate range

During editing of shift coordinate range data, pressing F1 (UNDO) reverses the last data input and restores the preceding data.
This function is enabled only on lines that are not yet complete.

11.5.3 Shift coordinate setting method 1

This method sets the shift coordinate data by performing teaching at 2 points and then entering the plus/minus direction of those 2 points
The first teach point 1 (1st P) becomes the shift coordinate origin. The Z value of teach point 1 is the Z value of the shift coordinate.

Shift coordinate setting method 1 (1)



NOTE

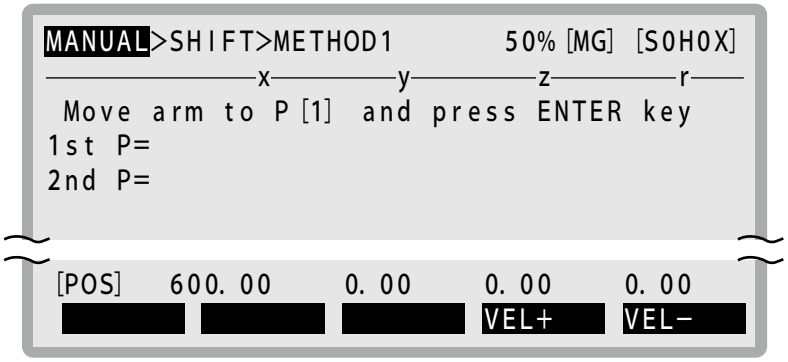
When two robots (main and sub robots) are specified, check the currently selected robot group on the RPB screen.
"(MG)" indicates the main robot group is selected, and "(SG)" indicates the sub robot group is selected. To change the robot group, use ROBOT (LOWER + MODE).

Step1 ***In "MANUAL>SHIFT" mode, select the shift coordinate number with the cursor (▲ / ▼) keys.***

Step2 ***Press F6 (METHOD1)***

"MANUAL>SHIFT>METHOD1" mode is entered.

Shift coordinate setting method 1 (2)



Step3 *Use the Jog keys to move the robot arm tip to teach point 1.*

Position the robot arm tip accurately.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

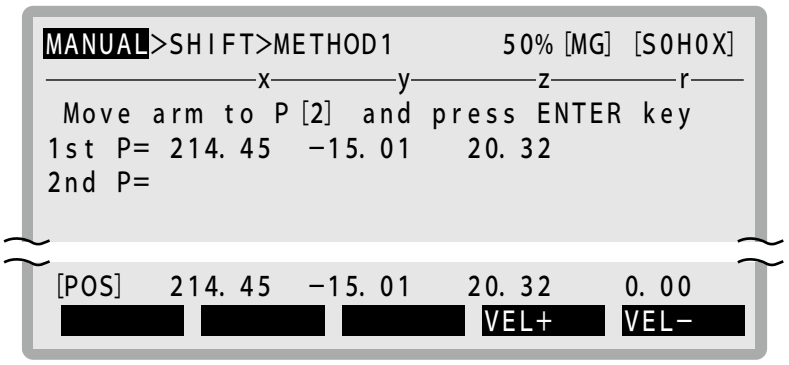
NOTE

Perform teaching carefully to obtain accurate teach points. Precise shift coordinates cannot be set if the teach point is inaccurate.

Step4 *Press* ENTER.

The current position is then obtained as "1st P". (This value becomes the shift coordinate origin.)

Shift coordinate teaching

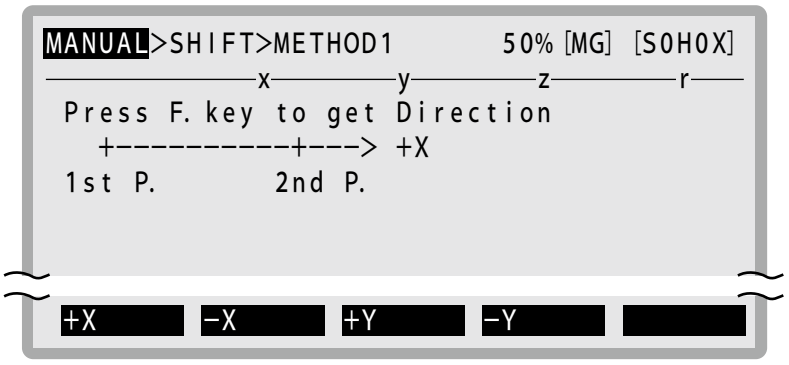


Step5 *Determine teach point 2 with the same procedure as for teach point 1.*

Step6 *Select the coordinate direction of teach point 1 towards point 2.*

Press F1 *(+X),* F2 *(-X),* F3 *(+Y), or* F4 *(-Y) to select the direction.*

Coordinate direction setting



Step 7 *Finish setting the shift coordinates.*

When the coordinate direction was selected in step 6, the shift coordinate values (dX, dY, dZ, dR) are automatically calculated and stored.
The screen then returns to "MANUAL>SHIFT" mode.

NOTE

The Z-direction shift value is automatically obtained when teach point 1 is determined. The Z-axis data at teach point 2 is therefore ignored.

Valid keys and submenu descriptions in "MANUAL>SHIFT>METHOD1" mode are shown below.

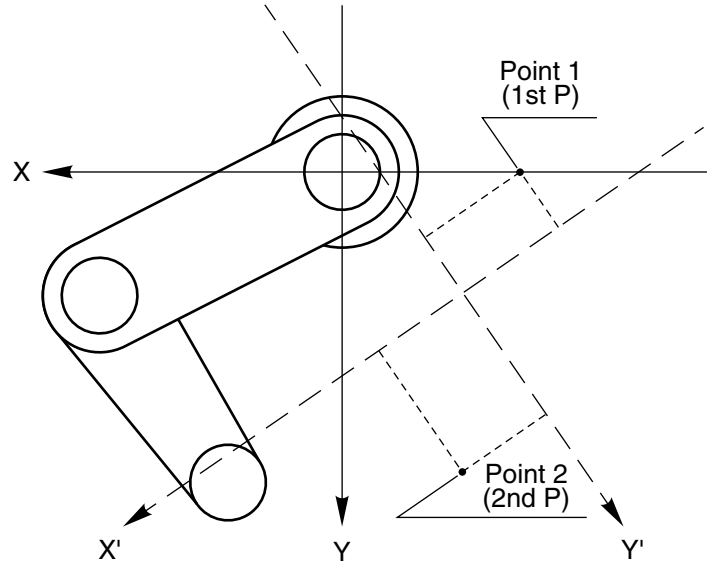
Valid keys	Menu	Function
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8 *1	UNITCHG	Switches between the current display units (mm or pulses).
F9 *1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.

*1: To use F8 to F10, press F8 F3 F13 to F10 F5 F15 while holding down UPPER.

11.5.4 Shift coordinate setting method 2

This method sets the shift coordinate data by performing teaching at 2 points and then entering the coordinate values of those 2 points.
The Z value of teach point 1 becomes the Z value of the shift coordinate.

Shift coordinate setting method 2 (1)



NOTE

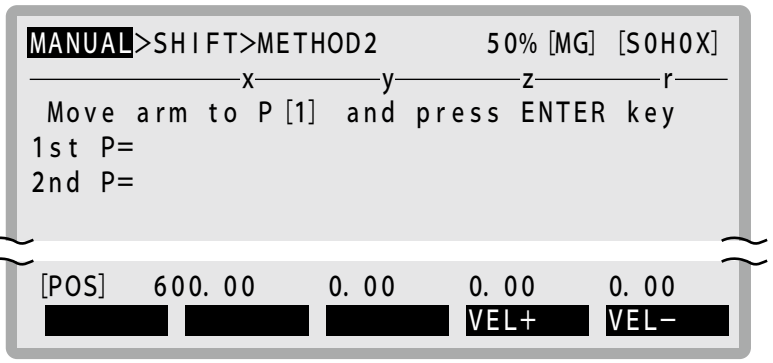
When two robots (main and sub robots) are specified, check the currently selected robot group on the RPB screen.
"(MG)" indicates the main robot group is selected, and "(SG)" indicates the sub robot group is selected. To change the robot group, use ROBOT (LOWER + MODE).

Step 1 ***In "MANUAL>SHIFT" mode, select the shift coordinate number with the cursor (▲ / ▼) keys.***

Step 2 ***Press F7 (METHOD2)***

"MANUAL>SHIFT>METHOD2" mode is entered.

Shift coordinate setting method 2 (2)



Step3 ***Use the Jog keys to move the robot arm tip to teach point 1. (Position it accurately.)***

Position the robot arm tip accurately.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

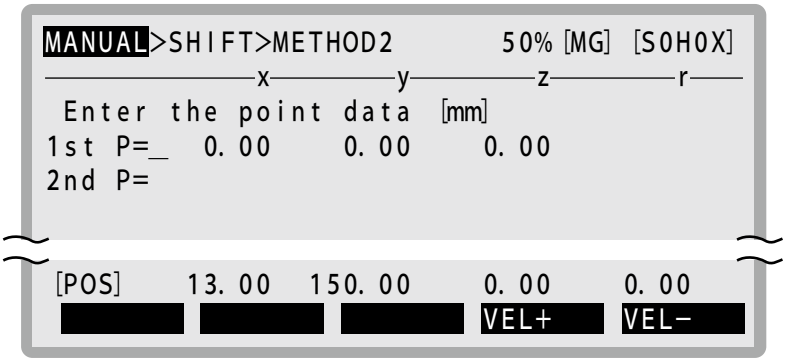
NOTE

Perform teaching carefully to obtain accurate teach points. Precise shift coordinates cannot be set if the teach point is inaccurate.

Step4 ***Press ENTER to obtain the current position as "1st P".***

An edit cursor appears at the head of the "1st P" line.

Shift coordinate setting



Step5 ***Use 0 to 9 , + , − , . and SPACE to enter the point data (x, y, z) and press ENTER.***

NOTE

Enter all point data (x, y, z) (x, y). If omitted, "0" will be automatically entered for that axis.

CAUTION

If teach points and input points are not accurately determined, calculation results will be inaccurate, so always determine these points correctly.

Step6 ***Determine teach point 2 with the same procedure as for teach point 1.***

NOTE

The Z-direction shift value is automatically obtained when teach point 1 is determined, so the Z-axis data at teach point 2 is ignored.

Step 7 *Finish setting the shift coordinates.*

When the teach point 2 has been entered, the shift coordinates (dX, dY, dZ and dR) are automatically calculated and stored.
The screen then returns to "MANUAL>SHIFT" mode.

Valid keys and submenu descriptions in "MANUAL>SHIFT>METHOD2" mode are shown below.

Valid keys		Menu	Function
F4		VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5		VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	*1	UNITCHG	Switches between the current display units (mm or pulses).
F9	*1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	*1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.

*1: To use F8 to F10, press F8 F3 F13 to F10 F5 F15 while holding down UPPER.

11.6 Displaying, editing and setting hand definitions

Press F7 (HAND) in "MANUAL" mode to enter "MANUAL>HAND" mode. This mode allows you to display, edit and set hand definitions. However, the standard coordinates must be set when a SCARA robot is used. Refer to "11.10 Setting the standard coordinates" for details.
Hand definitions cannot be used with MULTI type robots.



NOTE

When two robots (main and sub robots) are specified, hand definitions data cannot be shared between them. The main robot uses H0 - H3, and the sub robot H4 - H7 for hand definition data.

Four kinds of hand definitions can be set to change the robot working points with standard coordinate settings to the working points of the hand installed to the 2nd arm (Y-axis) or the R-axis. This function allows movement using different hands towards point data in the same Cartesian coordinate format.

Data format for hand definition

Hn= ±aaaaaa ±bbbbbb ±cccccc [R]
(main robot : n = 0 to 3 / sub robot : n = 4 to 7)

1st parameter : ±aaaaaa
Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point, or an integer of up to 7 digits (depending on the robot type setting and hand definition type).

2nd to 3rd parameters : ±bbbbbb, ±cccccc
Enter a number consisting of an integer portion of up to 5 digits and having 2 or less places below the decimal point.

4th parameter : R
Enter one character (depending on the hand definition type).

When all values for a hand definition are "0", this means the hand definition is not set.



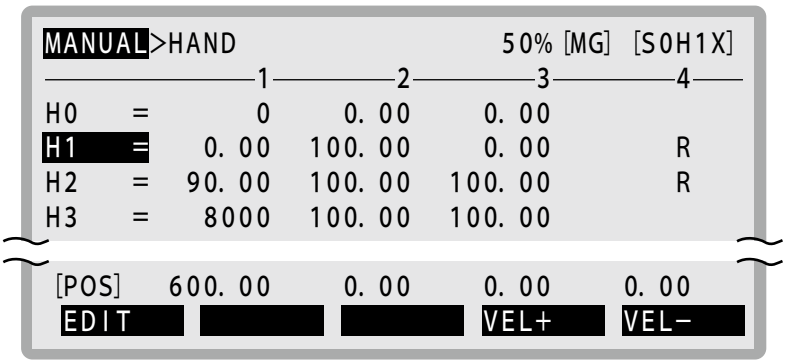
NOTE

Hand definition data cannot be used with MULTI type robots since the SHIFT/HAND selection display on the 1st line on the RPB screen appears blank.

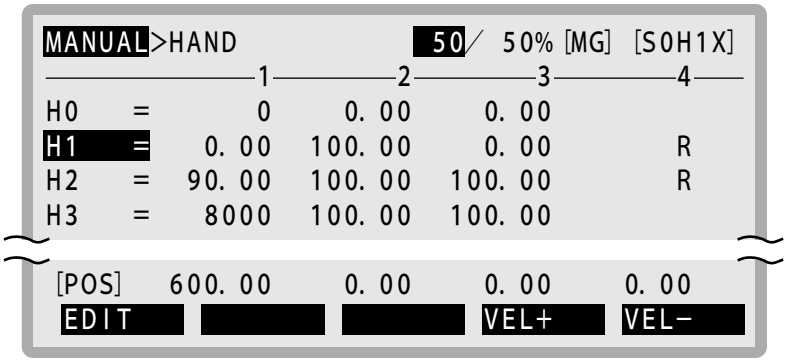
When "MANUAL>HAND" mode is entered, a screen like that shown below appears.

The currently selected hand definition number is highlighted.

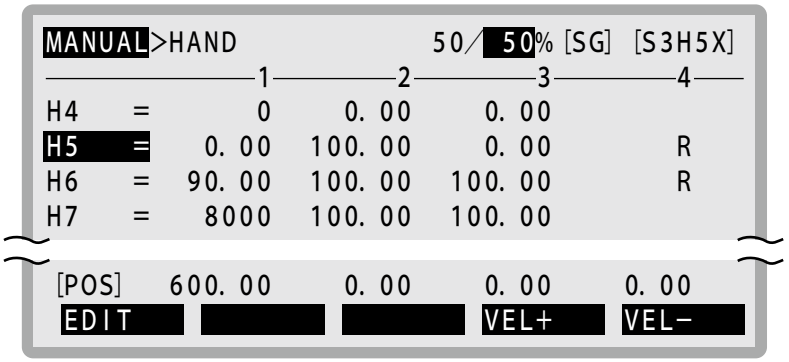
Hand definition screen (one-robot setting)



Hand definition screen (two-robot setting [1])
Main robot group is selected:



Hand definition screen (two-robot setting [2])
Sub robot group is selected:



Valid keys and submenu descriptions in "MANUAL>HAND" mode are shown below.

Valid keys	Menu	Function
▲ / ▼		Specifies the hand definition number.
F1	EDIT	Edits the hand definition.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F6 *1	METHOD1	Makes setting 1 for hand coordinates.
F8 *1	UNITCHG	Switches between the current display units (mm or pulses).
F9 *1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.
ROBOT *2		Switches the robot group.

*1: To use F6 or F8 to F10, press F1 (F11) or F3 (F13) to F5 (F15) while holding down UPPER.

*2: To use ROBOT, press MODE (ROBOT) while holding down LOWER.

Movement of each robot type and the parameter contents are shown below.

1. SCARA robots

1) Hand attached to 2nd arm

a. Robot movement

- Imaginary 2nd arm of hand "n" moves to a specified point as if it were the actual 2nd arm.
- Imaginary 2nd arm of hand "n" determines whether the robot is in a right-handed system or left-handed system.

b. Parameter descriptions

Setting units for each parameter are shown in parentheses.

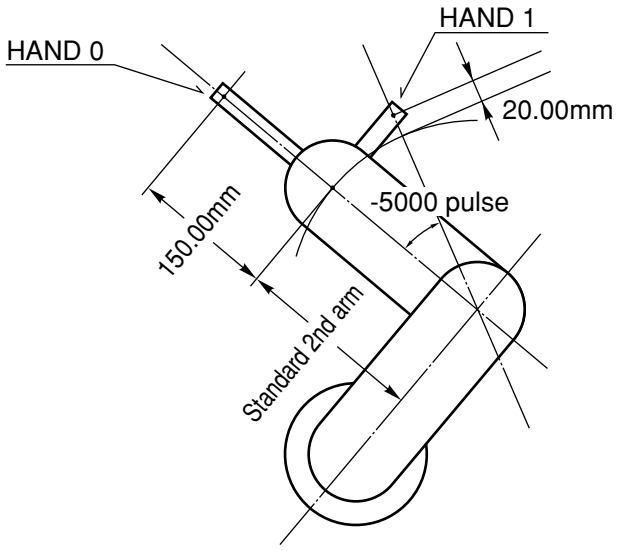
<1st parameter>: Specify with an integer, the difference between the number of offset pulses of the standard 2nd arm and the number of offset pulses of the imaginary 2nd arm of hand "n". If counterclockwise, enter a "+" value. (unit: pulses)

<2nd parameter>: Specify with a real number, the difference between the imaginary 2nd arm length of hand "n" and the standard 2nd arm length. (unit: mm)

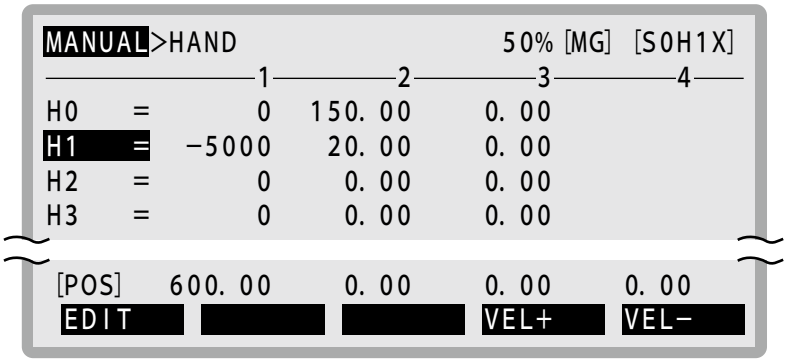
<3rd parameter>: Specify the Z-axis offset amount of hand "n" with a real number. (unit: mm)

<4th parameter>: No setting for "R".

Hands attached to 2nd arm (SCARA type) (1)



Hands attached to 2nd arm (SCARA type) (2)



2) Hand attached to R-axis

a. Robot movement

Hand "n" moves towards a specified point while changing its movement direction. The direction to be changed is set for the specified point with an R value. Obstacles can therefore be avoided by changing the R value.

b. Parameter descriptions

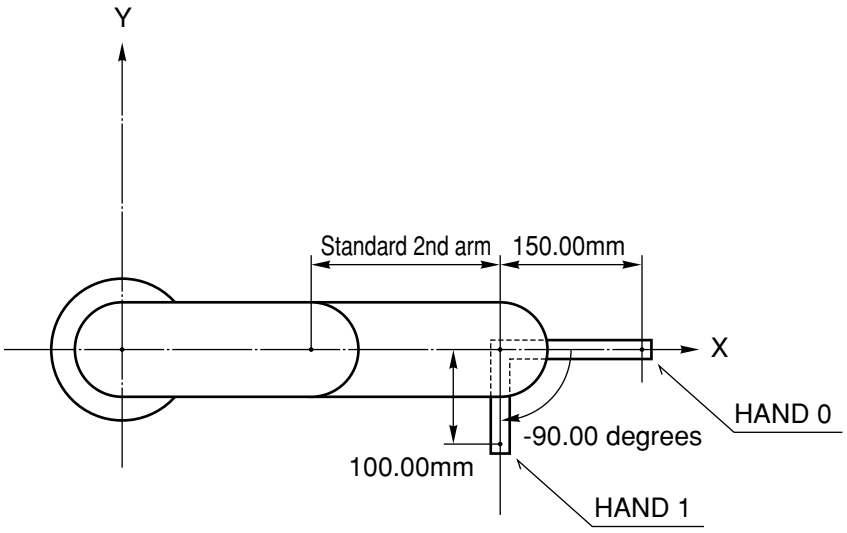
<1st parameter>: When the current R-axis position is 0.00, specify with a real number the angle between the +X direction of Cartesian coordinates and hand "n". If counterclockwise, enter a "+" value. (unit: degrees)

<2nd parameter>: Specify the length of hand "n" with a positive real number. (unit: mm)

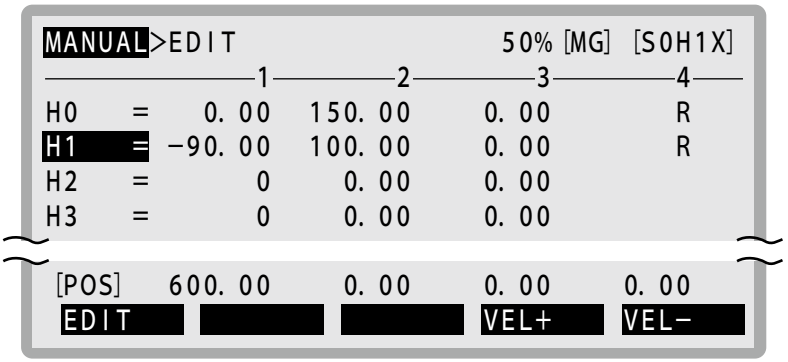
<3rd parameter>: Specify the Z-axis offset amount of hand "n" with a real number. (unit: mm)

<4th parameter>: Specify "R".

Hands attached to R-axis (SCARA type) (1)



Hands attached to R-axis (SCARA type) (2)



2. Cartesian robots

1) Hand attached to 2nd arm

a. Robot movement

Hand "n" moves to a specified point.

b. Parameter descriptions

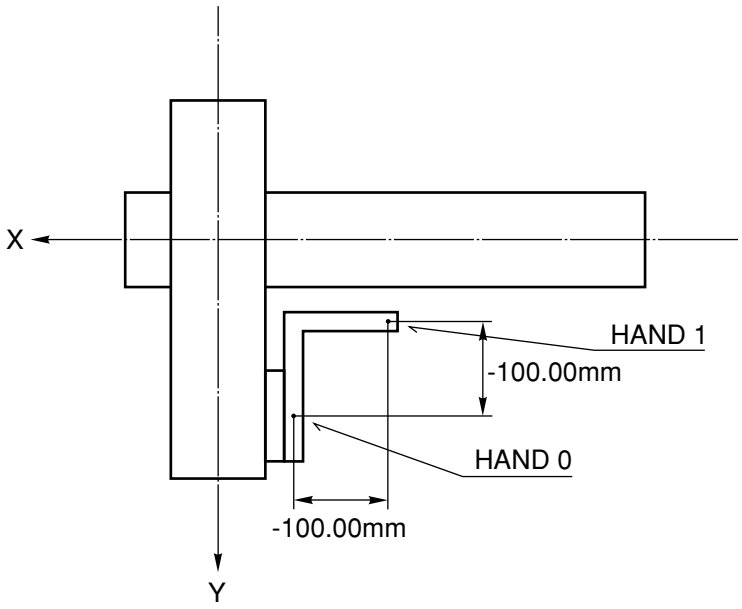
<1st parameter>: Specify the X-axis offset amount of hand "n" with a real number. (unit: mm)

<2nd parameter>: Specify the Y-axis offset amount of hand "n" with a real numbers. (unit: mm)

<3rd parameter>: Specify the Z-axis offset amount of hand "n" with a real number. (unit: mm)

<4th parameter>: No setting for "R".

Hands attached to 2nd arm (Cartesian type) (1)



Hands attached to 2nd arm (Cartesian type) (2)



2) Hand attached to R-axis

a. Robot movement

Hand "n" moves towards a specified point while changing its movement direction. The direction to be changed is set for the specified point with an R value. Obstacles can therefore be avoided by changing the R value.

b. Parameter descriptions

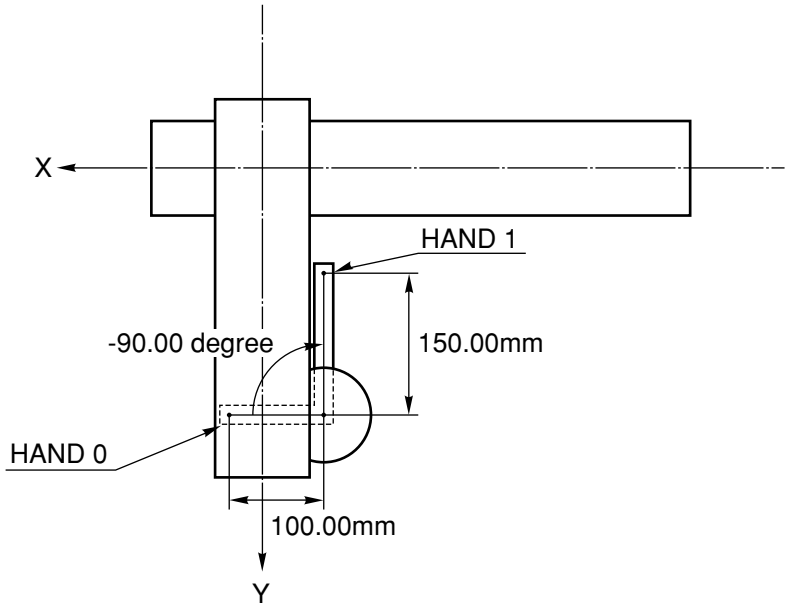
<1st parameter>: When the current R-axis position is 0.00, specify with a real number the angle between the +X direction of Cartesian coordinates and hand "n". If counterclockwise, enter a "+" value. (unit: degrees)

<2nd parameter>: Specify the length of hand "n" with a positive real number. (unit: mm)

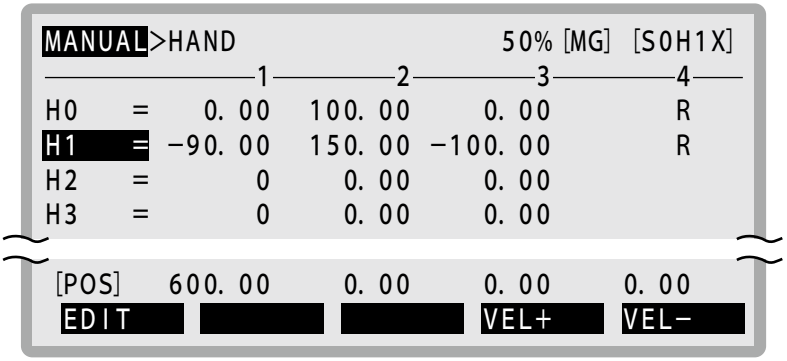
<3rd parameter>: Specify the Z-axis offset amount of hand "n" with a real number. (unit: mm)

<4th parameter>: Specify "R".

Hands attached to R-axis (Cartesian type) (1)



Hands attached to R-axis (Cartesian type) (2)



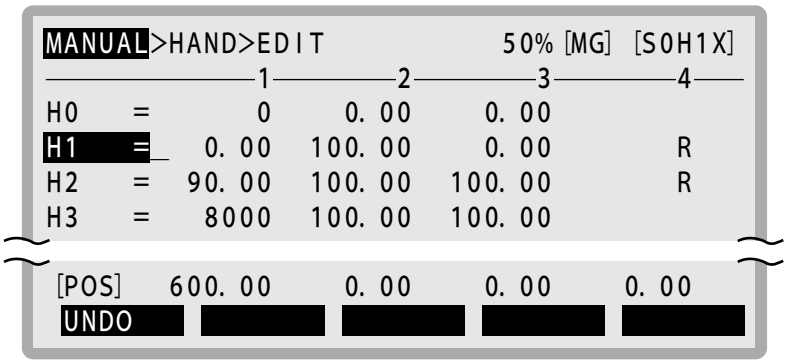
11.6.1 Editing hand definitions

Step 1 ***In "MANUAL>HAND" mode, press*** F1 ***(EDIT).***

Step 2 ***Use the cursor (▲ / ▼) keys to select the hand definition you want to edit.***

An edit cursor appears at the left end of the selected hand definition line.

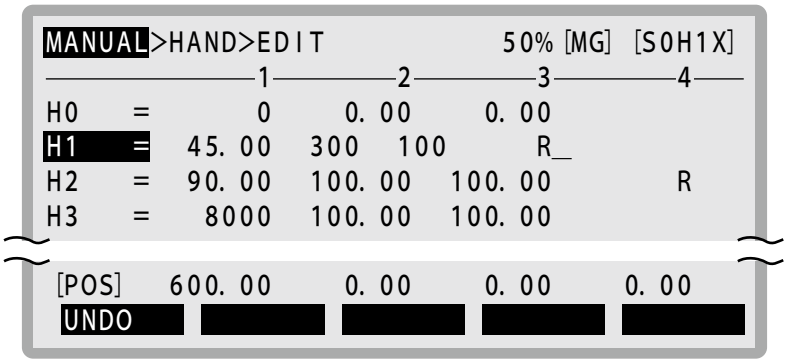
Hand editing screen (1)



Step 3 ***Use the cursor (◄ / ►) keys to move the cursor to the position you want to edit.***

Step 4 ***Use*** 0 ***to*** 9 **,** + **,** − **,** . **,** SPACE **,** R **and** ENTER ***to enter the data.***

Hand editing screen (2)



Step 5 ***Pressing*** ENTER ***or cursor up/down (▲ / ▼) keys completes the hand definition settings.***

Press ESC *if you want to cancel the settings.*

Step6 ***To continue editing, repeat steps 2 to 4.***

Step7 ***Press ESC to quit editing and return to "MANUAL>HAND" mode.***

NOTE

The hand definition data with which the cursor was positioned when returning to "MANUAL>HAND" mode is used as the current hand definition.

Valid keys and submenu descriptions in "MANUAL>HAND>EDIT" mode are shown below.

Valid keys	Menu	Function
F1	UNDO	Reverses the last data input and restores the preceding data.

11.6.1.1 Restoring hand definitions

During hand definition editing, pressing F1 (UNDO) reverses the last data input and restores the preceding data.
This function is enabled only on lines that are not yet complete.

11.6.2 Hand definition setting method 1

By using this method, a hand attached to the 2nd arm can be set to the current hand definition.

NOTE

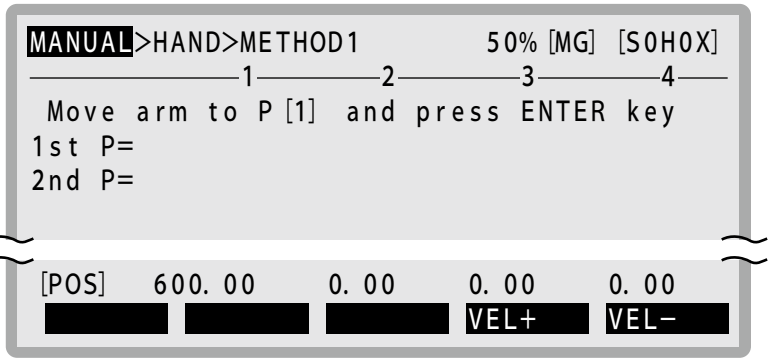
- Cartesian and SCARA robots use mutually different methods for making settings.
  Cartesian robots
  Hand definition data is set by teaching the identical points that are used for hand working points and non-hand working points.
  SCARA robots
  Hand definition data is set by teaching the identical points that are used at working points for right-handed and left-handed systems.
- When two robots (main and sub robots) are specified, check the currently selected robot group on the RPB screen. "(MG)" indicates the main robot group and "(SG)" the sub robot group. Switch the robot group with the ROBOT (LOWER + MODE) as needed.

Step 1 ***In "MANUAL>HAND" mode, use the cursor (▲ / ▼) keys to select the hand definition number.***

Step 2 ***Press F6 (METHOD1)***

"MANUAL>HAND>METHOD1" mode is entered.

Hand setting 1 (1)



Step 3 ***Use the Jog keys to move the robot working point to point 1.***

Position the robot at point 1 accurately.

WARNING

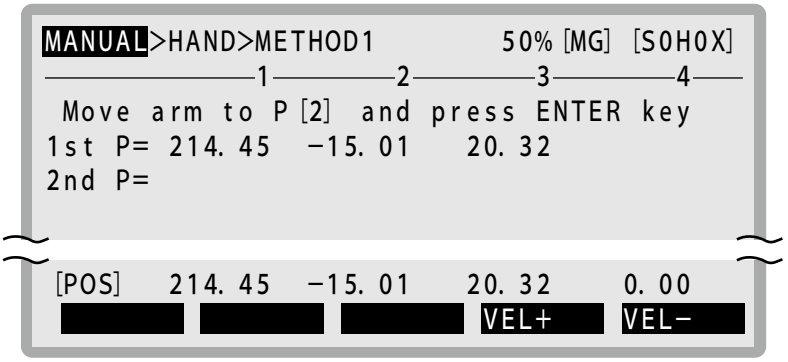
THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

To perform teaching at point 1 with a SCARA robot, always move in the right-hand system.
To perform teaching at point 2 with a SCARA robot, always move in the left-handed system.

Step4 *Press ENTER to enter the teaching value.*

Hand setting 1 (2)



Step5 *Use the Jog keys to move the robot working point to point 2.*

Position the robot at point 2 accurately.

NOTE

- When teach point 1 is obtained, the Z direction shift value is automatically determined.
- If the ESC was pressed during hand definition or hand definition was not calculated, the input data returns to the preceding value.
- If teach points are not accurately determined, the hand definition will be inaccurate, so always determine these points correctly.

Step6 *Press ENTER to enter the teaching value.*

The hand definition setting ends and the screen returns to "MANUAL> HAND" mode.

Valid keys and submenu descriptions in "MANUAL>HAND>METHOD1" mode are shown below.

Valid keys		Menu	Function
F4		VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5		VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F8	*1	UNITCHG	Switches between the current display units (mm or pulses).
F9	*1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10	*1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.

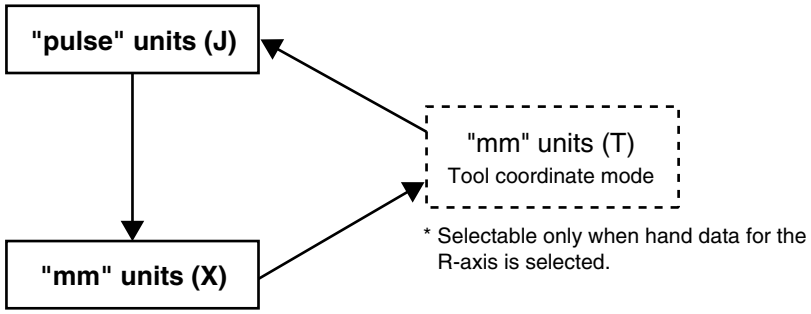
*1: To use F8 to F10, press F8 F3 F13 to F10 F5 F15 while holding down UPPER.

11.7 Changing the display units

The units used to indicate the current position on the RPB screen can be switched to either "pulses" and "mm". If hand data for the R-axis is selected (hand definition is made), then "Tool coordinate" mode can also be used.

- In "MANUAL" mode, pressing F8 (UNITCHG) switches the units used to indicate the current position.
- Each time the key is pressed, the units displayed on the upper right of the RPB screen are switched to "X" or "J" or "T". However, "T" (Tool coordinate mode) can be selected only when hand data for the R-axis is selected (hand definition is made),

Switching the display units



- "mm" units (Cartesian coordinates)
  Displays the current position with a number consisting of an integer and a decimal fraction.
- "pulse" units (joint coordinates)
  Displays the current position with an integer.

Robot manual movement with Jog keys differs depending on the currently selected display units. For more details, refer to "11.1 Manual movement" in this chapter.

11.8 Return-to-origin

After the power to the controller is turned on, return-to-origin must be performed before starting robot operation. When return-to-origin is performed, the robot arms move to their mechanical origin positions and the position data in the controller is reset.
Return-to-origin must be performed on incremental type axes. On semi-absolute type axes, an absolute search (also called absolute reset) is performed by return-to-origin operation (see 11.8.2).

The following parameters are for return-to-origin operation. For more details on each parameter, refer to items described in "12.1 Parameters" of Chapter 4.

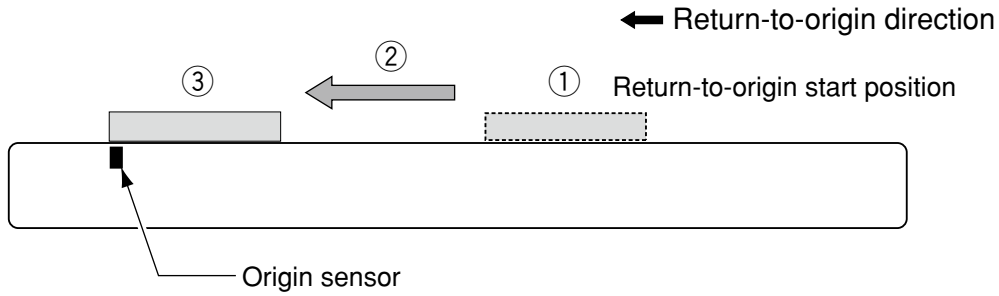
Category	Parameter name	Description
Robot parameter	Origin sequence	Sets the order in which to perform return-to-origin or absolute search on each axis.
Axis parameter	Origin speed	Sets the speed at which to perform return-to-origin or absolute search.
	Origin shift	Sets the offset of origin position data.
	Origin method	Sets the method for performing return-to-origin or absolute search.
	Origin direction	Sets the direction for performing return-to-origin or absolute search.

11.8.1 Return-to-origin operation

Return-to-origin methods include the sensor method and stroke end detection method.
Each return-to-origin method is described below.
Refer to "11.8.3 Return-to-origin procedure" for instructions on how to perform returnto-origin.

1. Return-to-origin operation using the sensor method

Return-to-origin operation using the sensor method



①Before performing return-to-origin, check that all axes are in positions that allow return-to-origin.

Return-to-origin direction	Position allowing return-to-origin
Minus (-) direction	Plus (+) side from origin sensor position
Plus (+) direction	Minus (-) side from origin sensor position

②Upon starting return-to-origin, the robot starts moving in the return-to-origin direction. However, if the origin sensor was on when return-to-origin was started, then the robot first moves in a direction opposite the return-to-origin direction. Then, when the origin sensor turns off, the robot stops and restarts return-to-origin from that position.

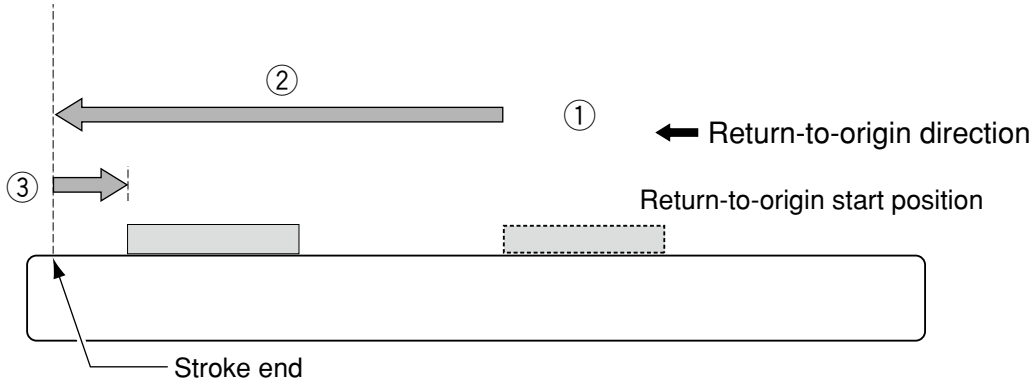
③After the origin sensor turns on, the robot stops and the origin position is then found. At this point, the position where the robot stopped is set as an origin shift parameter value.

NOTE

In the sensor method, if return-to-origin is started with the origin sensor turned on and continues without the origin sensor being turned off, then an error "17.21:Bad origin sensor" will occur.

2. Return-to-origin operation using the stroke end detection method

Return-to-origin operation using the stroke end detection method



①In the stroke end detection method, return-to-origin can start from any position.

②Upon starting return-to-origin, the robot starts moving in the return-to-origin direction.

③When the robot arm lightly strikes and detects the stroke end (mechanical stop), it moves back slightly and stops, and the origin position has now been found. At this point, the position where the robot stopped is set as an origin shift parameter value.

CAUTION

During stroke end detection, if the robot arm movement is obstructed or a load is applied to the robot arm during return-to-origin, the stroke end might not be detected accurately so return-to-origin ends at an incorrect position. If return-to-origin is interrupted while the robot arm is still contacting the stroke end, then an error "17.4:D?, Overload" might occur.

11.8.2 Semi-absolute

"Semi-absolute" is the name for a simple absolute scale used in the YAMAHA linear single-axis robot PHASER series. Robots with this simple absolute scale have a quick absolute search function that utilizes our unique method to automatically perform an absolute search on the position detection scale when return-to-origin starts. This function allows detecting the absolute position with just a minimal movement.
Using this scale drastically reduces the time needed for return-to-origin operation by PHASER series robots, especially those with long-stroke movements.

■ Absolute search

Absolute search (also called "absolute reset") includes the sensor method and stroke end detection method. Absolute search movement differs depending on the robot position from which absolute search starts. (In the sensor method, absolute search movement depends on whether the origin sensor turns on during absolute search. In the stroke end detection method, absolute search movement depends on whether or not the stroke end is detected during absolute search.)
After the absolute search is complete, the origin position is set to zero position on the simple absolute scale.

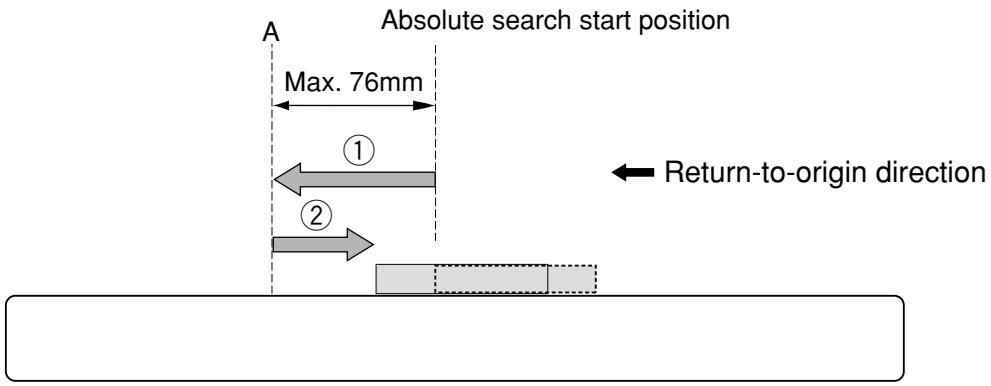
NOTE

Zero position can be shifted by using the "Origin shift" parameter of the axis parameters.

Refer to "11.8.3 Return-to-origin procedure" for instructions on how to perform return-to-origin.

- **Sensor method: When the origin sensor does not turn on during absolute search**
- **Stroke end detection method: When the stroke end is not detected during absolute search**

Absolute search (1)

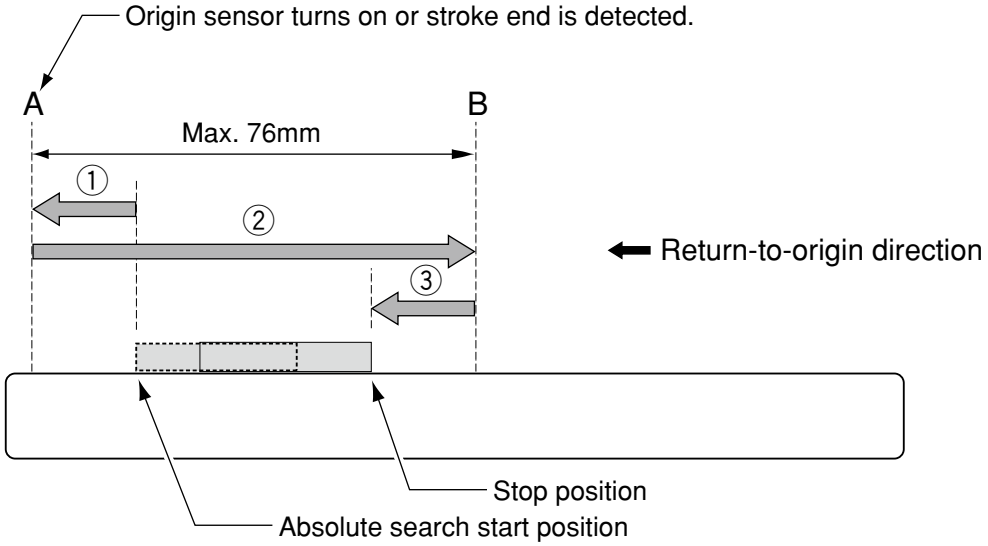


①Upon starting return-to-origin, the robot moves in the return-to-origin direction to start an absolute search.
The robot moves to a maximum position A. The maximum distance that the robot can move to position A from the absolute search start position is 76mm.

②The robot moves back from position A, determines the current position, and then stops. The stop position does not exceed the absolute search start position.

- **Sensor method: When the origin sensor turns on during absolute search**
- **Stroke end detection method: When the stroke end is detected during absolute search**

Absolute search (2)



①Upon starting return-to-origin, the robot moves in the return-to-origin direction to start an absolute search.

NOTE

If the origin sensor was on when the robot was at the absolute search start position, the robot moves in a direction opposite the return-to-origin direction to perform an absolute search. (The robot moves from ②.)

②In the sensor method, when the origin sensor turns on (position A), the robot moves back toward position B. In the stroke end detection method, when stroke end is detected (position A), the robot moves back toward position B. At this point, the maximum distance that the robot moves from position A to position B is 76mm.

CAUTION

During stroke end detection, if absolute search operation is interrupted while the robot arm is still contacting the stroke end, then an error "17.4:D?, Overload" might occur.

③The robot again moves in the return-to-origin direction, determines the current position, and then stops. The stop position will be between position A and position B.

11.8.3 Return-to-origin procedure

The robot must be at servo-on to perform return-to-origin on incremental type axes using the stroke end detection method or sensor method for return-to-origin. Likewise, the robot must be at servo-on to perform an absolute search on semi-absolute type axes.

CAUTION

Before performing return-to-origin, check that incremental type axes are in positions that allow return-to-origin operation.

WARNING

THE ROBOT STARTS MOVING AS SOON AS RETURN-TO-ORIGIN IS PERFORMED. TO AVOID HAZARDOUS SITUATIONS, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

CAUTION

Emergency stop might be triggered if return-to-origin or absolute search 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 or absolute search is simultaneously performed on two axes or is performed separately on each axis.

NOTE

When two robots are specified, return-to-origin is first performed on the main group and then on the sub group.

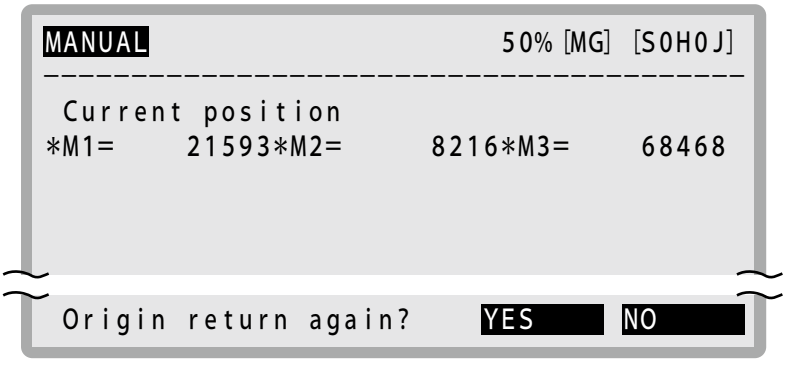
Step 1 ***In "MANUAL" mode, press F3 (ORIGIN).***

A confirmation message appears on the guideline.

Press F4 (YES) to perform return-to-origin.

Press F5 (NO) to cancel return-to-origin.

Return-to-origin procedure (1)



To stop the return-to-origin operation, press the STOP.

In this case, the message "0.14: Stop executed" appears on the message line.

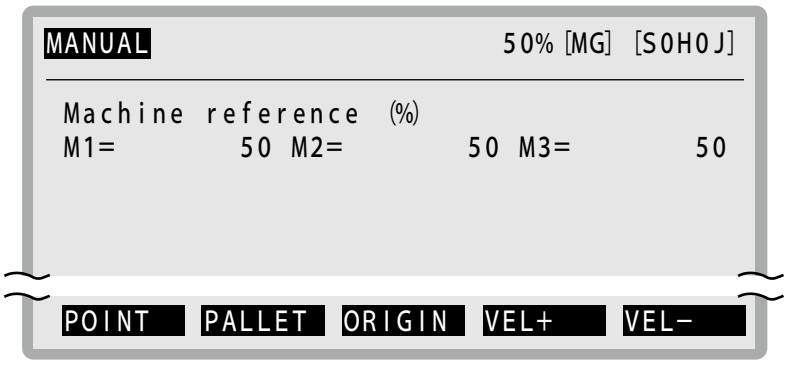
Step2 *Check the machine reference.*

After return-to-origin (absolute search on semi-absolute type axes) is complete, the machine reference on each axis is displayed. Check that the machine reference is within the allowable range.

NOTE

- Refer to "11.8.1 Return-to-origin operation" for details on return-to-origin operation, and refer to "11.8.2 Semi-absolute" for details on absolute search operation.
- The machine reference is expressed as a percentage of the number of encoder pulses showing the difference between the origin sensor signal and position detector reference signal (encoder zero signal, etc.). This is also called the "grid position" or "grid pulse".

Return-to-origin procedure (2)



Step3 *Check the message line display.*

When return-to-origin on all axes is complete, the dashed line (- - - -) on the message line changes to a solid line (——) indicating that return-to-origin is now complete. Then, pressing an axis movement key displays the current position on each axis.
When origin incomplete status cannot be cancelled, this means that absolute type axes exist and absolute reset has not yet been completed on those axes. Perform absolute reset on those axes.

NOTE

Once return-to-origin is completed, the origin position is retained until the controller power is turned off or system parameters are changed. So it is not necessary to re-perform return-to-origin even after using emergency stop.

11.9 Absolute reset

Absolute reset is an operation to find the origin position, when the position detector in the motor cannot identify the origin position (called "origin incomplete" from now on).
Movement commands in robot language cannot be executed if the origin is incomplete. Always perform absolute reset if the origin is incomplete.
Origin incomplete may occur due to the following conditions.

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.

NOTE

- Basically, use the RPB (programming box) to perform absolute reset.
- Absolute reset can also be performed by dedicated input. However, this technique is limited to axes using the stroke end method or sensor method for detecting the origin. This dedicated input technique will also not work if origin incomplete occurs on axes set by the mark method.

a. An absolute-related error occurred on the axis.
17.73:D?.Resolver wire breakage
17.91:D?.Cannot perform ABS.reset etc.

b. Absolute battery wire breakage or voltage drop was detected by the controller.

c. Cable connecting to the robot unit from the robot Controller was disconnected. (This is the status when shipped from the factory.)

d. Robot generation was changed.

e. Parameters were initialized.

f. Axis-related parameters such as "Origin shift", "Origin detection method" and "Origin return direction" and "Axis polarity" were changed. (This occurs when some parameters were changed.)

g. Motor was replaced.

h. All data files (data file with extension "ALL") or parameter files (data files with extension "PRM") were written into the robot controller.

Origin incomplete errors are listed below. These errors occur during startup of the robot controller.

17.81:D?.ABS.battery wire breakage
17.83:D?.Backup position data error 1
17.85:D?.Backup position data error 2
17.92:D?.Resolver disconnected during power off
17.93:D?.Position backup counter overflow etc.

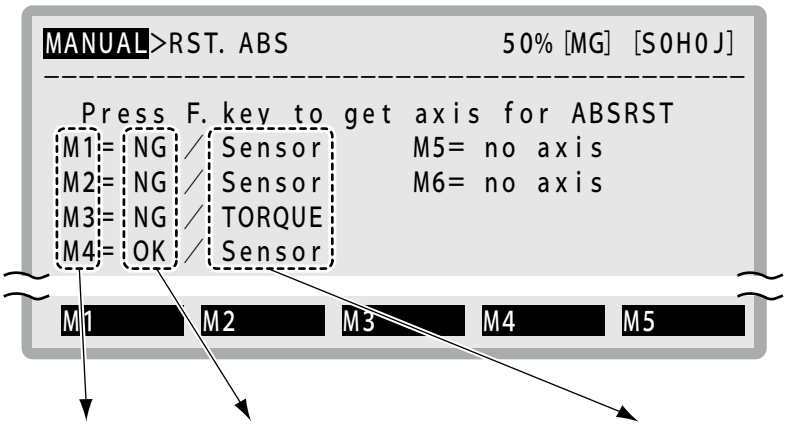
11.9.1 Checking absolute reset

To check the absolute reset status of each axis on the controller, press F13 (RST.ABS) in "MANUAL" mode. The "MANUAL>RST.ABS" mode screen appears as shown below. Check the absolute reset status of each axis.

1. When all axes are absolute type axes:

Checking absolute reset status (when all axes are absolute type axes)

This screen shows the following information.



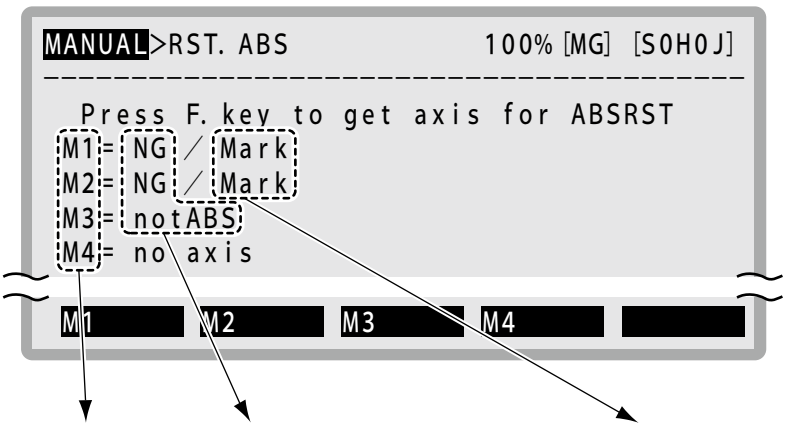
Axis	Absolute Reset Status	"Origin method" of Axis Parameter
Axis 1	Origin incomplete	Sensor method
Axis 2	Origin incomplete	Sensor method
Axis 3	Origin incomplete	Stroke end method
Axis 4	Return-to-origin complete	Sensor method
No axis		

The above RPB screen shows the return-to-origin is incomplete on axis 1, axis 2 and axis 3 but complete on axis 4. The robot controller is in origin incomplete status, since not all axes performed return-to-origin.

2. When both absolute and incremental type axes exist:

Checking absolute reset status
(when both absolute and incremental type axes exist)

This screen shows the following information.



Axis	Absolute Reset Status	"Origin method" of Axis Parameter
Axis 1	Origin incomplete	Mark method
Axis 2	Origin incomplete	Mark method
Axis 3	Incremental type axis	
No axis		

The above RPB screen shows the return-to-origin is incomplete on axis 1 and axis 2, and axis 3 is an incremental type axis which requires a return-to-origin operation to be performed. (Refer to "11.8 Return-to-origin". When return-to-origin has been performed on all axes including the incremental axis, the return-to-origin is complete.

Valid keys	Menu	Function
F1	M1	Performs absolute reset on axis 1.
F2	M2	Performs absolute reset on axis 2.
F3	M3	Performs absolute reset on axis 3.
F4	M4	Performs absolute reset on axis 4.
F11 *1	ALL	Performs absolute reset on all axes.

*1: To use F11, press F6 F1 F11 while holding down LOWER.

* Valid key menus differ depending on the sub robot or auxiliary axis settings.

11.9.2 Absolute reset on each axis

This section explains how to perform absolute reset of each axis using the robot controller. The absolute reset method differs depending on the following settings for the "Origin detection method" parameter.

1. Mark method
2. Stroke end or sensor method

NOTE

When the mark method is used as the origin detection method, absolute reset is impossible unless the machine reference is between 44 to 56%.

1. When the mark method is used as the origin detection method:

Return-to-origin is not performed on an axis using the mark method. So use the movement keys while in servo-on, or direct movement while in servo-off, to move to a position where absolute reset can be performed.

WARNING

THE ROBOT STARTS TO MOVE WHEN A MOVEMENT KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Valid keys	Menu	Function
F1	ADJ+	Moves the selected axis in the plus direction to the first position where absolute reset is possible.
F2	ADJ-	Moves the selected axis in the minus direction to the first position where absolute reset is possible.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F9 *1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.

*1: To use F9 to F10, press F4 (F9) to F5 (F10) while holding down UPPER.

■ Key operations to move to a position where absolute reset is possible

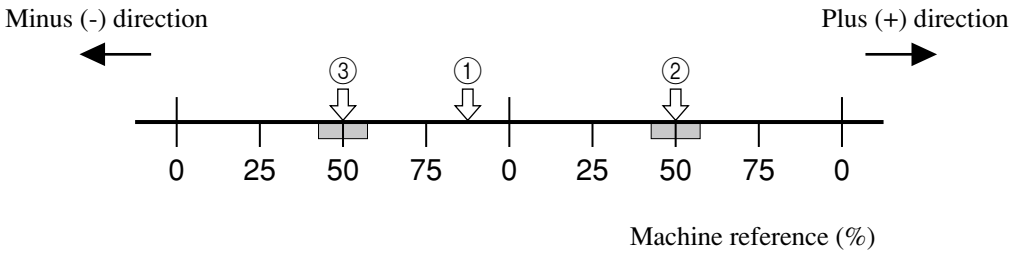
For instance, when the current axis position is ① (machine reference: 82%):

Press F1 (ADJ. +), and the axis moves to ② and the machine reference will change to around 50%. (Absolute reset is now possible.)

or

Press F2 (ADJ. -), and the axis moves to ③ and the machine reference will change to around 50%. (Absolute reset is now possible.)

Key operations to move to a position where absolute reset is possible



: Range in which absolute reset can be made (44 to 56%).

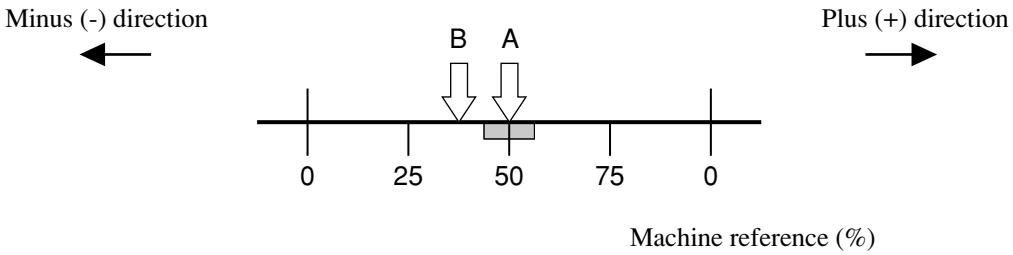
■ Absolute reset position and "0" pulse position

When absolute reset is performed at position A, position B (machine reference 38%) is reset as the "0" pulse position. This means that the robot will move to the "0" pulse position after performing absolute reset with the servo turned on.

WARNING

THE ROBOT STARTS TO MOVE SLIGHTLY WHEN ABSOLUTE RESET IS PERFORMED WHILE THE SERVO IS ON. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Absolute reset position and "0" pulse position

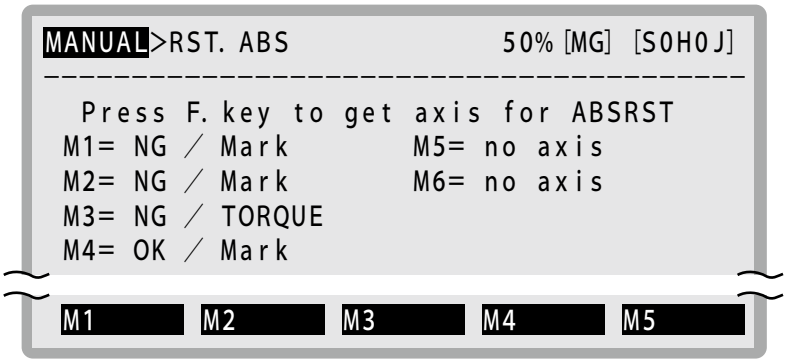


: Range in which absolute reset can be made (44 to 56%).

Step 1 *In "MANUAL>RST.ABS" mode, press F1 (M1) to F4 (M4).*

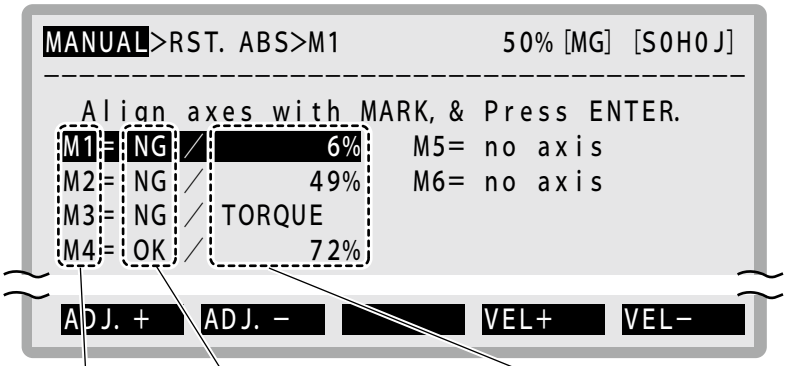
The absolute reset mode for each axis is entered. The selected axis is highlighted.

Absolute reset of each axis (mark method) (1)



Absolute reset of each axis (mark method) (2)

This screen shows the following information.



Axis	Absolute Reset Status	Machine Reference Setting(%)
Axis 1	Origin incomplete	6
Axis 2	Origin incomplete	49
Axis 3	Origin incomplete	Stroke end method
Axis 4	Return-to-origin complete	72
No axis		

Step2 Move the robot axis to a position where absolute reset can be performed.

- **In Servo-ON**

  Use the Jog keys or F1 (ADJ.+) and F2 (ADJ.-) to move the selected axis to a position where absolute reset is possible. Set so that the machine reference is within a range of 44 to 56%.

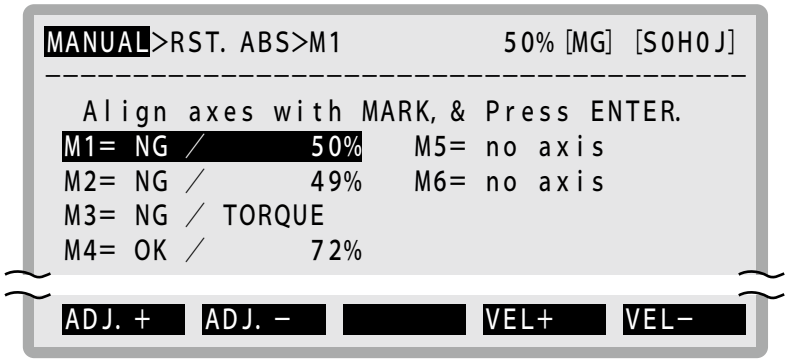
WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY OR MOVEMENT KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

CAUTION

An error message, "17.91:D?.Cannot perform ABS.reset" appears if the machine reference is not within a range of 44 to 56%. The absolute reset operation then terminates as an error.
If the robot controller is in origin incomplete due to some kind of problem perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

Absolute reset of each axis (mark method) (3)



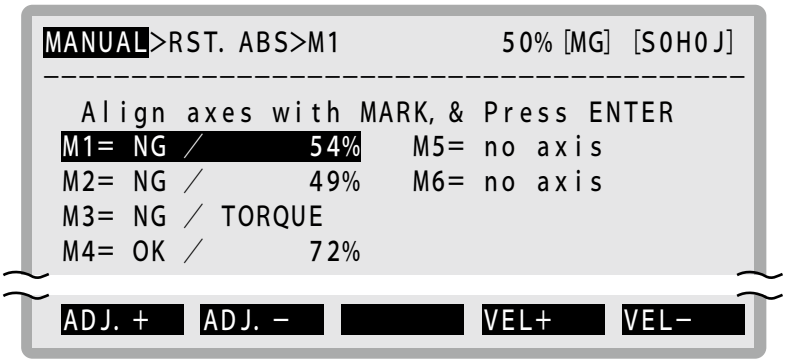
- **In Servo-OFF**

  Check that the emergency stop button on the RPB is on, and move the selected axis by direct movement to a position for absolute reset. Set so that the machine reference is within a range of 44 to 56%.

WARNING

WHEN YOU PERFORM DIRECT TEACHING, MAKE SURE THAT THE EMERGENCY STOP BUTTON IS PRESSED SO THAT THE SERVO WILL NOT TURN ON.

Absolute reset of each axis (mark method) (4)



Step3 *Press* ENTER.

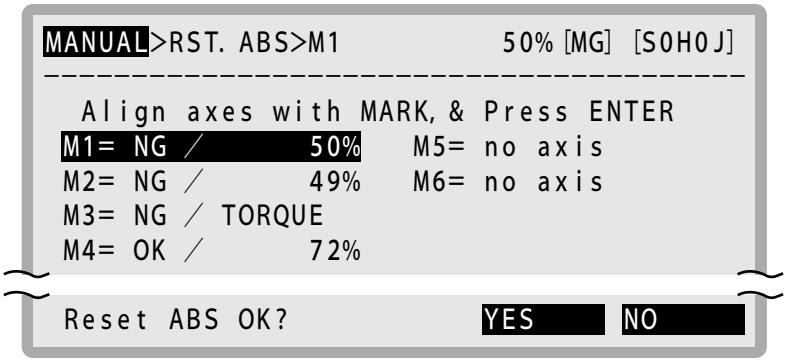
A confirmation message appears on the guideline.

Step4 *Perform absolute reset.*

Press F4 *(YES) to perform absolute reset of the selected axis.*

Press F5 *(NO) to cancel absolute reset of the selected axis.*

Absolute reset of each axis (mark method) (5)



When absolute reset is performed while the servo is on, the axis will move to the 0 pulse position after absolute reset is complete.

WARNING

THE ROBOT STARTS TO MOVE SLIGHTLY WHEN ABSOLUTE RESET IS PERFORMED WHILE THE SERVO IS ON. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Step5 *Check the message line.*

When all axes have returned to their origins, the dashed line (- - - -) on the message line changes to a solid line (——), and return-to-origin is now complete. Next, press an axis movement key and the RPB screen will display the current position of each axis.
When origin incomplete status cannot be canceled, this means an axis has still not returned to origin. So repeat the absolute reset operation.

2. When the stroke end or sensor method is used as the origin detection method:

When the selected axis uses the stroke end or sensor method, the servo must be turned on to perform return-to-origin.

WARNING

THE ROBOT STARTS TO MOVE WHEN ABSOLUTE RESET IS PERFORMED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

When the "Origin detection method" parameter is set to the stroke end method:

Each axis moves in the specified return-to-origin direction until it reaches the stroke end, and then moves back slightly in the opposite direction to a position where absolute reset is performed after checking that absolute reset is possible.

When the "Origin detection method" parameter is set to the sensor method:

Each axis moves in the specified return-to-origin direction. When the origin sensor detects the origin, the axis moves at low speed to a position where absolute reset is performed after checking that absolute reset is possible.

Step1* *In "MANUAL>RST.ABS" mode, press F1 (M1) to F4 (M4).

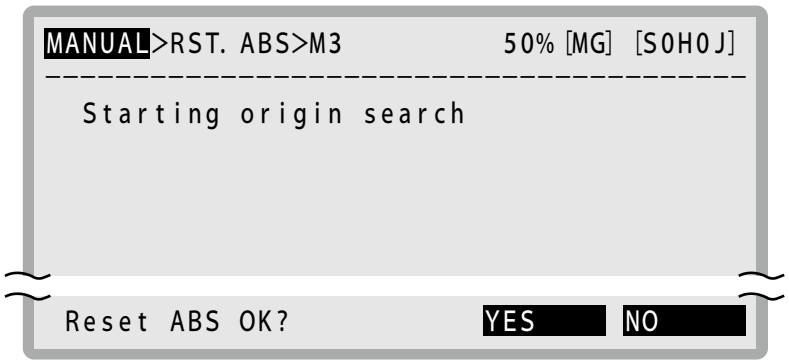
The absolute reset mode for each axis is entered. The selected axis is highlighted.

Step2* *Perform absolute reset.

Press F4 (YES) to perform absolute reset of the selected axis.

Press F5 (NO) to cancel absolute reset of the selected axis.

Absolute reset of each axis (stroke end / sensor method) (2)

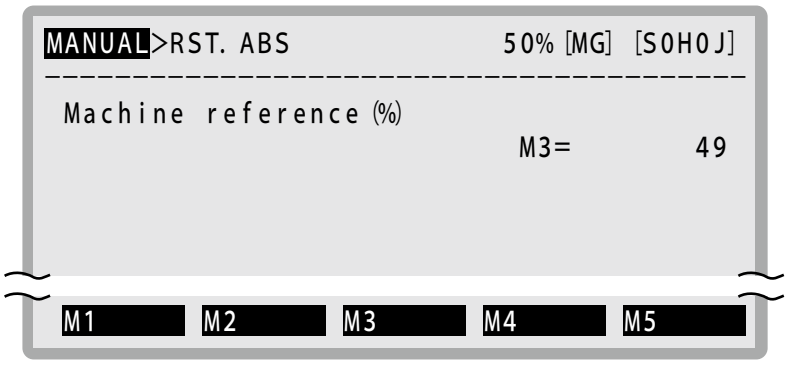


To stop the absolute reset, press STOP. In this case, the message "Origin incomplete" appears on the message line.

Step3 *Check the machine reference.*

After return-to-origin (absolute search on semi-absolute type axes) is complete, the machine reference for each axis is displayed. Check that the machine reference is within the allowable range.

Absolute reset of each axis (stroke end / sensor method) (2)



Step4 *Check the message line display.*

When all axes have returned to origin, the dashed line (- - - -) on the message line changes to a solid line (——), and return-to-origin is now complete. Then, press an axis movement key and the RPB screen displays the current position of each axis.
When origin incomplete status cannot be cancelled, this means that incremental type axes exist, but return-to-origin has not yet been completed on those axes. Perform return-to-origin on those axes.

11.9.3 Absolute reset on all axes

This section explains how to perform absolute reset on all axes of the robot controller. The sequence for performing absolute reset of the axes is given below.

1. First, perform absolute reset at the current position, on all axes that use the mark method.
2. Next, perform absolute reset according to the return-to-origin sequence on axes using the stroke end and sensor methods.

Valid keys	Menu	Function
▲ / ▼		Specifies the axis definition number.
F1	ADJ.+	Moves the selected axis in the plus direction to the first position where absolute reset is possible.
F2	ADJ.-	Moves the selected axis in the minus direction to the first position where absolute reset is possible.
F4	VEL+	Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)
F5	VEL-	Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)
F9 *1	VEL++	Increases manual movement speed for the selected robot group in 1% increments.
F10 *1	VEL--	Decreases manual movement speed for the selected robot group in 1% decrements.

*1: To use F9 to F10, press F4 (F9) to F5 (F10) while holding down UPPER.

■ Key operations to move to a position where absolute reset is possible

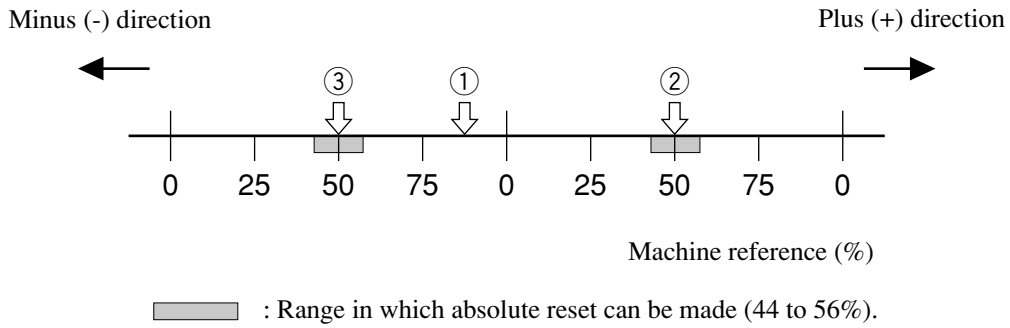
For instance, when the current axis position is ① (machine reference: 82%):

Press F1 (ADJ.+) to move to position ② and the machine reference will change to around 50%. (Absolute reset is now possible.)

or

Press the F2 (ADJ.-) to move to position ③ and the machine reference will change to around 50%. (Absolute reset is now possible.)

Key operations to move to a position where absolute reset is possible



: Range in which absolute reset can be made (44 to 56%).

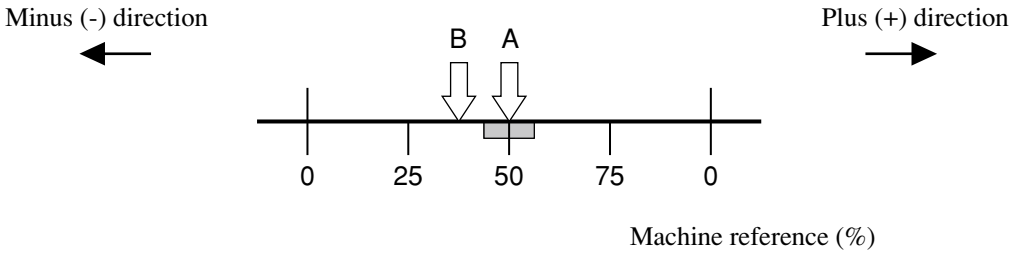
■ Absolute reset position and "0" pulse position

When absolute reset is performed at position A, the position B (machine reference 38%) is reset as the "0" pulse position. This means that the robot will move to the "0" pulse position after performing absolute reset with the servo turned on.

WARNING

THE ROBOT STARTS TO MOVE WHEN ABSOLUTE RESET IS PERFORMED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Absolute reset position and "0" pulse position

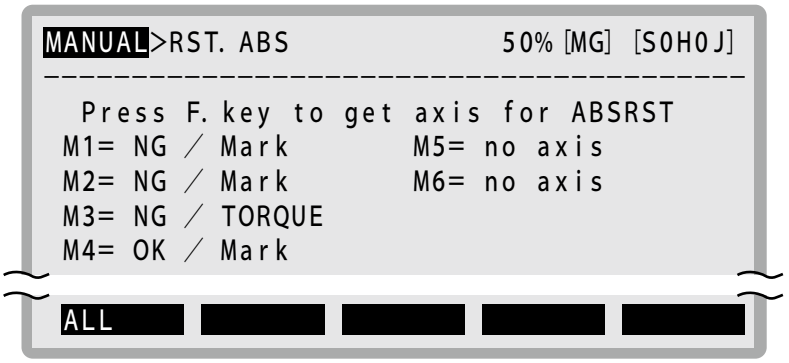


: Range in which absolute reset can be made (44 to 56%).

Step 1 ***In "MANUAL>RST.ABS" mode, press F11 (ALL).***

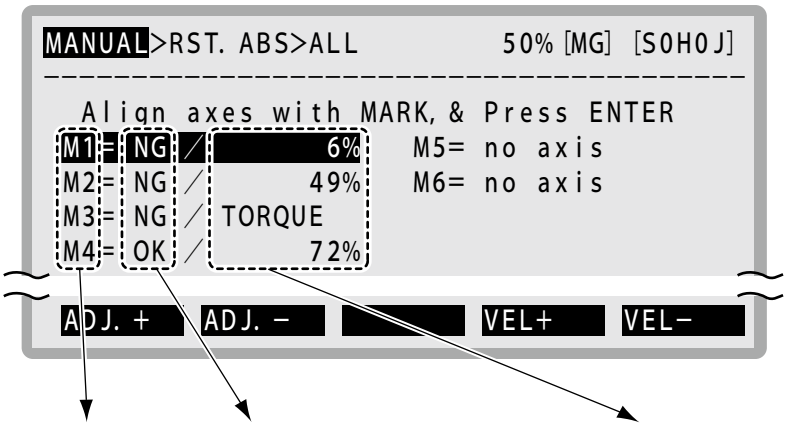
The absolute reset mode for all axes is entered. The mark method axes are highlighted.

Absolute reset of all axes (mark method) (1)



Absolute reset of all axes (mark method) (2)

This screen shows the following information.



Axis	Absolute Reset Status	Machine Reference Setting(%)
Axis 1	Origin incomplete	6
Axis 2	Origin incomplete	49
Axis 3	Origin incomplete	Stroke end method
Axis 4	Return-to-origin complete	72
No axis		

Step 2 ***Move the specified axis to a position where absolute reset can be performed.***

Use the Jog keys or F1 (ADJ.+) and F2 (ADJ.-) to move the selected axis to a position for performing absolute reset. Set at this time so that the machine reference is between 44 to 56%.

Use the cursor (▲ / ▼) keys to select each axis.

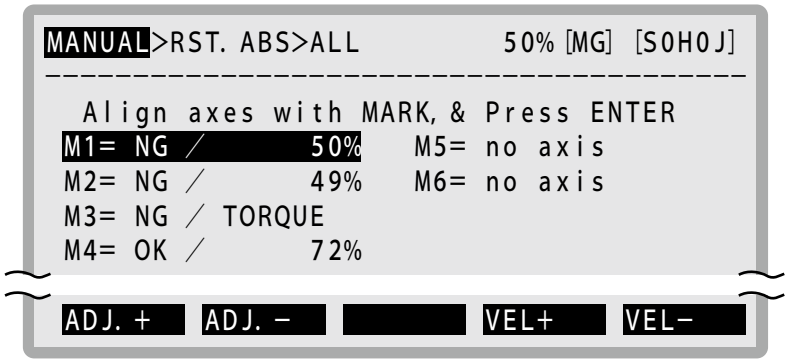
WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY OR MOVEMENT KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

When the mark method is used as the origin detection method, absolute reset is impossible unless the machine reference is between 44 to 56%.

Absolute reset of all axes (mark method) (3)



Step 3 ***Press*** ENTER.

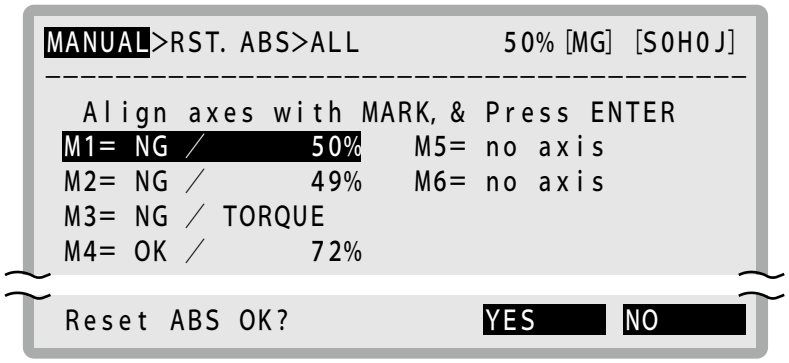
A confirmation message appears on the guideline.

Press F4 *(YES) to perform absolute reset on all axes using the mark method.*

Press F5 *(NO) to cancel absolute reset.*

If the servo is on when performing absolute reset on all axes that use the mark method, the robot will move to the "0" pulse position after reset.

Absolute reset of all axes (mark method) (4)



WARNING

THE ROBOT STARTS TO MOVE WHEN ABSOLUTE RESET IS PERFORMED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

An error message, "17.91:D?.Cannot perform ABS.reset" appears if the machine reference is not within a range of 44 to 56%. Absolute reset operation then terminates as an error.

If the robot controller is in origin incomplete due to some kind of problems, perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

Step4 *Check the message on the guideline.*

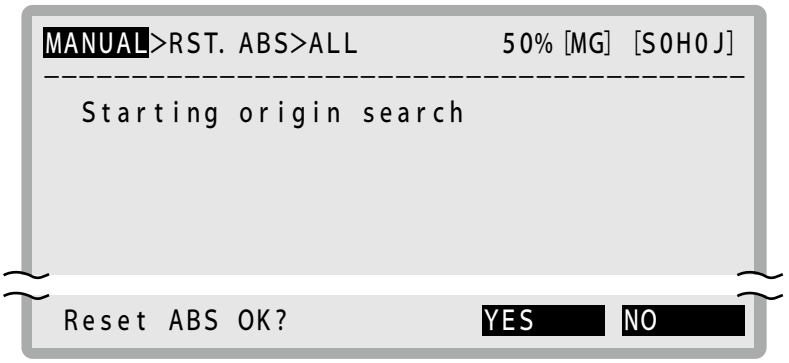
When absolute reset ends correctly on all axes using the mark method, a confirmation message appears on the guideline if axes using the stroke end or sensor methods are present.

Press F4 *(YES) to perform absolute reset on axes using the stroke end or sensor method.*

Press F5 *(NO) to cancel absolute reset on axes using the stroke end or sensor method.*

To cancel return-to-origin operation, press STOP*. In this case, the message "Origin Incomplete" then appears on the message line.*

Absolute reset of all axes (mark method) (5)



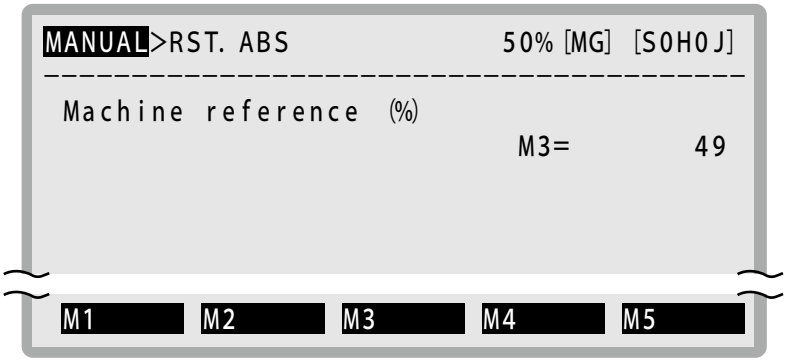
Step5 *Check the machine reference.*

After return-to-origin is complete, the machine reference for axes using the stroke end or sensor method is displayed. Check that the machine reference is within the allowable range.

CAUTION

If the robot controller is in origin incomplete due to some kind of problems, perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

Absolute reset of all axes (mark method) (6)



Step 6 *Check the message line display.*

When absolute reset of all axes ends correctly, the dashed line (- - - -)on the message line changes to a solid line (——), and return-to-origin is now complete. Next press an axis movement key and the RPB screen will display the current position of each axis.

CAUTION

If absolute reset does not end correctly after performing absolute reset on all axes, check the return-to-origin status on each axis. Then try absolute reset on all axes once again or try absolute reset on each individual axis until you can successfully set the return-to-origin.

11.10 Setting the standard coordinates

The standard coordinates set for SCARA robots are treated as Cartesian coordinates using the X-axis rotating center as the coordinate origin.
The following operations and functions are enabled on SCARA robots by setting the standard coordinates.

- Moving robot arm tip at right angles.
- Using pallet definition, SHIFT coordinates and HAND definition.
- Using commands requiring coordinate conversion (such as linear/circular interpolation and pallet movement commands).

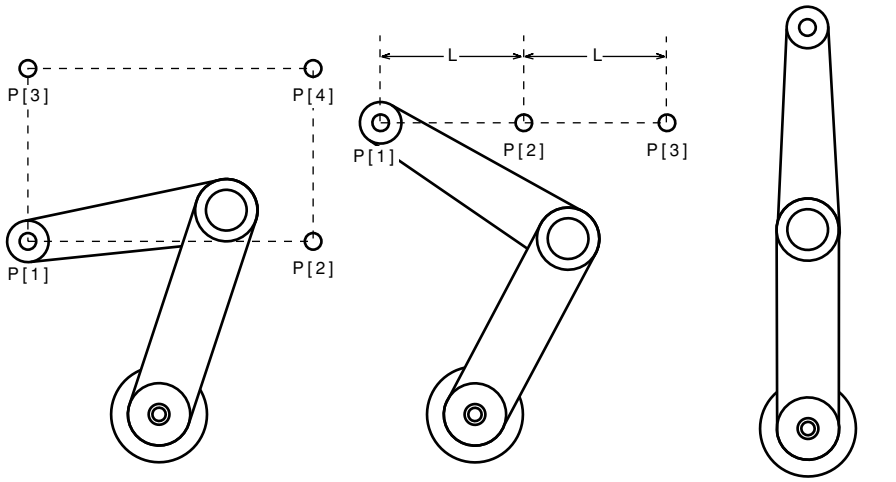
NOTE

On Cartesian type robots, there is no need to set the standard coordinates.

There are 3 methods for setting the standard coordinates.

- 4-point teaching
  This method sets the standard coordinates by using 4 teach points that form a rectangle. The first teach point is specified as the teaching origin and the positions of the other 3 points are entered relative to the first point.
- 3-point teaching
  This method sets the standard coordinates by using 3 teach points (equally spaced) on a straight line. The direction and length from the first teach point to the last teach point must be entered.
- Simple teaching
  This method sets the standard coordinates by moving the X and Y arms so as to set them in a straight line and then entering the length of the X and Y arms.

Setting the standard coordinates (1)



4-point teaching　3-point teaching　Simple teaching

The following parameters are automatically set when the standard coordinates are entered.

CAUTION

When setting the standard coordinates, note the following points.

- **Always perform teaching with the same hand system carefully and accurately.**
- **Set the teach points as near as possible to the center of actual work area and also separate them from each other as much as possible.**
- **The plane formed by the robot X and Y axes must be parallel to the actual working plane.**
- **If the robot has an R-axis, perform point teaching at the rotation center of the R-axis.**
- **The standard coordinate setting accuracy greatly affects the overall Cartesian coordinate precision.**

1) "Arm length [mm]"

M1= ###.## X-axis arm length (distance to rotation center X-axis and Y-axis)

M2= ###.## Y-axis arm length (distance to rotation center of Y-axis and R-axis, or distance to rotation center of Y-axis and working point)

2) "Offset pulse"

M1= ###### X-axis offset pulse (angle formed by the X-axis when the robot is at the origin (0 pulse) position and the X-axis on the standard coordinate plane)

M2= ###### Y-axis offset pulse (angle formed by the X-axis and Y-axis when the robot is at the origin (0 pulse) position)

M4= ###### R-axis offset pulse (angle formed by the R-axis when the robot is at the origin (0 pulse) position and the X-axis on the standard coordinate plane)

When two robots (main and sub robots) are specified, the following parameters are also entered automatically for the sub robot.

1) "Arm length [mm]"

S1= ###.## X-axis arm length (distance to rotation center X-axis and Y-axis)

S2= ###.## Y-axis arm length (distance to rotation center of Y-axis and R-axis, or distance to rotation center of Y-axis and working point)

2) "Offset pulse"

S1= ###### X-axis offset pulse (angle formed by the X-axis when the robot is at the origin (0 pulse) position and the X-axis on the standard coordinate plane)

S2= ###### Y-axis offset pulse (angle formed by the X-axis and Y-axis when the robot is at the origin (0 pulse) position)

S4= ###### R-axis offset pulse (angle formed by the R-axis when the robot is at the origin (0 pulse) position and the X-axis on the standard coordinate plane)

However, the R-axis offset is not entered automatically. Set it in "SYSTEM>PARAM>AXIS" mode.

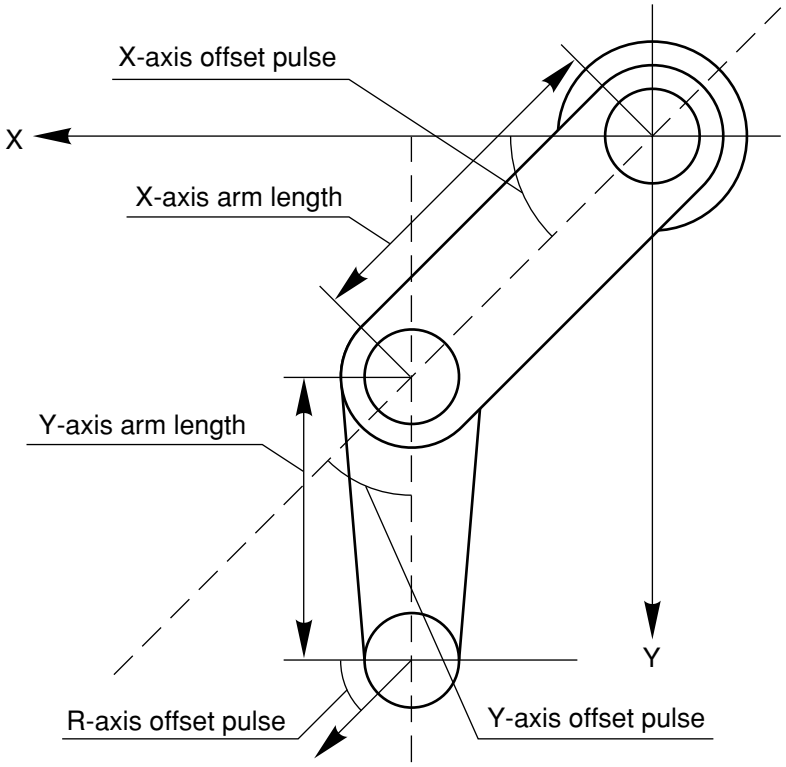
CAUTION

When two robots (main and sub robots) are specified, check the currently selected robot group on the RPB. To switch the robot group, use ROBOT (LOWER + MODE).

NOTE

- Approximate standard coordinate settings are made prior to shipment.
- The number of offset pulses equals the number of pulses used by the X, Y and R axes when they moved towards the X-axis on the standard coordinates.

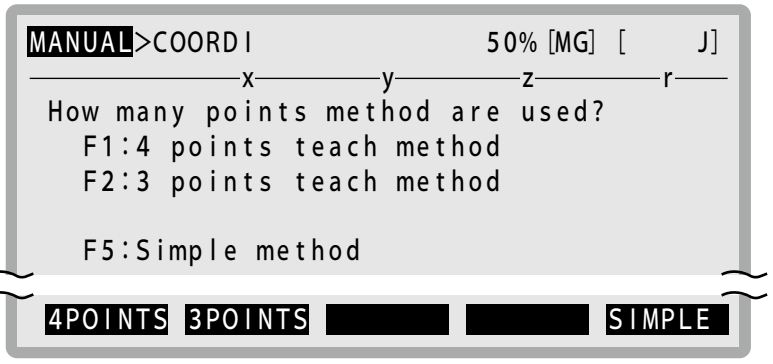
Setting the standard coordinates (2)



Press **F15** *(COORDI) in "MANUAL" mode.*

This mode allows setting the standard coordinates.

Setting the standard coordinates (3)



Valid keys and submenu descriptions in "MANUAL>COORDI" mode are as shown below.

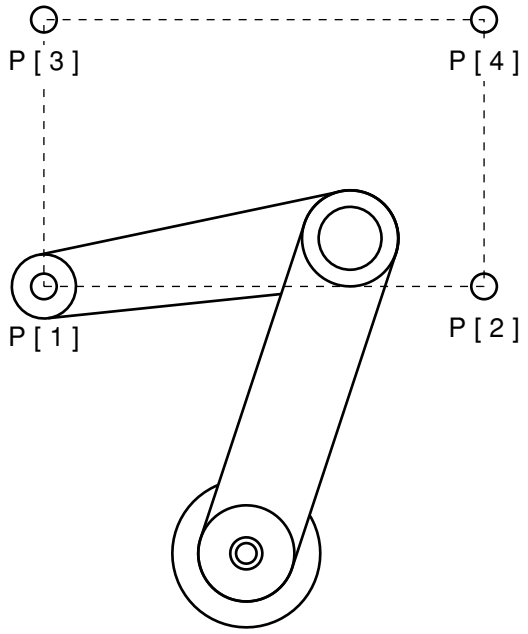
Valid keys	Menu	Function
F1	4POINTS	Sets standard coordinates by 4-point teaching.
F2	3POINTS	Sets standard coordinates by 3-point teaching.
F5	SIMPLE	Sets standard coordinates by simple teaching.

11.10.1 Setting the standard coordinates by 4-point teaching

NOTE

- Separate the teach points from each other as much as possible.
- Setting might be impossible if one side is less than 50mm.

Setting the standard coordinates by 4-point teaching (1)



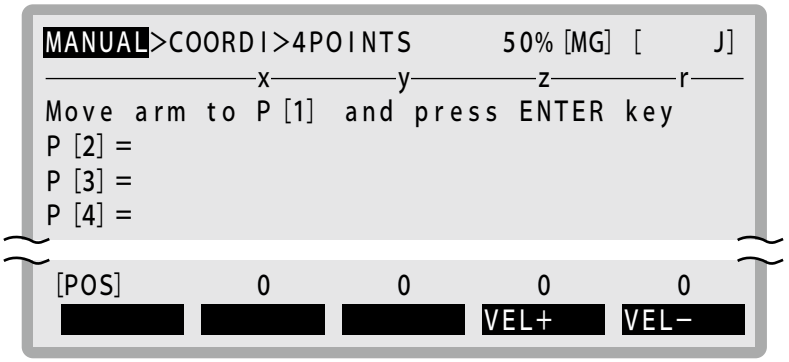
4-point teaching

Precondition: Coordinate values made for P[2], P[3], P[4] must be accurate when P[1] is set as the origin position.

Step 1 ***In "MANUAL>COORDI" mode, press F1 (4POINTS).***

The 4-point teaching mode is entered for setting standard coordinates.

Setting the standard coordinates by 4-point teaching (2)



Step 2 ***Determine teach point P[1].***

Use the Jog keys to move the robot arm tip to teach point P(1) and press ENTER.

NOTE

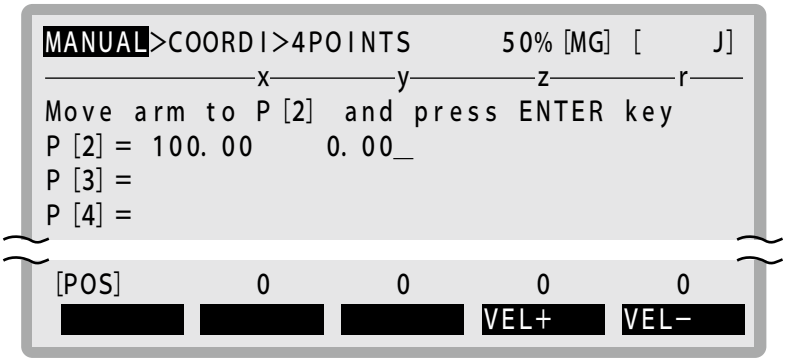
Standard coordinates are calculated based on the teach points and input point data, so perform teaching and point data input as accurately as possible.

Step 3 ***Determine teach point P[2].***

Use the same procedure as in step 2.

Step 4 ***Enter the position of teach point P[2] in millimeters, relative to P[1] set as the origin.***

Setting the standard coordinates by 4-point teaching (3)



Step 5 ***Determine teach points P[3] and P[4].***

Use the same procedure as in steps 3 and 4.

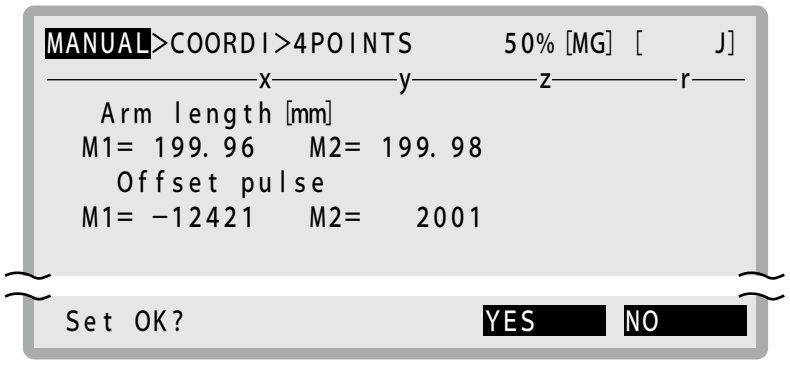
Step 6 ***Check the message on the guideline.***

A message for checking the length and offset pulse value appears on the guideline. (If the calculation failed, an error message appears.)

Press **F4** *(YES) to store the setting.*

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

Setting the standard coordinates by 4-point teaching (4)

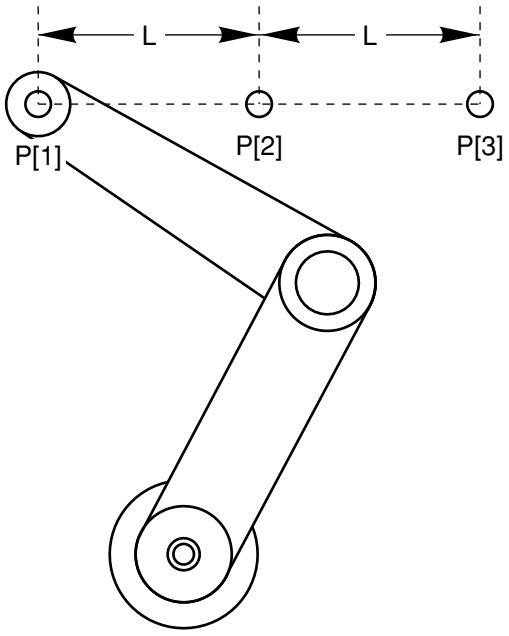


11.10.2 Setting the standard coordinate by 3-point teaching

NOTE

Separate the teach points from each other as much as possible.

Setting the standard coordinate by 3-point teaching (1)

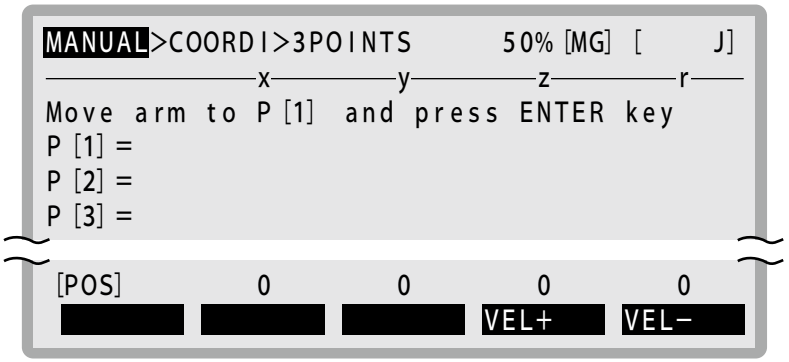


Precondition: All 3 points P[1], P[2] and P[3] must be on a straight line, with P[2] set at the midpoint between P[1] and P[3].

Step 1 ***In "MANUAL>COORDI" mode, press F2 (3POINTS).***

The 3-point teaching mode is entered for setting the standard coordinates.

Setting the standard coordinate by 3-point teaching (2)



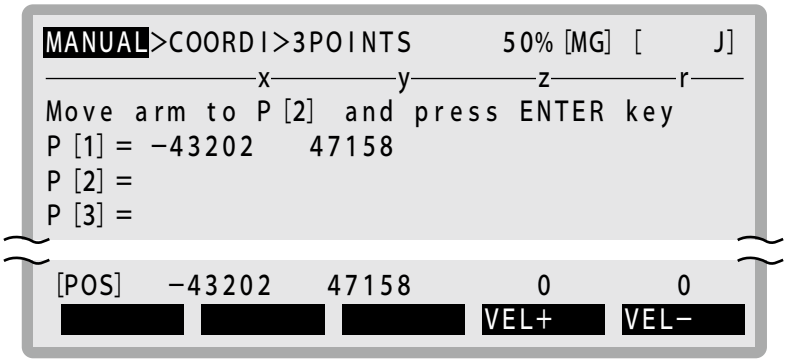
Step 2 ***Determine teach point P[1].***

Use the Jog keys to move the robot arm tip to teach point P(1) and press ENTER.

NOTE

Standard coordinates are calculated based on the teach points and input point data, so perform teaching and point data input as accurately as possible.

Setting the standard coordinate by 3-point teaching (3)

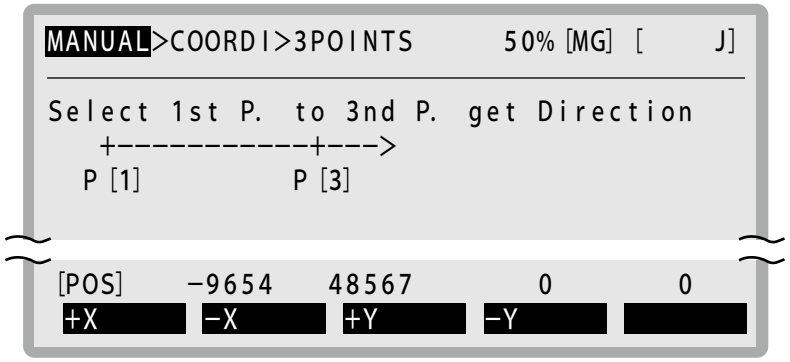


Step 3 ***Determine teach points P[2] and P[3].***

Use the same procedure as in step 2.

Step4 *Use* F1 *(+X) to* F4 *(-Y) to set the direction from P[1] to P[3].*

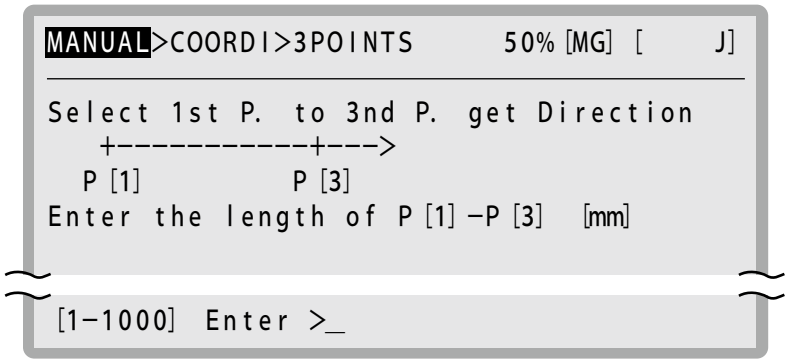
Setting the standard coordinate by 3-point teaching (4)



Step5 *Use* 0 *to* 9, . *to enter the length between P[1] and P[3], and press* ENTER.

The length should be less than 1000.

Setting the standard coordinate by 3-point teaching (5)



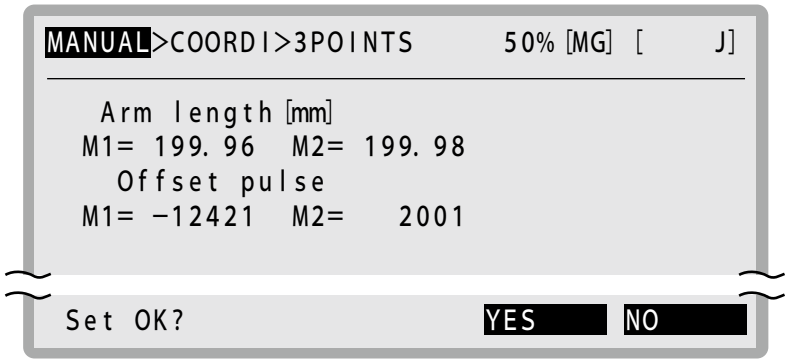
Step6 *Check the message on the guideline.*

A message for checking the arm length and offset pulse value appears on the guideline. (If the calculation failed, an error message appears.)

Press F4 *(YES) to store the setting.*

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

Setting the standard coordinate by 3-point teaching (6)

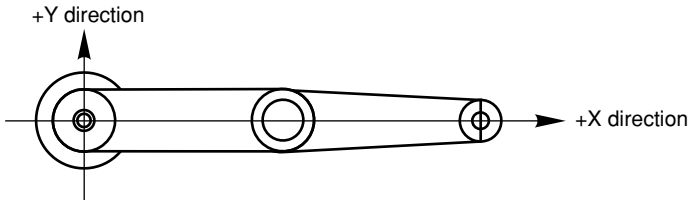


11.10.3 Setting the standard coordinates by simple teaching

NOTE

Position the XY arms as accurately as possible, so that they are exactly set in a straight line including the rotation center of the R-axis.

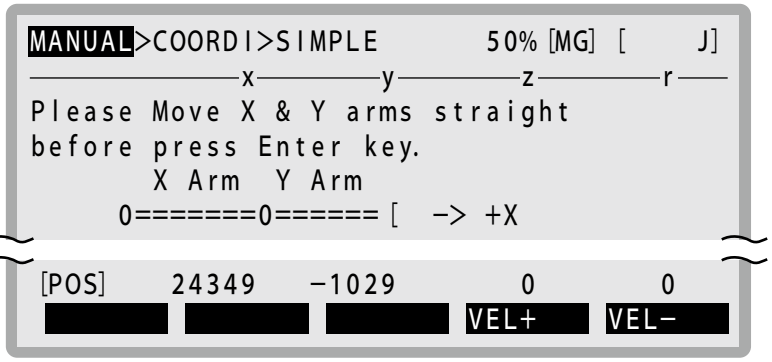
Setting the standard coordinates by simple teaching (1)



Step 1 ***In "MANUAL>COORDI" mode, press F5 (SIMPLE).***

The simple teaching mode is entered for setting the standard coordinates.

Setting the standard coordinates by simple teaching (2)



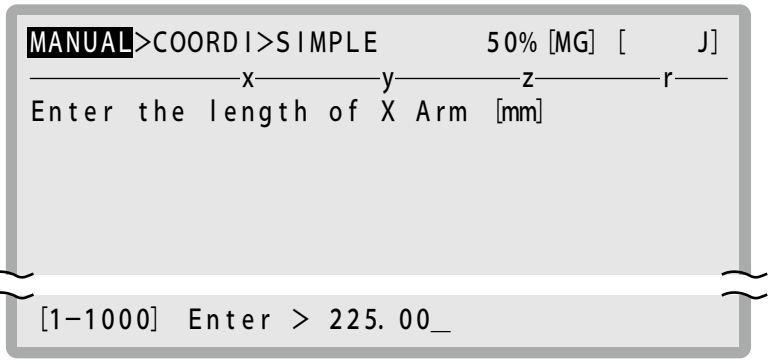
Step 2 ***Move the robot so that the X and Y arms are set in a straight line.***

Use the Jog keys or your hands (if the servo is off) to move the robot arm so that the X and Y arms are set in a straight line, then press ENTER.

At this point, the +X direction is set as shown above.

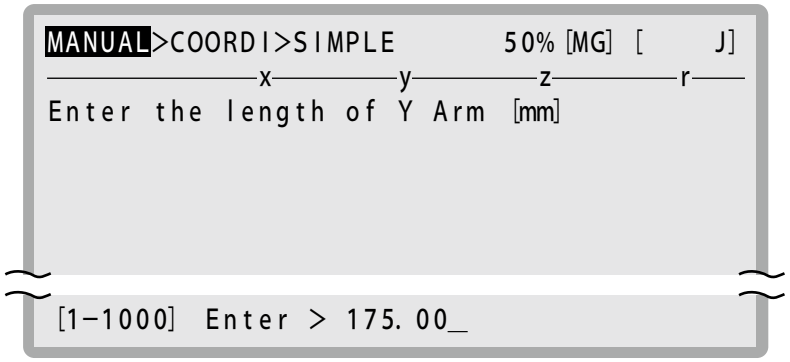
Step 3 ***Enter the X arm length and press ENTER.***

Setting the standard coordinates by simple teaching (3)



Step 4 *Enter the Y arm length and press* ENTER.

Setting the standard coordinates by simple teaching (4)



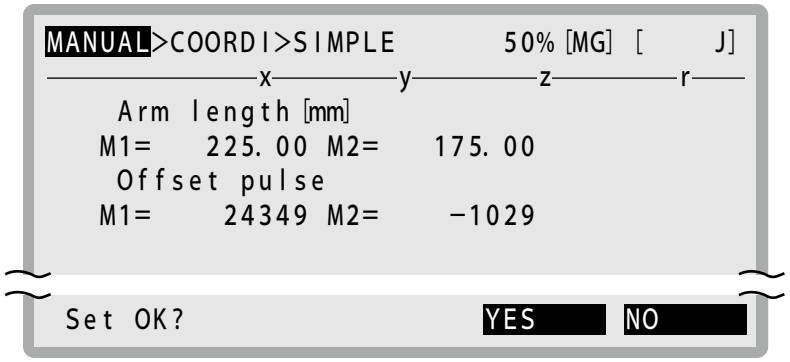
Step 5 *Check the message on the guideline.*

A message for checking the arm length and offset pulse value appears on the guideline.

Press F4 *(YES) if you want to store the setting.*

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

Setting the standard coordinates by simple teaching (5)



11.11 Executing the user function keys

User function keys allow you to perform various tasks easily when needed. For example, assigning operation of an air-driven unit connected to an output port to a function key will prove useful when performing point teaching in "MANUAL" mode.

NOTE

- When using the user function keys, it is necessary to make a program named "FUNCTION" and then write command statements for storing functions.
- When registering the function keys, refer to "10.3.9 Creating a sample program automatically" and "10.6 Registering user function keys" earlier in this chapter.

Step 1 *Press USER in "MANUAL" mode.*

The character strings assigned in advance to the function keys F1 to F15 appear on the guideline. Pressing USER again displays the character strings assigned to the function keys F16 to F30.

(Pressing USER once more returns to the display of F1 to F15.)

Each character string is displayed in up to 7 characters from the beginning.

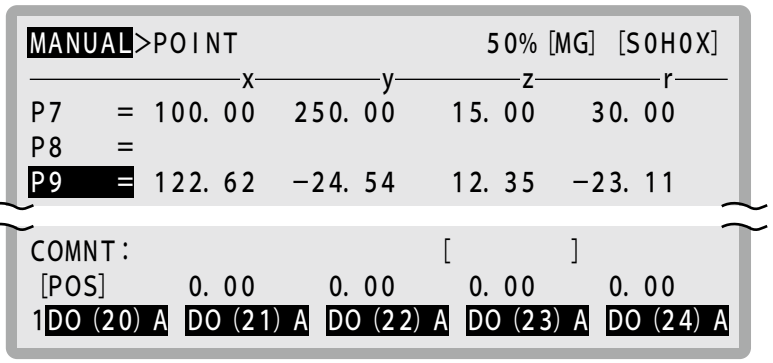
Step 2 *Press the desired function key.*

The preassigned task will be executed just as if using online commands.

WARNING

- **THE ROBOT STARTS TO MOVE WHEN SOME COMMANDS ARE EXECUTED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.**
- **ROBOT MOVEMENT COMMANDS ARE EXECUTED AT "AUTO" MODE SPEED RATHER THAN "MANUAL" MODE SPEED.**

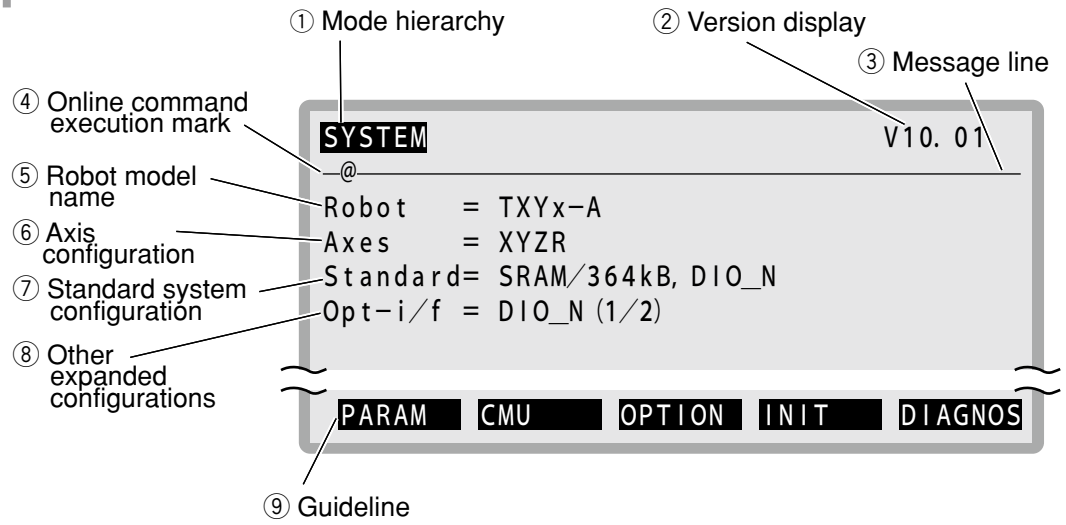
Executing the user function keys



12. "SYSTEM" mode

The "SYSTEM" mode controls all kinds of operating conditions for the overall robot system.
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 the servomotor power is on. When not highlighted it means the servomotor power is off.

② Version display

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

③ Message line

If an error occurs, the error message appears here.

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 specified by the controller.

When two robots (main robot and sub robot) are specified, their model names appear separated by a slash (/).

⑥ Axis configuration

Shows the axis configuration of the robot connected to the controller.

When two robots (main robot and sub robot) are specified, their axis configurations appear separated by a slash (/). If an auxiliary axis is added, it also appears preceded by a plus mark (+).

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.

CAUTION

See "7. 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 1 is installed.
Gripper2	Electric gripper 2 is installed.

CAUTION

- **See "7. 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

- When two grippers are installed, "Gripper1" and "Gripper2" are displayed.

When set to SAFE mode, the following display appears.

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

CAUTION

For details on "SERVICE" mode setting, refer to "12.3.2 Setting the "SERVICE" mode".

⑨ Guideline

The contents assigned to function keys are shown highlighted. A message on what to do next also appears here in some operation steps.

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 *1	BACKUP	Saves and restores data on internal flash ROM.

*1: To use F9, press F4 (F9 / F14) while holding down UPPER.

12.1 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 to the controller. Incorrect settings may cause errors. Be sure to make the correct settings.**
- **Before and after setting parameters, always save the data files (program, point, point comment, parameter, shift, hand and pallet) stored in the RCX240 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 us when changing a parameter.**
- **Absolute reset or return-to-origin may be required after changing a parameter.**

12.1.1 Parameter setting

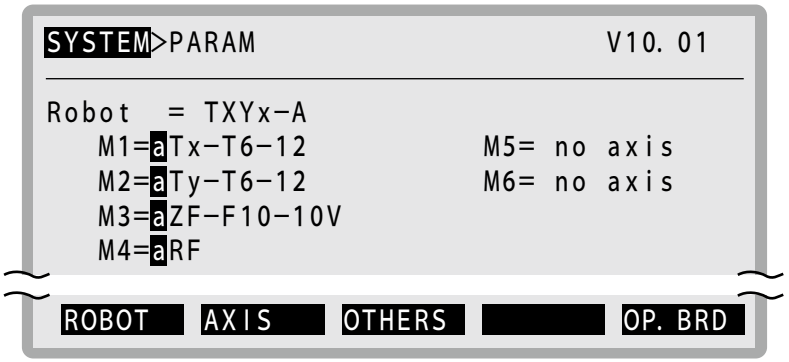
To set parameters relating to the controller setting and robot operation, follow these steps.

Step 1 ***Press*** F1 ***(PARAM) in "SYSTEM" mode.***

"SYSTEM>PARAM" mode is entered.

Step 2 ***Press*** F1 ***(RBOT) to*** F5 ***(OP. BRD) to display each parameter item.***

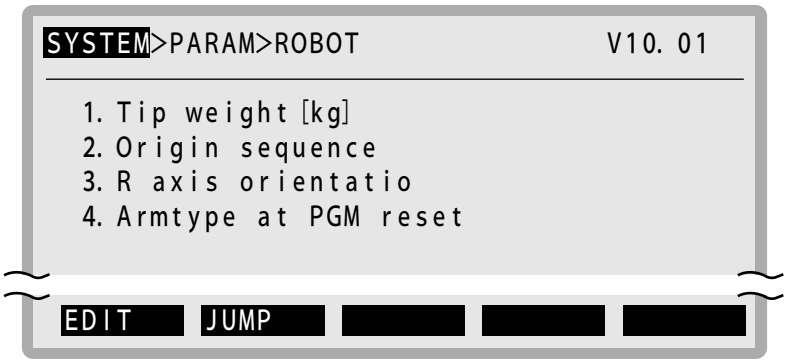
"SYSTEM>PARAM" mode



Step3 *Select a parameter item with the cursor (▲ / ▼) keys.*

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

Robot parameters



Step4 *Press* F1 *(EDIT).*

Step5 *Edit the selected parameter.*

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.
Also refer to "12.1.3 Robot parameters", "12.1.4 Axis parameters", "12.1.5 Other parameters" and "12.1.6 Parameters for option boards".

Step6 *Press* ESC *to quit the parameter editing.*

Valid keys and submenu descriptions in "SUSTEM>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 *1	PASSWRD	Allows write-prohibited axis parameters to be changed.

*1: To use F10, press F10 F5 F15 while holding down UPPER.

12.1.2 Parameter list

■ Robot parameters

No.	Name	Displayed name	Identifier	Setting range [Default setting]	Unit	Reference page
1	Tip weight	Tip weight [kg]	WEIGHT	0 to 200 [Robot type]	kg	4-191
2	Return-to-origin sequence	Origin sequence	ORIGIN	0 to 654321 [312456]	–	4-192
3 *1	R-axis direction retention	R axis orientation	RORIEN	KEEP, FREE [KEEP]	–	4-193
4 *1	Arm type at program reset	Armtype at PGM reset	ARMTYP	RIGHTY, LEFTY [RIGHTY]	–	4-194

*1 Only available for SCARA robots.

■ Axis parameters

No.	Name	Displayed name	Identifier	Setting range [Default setting]	Unit	Reference page
1	Acceleration coefficient	Accel. coefficient [%]	ACCEL	1 to 100 [100]	%	4-196
2	Deceleration rate	Decel. rate [%]	DECRAT	1 to 100	%	4-197
3	+ software limit	+Soft limit [pulse]	PLMT+	-6144000 to +6144000 [Robot type]	pulse	4-198
4	- software limit	-Soft limit [pulse]	PLMT-	-6144000 to +6144000 [Robot type]	pulse	4-198
5	Tolerance	Tolerance [pulse]	TOLE	1 or more [Robot type]	pulse	4-200
6	OUT effective position	OUT position [pulse]	OUTPOS	1 to 6144000 [Robot type]	pulse	4-201
7	Arch position	Arch position [pulse]	ARCH	1 to 6144000 [Robot type]	pulse	4-202
8	Return-to-origin speed	Origin speed [pulse/ms]	ORGSPD	1 or more [Robot type]	pulse/ms	4-204
9	Acceleration during manual mode	Manual accel [%]	MANACC	1 to 100 [100]	%	4-205
10	Origin position shift	Origin shift [pulse]	SHIFT	-6144000 to +6144000 [0]	pulse	4-206
11	Arm length	Arm length [mm]	ARMLEN	0 to 10000 [Robot type]	mm	4-207
12	Offset pulse	Offset pulse	OFFSET	-6144000 to +6144000 [Robot type]	pulse	4-208
13	Axis tip weight	Axis tip weight [kg]	AXSTIP	0 or more [Robot type]	kg	4-209
14	Return-to-origin method	Origin method	ORGSNS	SENSOR, TORQUE, MARK [Robot type]	–	4-210
15	Return-to-origin direction	Origin direction	ORGDIR	---, +++ [Robot type]	–	4-211
16	Robot movement direction	Motor direction	MOTDIR	---, +++ [Robot type]	–	4-212

■ Other parameters

No.	Name	Displayed name	Identifier	Setting range [Default setting]	Unit	Reference page
1	Display language	Display language (JPN/ENG)	DSPLNG	JAPANESE, ENGLISH	–	4-214
2	Data display length	Data display length	DATLEN	6 char, 8 char [6 char]	–	4-215
3	Parameter display unit	Parameter display unit	PDUNIT	PULSE, MM/DEG [PULSE]	–	4-216
4	DO output at emergency stop	DO cond. on EMG	EMGCDO	RESET, HOLD [HOLD]	–	4-217
5	STD.DIO DC24V monitor	Watch on STD.DIO DC24V	STDWCH	VALID, INVALID [VALID]	–	4-218
6	Incremental mode control	Incremental Mode control	INCMOD	VALID, INVALID [INVALID]	–	4-219
7	IO command from STD.DIO	IO cmd (DI05)	STDPRM	VALID, INVALID [INVALID]	–	4-220
8	DI noise canceling	DI noise filter	SCANMD	VALID, INVALID	–	4-221
9	TRUE condition	TRUE condition	EXPCFG	-1, no 0 [-1]	–	4-222
10	Unit selection	Unit select	PTUNIT	Normal, J (pulse), X (mm/°), T (mm/°) [Normal]	–	4-223
11	Error output port	Error output (DO & SO)	ERPORT	OFF, 20 to 27 [OFF]	–	4-224
12	MOVEI/DRIVEI start position	MOVEI/DRIVEI start pos.	MOVIMD	Keep, Reset [Keep]	–	4-225
13	DI17 mode	DI17 mode	DI17MD	ABS, ABS/ORG [ABS]	–	4-226
14	Servo ON at power-on	Servo on when power on	SRVOON	YES, NO [YES]	–	4-227
15	Battery alarm output (DO & SO)	Battery alarm (DO & SO)	BTALRM	OFF, 20 to 27, 30 to 33 [OFF]	–	4-228
16	Manual movement mode	Manual move mode	MOVMOD	NORMAL, MODE1 [NORMAL]	–	4-229
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 [INVALID]	–	–
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	–	4-230

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

*2 These parameters are dedicated to the electric gripper. For details, see the User’s Manual for YAMAHA Electric Gripper YRG-series.

■ Parameters for option boards

No.	Name	Displayed name	Setting range [Default setting]	Unit	Reference page
● Option DIO					
1	Enable/disable 24V power input monitor	Board condition	VALID, INVALID	–	4-233
● Serial I/O					
1	Enable/disable serial I/O board	Board condition	VALID, INVALID	–	4-234
2	Enable/disable remote command and I/O command functions	Remote cmd / IO cmd (SI05)	VALID, INVALID	–	4-234
3	Enable/disable function of message number output to SOW (1)	Output MSG to SOW (1)	VALID, INVALID	–	4-234
4	I/O size (DeviceNet only)	IO size	Large, Small [Large]	–	4-234
● Network setting					
1	Enable/disable Ethernet board	Board condition	VALID, INVALID	–	4-237
2	IP address	IP address	–	–	4-237
3	Subnet mask	Subnet mask	–	–	4-237
4	Gateway	Gateway	–	–	4-237
5	Communication mode	communication mode	OFFLINE, ONLINE [ONLINE]	–	4-237

12.1.3 Robot parameters

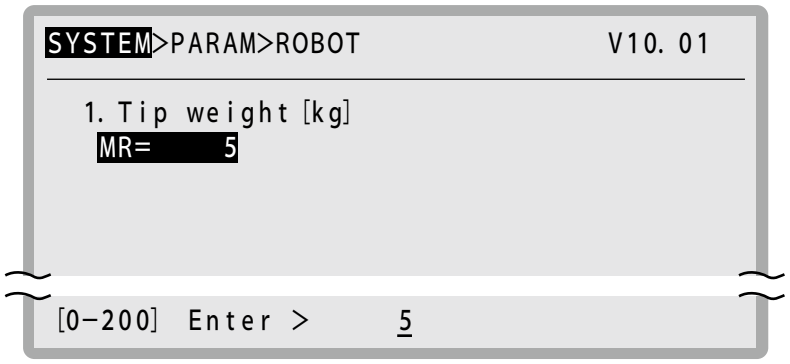
On the RPB screen each robot parameter appears in the following format.

Main group parameters	Sub group parameters
MG=<value>	SG=<value>
Main robot parameters	Sub robot parameters
MR=<value>	SR=<value>

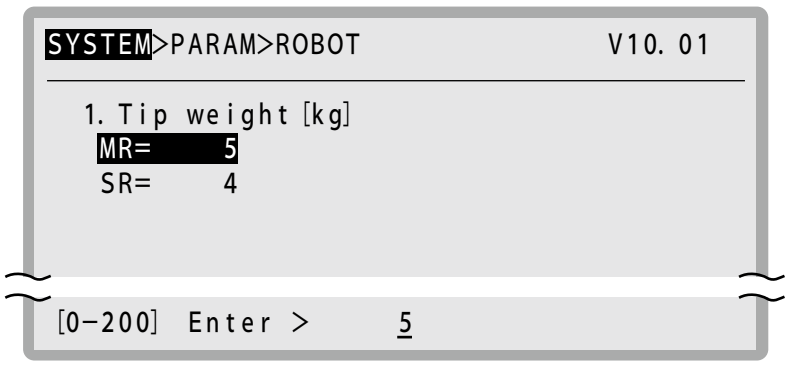
NOTE

A description and method for setting robot parameters No. 1 through No. 4 are listed in this manual.
Changing of robot parameters from No. 5 onward is basically prohibited. Please consult with us beforehand if these (parameter No. 5 onward) must be changed.

Robot parameter setting (one-robot setting)



Robot parameter setting (two-robot setting)



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

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⏫ / ⏬ *1		Switches to other screens.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

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 0.1 kg units when the currently set robot is YK120X, YK150X, YK180X or YK220X.
The maximum value is set when the parameters are initialized.
The maximum allowable value is determined automatically according to the current robot model.

NOTE

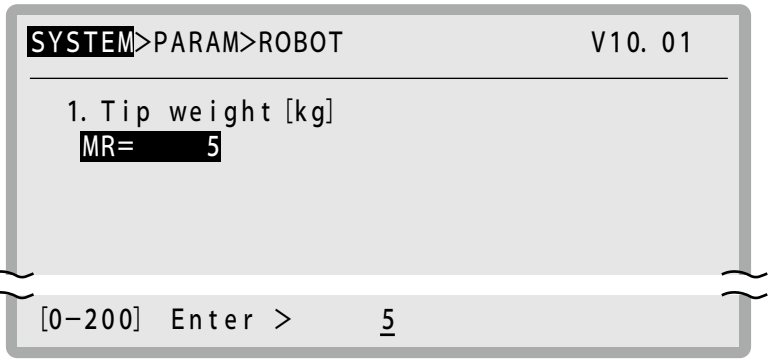
- This parameter cannot be input if the robot was set to MULTI.
- To set the auxiliary axis tip weight, use the axis tip weight settings of axis parameters.
- When the YRG series electric gripper is used, the gripper weight must be added to the tool weight. For details, refer to the user's manual for YRG series electric gripper.

Step1 ***Select "1.Tip weight [kg]" in "SYSTEM>PARAM>ROBOT" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the parameter with the cursor (*** ▲ / ▼ ***) keys.***

Setting the "Tip weight [kg]"



Step4 ***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.

Step5 ***Press*** ESC ***to quit the edit mode.***

2. Origin sequence /ORIGIN

This parameter sets a sequence for performing absolute reset and return-to-origin on each axis of the robot. 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.
If an axis number is not set, then return-to-origin for that axis number is performed last in the return-to-origin sequence.
It is recommended to perform return-to-origin first on those axes that might interfere with surrounding equipment.

NOTE

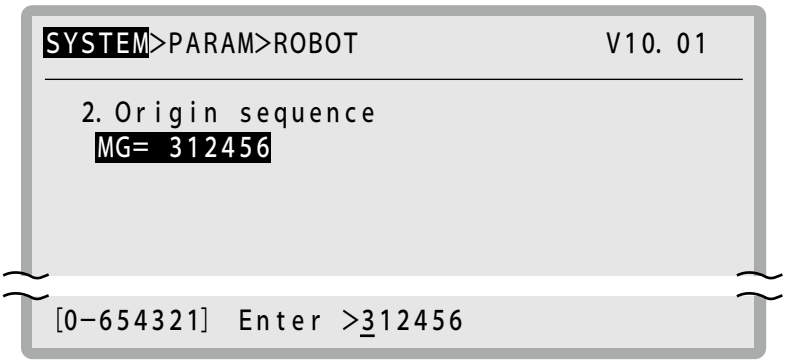
Perform origin-return first for those axes that might interfere with surrounding equipment.

Step1 ***Select "2.Origin sequence" in "SYSTEM>PARAM>ROBOT" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the parameter with the cursor (*** ▲ / ▼ ***) keys.***

Setting the "Origin sequence".



Step4 ***Enter the value with*** 0 ***to*** 9 ***and then press*** ENTER.

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.

Step5 ***Press*** ESC ***to quit the edit mode.***

3. R-axis orientation /RORIEN

On SCARA robots, this parameter sets whether or not to maintain the R-axis direction (orientation) when moving manually across the XY axes. The R direction (orientation) is automatically set when the parameters are initialized.
If the R-axis direction has been set (held) and the arm tip is moved in the X or Y directions, the R-axis automatically rotates to maintain its direction.
This is effective only on SCARA robots.

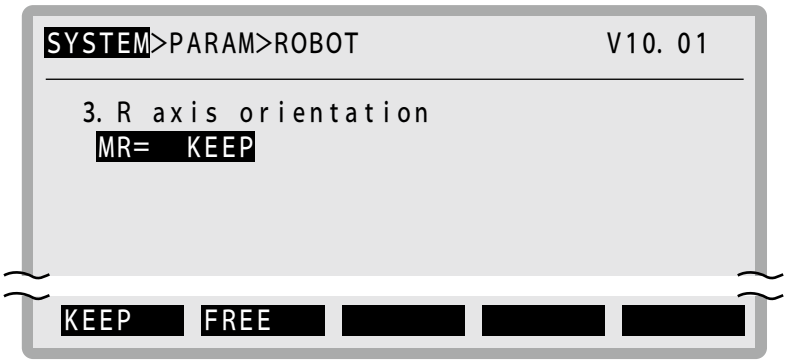
NOTE
This parameter is valid only on SCARA robots.

Step1 ***Select "3.R axis orientation" in "SYSTEM>PARAM>ROBOT" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the parameter with the cursor (*** ▲ / ▼ ***) keys.***

Setting the "R axis orientation"



Step4 ***Press*** F1 ***(KEEP) or*** F2 ***(FREE) to enter the setting.***

Step5 ***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.

4. Armtype at PGM reset/ARMTYP

On SCARA robots, it is necessary to set left-handed or right-handed system when moving along XY coordinates or converting point data. This parameter is used to set the initial hand system when the program is reset. The right-handed system is selected when the parameters are initialized.

This is effective only on SCARA robots.

NOTE

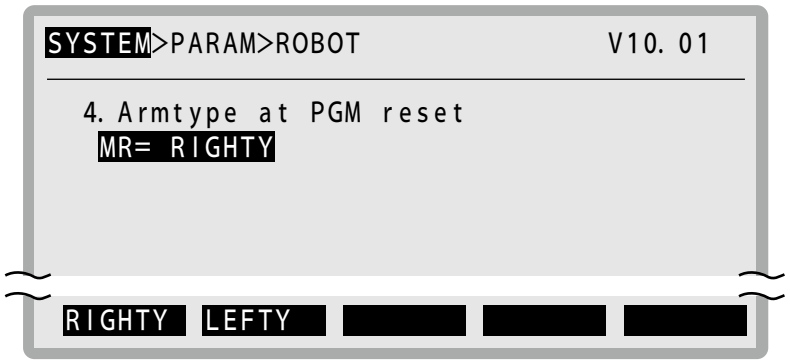
This parameter is valid only on SCARA robots.

Step1 ***Select "4. Armtype at PGM reset" in "SYSTEM>PARAM>ROBOT" mode.***

Step2 ***Press F1 (EDIT).***

Step3 ***Select the parameter with the cursor (▲ / ▼) keys.***

Setting the "Armtype at PGM reset"



Step4 ***Press F1 (RIGHTY) or F2 (LEFTY) to enter the setting.***

Step5 ***Press ESC to quit the edit mode.***

12.1.4 Axis parameters

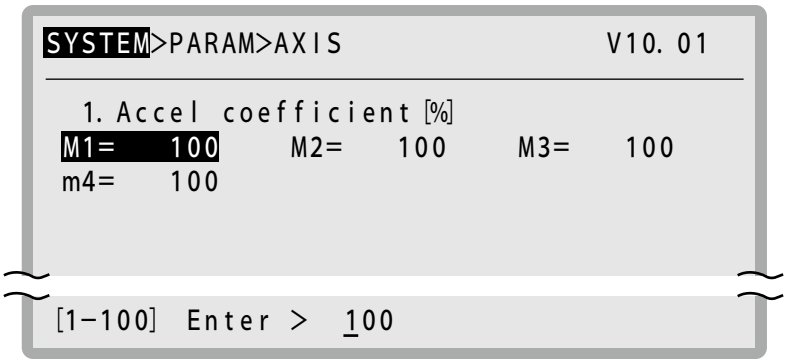
Each axis parameter is displayed in the following format on the RPB screen.

Main robot axis setting	Sub robot axis setting
M?=<value>	S?=<value>
Main auxiliary axis setting	Sub auxiliary axis setting
m?=<value>	s?=<value>

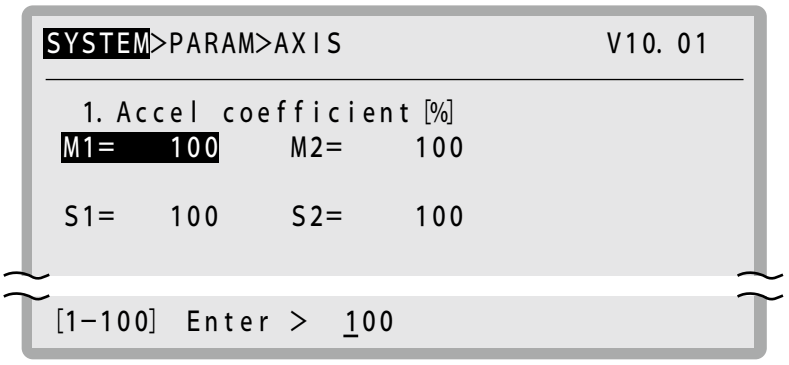
NOTE

A description and method for setting axis parameters No. 1 through No. 16 are listed in this manual.
Changing of parameters from No. 17 onward is basically prohibited. Please consult with us beforehand if these (parameter No. 17 onward) must be changed.

Axis parameter setting (one-robot setting)



Axis parameter setting (two-robot setting)



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

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⏫ / ⏬ *1		Scrolls up and down the screen.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

1. Accel coefficient [%] /ACCEL

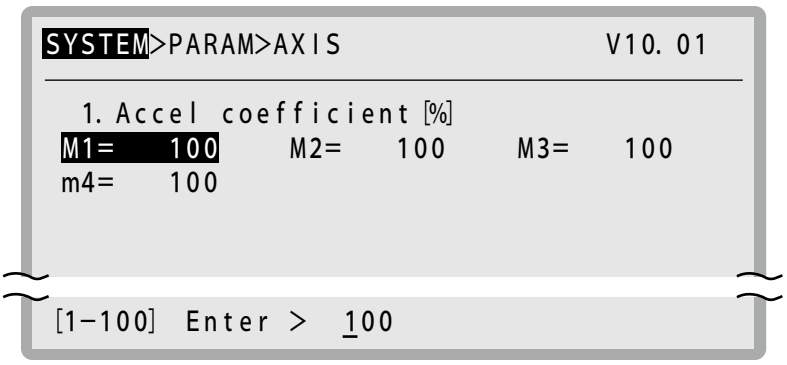
This parameter sets acceleration in "AUTO" mode in a range from 1 to 100% during movement by robot movement command. This is automatically set to 100% when the parameters are initialized. If the tip weight (workpiece weight + tool weight) is set correctly, then the actual acceleration is internally set in the control to be 100% at maximum performance.

Step1 ***Select "1.Accel coefficient [%]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ / ▼ ***) keys.***

Setting the "Accel coefficient [%]"



NOTE

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

Step4 ***Enter the value with*** 0 ***to*** 9 ***and then press*** ENTER.

CAUTION

Lowering the acceleration coefficient lengthens the time needed to stop, when the STOP **was pressed or an interlock was triggered. Do not use a drastically lowered acceleration coefficient.**

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

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

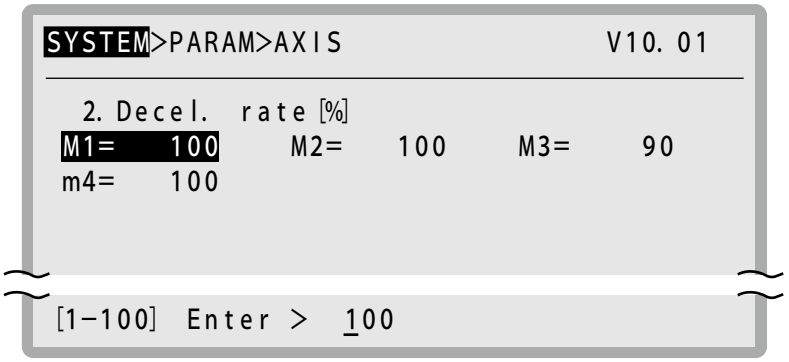
This parameter value is a rate to the acceleration.

Step1 ***Select "2. Decel. rate [%]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ / ▼ ***) keys.***

Setting the "Decel. rate [%]"



NOTE

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

Step4 ***Enter the value with*** 0 ***to*** 9 ***and then press*** ENTER.

CAUTION

Lowering the deceleration rate lengthens the time needed to stop, when the STOP **key was pressed or an interlock was triggered. Do not use a drastically lowered deceleration rate.**

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

3. +Soft limit [pulse] /PLMT+
4. -Soft limit [pulse] /PLMT-

These parameters set the plus (+) soft limits and minus (-) soft limits that determine the range the robot can move. Soft limits inherent to each axis are automatically set when the parameters are initialized.

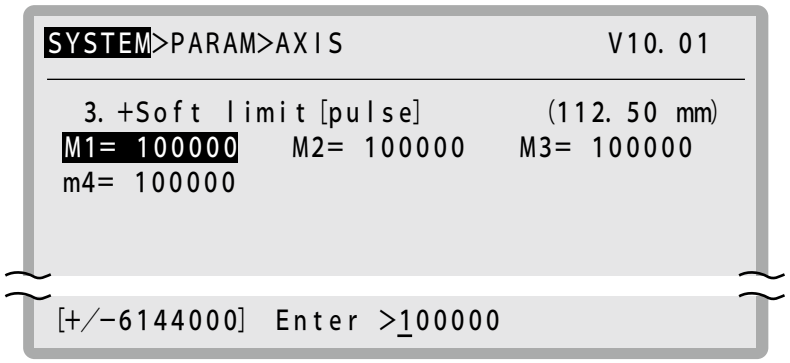
The robot controller checks whether or not the specified point data is within the soft limit range during automatic operation or point teaching. The value set for the selected axis is displayed in converted units on the 3rd line of the RPB screen.

Step1 ***Select "3. +Soft limit [pulse]" or "4. -Soft limit [pulse]" in "SYSTEM> PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ / ▼ ***) keys.***

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 IT IS SET OUTSIDE THE OPERATING RANGE, THE AXIS MAY COLLIDE WITH THE MECHANICAL STOPPER AT HIGH SPEED, RESULTING IN THE BREAKDOWN OF THE ROBOT AND THE SCATTERING OF THE WORKPIECE WHICH WAS HELD BY THE END EFFECTOR.

CAUTION

- **This is a critical parameter for establishing the robot operating range so set it to a correct value.**
- **On SCARA robots, 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.**
- **Software limits are disabled when origin return is incomplete. Use caution during jog movement.**

Step 4 ***Enter the value with 0 to 9, and . , − and then press ENTER.***

If the value you input was a real number (number containing a decimal point), then the soft limit setting is converted into "pulse" units.

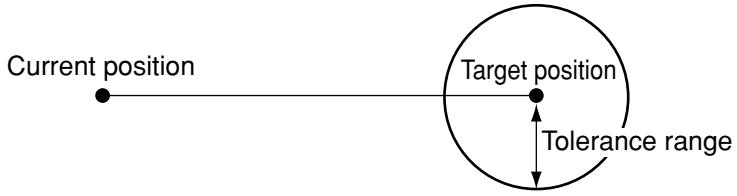
Step 5 ***Repeat steps 3 and 4 as needed.***

Step 6 ***Press ESC to quit the edit mode.***

5. Tolerance [pulse] /TOLE

This parameter sets the tolerance range of the target position where robot movement ends. This is set to a value unique to each axis when initialized.
Positioning on an axis is judged to be complete when the robot axis enters within the specified tolerance range. During consecutive PTP movement in a program, the larger this value is made, the more the positioning time can be shortened.
The tolerance range set for the selected axis is displayed in converted units on the 3rd line of the RPB screen.

Tolerance range

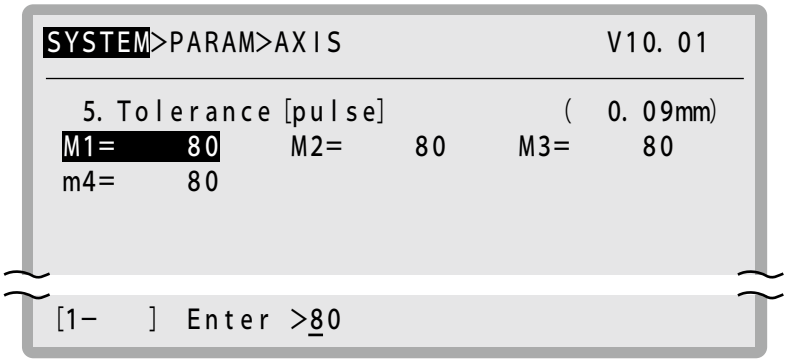


Step1 ***Select "5. Tolerance [pulse]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ ***/*** ▼ ***) keys.***

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.**

Step4 ***Enter the value with*** 0 ***to*** 9***, and*** . ***and then press*** ENTER.

If the value you input was a real number (number containing a decimal point), then the tolerance range is converted into "pulse" units.

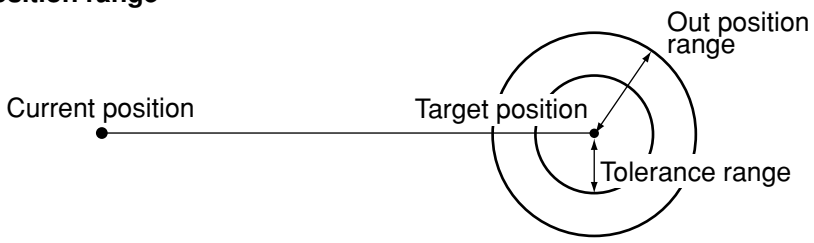
Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

6. Out position [pulse] /OUTPOS

During PTP movement in a program, the next command can be executed when the robot enters the range specified by the Out position for the target position. This parameter sets the Out position range. When initialized, this is set to a value unique to each axis.
When the robot enters the Out position range, the controller determines that the program line has been executed. (However, the robot continues moving to the target position.) When consecutive PTP movement commands are in a program, the larger the value that is set, the more the time required to shift to the next command line can be shortened.
The robot is verified to have entered the tolerance range before executing the movement command so the previous positioning operation will end, even when executing consecutive PTP operations.
The value set for the selected axis is displayed in converted units on the 3rd line of the RPB screen.

OUT position range

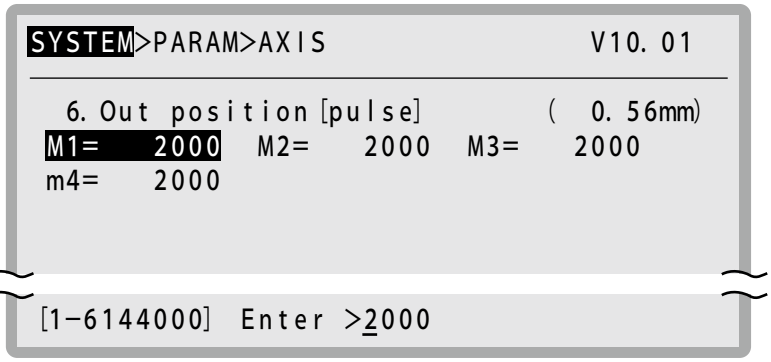


Step1 ***Select "6. Out position [pulse]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with cursor (*** ▲ / ▼ ***) keys.***

Setting the "Out position [pulse]"



Step4 ***Enter the value with*** 0 ***to*** 9 ***, and*** . ***and then press*** ENTER ***.***

If the value you input was a real number (number containing a decimal point), then it is converted into pulse units.

CAUTION

When the tolerance range is larger than the Out position range, the PTP operation is performed until the robot is within the Out position range.

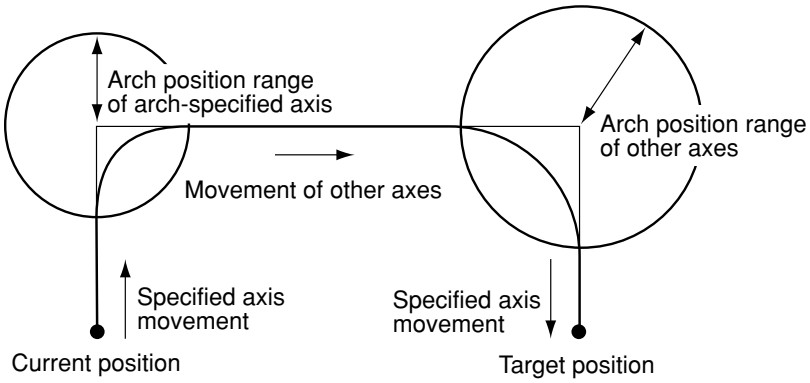
Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

7. Arch position [pulse] /ARCH

When an arch motion command (optional PTP operation) is executed, arch movement begins when the robot enters the arch position range set by this parameter for the target position. This parameter is set to a value unique to each axis when initialized.
When the axis specified for arch movement starts PTP movement toward the specified position and enters the arch position range, the other axes start to move. When those axes enter the arch position range, the arch-specified axis moves by PTP toward the target position. Movement time can be shortened by making this value larger since there is a greater overlap for axis operation.
The value set for the selected axis is displayed in converted units on the 3rd line of the RPB screen.

Arch motion

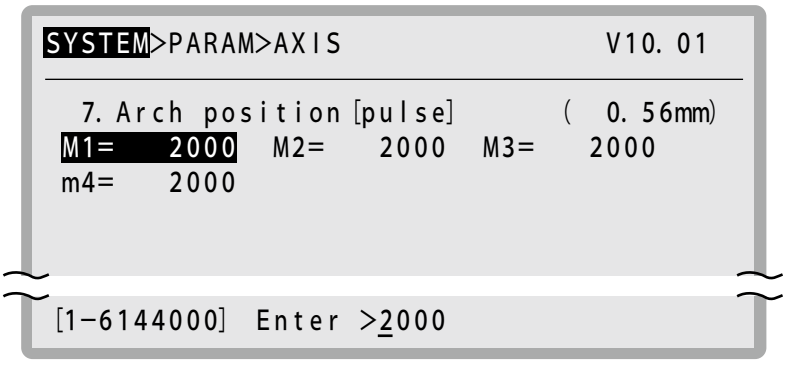


Step1 ***Select "7. Arch position [pulse]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with cursor (*** ▲ / ▼ ***) keys.***

Setting the "Arch position [pulse]"



CAUTION

- **The arch-specified axis may sometimes reach the target position faster than the other axes if the arch position is large. So set an accurate value for the arch position.**
- **Movement may be along different paths during arch operation due to the movement speed. Check the arch motion at a speed at which the robot actually moves.**

Step4 ***Enter the value with*** [0] ***to*** [9]***, and*** [.] ***and then press*** [ENTER].

If the value you input was a real number (number containing a decimal point), then it is converted into pulse units.

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** [ESC] ***to quit the edit mode.***

8. Origin speed [pulse/ms] /ORGSPD

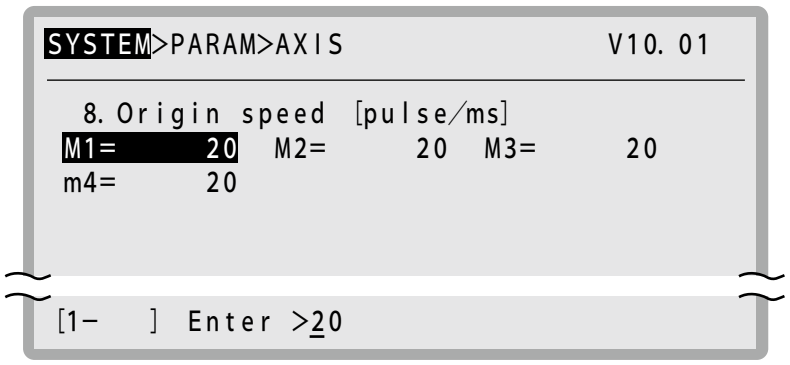
This parameter sets the speed at which the robot will move during return-to-origin or absolute reset operation. Set this parameter in terms of the number of pulses per millisecond. When initialized, this parameter is set to a value unique to each incremental type axis and absolute type axis. On semi-absolute type axes, this parameter is set to 20 pulses/ms (=20mm/s).

Step1 ***Select "8. Origin speed [pulse/ms]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ ***/*** ▼ ***) keys.***

Setting the "Origin speed [pulse/ms]"



Step4 ***Enter the value with*** 0 ***to*** 9 ***and then press*** ENTER.

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).

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

9. Manual accel [%] /MANACC

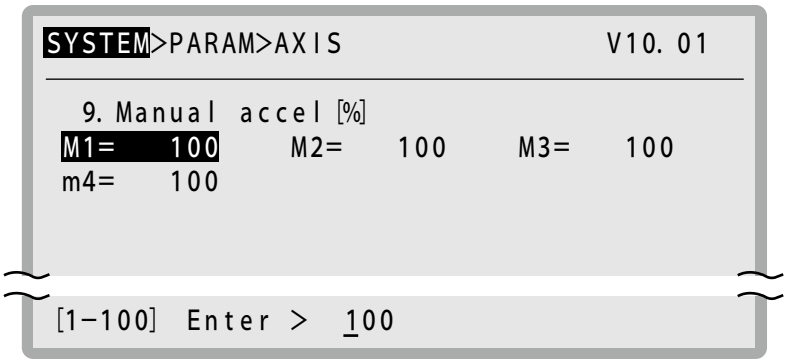
This parameter sets the acceleration in a range from 1 to 100% during robot manual movement. The manual acceleration is automatically set to 100 when the parameters are initialized.
If the tip weight (workpiece weight + tool weight) is set correctly, then the actual acceleration is automatically determined internally in the controller to obtain optimum performance at 100%.

Step1 ***Select "9. Manual accel [%]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ ***/*** ▼ ***) keys.***

Setting the "Manual accel [%]"



NOTE

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

Step4 ***Input the value with*** 0 ***to*** 9 ***and then press*** ENTER.

CAUTION

Lowering the acceleration coefficient lengthens the time needed to stop, when the STOP **was pressed or an interlock was triggered. Do not use a drastically lowered acceleration coefficient.**

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

10. Origin shift [pulse] /SHIFT

This parameter is used to correct the origin position error when the motor has been replaced for some reason or the robot origin position has shifted due to mechanical shocks. This parameter is set to 0 when initialized.

To correct the origin position error, enter the number of pulses required to move the origin back to the correct position.

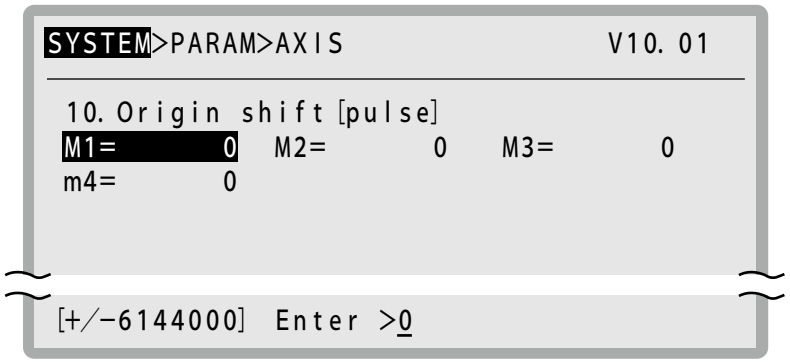
For example, if the B pulses represent the origin position that the robot arm moved to after position error, and the A pulses are the origin position before position error, then enter a value of "A - B".

Step1 ***Select "10. Origin shift [pulse]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ / ▼ ***) keys.***

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.**

Step4 ***Enter the value with*** 0 ***to*** 9, − ***and then press*** ENTER.

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

11. Arm length [mm] /ARMLEN

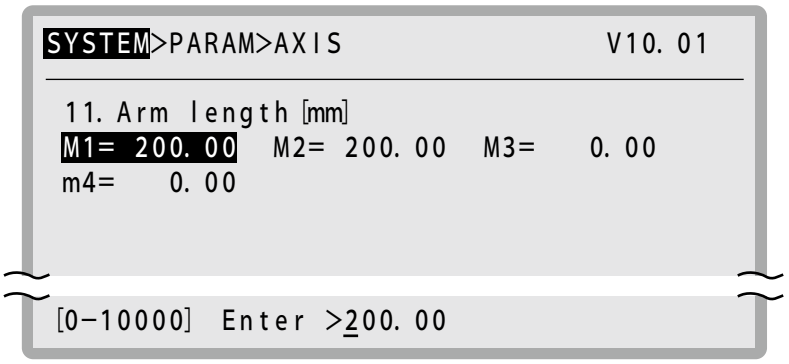
This parameter sets the X, Y axis arm length on SCARA robots.
This is automatically determined according to the current robot type when initialized.
The arm length is also determined automatically when standard coordinates are set.
On XY robots and MULTI type robots, setting the axis length also automatically determines the weight of each axis. This is set to 0 when initialized.

Step1 ***Select "11. Arm length [mm]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ / ▼ ***) keys.***

Setting the "Arm length [mm]"



CAUTION

On SCARA robots, the arm length and offset pulses are used to change coordinates to the Cartesian coordinate system. Make sure the arm length setting is accurate so the Cartesian coordinates can be used effectively and with high precision.

Step4 ***Enter the value with*** 0 ***to*** 9***, and*** . ***and then press*** ENTER.

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

12. Offset pulse /OFFSET

On SCARA robots, this parameter sets the offset pulses when the X, Y, R axes are at 0 pulses. When initialized, this is set to a value unique to each robot type that is currently set.

- 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)

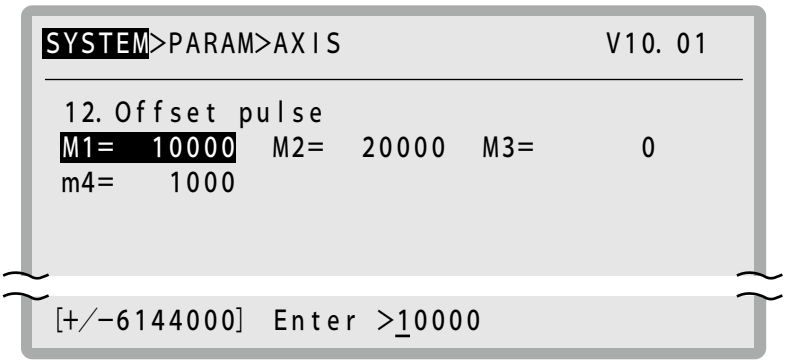
The offset is determined automatically when the standard coordinates are set.

Step1 ***Select "12. Offset pulse" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ / ▼ ***) keys.***

Setting the "Offset pulse"



CAUTION

- **On SCARA robots, the arm length and offset pulses are used to change coordinates to the Cartesian coordinate system. Make sure the arm length setting is accurate so the Cartesian coordinates can be used effectively and with high precision.**
- **When some value (including 0) has been entered for this parameter, it means the settings are in standard coordinates.**

Step4 ***Enter the value with*** 0 ***to*** 9 ***and then press*** ENTER.

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

13. Axis tip weight [kg] /AXSTIP

This parameter sets the weight of each axis tip (workpiece weight + tool weight) in kilogram units on MULTI type robots or auxiliary axes. A maximum value is set when the parameters are initialized.

The maximum weight is automatically determined according to the currently used axis type.

NOTE

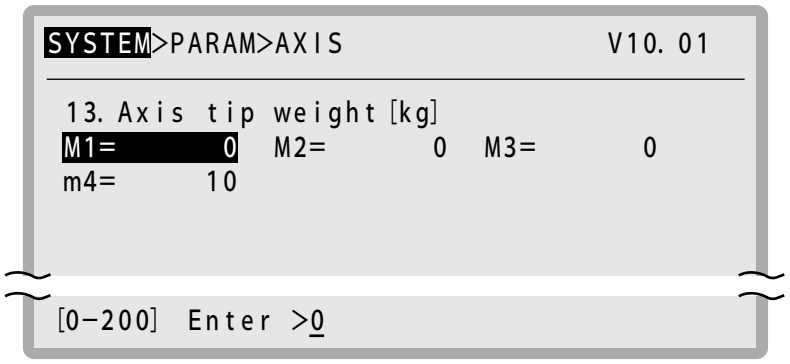
- This parameter can be entered only for MULTI type robots or auxiliary axes.
- For robots other than MULTI type robots, set the robot arm tip weight.

Step1 ***Select "13. Axis tip weight [kg]" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press F1 (EDIT).***

Step3 ***Select the axis with the cursor (▲ / ▼) keys.***

Setting the "Axis tip weight [kg]"



CAUTION

Optimal acceleration and other items are automatically set according to 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.

Step4 ***Enter the value with 0 to 9 and then press ENTER.***

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press ESC to quit the edit mode.***

14. Origin method /ORGSNS

This parameter selects the method for performing return-to-origin on the robot. When initialized, this is automatically set according to the current robot model. Three methods are available as follows:

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

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

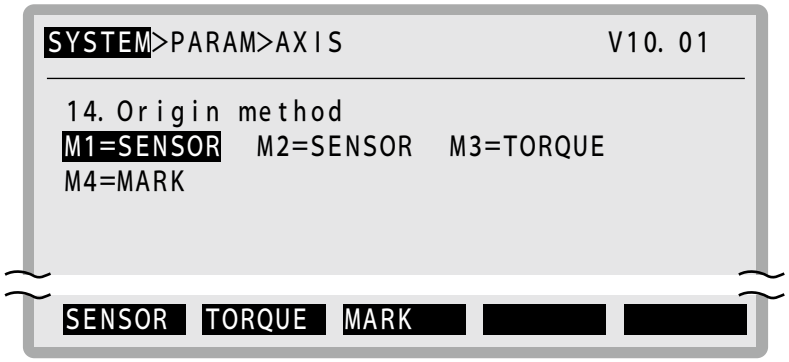
"mark" .....: Origin position is set by the user, such as with mating marks. (Axis specified as the "mark" does not perform return-to-origin.)

Step 1 ***Select "14. Origin method" in "SYSTEM>PARAM>AXIS" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Step 3 ***Select the axis with the cursor (*** ▲ ***/*** ▼ ***) keys.***

Setting the "Origin method"



Step 4 ***Press*** F1 ***(SENSOR) or*** F2 ***(TORQUE) or*** F3 ***(MARK) to enter the setting.***

Step 5 ***Repeat steps 3 and 4 as needed.***

Step 6 ***Press*** ESC ***to quit the edit mode.***

CAUTION

- **YAMAHA can accept no liability from problems arising due to changing the return-to-origin method without consulting YAMAHA beforehand.**
- **Return-to-origin will be incomplete if this parameter is changed.**

15. Origin direction /ORGDIR

This parameter specifies the direction for return-to-origin. When initialized, this is automatically set according to the current robot model.

"---" .....: Axis returns to origin in the manual movement minus (-) direction.

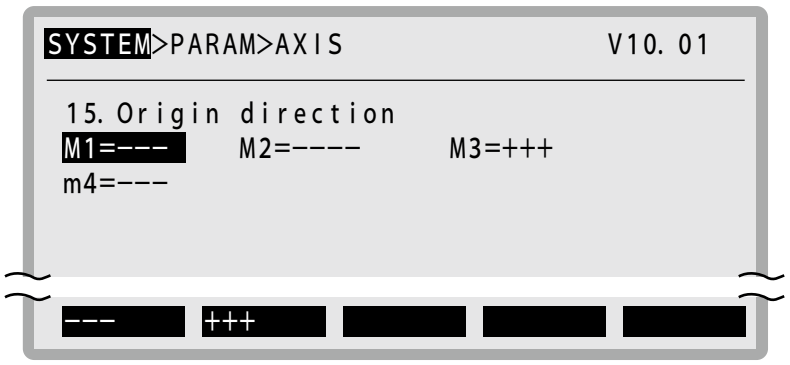
"+++" .....: Axis returns to origin in the manual movement plus (+) direction.

Step 1 ***Select "15. Origin direction" in "SYSTEM>PARAM>AXIS" mode.***

Step 2 ***Press F1 (EDIT).***

Step 3 ***Select the parameter with the cursor (▲ / ▼) keys.***

Setting the "Origin direction"



Step 4 ***Press F1 (---) or F2 (+++) to enter the setting.***

Step 5 ***Repeat steps 3 and 4 as needed.***

Step 6 ***Press ESC to quit the edit mode.***

CAUTION

- **YAMAHA can accept no liability from problems arising due to changing the return-to-origin direction without consulting YAMAHA beforehand.**
- **Return-to-origin will be incomplete if this parameter is changed.**

16. Motor direction /MOTDIR

This parameter specifies the robot movement direction. When initialized, this is set automatically according to the current robot model.

"---" .....: Motor minus (-) direction is set as the - direction.

"+++" .....: Motor plus (+) direction is set as the + direction.

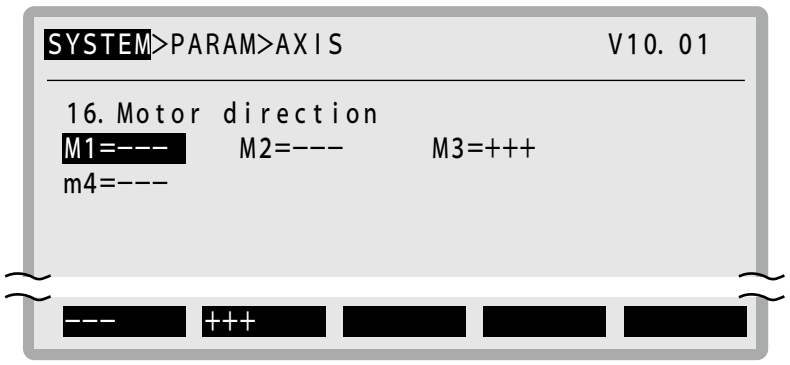
This parameter cannot be changed while the servo is on. To change the parameter, make sure the servo is off.

Step1 ***Select "16. Motor direction" in "SYSTEM>PARAM>AXIS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Select the axis with the cursor (*** ▲ ***/*** ▼ ***) keys.***

Setting the "Motor direction"



Step4 ***Press*** F1 ***(---) or*** F2 ***(+++) to enter the setting.***

Step5 ***Repeat steps 3 and 4 as needed.***

Step6 ***Press*** ESC ***to quit the edit mode.***

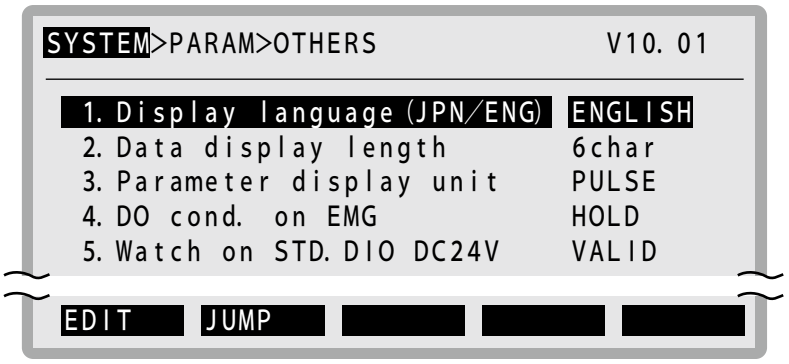
CAUTION

- **YAMAHA can accept no liability from problems arising due to changing the axis polarity without consulting YAMAHA beforehand.**
- **Return-to-origin will be incomplete if this parameter is changed.**
- **On SCARA robots, changing the initial setting for an axis will cause problems during linear movement on that axis, so do not change the initial setting.**

12.1.5 Other parameters

When changing other parameters on the RPB, use the descriptions in this section.

Editing other parameters



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

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⏫ / ⏬ *1		Switches to other screens.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

*1: To use ⏫ / ⏬, press ▲ / ▼ while holding down LOWER.

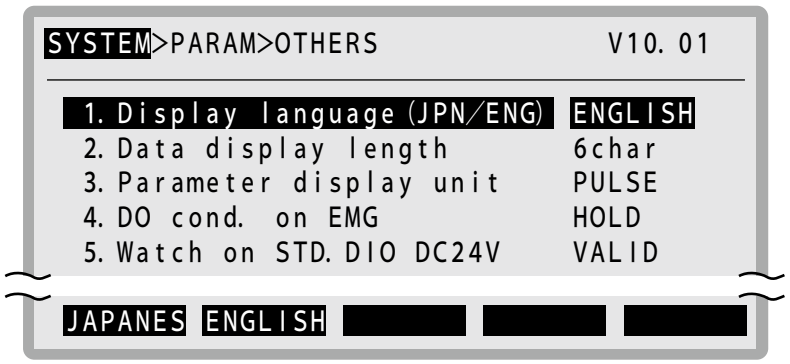
1. Display language/DSPLNG

This parameter sets the language for displaying messages on the RPB.

Step1 ***Select "1. Display language (JPN/ENG)" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting the display language



Step3 ***Press*** F1 ***(JAPANES) or*** F2 ***(ENGLISH) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

NOTE

This parameter will not change even if parameter initialization is performed.

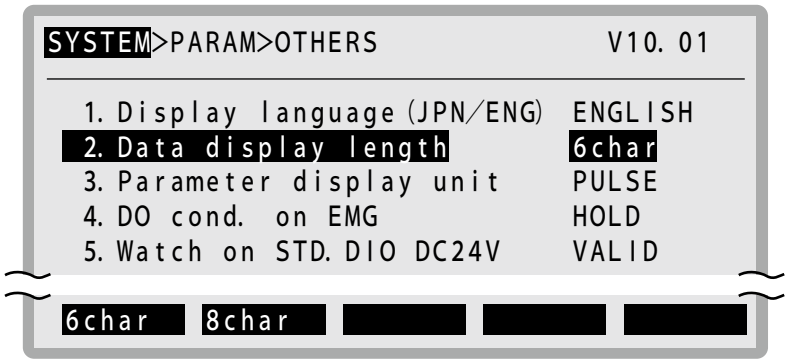
2. Data display length/DATLEN

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.

Step1 ***Select "2. Data display length" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting the "Data display length"



Step3 ***Press*** F1 ***(6char) or*** F2 ***(8char) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

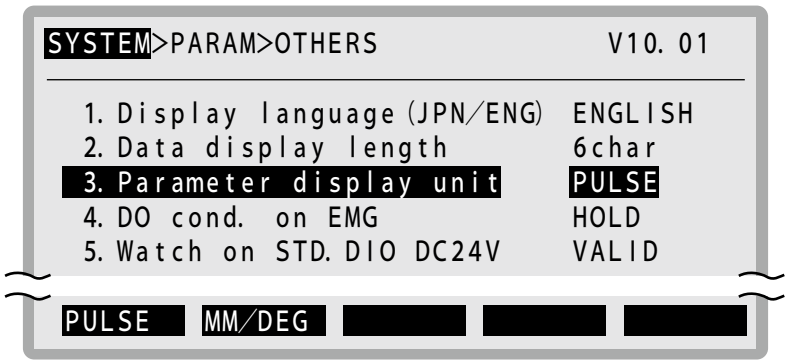
3. Parameter display unit/PDUNIT

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

Step1 ***Select "3. Parameter display units" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting the parameter display units



Step3 ***Press*** F1 ***(PULSE) or*** F2 ***(MM/DEG) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

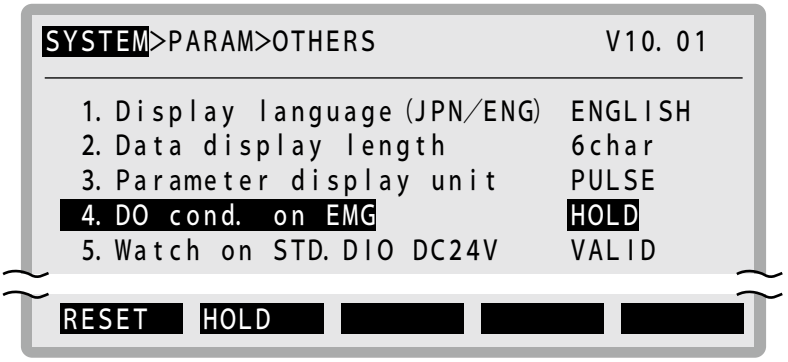
4. DO cond. on EMG /EMGCDO

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. This is automatically set to "HOLD" when the parameters are initialized.

Step1 ***Select "4. DO cond. on EMG " in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting " DO cond. on EMG"



Step3 ***Press*** F1 ***(RESET) or*** F2 ***(HOLD) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

CAUTION

This parameter is invalid if the sequence program starts up.

5. Watch on STD.DIO DC24V /STDWCH

This parameter sets whether or not to enable the dedicated interlock signal input when there is no STD.DIO DC24V power being supplied. This is automatically enabled (valid) when the parameters are initialized.

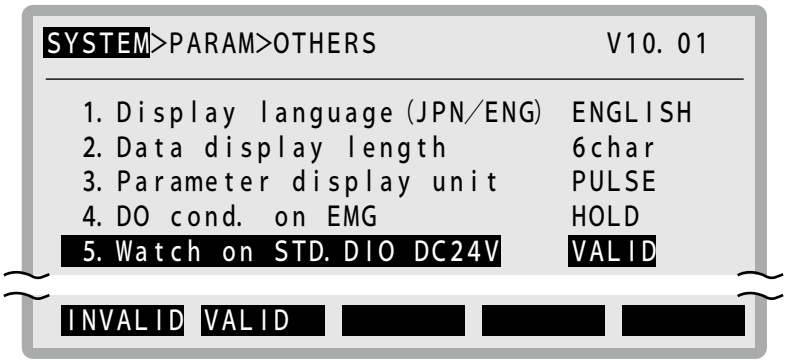
NOTE

When DC 24V is supplied to the STD. DIO and SAFETY connector, this parameter is enabled (valid) regardless of the setting.

Step1 ***Select "5. Watch on STD.DIO DC24V" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press F1 (EDIT).***

Setting the "Watch on STD.DIO DC24V"



CAUTION

- **Make sure this setting is enabled (valid) when the robot will be in normal operation.**
- **The interlock signal sends a stop command such as for stopping robot operation. If the interlock setting is off (disabled) use caution during robot operation.**

Step3 ***Press F1 (INVALID) or F2 (VALID) to enter the setting.***

Step4 ***Press ESC to quit the edit mode.***

6. Incremental Mode control /INCMOD

This parameter sets whether to have origin incomplete status every time power to this controller is turned on. This is automatically set invalid when the parameters are initialized.

NOTE

- When this parameter is valid (enabled), return-to-origin will always be incomplete each time the controller power is turned on. Absolute reset must therefore always be performed.
- Enable this parameter if the controller does not have an absolute battery installed.

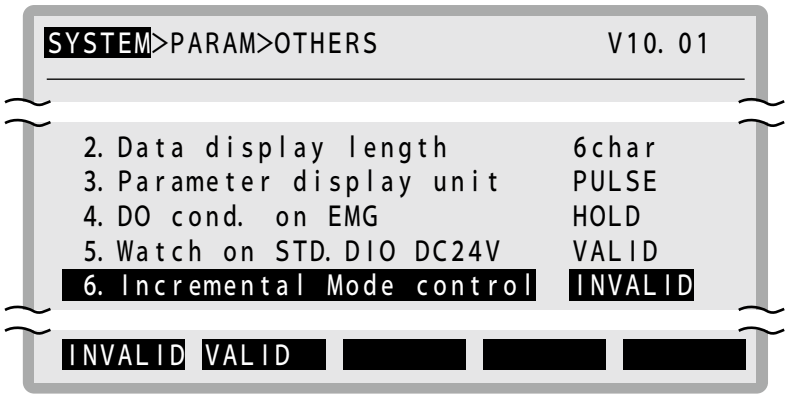
CAUTION

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

Step1 ***Select "6. Incremental Mode control" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "Incremental Mode control"



Step3 ***Press*** F1 ***(INVALID) or*** F2 ***(VALID) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

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.

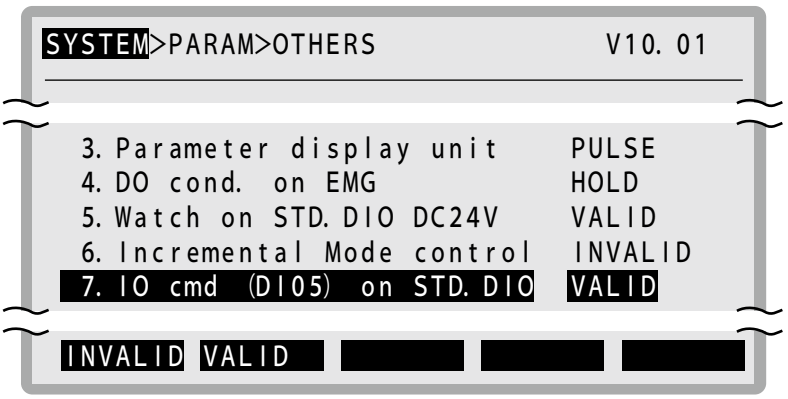
NOTE

- Command functions using DI05 (I/O command execution trigger) of the STD.DIO connector utilize part of the general-purpose input and output. When you are utilizing a general-purpose input and output, the value may change so use caution when using such commands.
- For detailed information on I/O commands, refer to the programming manual.

Step1 ***Select "7. IO cmd (DI05) on STD.DIO" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "IO cmd (DI05) on STD.DIO"



Step3 ***Press*** F1 ***(INVALID) or*** F2 ***(VALID) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

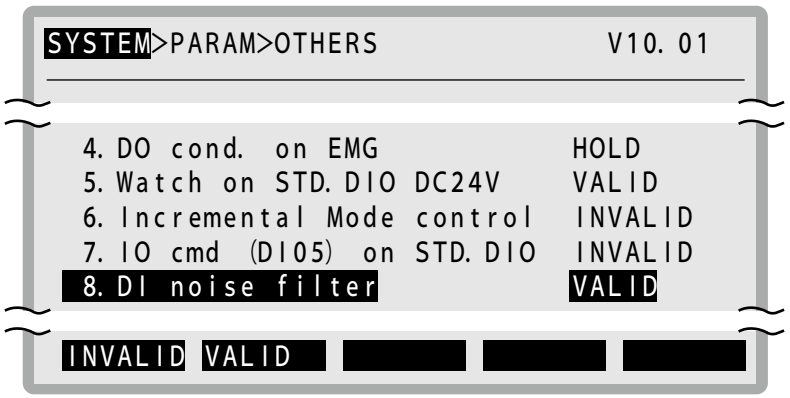
8. DI noise filter/SCANMD

This parameter sets whether to cancel external input signals (dedicated input signals, general-purpose input signals) that might appear like noise in the form of short pulses.
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. This prevents the controller from responding to noise inputs.

Step1 ***Select "8. DI noise filter" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "DI noise filter"



Step3 ***Press*** F1 ***(INVALID) or*** F2 ***(VALID) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

9. TRUE condition / EXPCFG

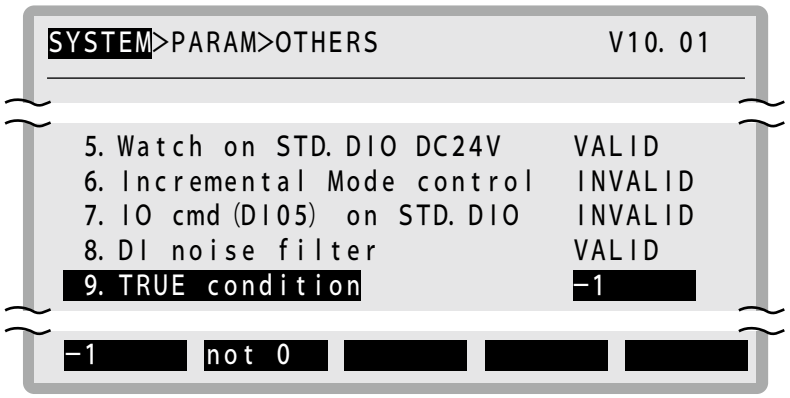
This parameter selects the operation when the conditional expression, which is used for the STOPON option in an IF (including ELSEIF), WHILE to WEND, WAIT, MOVE, or DRIVE statement, is a numeric expression.
This parameter is set to "-1" when the parameters are initialized.

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

Step1 ***Select "9. TRUE condition" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "TRUE condition"



Step3 ***Press*** F1 ***(-1) or*** F2 ***(not 0) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

10. Unit select / PTUNIT

This parameter selects the point data unit system to be used when the controller is started. For incremental specification robots and semi-absolute specification robots, the current position is displayed in "pulse" units at controller startup because return-to-origin is incomplete. When this parameter is used to select "mm" units, the position display is switched to "mm" units at the same time when return-to-origin is completed. This parameter is set to "Normal" when the parameters are initialized.

NOTE

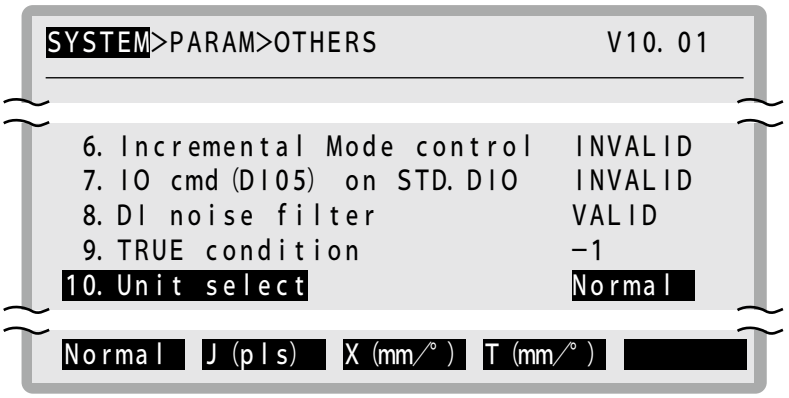
Tool coordinate mode is enabled when the robot has an R-axis and the hand installed on the R-axis is specified by hand data (hand definition is set). If the robot does not have an R-axis or the hand installed on the R-axis is not specified by hand data, the unit system will be automatically changed to X (mm/°) after starting the controller even if T (mm/°) is selected by parameter.

Setting	Meaning
Normal (default setting)	Sets to the unit system that was last selected.
J (pls)	Sets to "pulses" unit system.
X (mm/°)	Sets "mm" unit system in normal setting (other than tool coordinate mode).
T (mm/°)	Sets "mm" unit system in tool coordinate mode.

Step 1 ***Select "10. Unit select" in "SYSTEM>PARAM>OTHERS" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Setting "Unit select"



Step 3 ***Press a key from*** F1 ***(Normal) to*** F4 ***(mm/°) to enter the setting.***

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

11. Error output (DO & SO) / ERPORT

If an error has occurred in the controller, that error can be output by turning on a general-purpose output DO and SO, except for those with an error group number beginning with "0" (ex. 0.1: Origin incomplete). This parameter selects the port used for error output. 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

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).

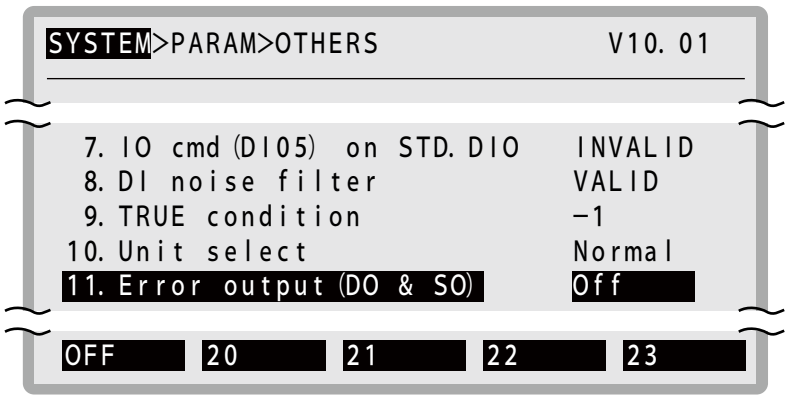
In any of the following cases, the general-purpose output selected for error output turns off.

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

Step1 ***Select "11. Error output (DO & SO)" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "Error output (DO & SO)"



Step3 ***Press a key from*** F1 ***(OFF) to*** F9 ***(27) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

12. MOVEI/DRIVEI start pos./MOVIMD

When the robot stops during execution of a relative movement command due to an interlock or emergency stop, this parameter sets whether to keep the initial target position or set a new target position relative to the current position (stopped position) after the robot movement is resumed. When initialized, this parameter is set to “Keep”.

NOTE

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

- Controllers with software version 10.01 to 10.36 or version 10.50 to 10.56

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)

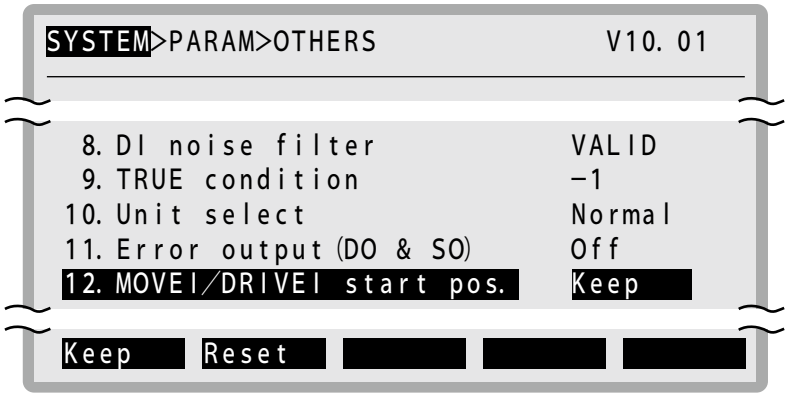
- Controllers with software version 10.37 to 10.49 or version 10.57 onward

Setting	Meaning
Keep (Default setting)	When relative movement is interrupted and then resumed, the robot moves to complete the remaining movement. The target position is not changed even after movement is resumed. If return-to-origin or absolute reset is performed after an interruption of relative movement, the target position will be reset.
Reset	When relative movement is interrupted and then resumed, the robot moves to a new relative position from the current position (stopped position). The target position is changed after movement is resumed.
Keep 2	When relative movement is interrupted and then resumed, the robot moves to complete the remaining movement. The target position is not changed even after movement is resumed. Even if return-to-origin or absolute reset is performed after an interruption of relative movement, the target position will not be reset. (Compatible with previous versions)

Step 1 Select "12. MOVEI/DRIVEI start pos." in "SYSTEM>PARAM>OTHERS" mode.

Step2 *Press* F1 *(EDIT).*

Setting "MOVEI/DRIVEI start pos."



Step3 *Press* F1 *(Keep) or* F2 *(Reset) to enter the setting.*

Step4 *Press* ESC *to quit the edit mode.*

13. DI17 mode /DI17MD

Operation to be performed by dedicated input DI17 can be selected. Use this parameter to select either of the following operations.

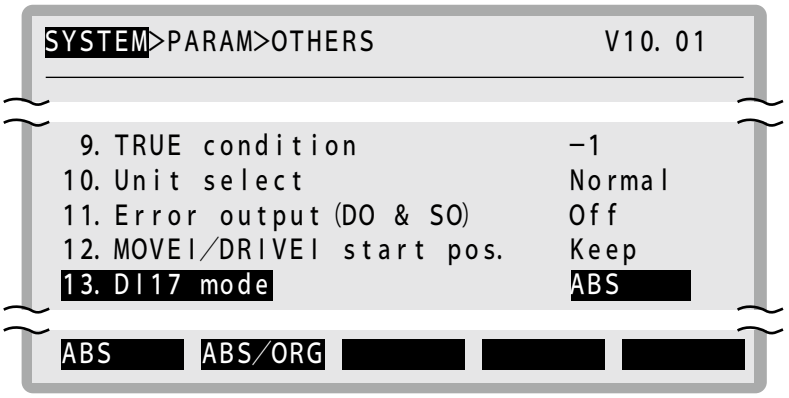
This parameter is reset to "ABS" when robot numbers are set by generation.

Setting	Meaning
ABS	DI17 is only used for "absolute reset". When the DI17 contact is closed (ON) in "MANUAL" mode, absolute reset is performed on absolute type axes at the rising edge of the signal pulse according to the return-to-origin sequence. Use this setting when only absolute type axes exist or when both absolute type axes and incremental type axes exist. In the latter case, absolute reset is performed by DI17, and return-to-origin performed by DI14.
ABS/ORG	DI17 is used for both "absolute reset" and "return-to-origin". Use this setting to perform both absolute reset and return-to-origin by DI17. When the DI17 contact is closed (ON) in "MANUAL" mode, absolute reset and return-to-origin are performed at the rising edge of the signal pulse according to the return-to-origin sequence. Absolute reset is first performed on an absolute type axis if it exists, and then return-to-origin performed on incremental type axes. In most cases, do not use this setting. Use this setting only when return-to-origin signal must be input to DI17. (For example, in cases where an RCX141 or RCX221 controller was replaced by the RCX240) When both absolute type axes and incremental type axes exist, set this parameter to "ABS" so that absolute reset is performed by DI17 and return-to-origin performed by DI14.

Step1 ***Select "13. DI17 mode" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "DI17 mode"



Step3 ***Press*** F1 ***(ABS) or*** F2 ***(ABS/ORG) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

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.

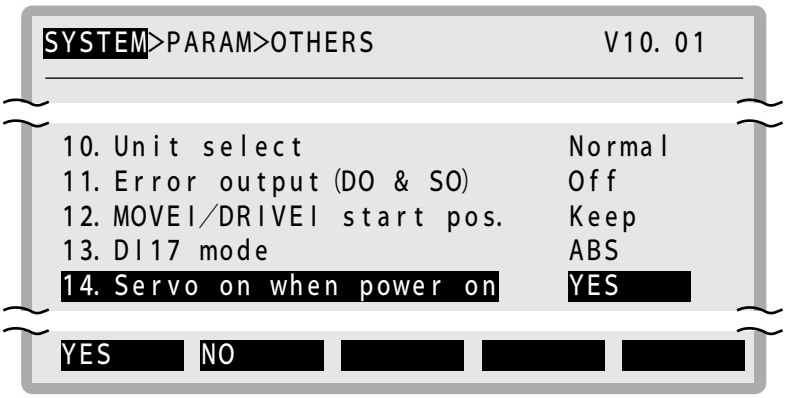
When robot numbers are set by generation, this parameter is reset to "YES".

Setting	Meaning
YES	When SAFE mode setting or serial I/O setting is enabled, the controller starts with servo-off when the controller power is turned on. In other cases, the controller starts with servo-on when the controller power is turned on. (Compatibility mode for the RCX141/142 and RCX221/222 controllers)
NO	The controller always starts with servo-off when the power is turned on. (Compatibility mode for the RCX143/144 controllers)

Step1 ***Select "14. Servo on when power on" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "Servo on when power on"



Step3 ***Press*** F1 ***(YES) or*** F2 ***(NO) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

15. Battery alarm (DO & SO) /BTALRM

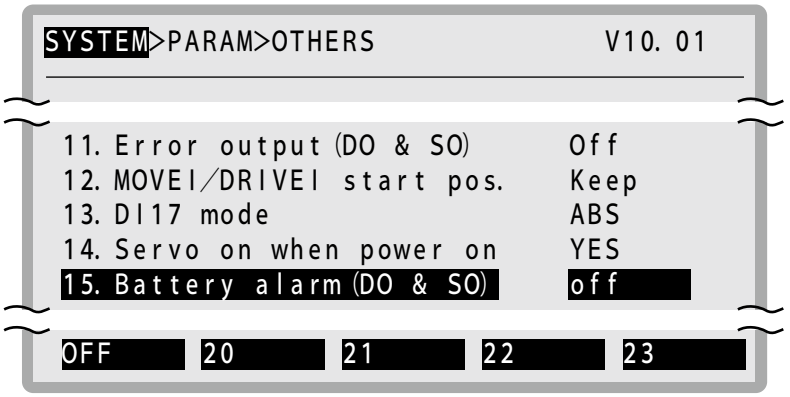
When the system backup battery or absolute battery becomes low, DO and SO general-purpose outputs can be turned on.
Use this parameter to set the port to output a battery alarm.
The battery alarm can be output from one of the standard I/O interface general-purpose output ports (DO20 to 27, SO20 to 27) and the option I/O interface general-purpose output ports (DO30 to 33, 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.

Step1 ***Select "15. Battery alarm (DO & SO)" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "Battery alarm (DO & SO)"



Step3 ***Press a key from*** F1 ***(OFF) to*** F9 ***(27) or from*** F11 ***(30) to*** F14 ***(33) to enter the setting.***

Step4 ***Press*** ESC ***to quit the edit mode.***

16. Manual move mode /MOVMOD

When an axis movement key is held down, inching movement switches to continuous movement. Use this parameter to shorten the time taken to switch to the continuous movement. This parameter can also be used for the online command @JOG and jog movement command of remote commands to shorten the time taken to switch from the inching movement to the continuous movement.

NOTE

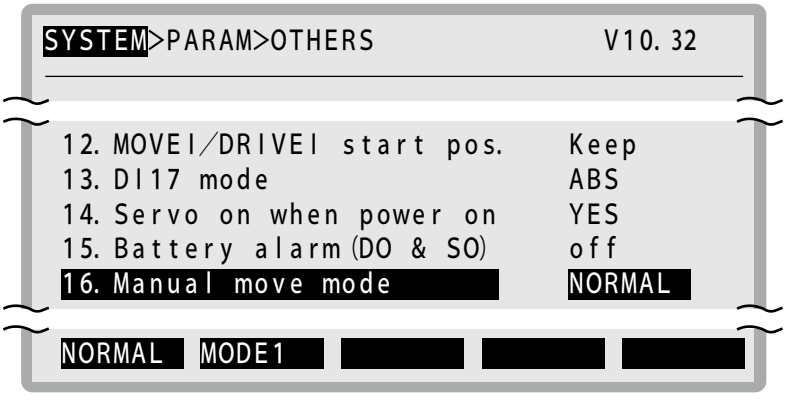
This parameter is enabled from controllers with software version 10.32 onwards.

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)	

Step1 ***Select "16. Manual move mode" in "SYSTEM>PARAM>OTHERS" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting "Manual move mode"



Step3 ***Press*** F1 ***(NORMAL) or*** F2 ***(MODE1) to set the manual move mode.***

Step4 ***Press*** ESC ***to quit the edit mode.***

17. DO cond. on PGM reset / RESCDO

Use this parameter to select whether to reset the DO/MO/LO/TO/SO port outputs when a program is reset or a HALT statement is executed. When initialized, this parameter is set to "RESET".

NOTE

This parameter is enabled from controllers with software version 10.61 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.

Setting	Meaning	
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

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 parameters" occurs.
If this parameter is set to "VALID", the undefined parameters (newly added parameters) in the file will then be ignored. 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

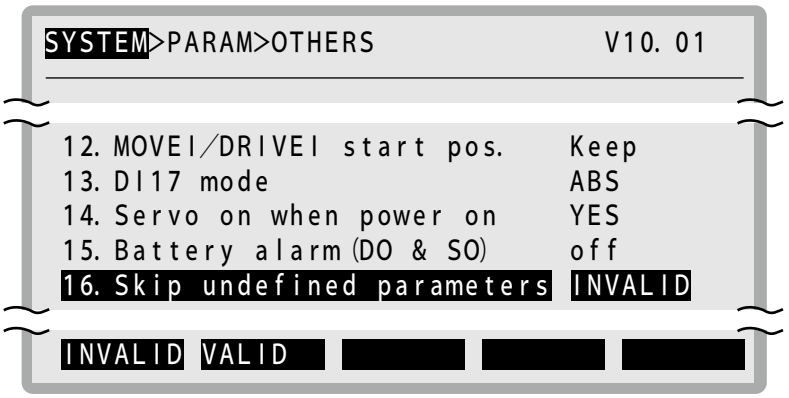
- **If this parameter is set to "VALID", then misspellings in the parameter file cannot be detected. Do not use this function except for cases in which you must load the parameters of a new version into a controller of an earlier version.**
- **This parameter number changes according to the controller version.**

Controller version	Parameter number
Prior to Ver. 10.24	16.
Ver. 10.24 to Ver. 10.31	22.
Ver. 10.32 to Ver. 10.60	23.
Ver. 10.61 onward	24.

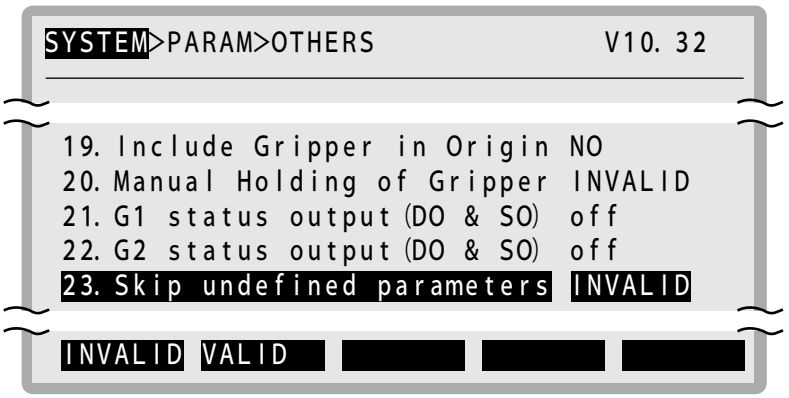
Step 1 ***Select "23. Skip undefined parameters" in "SYSTEM>PARAM>OTHERS" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Setting the "16. Skip undefined parameters" (Controller prior to Ver. 10.24)



Setting the "23. Skip undefined parameters" (Controller from Ver. 10.32 onwards)



Step 3 ***Press*** F1 ***(INVALID) or*** F2 ***(VALID) to enter the setting.***

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

12.1.6 Parameters for option boards

This section explains how to set parameters for option boards from the RPB.
Option boards are roughly divided into three types: option DIO boards, serial I/O boards and network board.
For option DIO boards, set the parameter to enable or disable the DC 24V power input monitor.
For serial I/O boards (CC-Link/DeviceNet/PROFIBUS), set 3 parameters (4 parameters for DeviceNet only) including the parameter to enable or disable the boards. When using a network board (Ethernet), set 4 parameters including the parameter to enable or disable the board.

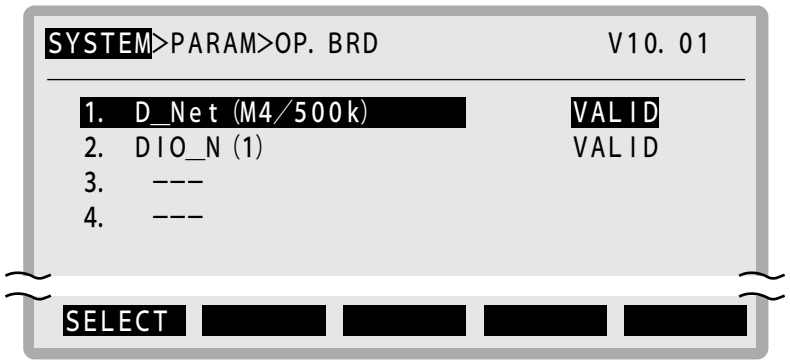
NOTE

- 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.

Step 1 ***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



Step 2 ***Check the option board settings.***

To change the settings, refer to the next sections "12.1.6.1" to "12.1.6.3".

Option boards installed into the option slots are displayed on the RPB screen.

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 1 is installed.
	Gripper2	Electric gripper 2 is installed.

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

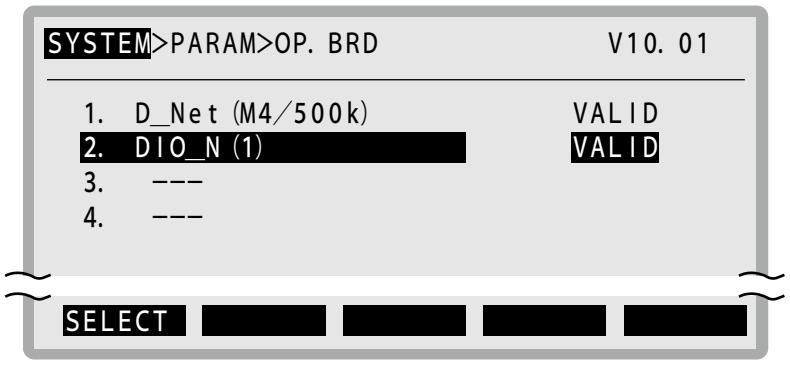
Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
F1	SELECT	Selects the option board for parameter setting.

12.1.6.1 Option DIO setting

The following parameter for option DIO (NPN or PNP specifications) boards is used to enable or disable monitoring of the DC 24V 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 as a warning and recorded in the error history if the DC 24V supply is shut off. When set to "INVALID", no error message will be issued and recorded in the error history even if the DC 24V supply is shut off.

Option DIO setting (1)



NOTE

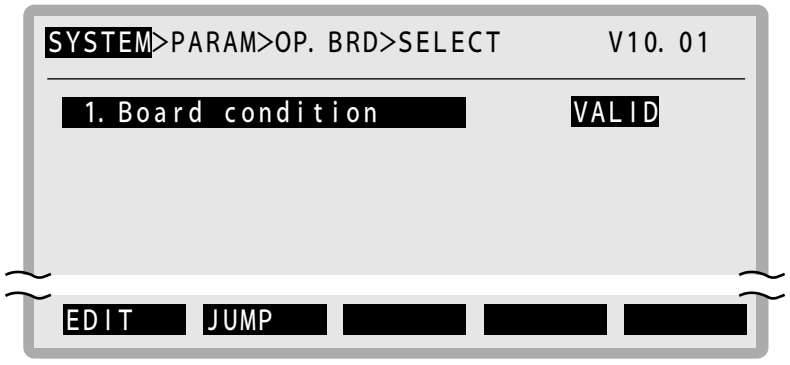
Setting to "VALID" is recommended so that the 24V supply for the option board is monitored during operation. Set to "INVALID" only when option boards that are not to be used are installed.

CAUTION

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

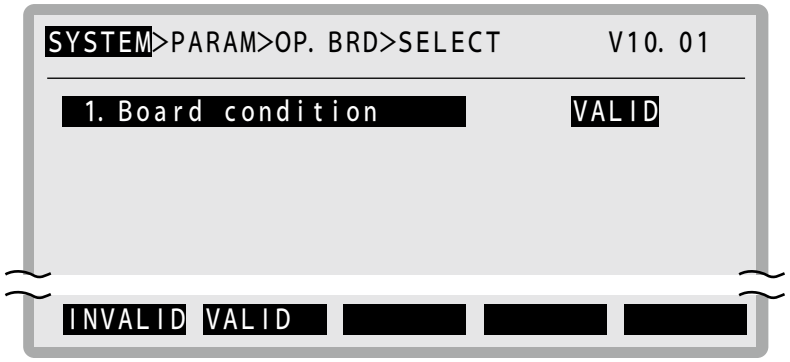
Step 1 ***In "SYSTEM>PARAM>OP.BRD" mode, select the desired option DIO with the cursor keys and press*** F1 ***(SELECT).***

Option DIO setting (2)



Step2 ***Press*** F1 ***(EDIT).***

Option DIO setting (3)



Step3 ***Press*** F1 ***(INVALID) or*** F2 ***(VALID) to select whether to monitor the DC24V power input.***

Step4 ***Press*** ESC ***to quit the edit mode.***

12.1.6.2 Serial I/O setting

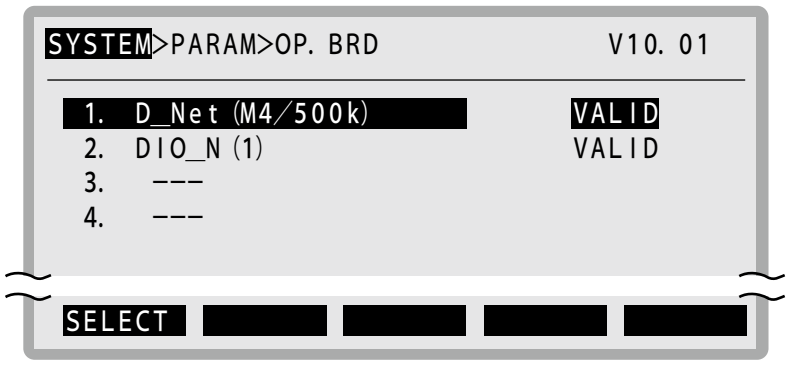
For serial I/O boards (CC-Link/DeviceNet/PROFIBUS), there are 3 parameters (4 parameters for DeviceNet only) to be set, including the parameter to enable or disable the serial I/O unit monitor.

	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 RPB, to word information SOW(1). When set to "VALID" the message number to be displayed on the RPB will be output. When set to "INVALID" the message number to be displayed on the RPB 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

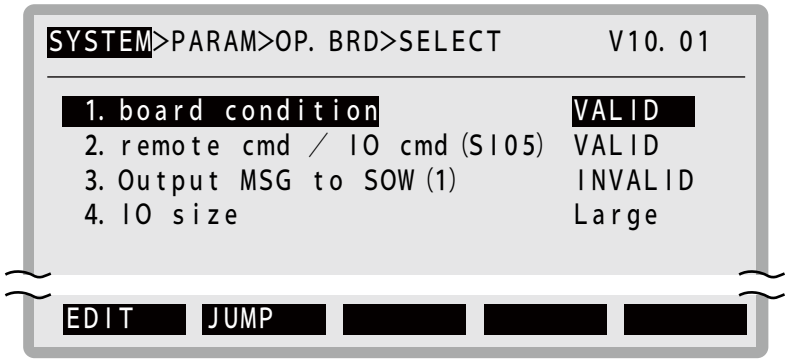
- Set the Board status parameter to "INVALID" when not using serial I/O boards.
- When the Board status parameter is set to "INVALID", the dedicated input/output of the STD.DIO connector is enabled. When the Board status parameter is set to "VALID", the dedicated input (except DI1) of the STD.DIO connector 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 "1. Error messages" in Chapter 10.
- 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 commands 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.

"Serial IO" setting (1)



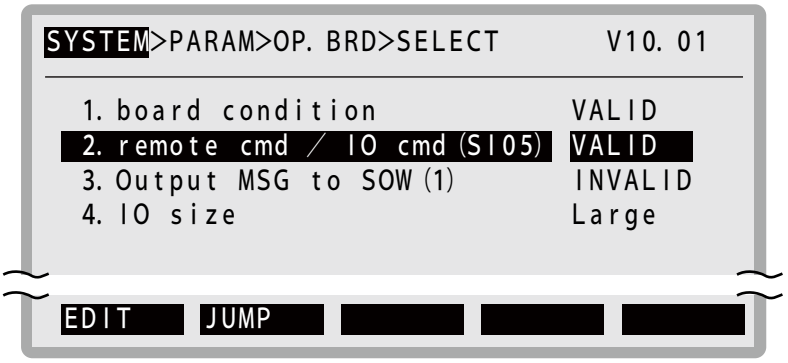
Step 1 ***In "SYSTEM>PARAM>OP.BRD" mode, select the desired serial I/O with the cursor keys and press*** F1 ***(SELECT).***

"Serial IO" setting (2)



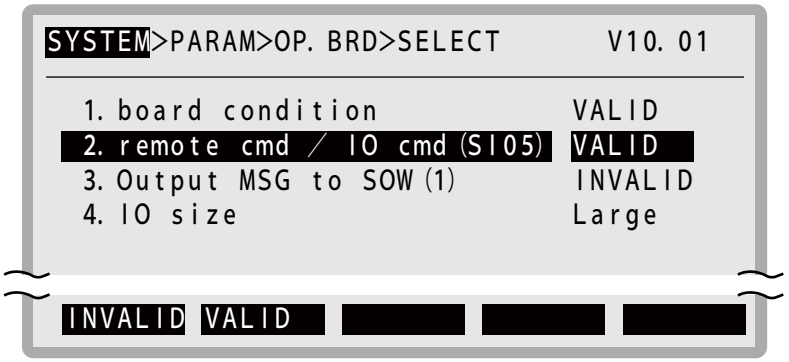
Step2 ***Select the parameter with the cursor (▲ / ▼) keys.***

"Serial IO" setting (3)



Step3 ***Press F1 (EDIT).***

"Serial IO" setting (4)



Step4 ***Press F1 (INVALID) or F2 (VALID) to enter the setting.***

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

Step5 ***Press ESC to quit the edit mode.***

12.1.6.3 Setting the network parameters

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

CAUTION

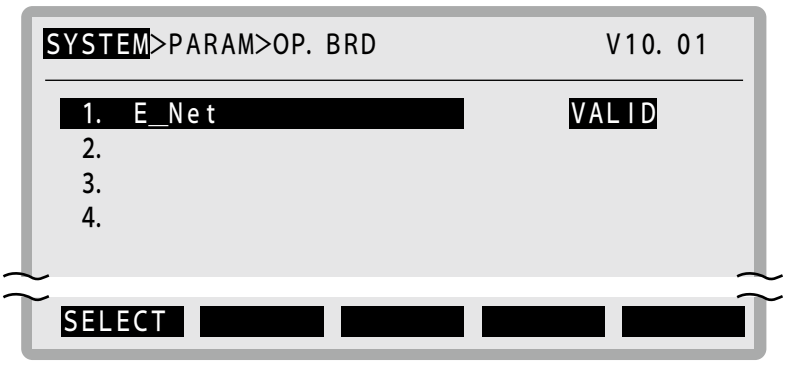
When making the Ethernet settings to use TELNET, you will need to set any other parameters than those shown below. For more details, see the Ethernet manual.

	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

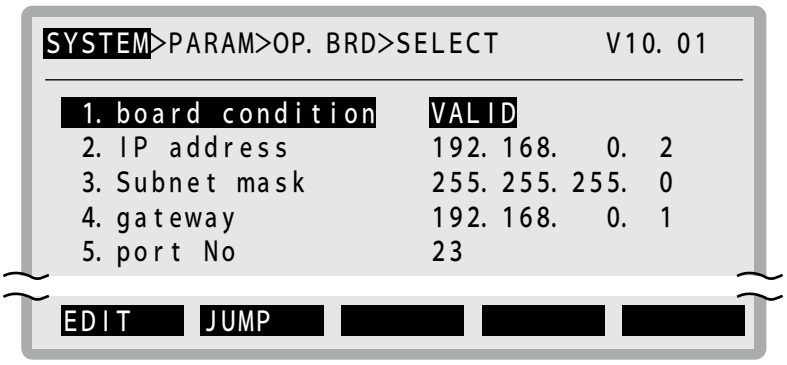
- The communication mode parameter is applicable to a controller of Ver. 10.20 onwards.
- The communication mode parameter can also be changed by the ONLINE or OFFLINE statement of the robot language.

Network setting (1)



Step 1 ***In "SYSTEM>PARAM>OP. BRD" mode, select "E_Net" with the cursor keys and press*** F1 ***(SELECT).***

Network setting (2)

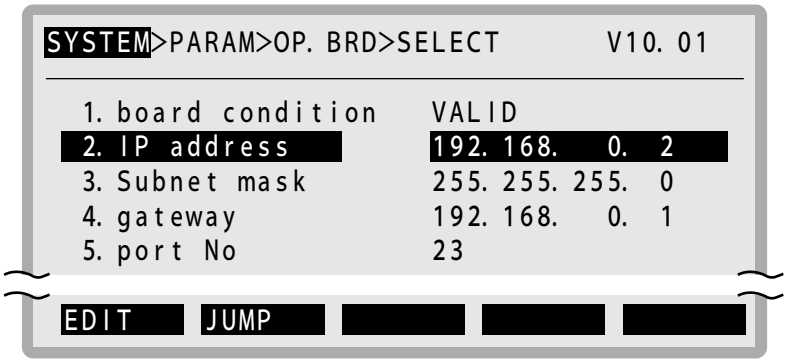


Step2 ***Select the parameter with the cursor (▲ / ▼) keys.***

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.

Network setting (3)



Step3 ***Press F1 (EDIT).***

Step4 ***Set the parameters.***

When changing the "Board condition" parameter, press F1 (INVALID) to disable the Ethernet unit or press F2 (VALID) to enable the Ethernet unit.

When changing the communication mode, press F1 (OFFLINE) to set the offline mode or press F2 (ONLINE) to set the online mode.

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

Step5 ***Press ESC to quit the edit mode.***

12.2 Communication parameters

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

There are 8 kinds of communication parameters.

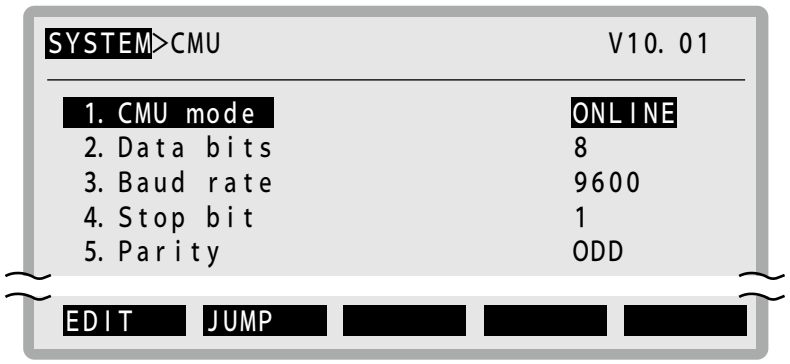
1. Communication mode
2. Data bit
3. Baud rate
4. Stop bit
5. Parity
6. Termination code
7. XON/XOFF control
8. RTS/CTS control

For detailed information, refer to Chapter 8, "RS-232C INTERFACE".

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

The communication parameter screen appears.

Communication parameter screen



Step 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.

Step 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.

Step4 *Set the parameter with the function keys.*

The selectable values or items appear as function key menus on the guideline.

Step5 *Press ESC to quit the editing.*

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

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

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up and down.
⇈ / ⇊ *1		Switches to other screens.
F1	EDIT	Edits the parameter.
F2	JUMP	Moves the cursor to the designated parameter.

*1: To use ⇈ / ⇊, press ▲ / ▼ while holding down LOWER.

1. CMU (communication) mode

This parameter sets the communication mode on the computer.

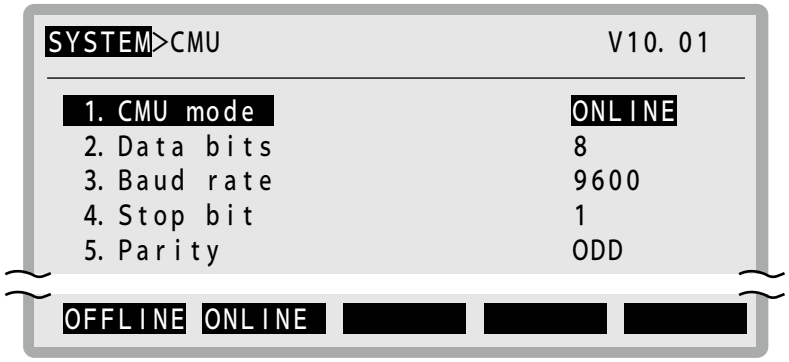
NOTE

- Online commands can be executed only in "ONLINE" mode.
- The CMU (communication) mode can be changed with either ONLINE or OFFLINE statements in robot language.

Step1 ***Select "1. CMU mode" in "SYSTEM>CMU" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting the "CMU mode"



Step3 ***Press*** F1 ***(OFFLINE) or*** F2 ***(ONLINE) to select the communication mode.***

Step4 ***Press*** ESC ***to quit the editing.***

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

2. Data bits

This parameter sets the data bit length.

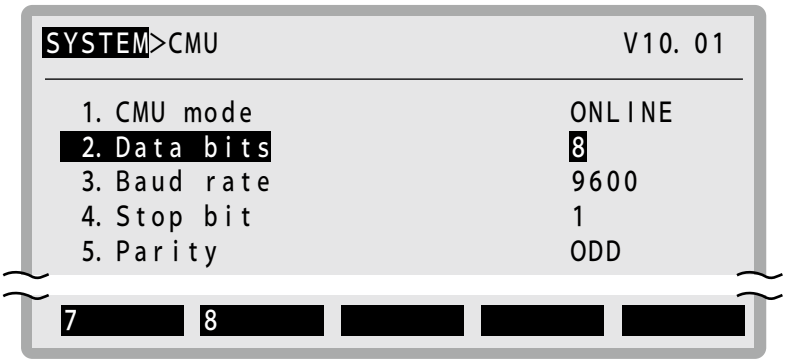
NOTE

Katakana letters (Japanese phonetic) cannot be sent if data bit length was set to 7 bits.

Step 1 ***Select "2. Data bits" in "SYSTEM>CMU" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Setting the "Data bits"



Step 3 ***Press*** F1 ***(7) or*** F2 ***(8) to select the data bit length.***

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

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

3. Baud rate

This parameter sets the communication speed.

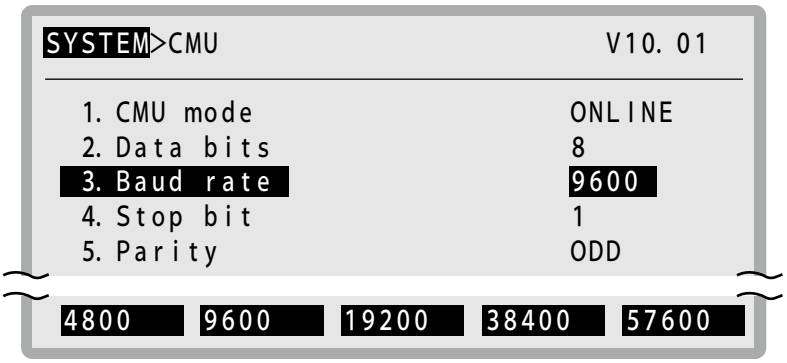
NOTE

Communication errors are more prone to occur at high communication speeds. If communication errors frequently occur, set a lower communication speed.

Step1 ***Select "3. Baud rate" in "SYSTEM>CMU" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting the "Baud rate"



Step3 ***Press a key from*** F1 ***(4800) to*** F5 ***(57600) to enter the setting.***

Step4 ***Press*** ESC ***to quit the editing.***

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

4. Stop bit

This parameter sets the stop bit length.

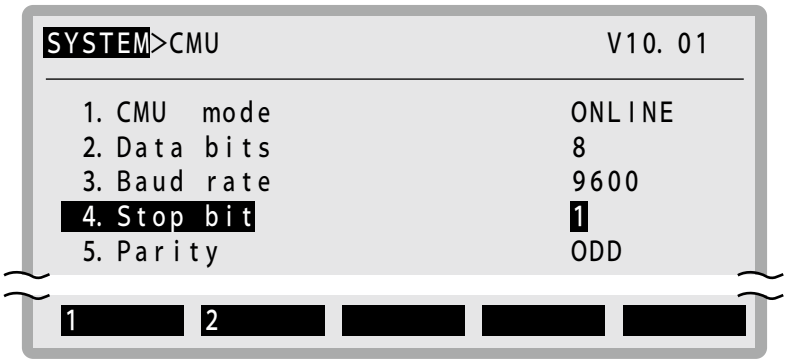
NOTE

Set to 2 bits if communication errors frequently occur.

Step1 ***Select "4. Stop bit" in "SYSTEM>CMU" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting the "Stop bit"



Step3 ***Press*** F1 ***(1) or*** F2 ***(2) to set the stop bit length.***

Step4 ***Press*** ESC ***to quit the editing.***

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

5. Parity

This parameter sets the parity check.

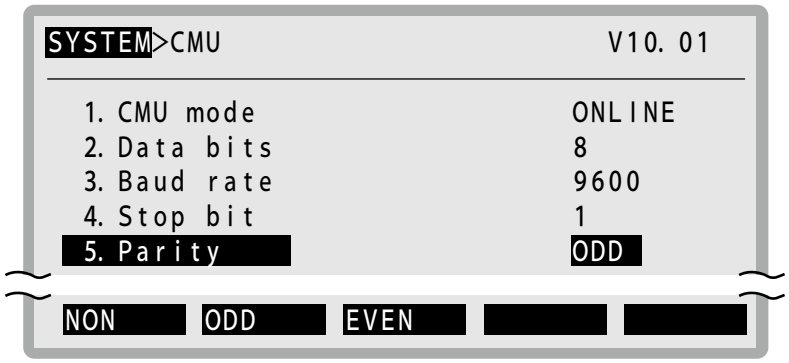
NOTE

Use the parity check as often as possible.

Step 1 ***Select "5. Parity" in "SYSTEM>CMU" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Setting the "Parity"



Step 3 ***Press a key from*** F1 ***(NON) to*** F3 ***(EVEN) to set the parity check.***

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

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

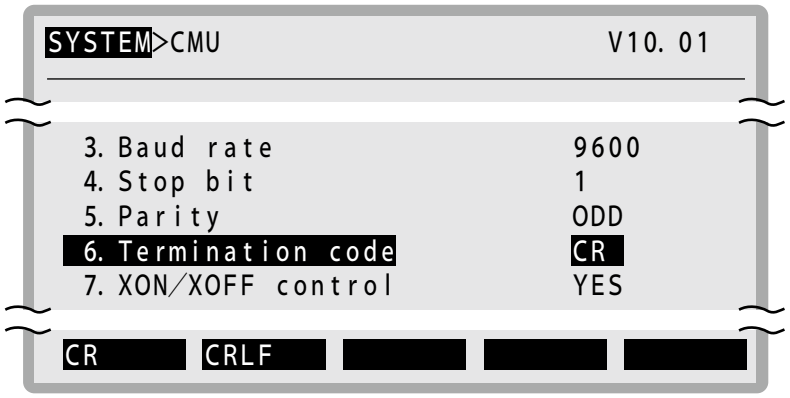
6. Termination code

This parameter sets the line feed code.

Step 1 ***Select "6. Termination code" in "SYSTEM>CMU" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Setting the "Termination code"



Step 3 ***Press*** F1 ***(CR) or*** F2 ***(CRLF) to set the termination code.***

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

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

7. XON/XOFF control

This parameter sets whether to control the data flow using XON/XOFF control.

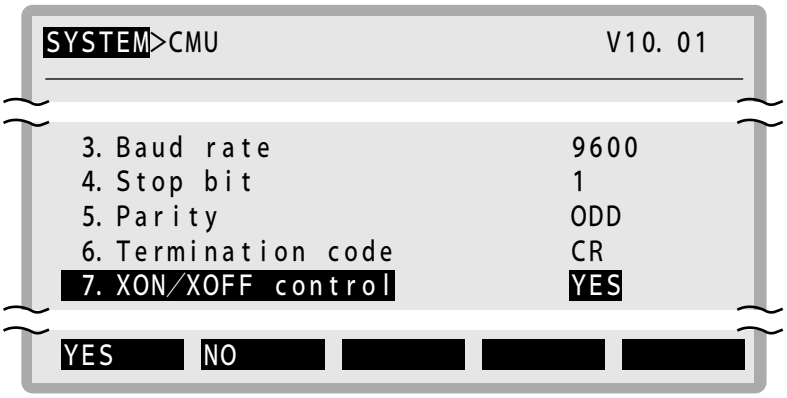
NOTE

Data omissions may occur if data flow control is not performed. Make use of data flow control as often as possible.

Step1 ***Select "7. XON/XOFF control" in "SYSTEM>CMU" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Setting the "XON/XOFF control"



Step3 ***Press*** F1 ***(YES) or*** F2 ***(NO) to set the XON/XOFF control.***

Step4 ***Press*** ESC ***to quit the editing.***

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

8. RTS/CTS control

This parameter sets whether to control the data flow using RTS/CTS signal.

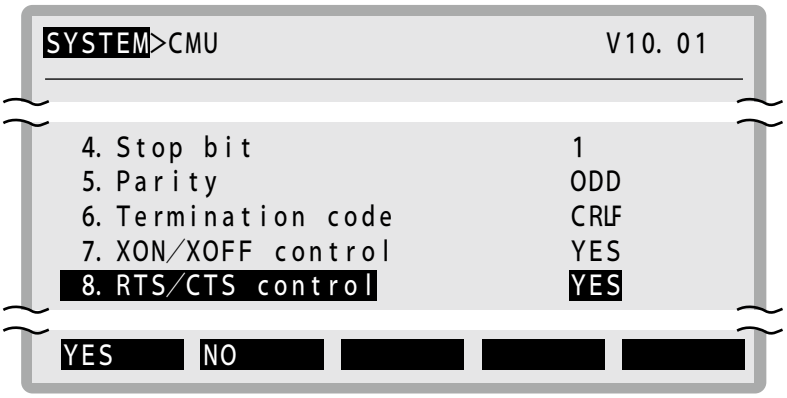
NOTE

Data omissions may occur if data flow control is not performed. Make use of data flow control as much as possible.

Step 1 ***Select "8. RTS/CTS CONTROL> in "SYSTEM>CMU " mode.***

Step 2 ***Press*** F1 ***(EDIT).***

"RTS/CTS CONTROL" setting



Step 3 ***Press*** F1 ***(YES) or*** F2 ***(NO) to enter the setting.***

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

12.3 OPTION parameters

The OPTION parameters are used to set expanded controller functions.
These parameters consist of 5 types: parameters for the area check output, parameters relating to the SAFE mode, parameters relating to the serial I/O, parameters relating to the double-carrier type robots, and parameters relating to the individual axis return-to-origin function by general-purpose DI/SI.

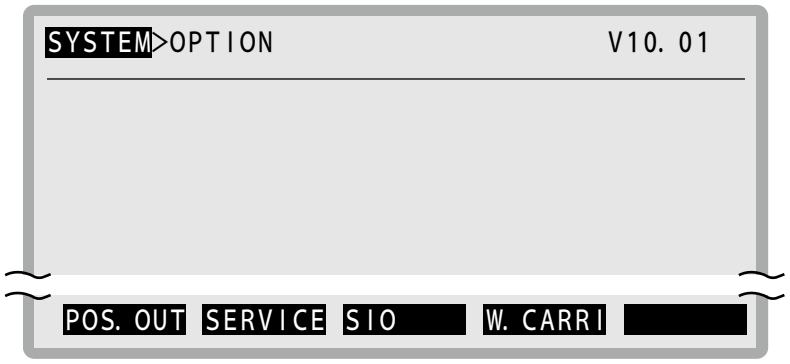
Step 1 ***Press F3 (OPTION) in "SYSTEM " mode.***

"SYSTEM>OPTION" mode is entered.

Step 2 ***Press a key from F1 (POS. OUT) to F6 (DI. ORG).***

Each parameter item is displayed.

OPTION parameter setting



Step 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.

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

12.3.1 Setting the area check output

This function checks whether the current robot position is within an area specified by the area check output parameter's point data, and outputs the result to the specified port.
A maximum of 4 areas can be checked with controllers prior to Ver. 10.10, and a maximum of 8 areas can be checked with controllers from Ver. 10.10 onwards.
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. 10.10

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

   - Controller from Ver. 10.10 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

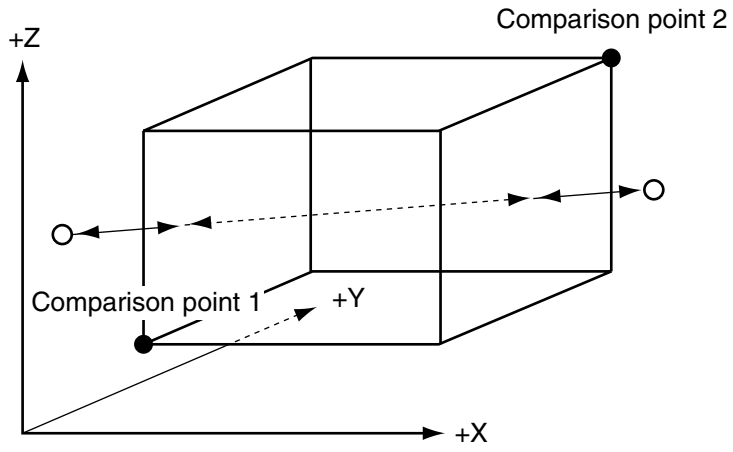
3. Comparison point No. 1
4. Comparison point No. 2
   Sets the points for determining the area. (Usable point No. : P0 to P4000)
   The area is applied to all set axes.
   If the R axis is set, always make sure that the comparison point's R axis data is set.
5. Condition for area check output
   Selects 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 the output port used by the program, then the output data might be changed. So do not use the same output port.
- 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.
- Always provide a margin when setting the comparison point data.
- 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.

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")

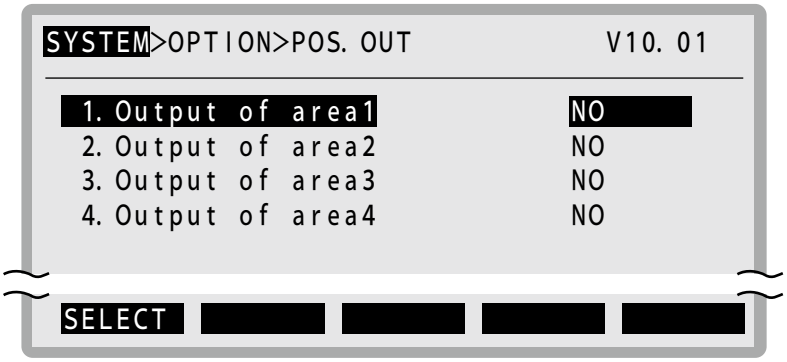
When points are designated in Cartesian coordinates ("mm" unit system)



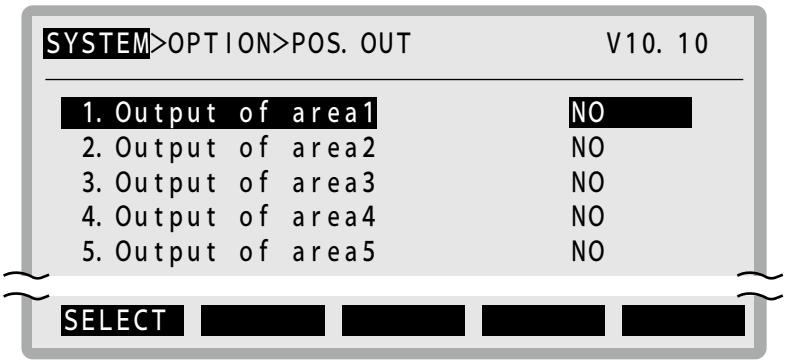
Step 1 *Press* F1 *(POS. OUT) in "SYSTEM>OPTION " mode.*

The area check output mode is entered.

Selecting the area check output number (controller prior to Ver. 10.10)



Selecting the area check output number (controller from Ver. 10.10 onwards)

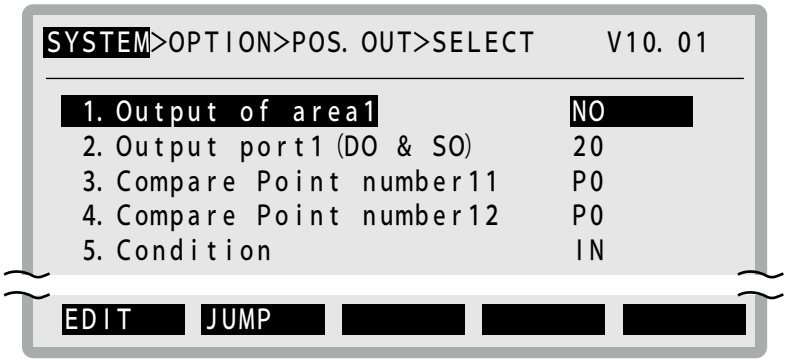


Step 2 *Select an area check output number.*

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

Step3 *Select the parameter items with the cursor (▲ / ▼) keys.*

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.

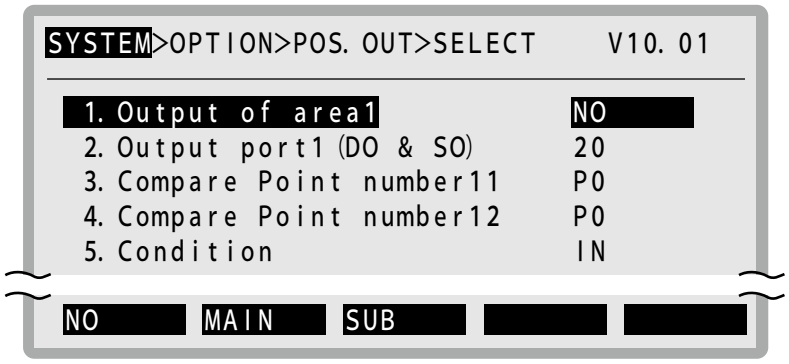
NOTE

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

Step1 ***Select "1. Output of area n" in "SYSTEM>OPTION>POS.OUT>SELECT" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Selecting the area check output target robots



Step3 ***Select the robot for the area check with*** F1 ***(NO),*** F2 ***(MAIN) or*** F3 ***(SUB).***

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.

Step4 ***Press*** ESC ***to quit the editing.***

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

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. 10.10

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

- Controller from Ver. 10.10 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

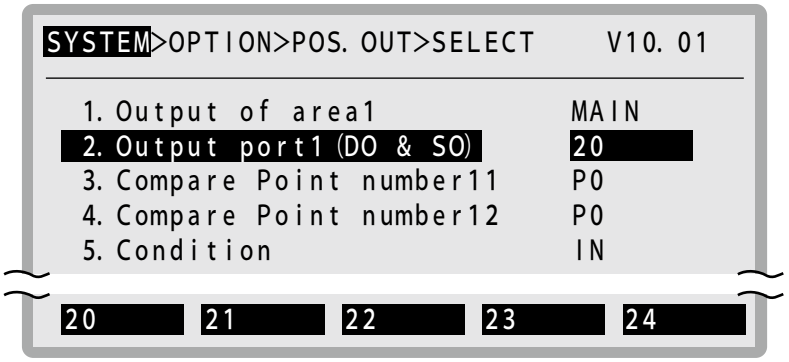
- If the port used for area check output is the same as the output port used by the program, then the output data might be changed. So do not use the same output port.
- If a serial board such as a CC-Link serial board is added to the option board slot, then errors are also output to the SO of the same number as DO.

[When using a controller prior to Ver. 10.10]

Step 1 ***Select "2. Output port1(DO & SO)" in "SYSTEM>OPTION>POS. OUT>SELECT" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Selecting the area check output port (controller prior to Ver. 10.10)



Step 3 ***Press a key from*** F1 ***(20) to*** F8 ***(27) to select the output port.***

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

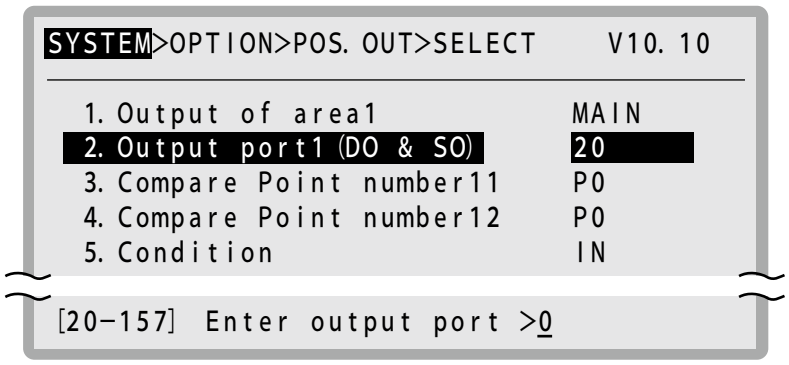
To continue setting other items, use the cursor (▲ / ▼ *) keys to select them.*

[When using a controller of Ver. 10.10 onwards]

Step1 *Select "2. Output port1(DO & SO)" in "SYSTEM>OPTION>POS. OUT>SELECT" mode.*

Step2 *Press* F1 *(EDIT).*

Selecting the area check output port (controller from Ver. 10.10 onwards)



Step3 *Enter the port number using the number keys* 0 *to* 9 *and press* ENTER *to enable the setting.*

Step4 *Press* ESC *to quit the editing. To continue setting other items, use the cursor (* ▲ */* ▼ *) keys to select them.*

3. Comparison point No. 1

4. Comparison point No. 2

Set the point numbers for determining the area to perform area check. Point numbers from P0 to P4000 can be used to specify an area.

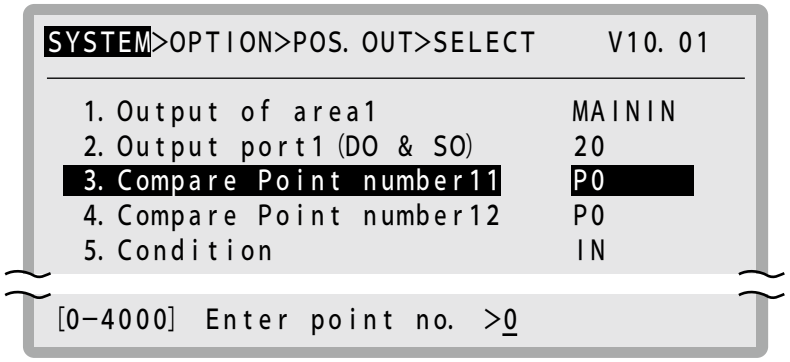
NOTE

- 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 cannot be performed until the error is cleared.
- 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.

Step 1 ***Select "3. Compare point number n" in "SYSTEM>OPTION>POS. OUT>SELECT" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Entering the comparison point numbers for area check output



Step 3 ***Enter the point number with*** 0 ***to*** 9 ***and press*** ENTER.

Step 4 ***Select "4. Compare Point number n2" with the cursor (*** ▲ / ▼ ***) keys.***

Step 5 ***Enter the other point number as in step 3.***

Step 6 ***Press ESC to quit the editing.***

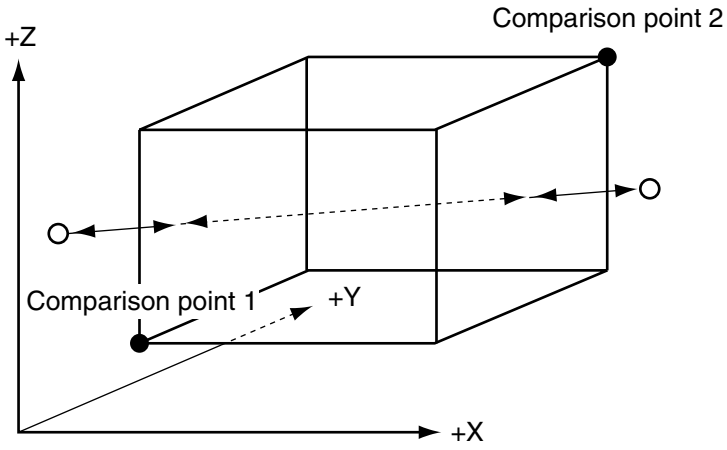
To continue setting other items, use the cursor (▲ / ▼) keys to select them.

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)



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.

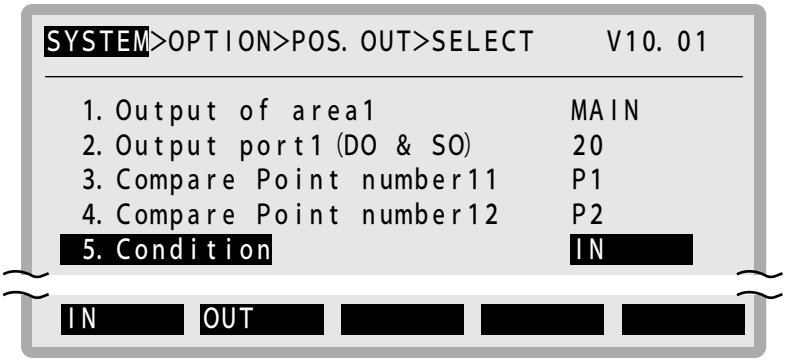
NOTE

- 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).

Step 1 ***Select "5. Condition" in "SYSTEM>OPTION>POS.OUT>SELECT" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Criterion selection for area check output



Step 3 ***Press*** F1 ***(IN) or*** F2 ***(OUT) to select the criterion for area check output.***

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

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

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

12.3.2 Setting the "SERVICE" mode

When using "SERVICE" mode to safely perform tasks with the RPB within the robot system safety enclosure, make parameter settings and set the mode level as explained in this section.
Parameter settings made here are only valid until the controller power is turned off, unless those settings are saved.
"SERVICE" mode is enabled or disabled by input through the SAFETY interface.

NOTE

The "SERVICE" mode functions can only be utilized when the necessary settings were made by YAMAHA 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.

1. "SERVICE" mode level

Select the 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 RPB.

2. 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.

3. Operating device during "SERVICE" mode

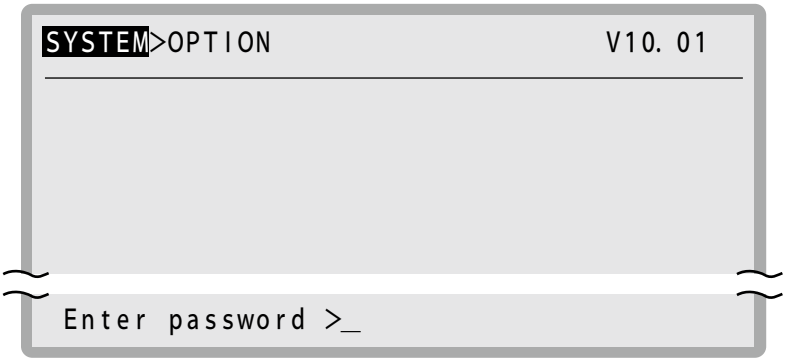
Specify the operating device to use.

	Description
RPB (default setting)	Only RPB operation is allowed.
RPB/DI	Allows RPB and dedicated input.
RPB/COM	Allows RPB and online commands.
ALL	Allows RPB, dedicated input and online command operation devices.

Step 1 ***Press F2 (SERVICE) in "SYSTEM>OPTION" mode.***

The message, "Enter password" appears on the guideline.

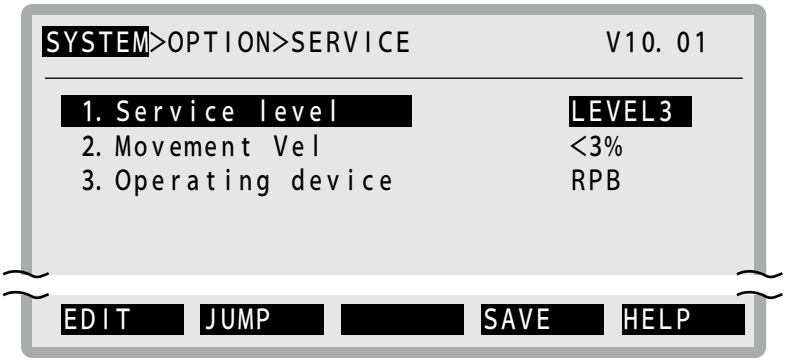
Entering the "SERVICE" mode setting password



Step 2 ***Enter "SAF" as the password and press ENTER.***

The "SYSTEM>OPTION>SERVICE" mode screen appears when the correct password is entered.

"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.

1. "SERVICE" mode level

Set 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	Enabled	Prohibited

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.

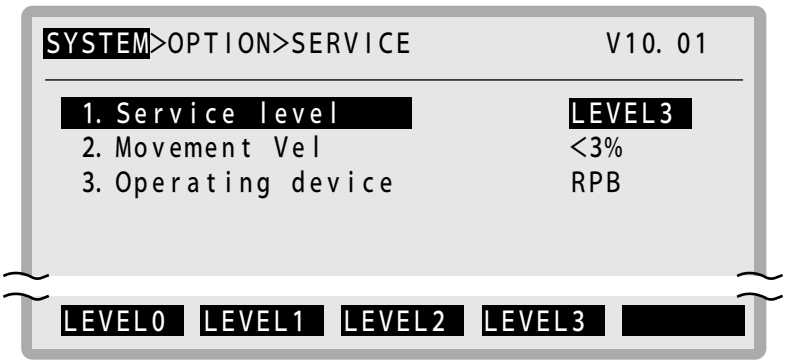
WARNING

SETTINGS MAY BE CHANGED BUT THE CUSTOMER MUST BEAR RESPONSIBILITY FOR THEM. THE CUSTOMER SHOULD KEEP SAFETY IN MIND WHEN MAKING CHANGES.

Step1 Select "1. Service level" in "SYSTEM>OPTION>SERVICE" mode.

Step2 Press F1 (EDIT).

Editing the "SERVICE" mode level



Step3 Press a key from F1 (LEVEL0) to F4 (LEVEL3) to select the "SERVICE" mode level.

Step4 Press ESC to quit the editing.

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

2. Operating speed limits in "SERVICE" mode

Specify the maximum robot operating speed.

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

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.

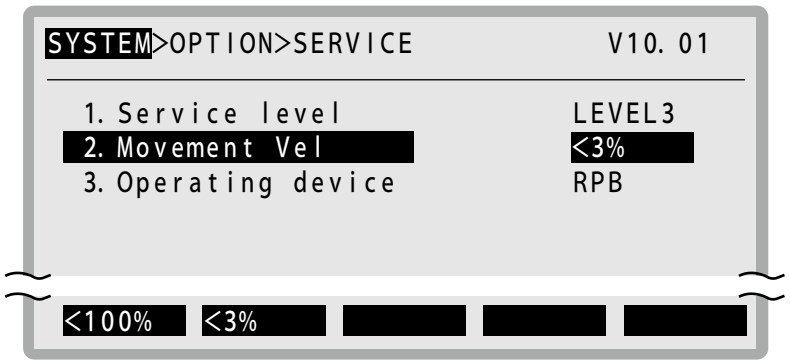
WARNING

SETTINGS MAY BE CHANGED BUT THE CUSTOMER MUST BEAR RESPONSIBILITY FOR THEM. THE CUSTOMER SHOULD KEEP SAFETY IN MIND WHEN MAKING CHANGES.

Step 1 ***Select "2. Movement Vel" in "SYSTEM>OPTION>SERVICE" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Editing the "SERVICE" mode operating speed



Step 3 ***Press*** F1 ***(<100%) or*** F2 ***(<3%) to select the maximum robot operating speed.***

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

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

3. Operating device in "SERVICE" mode

Specify the operating device to use.

	Description
RPB	Only RPB operation is allowed.
RPB/DI	Allows RPB and dedicated input.
RPB/COM	Allows RPB 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.

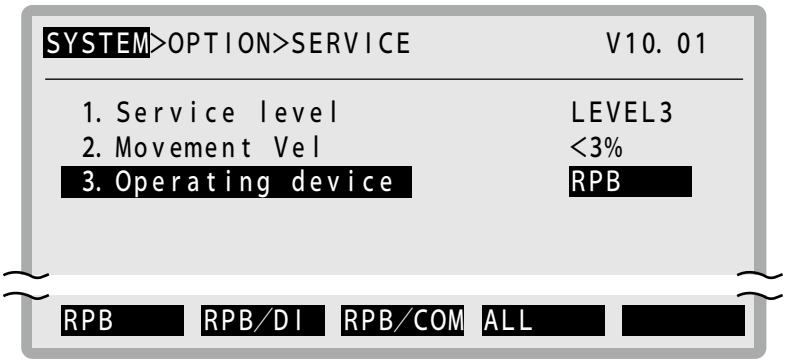
WARNING

SETTINGS MAY BE CHANGED BUT THE CUSTOMER MUST BEAR RESPONSIBILITY FOR THEM. THE CUSTOMER SHOULD KEEP SAFETY IN MIND WHEN MAKING CHANGES.

Step1 ***Select "3. Operating device" in "SYSTEM>OPTION>SERVICE" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Editing the "SERVICE" mode devices



Step3 ***Press a key from*** F1 ***(RPB) to*** F4 ***(ALL) to select the operating device.***

Step4 ***Press*** ESC ***to quit the editing.***

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

12.3.2.1 Saving the "SERVICE" mode parameters

To save the parameter settings for "SERVICE" mode, follow the procedure below.
The parameter settings made here are only valid until the controller power is turned off, unless you save those settings.

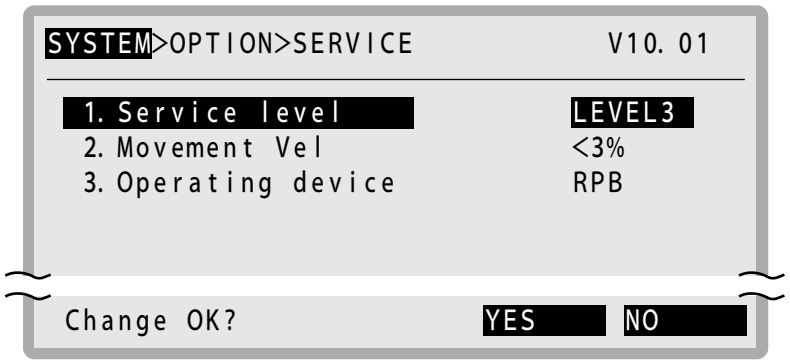
WARNING

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.

Step 1 ***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



Step 2 ***Press F4 (YES) to save the setting.***

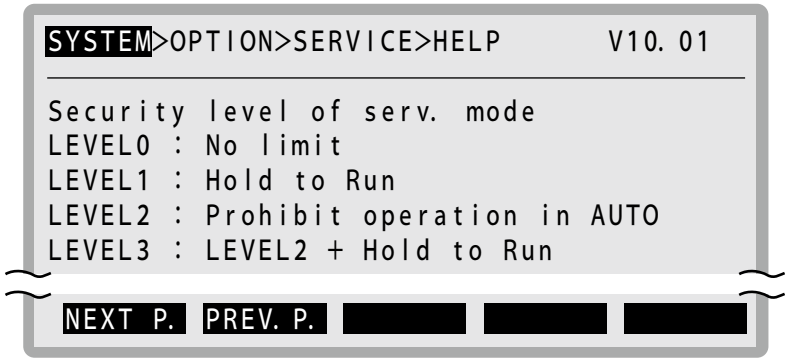
Press F5 (NO) if you want to cancel the setting.

12.3.2.2 Help display in "SERVICE" mode

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

Step 1 ***Press F5 (HELP) in "SYSTEM>OPTION>SERVICE" mode.***

Help display in "SERVICE" mode



Step 2 ***Check the message display.***

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

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

Step 3 ***Press ESC to quit this mode.***

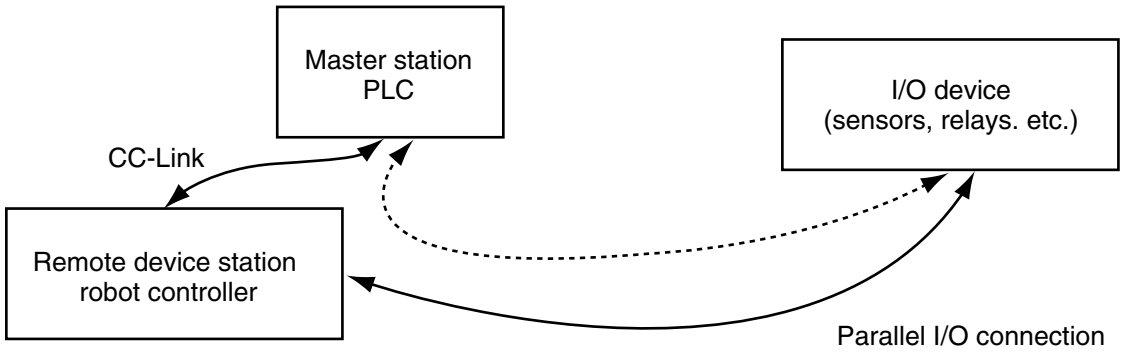
12.3.3 SIO settings

The serial I/O unit allows the master station sequencer (PLC) to send and receive parallel port ON/OFF data in the robot controller I/O unit, regardless of the robot program. This function allows using I/O devices such as sensors and relays as serial-connected devices.

NOTE

- Output results might be incorrect if the SIO specified port is the same as the port used by the program.
- These settings are only valid when the serial I/O unit is connected.

SIO overview

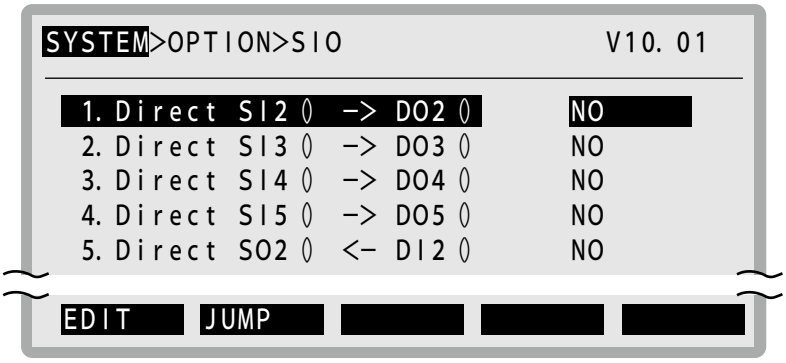


The relation between parallel and serial ports that can be set are shown below.

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 initial 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

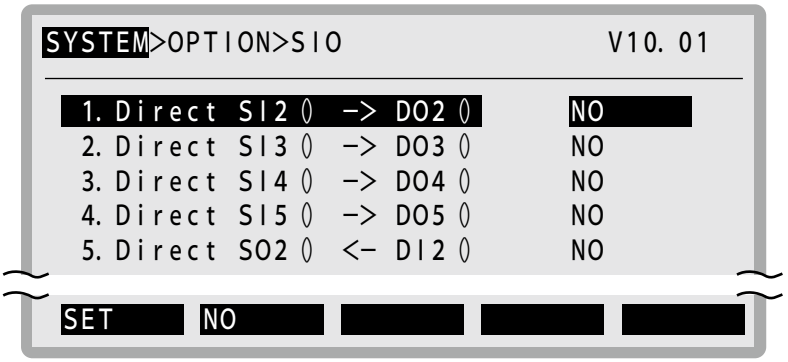
Output results might be incorrect if the SIO specified port is the same as the port used by the program.

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

Step 1 ***Select from 1 to 4 in "SYSTEM>OPTION>SIO" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Editing the SIO settings (1)



Step 3 ***Press*** F1 ***(SET) or*** F2 ***(NO) to enter the setting.***

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

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

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

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

NOTE

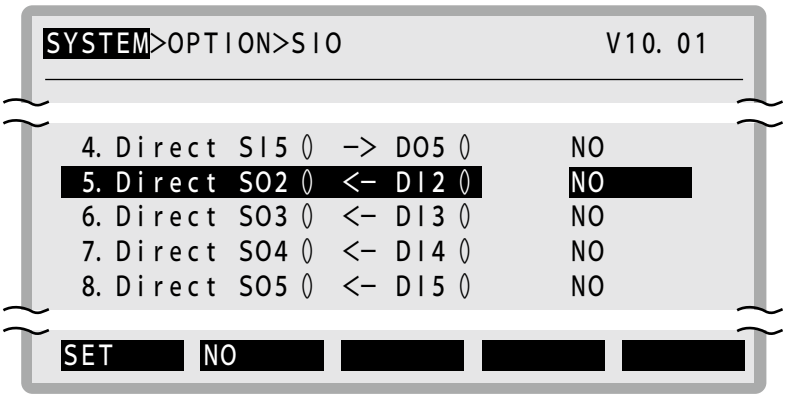
Output results might be incorrect if the SIO specified port is the same as the port used by the program.

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

Step1 ***Select from 5 to 8 in "SYSTEM>OPTION>SIO" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Editing the SIO settings (2)



Step3 ***Press*** F1 ***(SET) or*** F2 ***(NO) to enter the setting.***

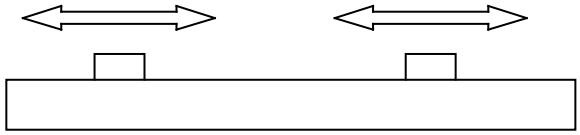
Step4 ***Press*** ESC ***to quit the editing.***

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

12.3.4 Double-carrier setting

This controller has a function to prevent two carriers (sliders) from colliding with each other, when the two carriers are installed on the same axis of double-carrier type robots.

Double-carrier type robot



CAUTION

The anti-collision function does not work if return-to-origin is incomplete. This function does not work correctly unless the lead length and deceleration ratio parameters are set correctly.

The anti-collision function works as follows:

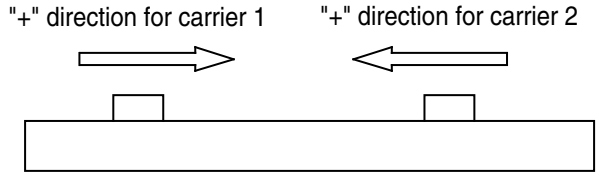
- During manual movement
  When one carrier is moving towards the other carrier, it stops just short of the other carrier.
- During automatic operation
  The target position of one carrier and the other carrier condition are first checked.
  If there is a possibility that a collision may occur, then one carrier waits until the other carrier has moved to a position where no collision will occur and next moves to the target position, or the operation stops as an error.

12.3.4.1 Before using a double-carrier

Check the following items before using the anti-collision function.

1. As shown in the drawing below, each carrier should approach the other carrier when it moves in the "+" direction. If not, please consult us.

   Double-carrier setting

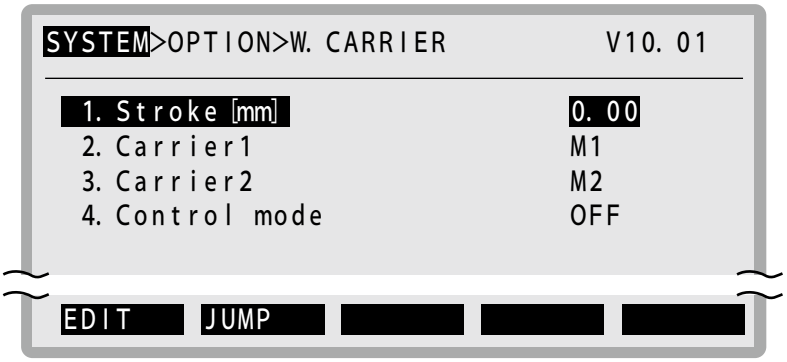


2. Each carrier's movement distance on the display should match the distance that the carrier has actually moved. If not, please consult us.

12.3.4.2 Setting the double-carrier parameters

In "SYSTEM>OPTION" mode, pressing F4 (W. CARRI) displays the "SYSTEM>OPTION>W. CARRIER" mode screen.

Double-carrier parameter setting (1)



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

Valid keys	Menu	Function
F1	EDIT	Edits the parameter being selected with the cursor.
F2	JUMP	Jumps to the specified point number.
▲ / ▼		Moves the cursor up and down.

1. Stroke setting

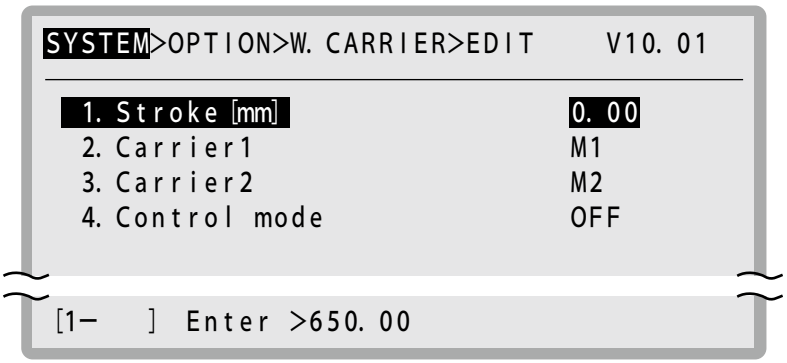
NOTE

The stroke corresponds to the current position of one carrier that was moved from its origin position, to a point closest to the other carrier remaining at its origin position after return-to-origin.

Step1 ***Select "1. Stroke [mm]" in "SYSTEM>OPTION>W. CARRIER" mode.***

Step2 ***Press*** F1 ***(EDIT).***

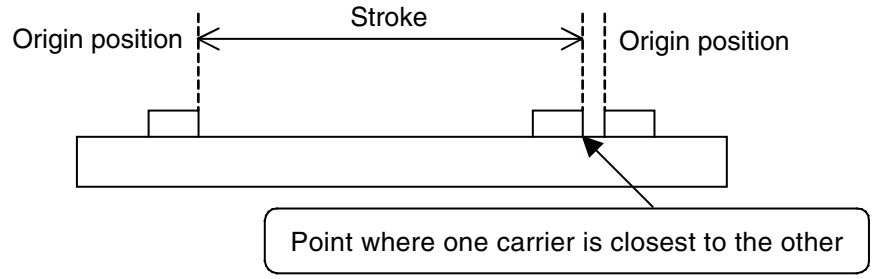
Double-carrier parameter setting (2)



Step3 ***Enter the stroke in "mm" units and press*** ENTER.

Up to 2 decimal places are allowed. Refer to the drawing below to determine the stroke.

Stroke setting



2. Carrier 1 setting

3. Carrier 2 setting

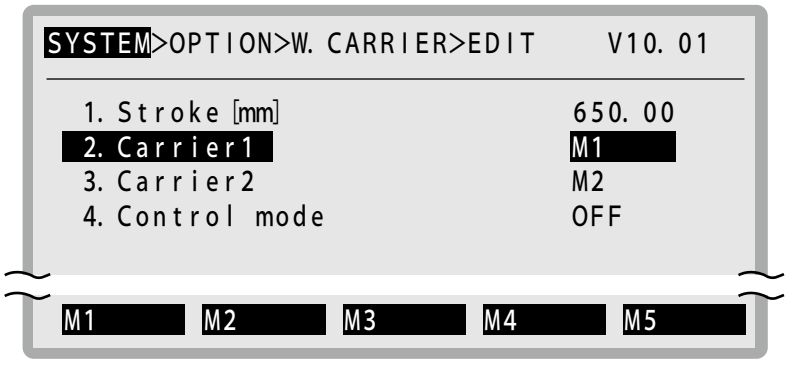
NOTE

Each function key display differs depending on how the axis is set.

Step1 ***Select "2. Carrier1 [mm]" or "3. Carrier2" in "SYSTEM>OPTION>W. CARRIER" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Double-carrier parameter setting (3)



Step3 ***Select the double-carrier axis with the function key.***

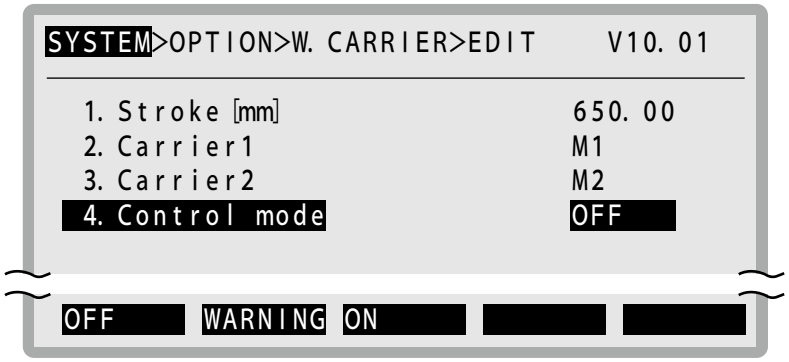
4. Control mode setting

Select the double-carrier functions.

Step1 ***Select "4. Control mode" in "SYSTEM>OPTION>W. CARRIER" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Double-carrier parameter setting (4)



Step3 ***Set the control mode with the function key.***

The robot moves as follows according to the control mode setting.

Valid keys	Menu	Function	
F1	OFF	Anti-collision function is disabled.	
F2	WARNING	During Manual movement	Stops a carrier moving toward the other carrier before reaching that carrier.
		During auto operation	Program operation "error stop" occurs during auto operation when the target position of one carrier will interfere with the other carrier.
F3	ON	During Manual movement	Stops a carrier moving toward the other carrier before reaching that carrier.
		During auto operation	If the target position of one carrier will interfere with the other carrier during auto operation, the carrier stands by until interference-free motion is possible.

* The "manual movement" and "auto operation" conditions indicated in the above table are defined as shown below

During Manual movement:

- Manual movement at RPB
- Jog and inching movement by I/O commands
- Jog and inching movement by online commands
- Jog and inching movement by remote commands

During auto operation:

- During "AUTO" mode program operation (including "step" and "next" execution)
- MOVE, MOVEI, Pallet motion by I/O commands
- Motion by online commands executed independently by robot language (including Return-to-origin command)
- MOVE, MOVEI, DRIVE, DRIVEI, Pallet motion by remote commands
- Direct motion command execution by RPB

NOTE

During automatic operation with the control mode ON, operation is stopped as an error ("2.27:W. carrier deadlock" error) when one carrier attempts to move to a position where it will interfere with the other carrier that is ready to move.

12.3.5 Individual axis return-to-origin by general-purpose DI/SI

12.3.5.1 Individual axis return-to-origin function

Use of this function makes it possible to perform the return-to-origin or absolute reset of an individual axis by the general-purpose DI or SI.
The return-to-origin of an individual incremental type axis can be performed.
Additionally, the absolute reset of an individual absolute type axis can also be performed.

NOTE

The individual axis return-to-origin function by the general-purpose DI/SI is applicable to a controller of Ver. 10.24 onwards.

The individual axis return-to-origin function by the general-purpose DI/SI provides 3 kinds of parameters as shown below.
These parameters are set for each robot (main robot, sub-robot).

1. **Individual axis return-to-origin**
   This parameter specifies whether or not the individual axis return-to-origin is performed.
2. **Axes selection port number (DI & SI)**
   This parameter specifies the port number for which the information on axis to be used for the return-to-origin/absolute reset is set.
3. **Done output port (DO & SO)**
   This parameter specifies the DO and SO port numbers to which the individual axis return-to-origin/absolute reset complete is output.

The following explains the outline of the return-to-origin or absolute reset operation.

- **Return-to-origin of individual incremental type axis**
  ① Specify an axis to be used for the return-to-origin by the general-purpose DI or SI.
  (DI and SI port numbers to be used are specified by the "Axes selection port number (DI & SI)" parameter.)
  ② Close the return-to-origin input DI14 or SI14 (ON).
  The return-to-origin of the incremental type axis specified in step ① is started at the rising edge of the signal pulse.
  ③ When the return-to-origin is complete, the return-to-origin complete output is turned on.
  (DO and SO port numbers to be used are set by the "Done output port number (DO & SO)" parameter.)

- **Absolute reset of individual absolute type axis**
  ① Specify an axis to be used for the absolute reset by the general-purpose DI or SI.
  (DI and SI port numbers to be used are specified by the "Axes selection port number (DI & SI)" parameter.)
  ② Close the ABS reset input DI17 or SI17 (ON).
  The absolute reset of the axis specified in step ① is started at the rising edge of the signal pulse.
  ③ When the absolute reset is complete, the absolute reset complete output is turned on.
  (DO and SO port numbers to be used are specified by the "Done output port number (DO & SO)" parameter.)

CAUTION

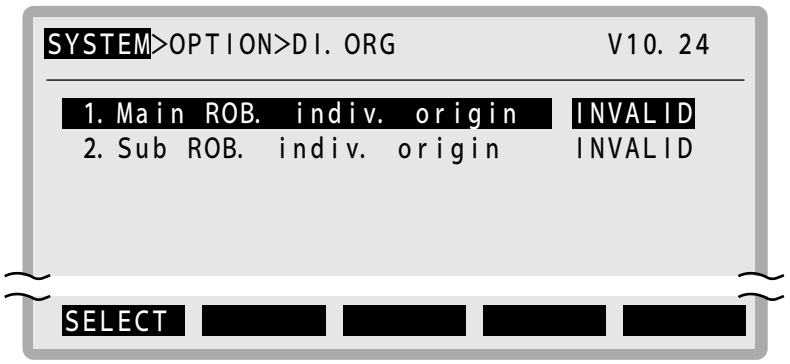
- When the return-to-origin and absolute reset of all robot axes are complete, the return-to-origin complete outputs DO11 and SO11 are turned on.
- If the same port as that used for the individual axis return-to-origin which is specified by the "Axes selection port number (DI & SI)" parameter is turned on during program operation, the return-to-origin/absolute reset may be started. So, do not use the "Axes selection port number (DI & SI)" parameter for a purpose other than the return-to-origin/absolute reset.
- The return-to-origin or absolute reset of 2 or more axes cannot be performed at the same time. Be sure to use this function for an individual axis.
  If multiple axes are specified, relevant error appears.
- If any serial board, such as CC-Link, etc. is not used (including a status that "Board condition" is set at "Invalid"), the DI port is used for the "Axes selection port number (DI & SI)" parameter and the DO port is used for "Done output port number (DO & SO)" parameter.
  An axis to be used for the return-to-origin or absolute reset is specified by the specified DI port. After the return-to-origin or absolute reset has been complete, the complete output of the specified DO port turns on.
- When a serial board, such as CC-Link, etc. is added and "Board condition" is set to "VALID", the SI port is used for the "Axes selection port (DI & SI)" parameter, and the DO and SO ports are used for the "Done output port (DO & SO)" parameter.
  An axis to be used for the return-to-origin or absolute rest is specified by the specified SI port.
  After the return-to-origin or absolute reset has been complete, the complete outputs of the specified DO and SO ports turn on.
- When the return-to-origin of each electric gripper axis is performed using this function, set the "Include Gripper in Origin" parameter to "YES". If this parameter is set to "NO", the return-to-origin of each gripper axis cannot be performed.

12.3.5.2 Setting the individual axis return-to-origin

Set the individual axis return-to-origin in "SYSTEM>OPTION>DI.ORG" mode.

Press F6 (DI. ORG) in "SYSTEM>OPTION" mode. The "SYSTEM>OPTION>DI.ORG" mode screen appears.

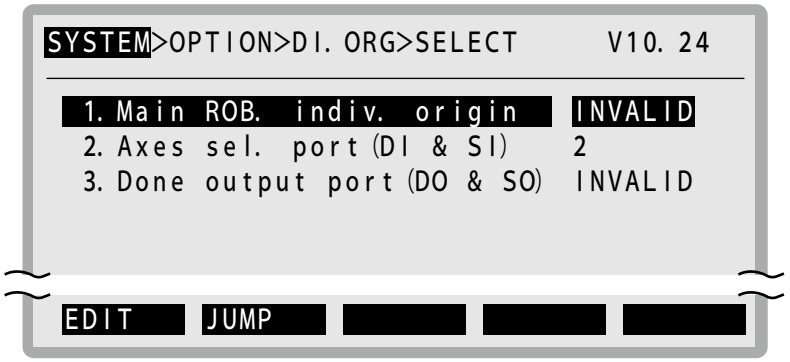
Individual axis return-to-origin setting screen



Use the cursor (▲ / ▼) keys to select "1. Main ROB. indiv. origin" or "2. Sub ROB. indiv. origin" and press F1 (SELECT).

The setting contents of the selected item will appear.

Individual axis return-to-origin setting parameter selection screen



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

Valid keys	Menu	Function
▲ / ▼		Moves the cursor up or down to select a desired parameter.
F1	EDIT	Edits each parameter.
F2	JUMP	Moves to the specified parameter.

1. Individual axis return-to-origin

This parameter specifies whether or not the individual axis return-to-origin is performed.

Step1 ***Select "1. Main. ROB. indiv. origin" or "2. Sub ROB. indiv. origin" in "SYSTEM>OPTION>DI.ORG" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Press*** F1 ***(INVALID) or*** F2 ***(VALID) to set the individual axis return-to-origin to "INVALID" or "VALID".***

Valid keys	Menu	Function
F1	INVALID	The individual axis return-to-origin function becomes invalid. The operation is performed as usual. Actually, the operation is performed in the manner described below. When the return-to-origin input DI14 or SI14 is closed (ON), all incremental type axes perform the return-to-origin operation at the rising edge of the signal pulse according to the return-to-origin sequence of the parameter. When the ABS reset input DI17 or SI17 is closed (ON), all absolute type axes (whose return-to-origin method is set to “SENSOR” or “TORQUE” (stroke end)) perform the absolute reset operation according to the return-to-origin sequence of the parameter.
F2	VALID	The individual axis return-to-origin function becomes valid. The return-to-origin or absolute reset of an individual axis is performed.

CAUTION

The return-to-origin and absolute reset operations may vary depending on the setting value of this parameter.
So, take great care when changing this parameter.

2. Axes selection port (DI & SI)

This parameter specifies an axis to be used for the return-to-origin/absolute reset.

Step 1 ***Select "2. Axes sel. port (DI & SI)" in "SYSTEM>OPTION>DI.ORG" mode.***

Step 2 ***Press*** F1 ***(EDIT).***

Step 3 ***Use the function keys to select a DI/SI port number to be used for the return-to-origin/absolute reset.***

Valid keys	Menu	Function
F1	2	An axis to be used for the return-to-origin/absolute reset is set by DI2 or SI2.
F2	3	An axis to be used for the return-to-origin/absolute reset is set by DI3 or SI3.
F3	4	An axis to be used for the return-to-origin/absolute reset is set by DI4 or SI4.
F4	5	An axis to be used for the return-to-origin/absolute reset is set by DI5 or SI5.
F5	6	An axis to be used for the return-to-origin/absolute reset is set by DI6 or SI6.
F6	7	An axis to be used for the return-to-origin/absolute reset is set by DI7 or SI7.
F7	10	An axis to be used for the return-to-origin/absolute reset is set by DI10 or SI10.
F8	11	An axis to be used for the return-to-origin/absolute reset is set by DI11 or SI11.
F9	12	An axis to be used for the return-to-origin/absolute reset is set by DI12 or SI12.
F10	13	An axis to be used for the return-to-origin/absolute reset is set by DI13 or SI13.
F11	14	An axis to be used for the return-to-origin/absolute reset is set by DI14 or SI14.
F12	15	An axis to be used for the return-to-origin/absolute reset is set by DI15 or SI15.
F13	16	An axis to be used for the return-to-origin/absolute reset is set by DI16.
F14	17	An axis to be used for the return-to-origin/absolute reset is set by DI17.

The axes of the specified port are assigned as follows.

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Contents	Not used.	Not used.	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

Example: Press F1 to set this parameter to "2".

The axis assignment of the individual axis return-to-origin/absolute reset of the robot is as follows.

Bit	DI27 SI27	DI26 SI26	DI25 SI25	DI24 SI24	DI23 SI23	DI22 SI22	DI21 SI21	DI20 SI20
Contents	Not used.	Not used.	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

CAUTION

- **When the return-to-origin input DI14 or SI14 is closed (ON), the return-to-origin of the incremental type axis specified by this parameter is started at the rising edge of the signal pulse.**
- **When the ABS reset input DI17 or SI17 is closed (ON), the absolute reset of the absolute type axis specified by this parameter is started at the rising edge of the signal pulse.**
- **When "DI17 mode" of other parameters is set to "ABS/ORG", DI17 becomes an input that is common to "absolute reset" and "return-to-origin". For details, see "12.1.5 Other parameters".**

3. Done output port (DO & SO)

This parameter specifies the DO and SO port numbers to which the individual axis return-to-origin/absolute reset complete is output.

Step1 ***Select "3. Done output port (DO & SO)" in "SYSTEM>OPTION>DI. ORG" mode.***

Step2 ***Press*** F1 ***(EDIT).***

Step3 ***Use the function keys to select the DO and SO port numbers to which the individual axis return-to-origin/absolute reset complete is output.***

Valid keys	Menu	Function
F1	INVALID	Does not output the individual axis return-to-origin/ absolute reset complete output.
F2	2	Outputs the individual axis return-to-origin/absolute reset complete output to DO2 or SO2.
F3	3	Outputs the individual axis return-to-origin/absolute reset complete output to DO3 or SO3.
F4	4	Outputs the individual axis return-to-origin/absolute reset complete output to DO4 or SO4.
F5	5	Outputs the individual axis return-to-origin/absolute reset complete output to DO5 or SO5.
F6	6	Outputs the individual axis return-to-origin/absolute reset complete output to DO6 or SO6.
F7	7	Outputs the individual axis return-to-origin/absolute reset complete output to DO7 or SO7.
F10	10	Outputs the individual axis return-to-origin/absolute reset complete output to DO10 or SO10.
F11	11	Outputs the individual axis return-to-origin/absolute reset complete output to DO11 or SO11.
F12	12	Outputs the individual axis return-to-origin/absolute reset complete output to DO12 or SO12.
F13	13	Outputs the individual axis return-to-origin/absolute reset complete output to SO13.
F14	14	Outputs the individual axis return-to-origin/absolute reset complete output to SO14.
F15	15	Outputs the individual axis return-to-origin/absolute reset complete output to SO15.

The axes of the specified port are assigned as follows.

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Contents	Not used.	Not used.	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

Example: Press F10 to set this parameter to "10".

The axis assignment of the individual axis return-to-origin/absolute reset complete output is as follows.

Bit	DO107 SO107	DO106 SO106	DO105 SO105	DO104 SO104	DO103 SO103	DO102 SO102	DO101 SO101	DO100 SO100
Contents	Not used.	Not used.	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

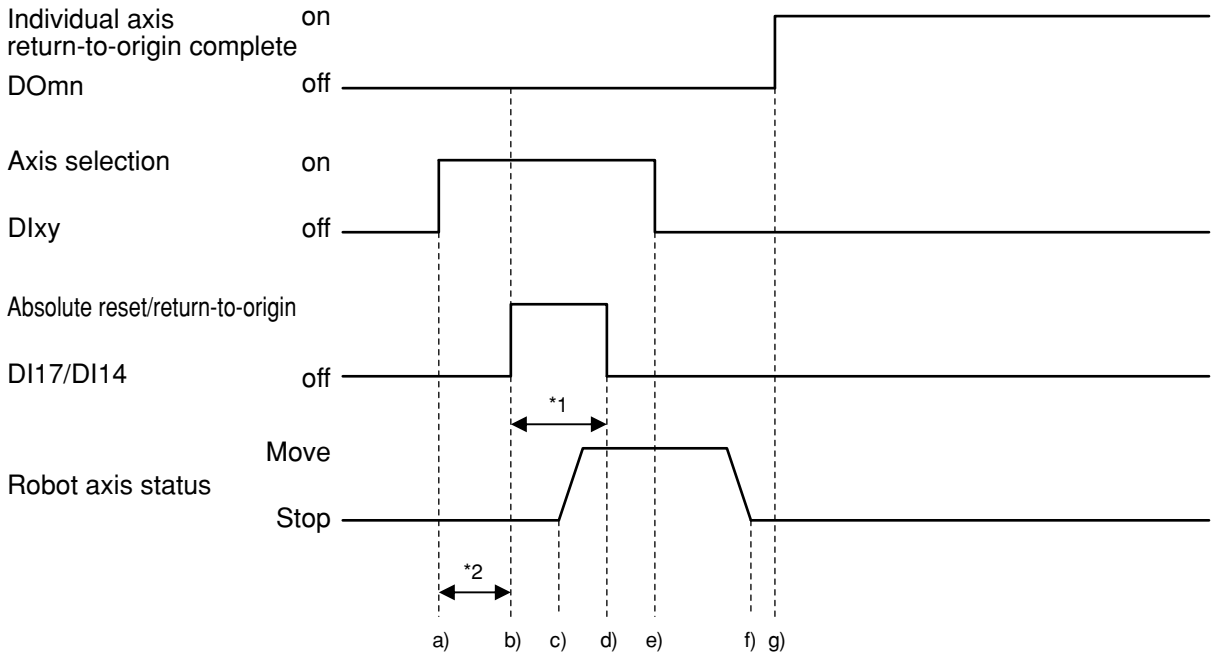
CAUTION

- **When the area check output option ("SYSTEM>OPTION>POS.OUT") is used jointly and the port to be used for the area check output is the same as the complete output port, the logical OR is output.**
- **When the error output port is used jointly and the port to be used for the error output is the same as the complete output port, the logical OR is output.**
- **When the battery alarm output is used jointly, the port to be used for the battery alarm output is the same as the complete output port, the logical OR is output.**
- **When the main robot and sub robot use the same DO or SO port, the logical OR is output.**

12.3.5.3 Timing chart of individual axis return-to-origin by general-purpose DI/SI

Timing chart of individual axis return-to-origin by general-purpose DI/SI

Operation conditions: MANUAL mode and servo ON



Absolute reset/return-to-origin processing

a) Axis selection input turns on.

b) Absolute reset/return-to-origin input turns on.

c) Specified robot axis starts moving to its origin position.

d) Absolute reset/return-to-origin input turns off.

e) Axis selection input turns off.

f) Specified robot axis completes the movement to its origin position.

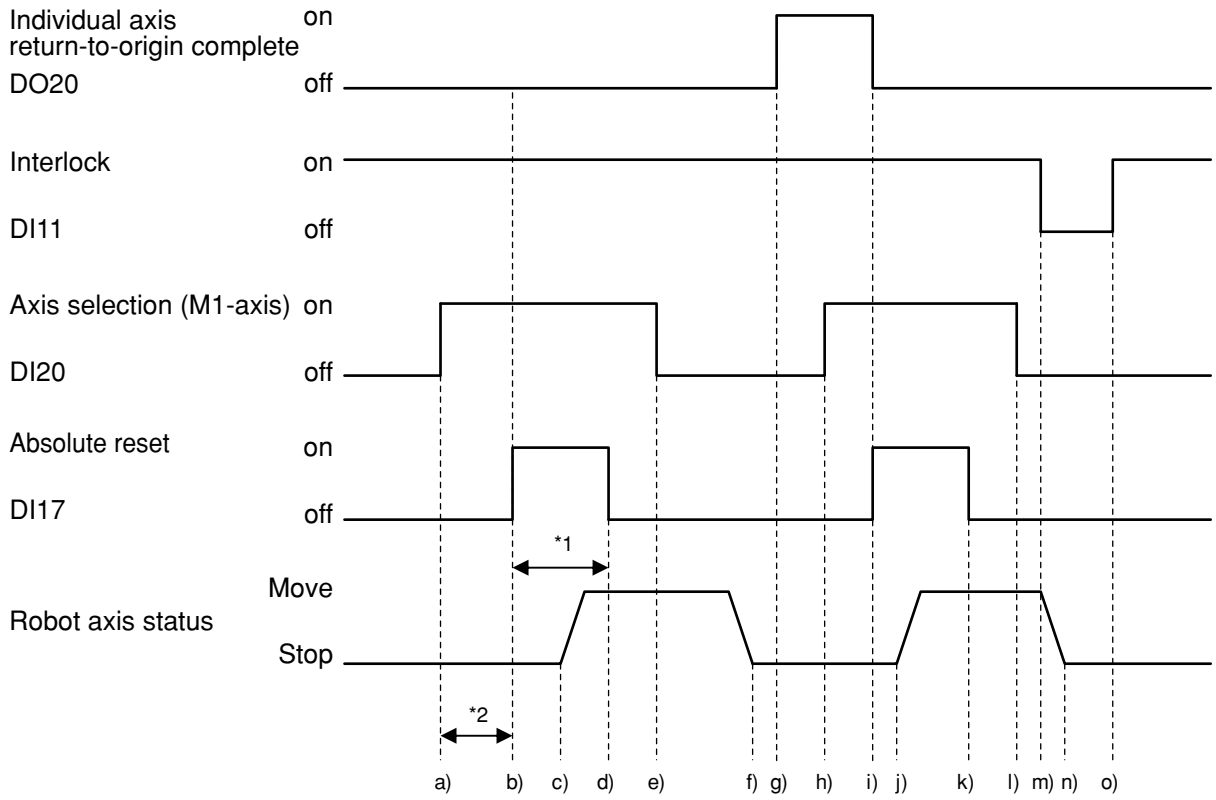
g) Individual axis return-to-origin complete output turns on.

*1 Absolute reset input DI17 and return-to-origin input DI14 are kept turned on for 100 ms or more.

*2 After the axis selection input has been kept turned on for 30 ms or more, the absolute reset input DI17 or the return-to-origin input DI14 is turned on.

Example: Robot : SXYx 2-axis specifications
m3-axis : Electric gripper
Individual axis return-to-origin setting
"1. Main ROB. indiv. origin" : VALID
"2. Axes sel. port (DI & SI)" : 2
"3. Done output port (DO & SO)" : 2
Operation conditions: MANUAL mode and servo ON

M1-axis absolute reset processing



Normal operation

a) Axis selection input turns on.
b) Absolute reset input turns on.
c) Robot M1-axis starts moving to its origin position.
d) Absolute reset input turns off.
e) Axis selection input turns off.
f) Robot M1-axis completes the movement to its origin position.
g) Individual axis return-to-origin complete output turns on.

Stop operation during movement

h) Axis selection input turns on.
i) Absolute reset input turns on.
j) Robot M1-axis starts moving to its origin position.
k) Absolute reset input turns off.

l) Axis selection input turns off.

m) Interlock input turns off.

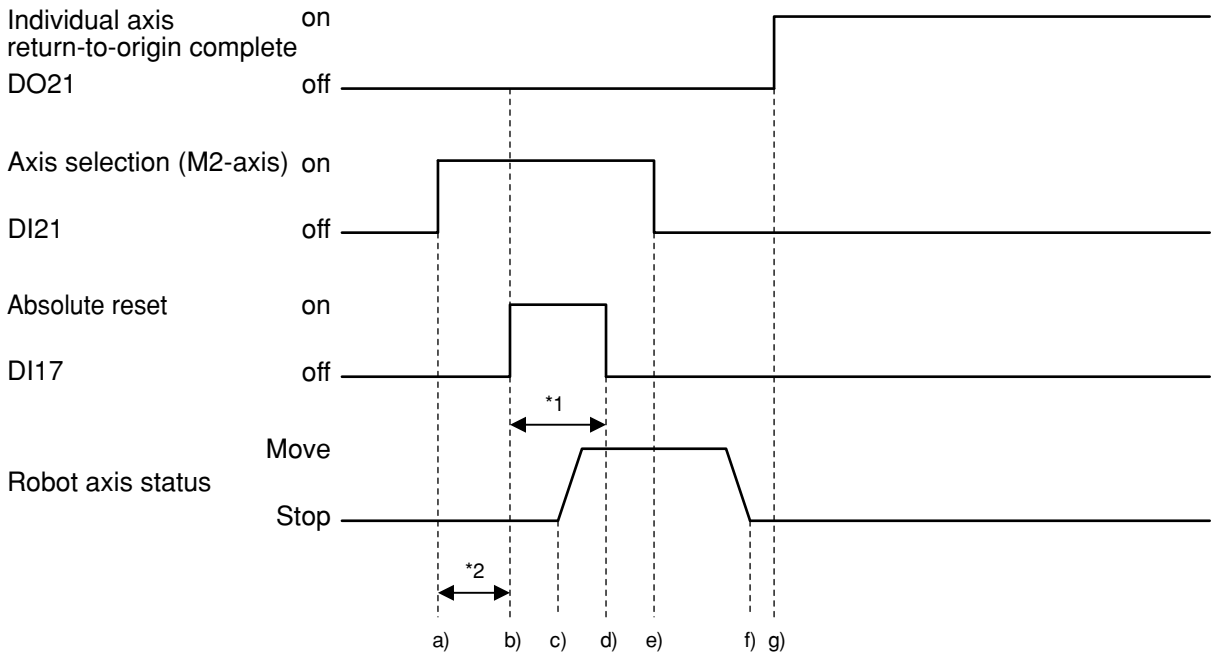
n) Robot M1-axis stops during movement.

o) Interlock input turns on.

*1 Absolute reset input DI17 is kept turned on for 100 ms or more.

*2 After the axis selection input has been turned on for 30 ms or more, the absolute reset input DI17 is turned on.

M2-axis absolute reset processing



Normal operation

a) Axis selection input turns on.

b) Absolute reset input turns on.

c) Robot M2-axis starts moving to its origin position.

d) Absolute reset input turns off.

e) Axis selection input turns off.

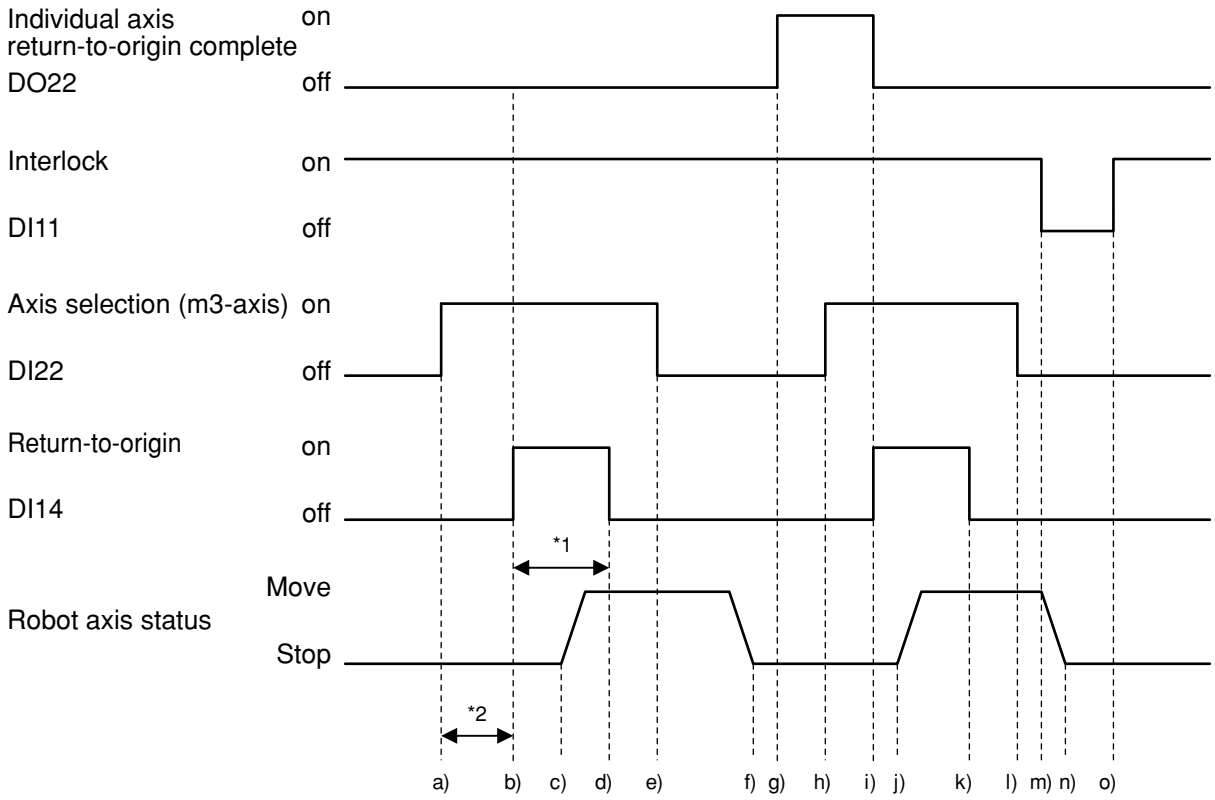
f) Robot M2-axis moves to its origin position completely.

g) Individual axis return-to-origin complete output turns on.

*1 Absolute reset input DI17 is kept turned on for 100 ms or more.

*2 After the axis selection input has been kept turned on for 30 ms or more, the absolute reset input DI17 is turned on.

m3-axis return-to-origin processing



Normal operation

a) Axis selection input turns on.

b) Return-to-origin input turns on.

c) Robot m3-axis starts moving to its origin position.

d) Return-to-origin input turns off.

e) Axis selection input turns off.

f) Robot m3-axis completes the movement to its origin position.

g) Individual axis return-to-origin complete output turns on.

Stop operation during movement

h) Axis selection input turns on.

i) Return-to-origin input turns on.

j) Robot m3-axis starts moving to its origin position.

k) Return-to-origin input turns off.

l) Axis selection input turns off.

m) Interlock input turns off.

n) Robot m3-axis stops moving during movement.

o) Interlock input turns on.

*1 Origin-to-return input DI14 is kept turned on for 100 ms or more.

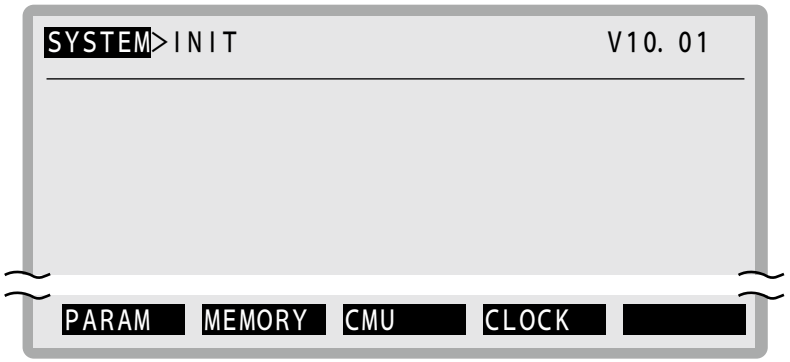
*2 After the axis selection input has been kept turned on for 30 ms or more, the return-to-origin input DI14 is turned on.

12.4 Initialization

When initializing the parameter data you entered, follow the descriptions in this section.

In "SYSTEM" mode, pressing F4 (INIT) displays the "SYSTEM>INIT" mode screen.

Initialization screen



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

Valid keys and submenu descriptions in "SYSTEM>INT" 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 *1	GENERAT	Sets the robot model. (Normally invalid)
F10 *2	PASSWRD	Enables the F6 setting.

*1: To use F6, press F6 F1 F11 while holding down UPPER.

*2: To use F10, press F10 F5 F15 while holding down UPPER.

12.4.1 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

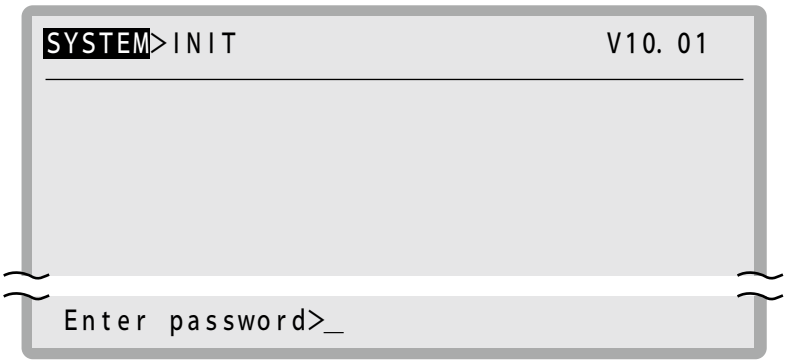
- Entire parameter is initialized. (Except for display letters.)
- Return-to-origin will be incomplete if this parameter is changed.

Step1 ***Press F1 (PARAM) in "SYSTEM>INIT" mode.***

A message "Enter password" appears on the guideline.

Step2 ***Enter "INI" as the password and press ENTER.***

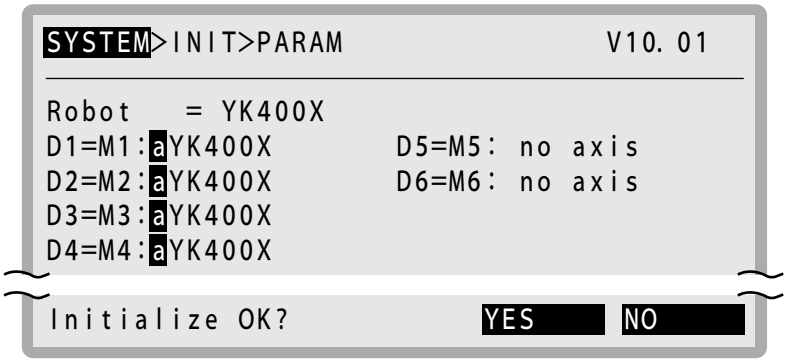
Initializing the parameters (1)



Step3 ***Check the message.***

A confirmation message appears on the guideline when the correct password is entered.

Initializing the parameter (2)



Step4 ***Press F4 (YES) to initialize the parameters.***

If not initializing, press F5 (NO).

12.4.2 Initializing the memory

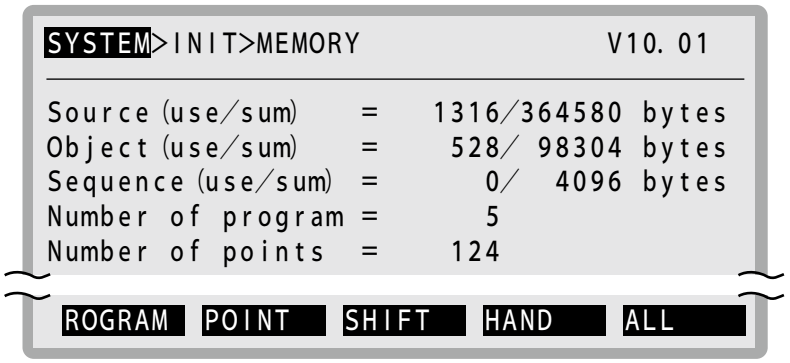
This initializes the program, point data, shift coordinates, hand definitions and pallet definitions. Before initializing, make sure that the currently input data is no longer needed.

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.

Step 1 ***Press F2 (MEMORY) in "SYSTEM>INIT" mode.***

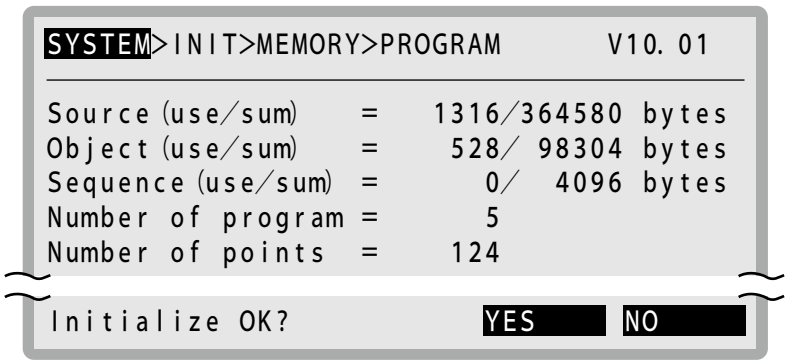
Initializing the memory



Step 2 ***Press a key from F1 (PROGRAM) to F7 (COMMENT) to select the item to initialize.***

A confirmation message appears on the guideline.

Initializing the memory (program)



Step 3 ***Press F4 (YES) to initialize the selected item.***

If not initializing, press F5 (NO).

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 *1	PALLET	Deletes the pallet definition data.
F7 *1	COMMENT	Deletes the point comment data.

*1: To use F6 or F7, press F1 (F6) or F2 (F7) while holding down UPPER.

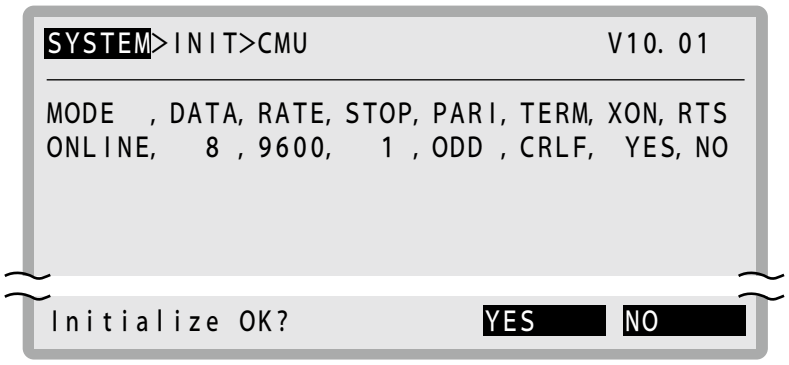
12.4.3 Initializing the communication parameters

To initialize the communication parameters, proceed as follows.

Step 1 ***Press F3 (CMU) in "SYSTEM>INIT" mode.***

A confirmation message appears on the guideline

Initializing the communication parameters



Step 2 ***Press F4 (YES) to initialize the parameters.***

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

12.4.4 Clock setting

A clock function is provided in the controller for setting the date and time.

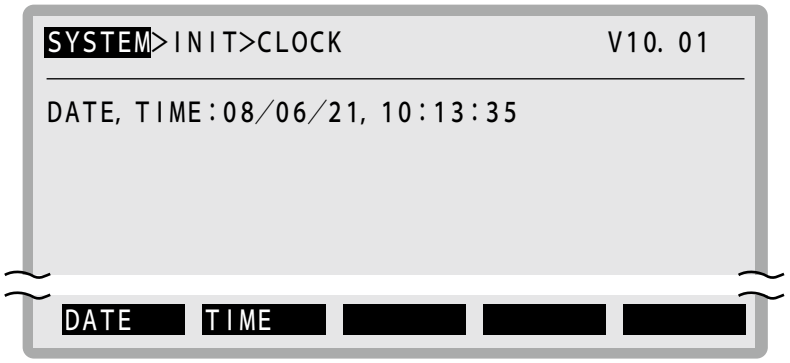
CAUTION

The clock used in the controller might differ from the correct time.
If this happens, set the correct time.

Step 1 *Press F4 (CLOCK) in "SYSTEM>INIT" mode.*

The present date and time are displayed.

Initializing the clock



Step 2 *Select the item with F1 (DATE) or F2 (TIME).*

A confirmation message appears on the guideline.

Step 3 *Enter the date or time in the specified format.*

Use 0 to 9, /, and : to enter the date or time, and press ENTER.

Valid keys	Menu	Function
F1	DATE	Sets the year/month/date.
F2	TIME	Sets the hours/minutes/seconds.

12.4.5 System generation

In system generation in the robot controller, the specifications for the robot being connected and the axis configurations are set prior to shipment. The user does not normally need to set the system generation with F6 (GENERAT) in "SYSTEM>INIT" mode.

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 YAMAHA and the parameter data from system upgrades onto an external PC storage device by way of the RS-232C.

Please contact us for system generation operating methods.

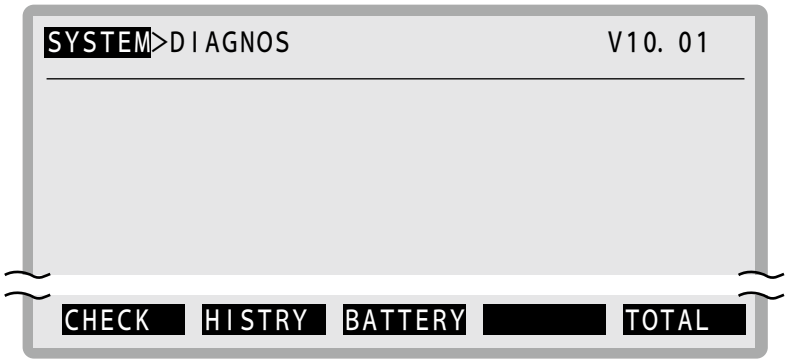
CAUTION

- **If you change the system generation by mistake, this may adversely effect robot operation or create operator hazards. Always consult YAMAHA if changes have been made.**
- **Please note that YAMAHA cannot be held liable for problems resulting from changing the system generation settings without first consulting YAMAHA.**

12.5 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 *1	SYS.CHK	Displays details of major software errors that occurred in the past.

*1: To use F15, press F10 F5 F15 while holding down LOWER.

12.5.1 Controller check

This makes a self-diagnosis check of the controller.

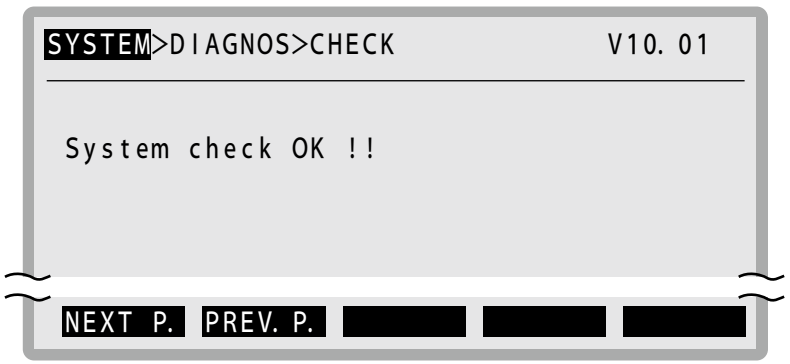
NOTE

- An error message will always appear if DC 24V is not supplied to STD.DIO.
- An error message will always appear if DC 24V is not supplied to the option DIO.

Step 1 ***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.

System check



Step 2 ***Press ESC to return to "SYSTEM>DIAGNOS" mode.***

12.5.2 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.

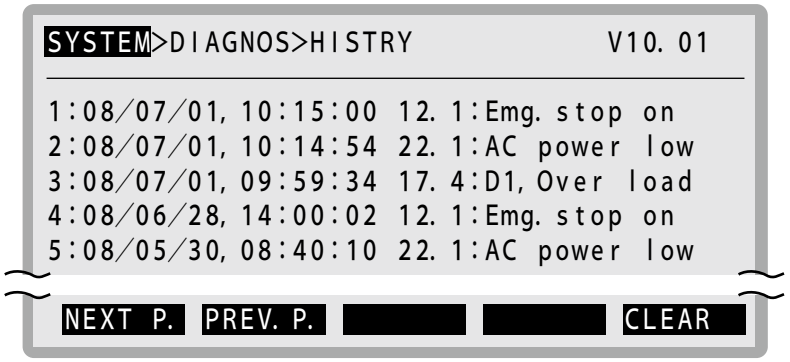
Step 1 ***Press F2 (HISTRY) in "SYSTEM>DIAGNOS" mode.***

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

- **Errors are not recorded when identical to a preceding error that just occurred.**
- **The error category "0" is not recorded.**
- **The error history is initialized when F5 (CLEAR) is used. Do not initialize if you want to retain the error history.**

Step 2 ***To reset the error history, press F5 (CLEAR).***

Step 3 ***Press ESC to return to "SYSTEM>DIAGNOS" mode.***

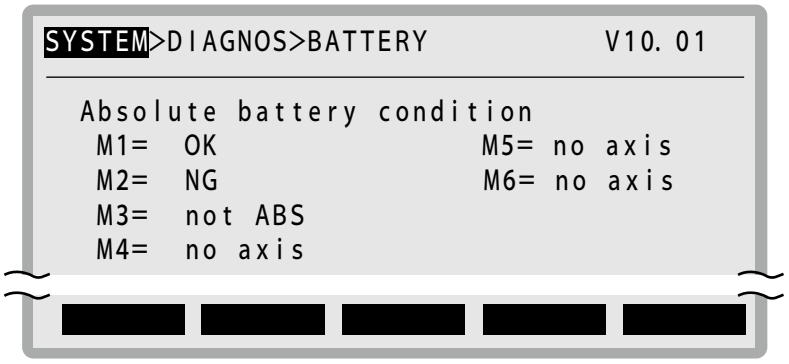
12.5.3 Displaying the absolute battery condition

Use the following procedure to check whether the battery for retaining absolute data is low or not.

Step 1 ***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.

Step 2 ***Press ESC to return to "SYSTEM>DIAGNOS" mode.***

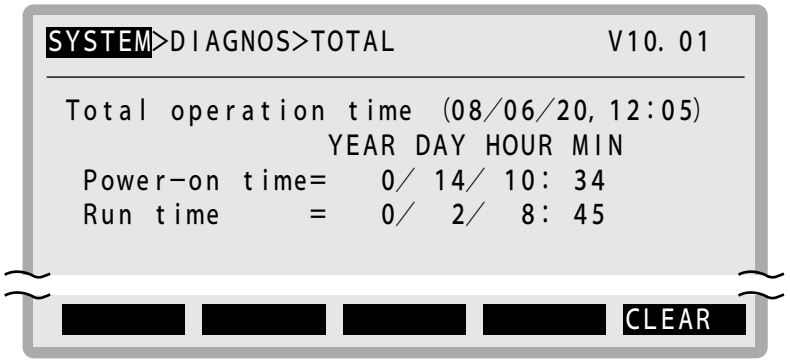
12.5.4 Displaying the total operation time

Use the following procedure to check the total controller operation time.

Step 1 ***Press F5 (TOTAL) in "SYSTEM>DIAGNOS" mode.***

The total controller operation time is displayed.

Displaying the total operation time



The 3rd line shows the date and time that the total operation time was reset.
The "Power-on time" is the total time that the controller power has been on.
The "Run time" is the total time that the controller has performed automatic operation.

Step 2 ***To reset the total operation time, press F5 (CLEAR).***

The display shows the new total operation time starting from the date and time after reset.

Step 3 ***Press ESC to return to "SYSTEM>DIAGNOS" mode.***

12.5.5 System error details display

Details of important software errors that have occurred in the past can be displayed.

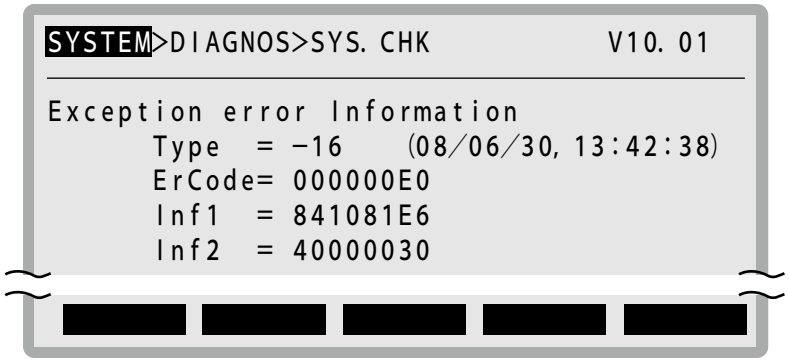
NOTE

All error information will be initialized when the error history is initialized.

Step 1 ***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



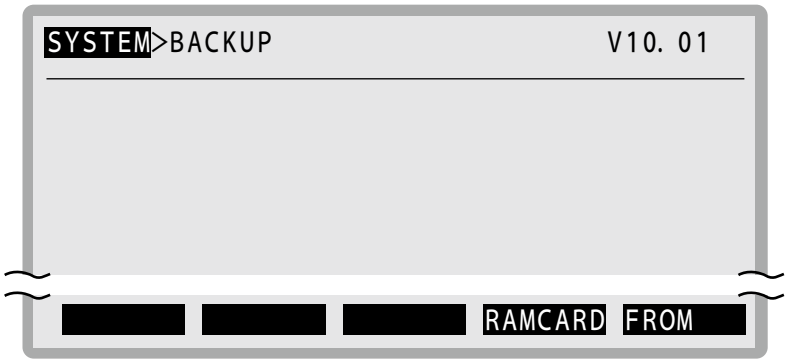
Step 2 ***Press ESC to return to the "SYSTEM>DIAGNOS" mode.***

12.6 Backup processes

In "SYSTEM" mode, pressing F9 (BACKUP) displays the "SYSTEM>BACKUP" mode screen.

The various data in the controller's internal memory can be backed up in the internal flash ROM.

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.

12.6.1 Internal flash ROM

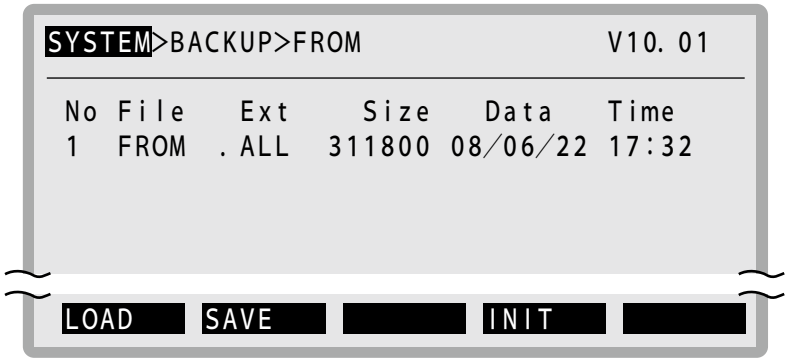
Various data can be backed up in the controller's internal flash ROM. The data backed up in the flash ROM can then be loaded back into the controller's internal memory.

NOTE

If the data in the internal memory is destroyed for any reason, it can be restored by loading the backup 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

- **Data saved in the internal flash ROM cannot be loaded back if any hardware trouble occurs. Always save the data onto an external PC storage device.**
- **If an abnormal process occurs, such as if the power is turned OFF while saving data, 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.

12.6.1.1 Loading files

The various data backed up in the controller's internal flash ROM can be loaded back into the controller's internal memory.

NOTE

If the data in the internal memory is destroyed for any reason, it can be restored by loading the backup data from the internal flash ROM. We recommend backing up the data in the internal flash ROM before starting the robot system.

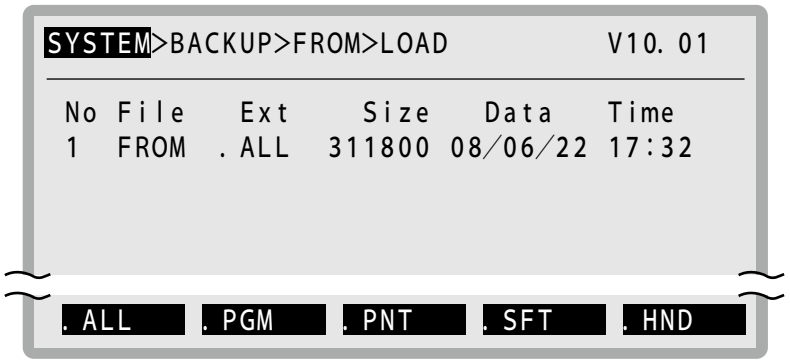
Step 1 ***Press F1 (LOAD) in the "SYSTEM>BACKUP>FROM" mode.***

The types of files will appear in the guideline.

Step 2 ***Select the type of file to be loaded with F1 (.ALL) to F9 (.PCM).***

A confirmation message appears on the guideline.

Loading FROM



CAUTION

- **When reading data with ALL files or as parameter files, the servo must be off. After the files are read in, the return-to-origin incomplete state will be set.**
- **Data saved in the internal flash ROM cannot be loaded back if any hardware trouble occurs. Always save the data onto an external PC storage device.**
- **If an abnormal process occurs, such as if the power is turned OFF while saving data, the data cannot be guaranteed.**

Valid keys and submenu descriptions in "SYSTEM>BACKUP>FROM>LOAD" mode are shown below.

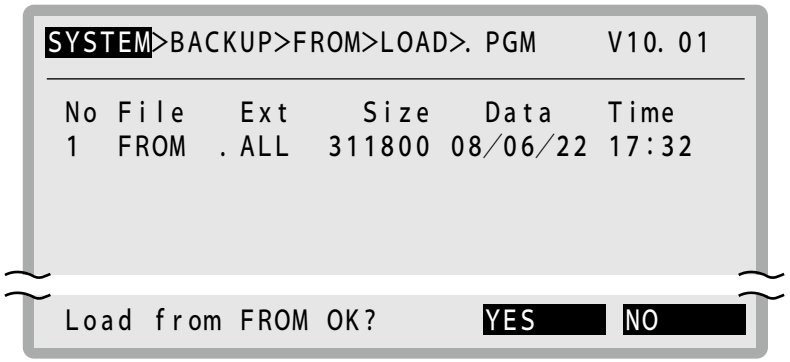
Valid keys	Menu	Function
F1	.ALL	Files are loaded as ALL files.
F2	.PGM	Only program files are loaded.
F3	.PNT	Only point files are loaded.
F4	.SFT	Only shift files are loaded.
F5	.HND	Only hand files are loaded.
F6 *1	.PRM	Only parameter files are loaded.
F8 *1	.PLT	Only pallet files are loaded.
F9 *1	.PCM	Only point comment files are loaded.

*1: To use F6, F8 or F9, press F1 (F11), F3 (F13) or F4 (F14) while holding down UPPER.

Step 3 ***Press F4 (YES) to load the data.***

Press F5 (NO) to cancel the procedure.

Check of FROM loading



The message "0.5: Accessing" appears during loading.

12.6.1.2 Saving files

The data in the controller's internal memory are saved as ALL files on the flash ROM. The data cannot be saved separately. If data is already saved, the new data cannot be saved until the files are initialized.

NOTE

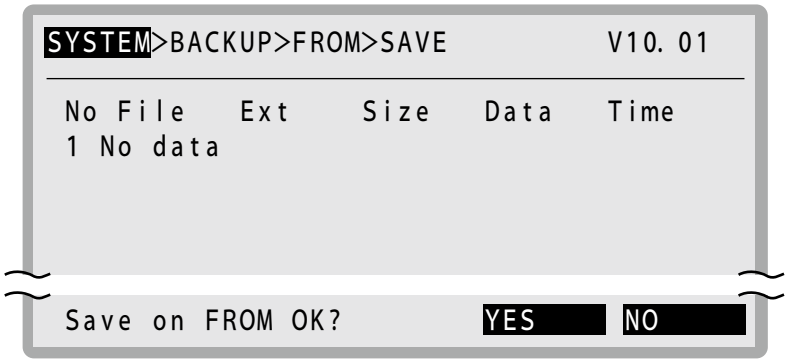
If the data in the internal memory is destroyed for any reason, it can be restored by loading the backup data from the internal flash ROM. We recommend backing up the data in the internal flash ROM before starting the robot system.

Step 1 ***Press F2 (SAVE) in the "SYSTEM>BACKUP>FROM" mode.***

Step 2 ***Press F4 (YES) to save the data.***

Press F5 (NO) to cancel saving the data.

Check of saving on FROM



The message "0.5: Accessing" appears during saving.

CAUTION

- **If data has already been written in, it cannot be overwritten and saved. If data has already been written in, initialize the memory, and then save the new data.**
- **The data saved on the internal flash ROM cannot be restored if any hardware trouble occurs. Always save the data onto an external PC storage device.**
- **If an abnormal process occurs, such as if the power is turned OFF while saving the data, the data cannot be guaranteed.**
- **The "Skip undefined parameters" setting among "other" parameters will not be saved.**

12.6.1.3 Initializing the files

The data saved on the controller's flash ROM is initialized.

NOTE

If the data in the internal memory is destroyed for any reason, it can be restored by loading the backup data from the internal flash ROM. We recommend backing up the data in the internal flash ROM before starting the robot system.

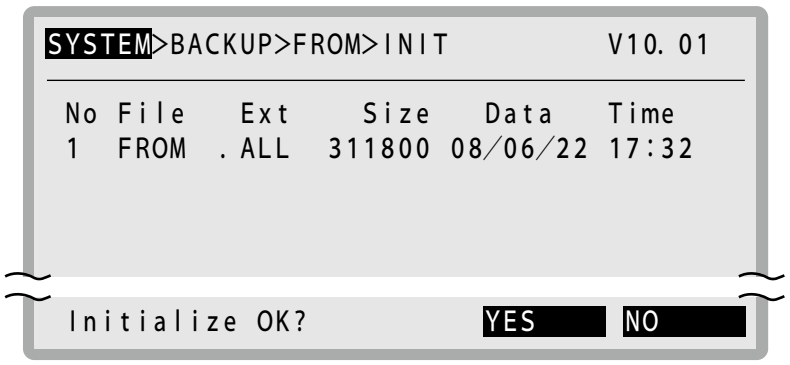
Step 1 ***Press F4 (INIT) in the "SYSTEM>BACKUP>FROM" mode.***

A confirmation message appears on the guidelines.

Step 2 ***Press F4 (YES) to initialize the data.***

Press F5 (NO) to cancel the procedure.

Check of FROM initialization



The message "0.5: Accessing" appears during initialization.

CAUTION

- **If data is already written in, the data must be saved after the initialization process.**
- **The data saved on the internal flash ROM cannot be restored if any hardware trouble occurs. Always save the data onto an external PC storage device.**
- **If an abnormal process occurs, such as if the power is turned OFF while initializing the data, then the data cannot be guaranteed.**

13. "MONITOR" mode

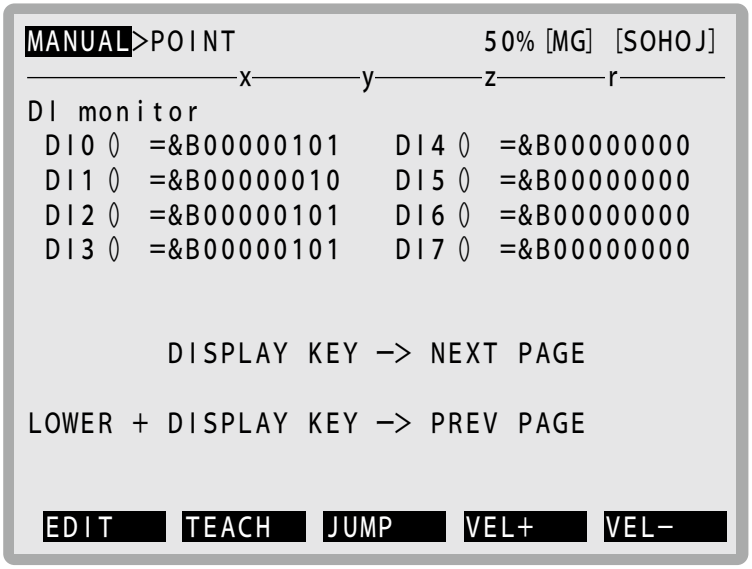
The "MONITOR" mode displays the I/O status regardless of the current mode and level. The "MONITOR" mode display is overlapped onto the screen during normal operation. So the robot controller can still be operated even with the monitor screen displayed.

NOTE

I/O ports that do not actually exist are also displayed.

- Pressing DISPLAY displays the input status in the data area (3rd to 7th lines) as shown below.

Input status display (1)

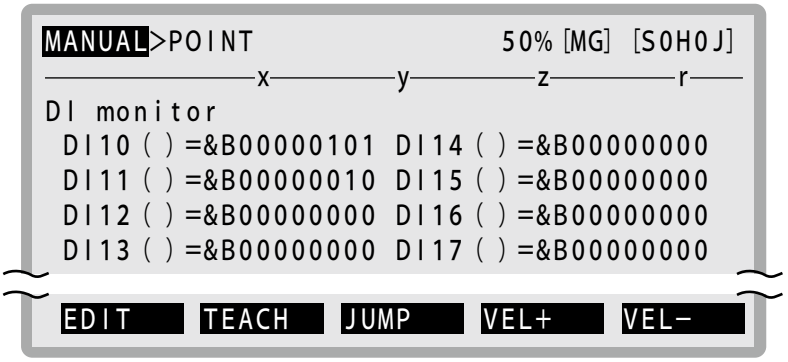


The display format is as follows:

<Port No.> = &B<bit 7><bit 6> to <bit 0>

- Pressing DISPLAY again displays the input status in the data area (3rd to 7th lines) as shown below.

Input status display (2)



- Press DISPLAY again to display other monitor screens.

  Pressing DISPLAY shifts the monitor screen in the following sequence.

  DI monitor → DO monitor → MO monitor → LO/TO monitor → SI monitor → SO monitor → SIW monitor → SOW monitor → Variable monitor → Task monitor → Current monitor → Normal screen display

  Pressing LOWER + DISPLAY displays each monitor in the reverse sequence of the above.

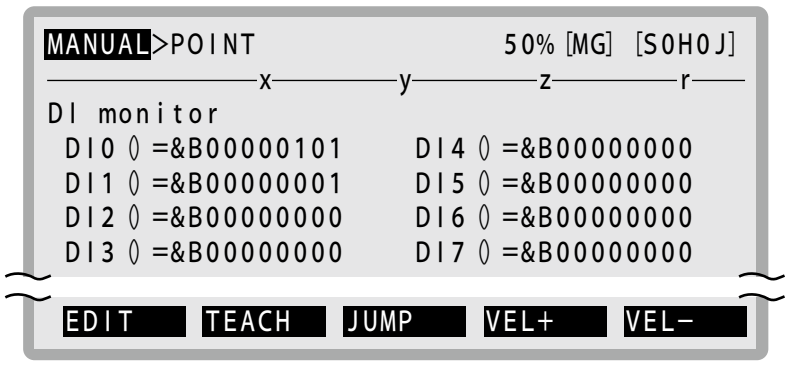
NOTE

The screen display is updated at periodic intervals.

- Press ESC to return to the normal screen display.

■ Monitor screen display examples

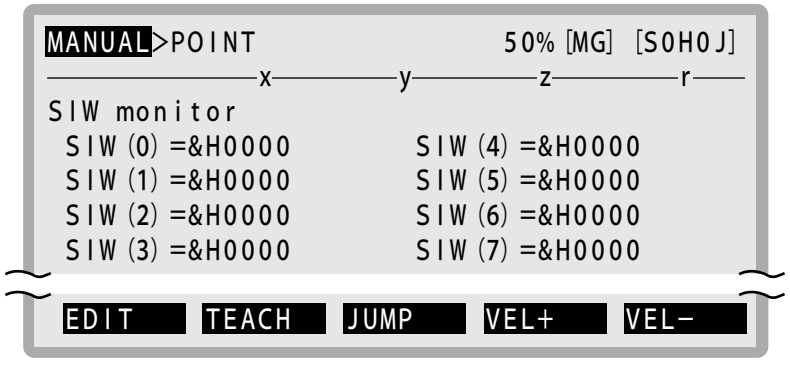
Example of bit information display



Display format:

<Port No.> = &B <7th bit> <6th bit> to <0th bit>

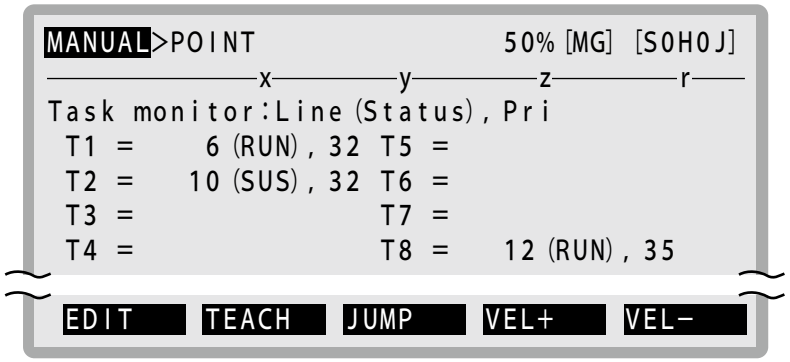
Example of word information display



Display format:

<Register No.> = &H<hexadecimal>

Example of task information display

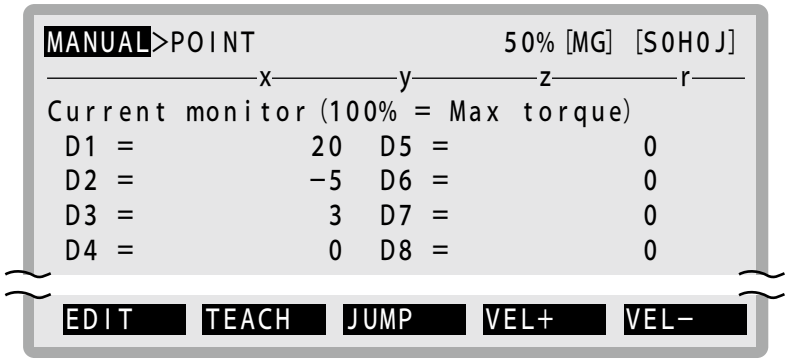


Display format:

<Task No.> = <Execution line> (<Execution state>), <Task priority>

<Execution state> : RUN (execute)/SUS (forced standby)/STP (stop)

Current command monitor display



Display format:

D<axis number> = <current command value>

Current command value is shown as a percent (%) of the maximum current command.

14. "UTILITY" mode

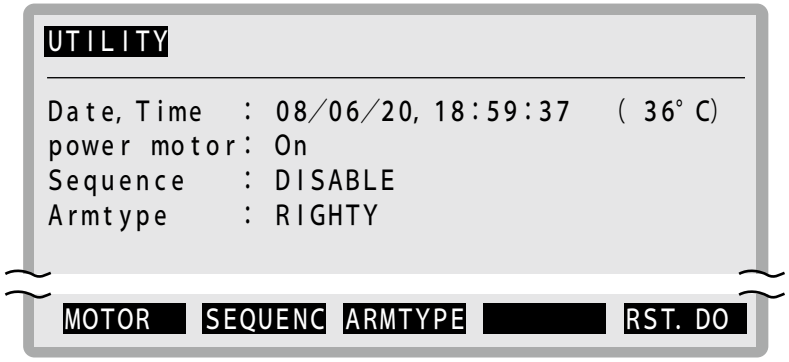
The "UTILITY" mode can be entered from any other mode regardless of the mode level.

NOTE

The current internal controller temperature is displayed on the right end of the 3rd line.

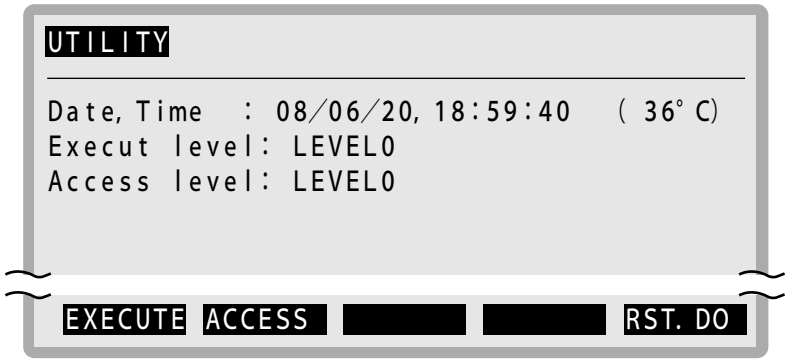
- Pressing UTILITY (LOWER + ESC) enters "UTILITY" mode and the following screen is displayed.

"UTILITY" mode (1)



- Pressing UTILITY (LOWER + ESC) again displays the following screen.

"UTILITY" mode (2)



- Pressing ESC returns to the mode that was displayed before selecting "UTILITY" mode.

Valid keys and submenu descriptions in "UTILITY" mode are shown below.

Valid keys	Menu	Function
F1	MOTOR	Turns the motor power and servo on and off.
F2	SEQUENC	Prohibits or permits executing the sequence program.
F3	ARMTYPE	Sets the arm hand type. (Valid only on SCARA robots)
F5	RST.DO	Clears the output port.

Valid keys	Menu	Function
F1	EXECUTE	Sets the execution level.
F2	ACCESS	Sets the access level.
F5	RST.DO	Clears the output port.

14.1 Canceling emergency stop; Motor power and servo on/off

14.1.1 Canceling emergency stop

Emergency stop must be cancelled to turn the servo on and operate the robot again in the following cases.

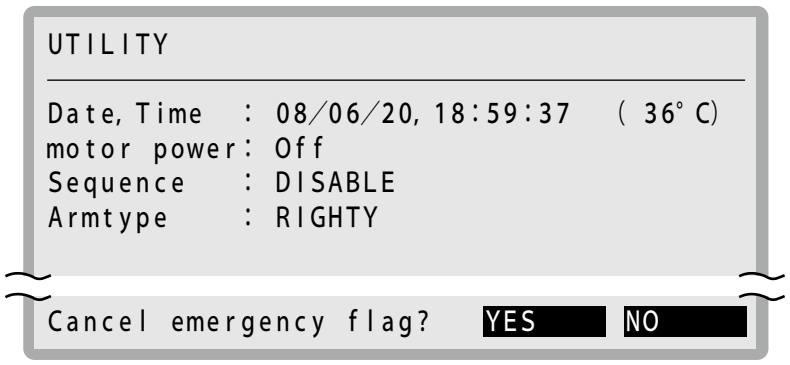
(1) When the emergency stop button was released after pressing the emergency stop button.

(2) When the switch contact was closed after triggering emergency stop by opening the emergency stop input contact.

Step 1 ***Press*** UTILITY ***(*** LOWER ***+*** ESC ***) to enter "UTILITY" mode.***

The display changes to the "UTILITY" mode screen and a confirmation message appears on the guideline.

Canceling emergency stop



Step 2 ***Press*** F4 ***(YES) to cancel the internal emergency stop flag.***

The internal emergency stop flag is cancelled. You can then move on to the next operation explained in 14.1.2, "Motor power and servo on/off".

If not canceling the internal emergency stop flag, press F5 *(NO).*

14.1.2 Motor power and servo on/off

This is usually used with the motor power turned on.
This operation is performed after emergency stop has been cancelled or when turning the servo on/off temporarily in order to perform direct teaching.

WARNING

THE BRAKE FOR THE BRAKE-EQUIPPED AXIS CAN BE RELEASED BY PRESSING THE F8 (FREE) KEY. HOWEVER, RELEASING THE BRAKE OF THE VERTICAL AXIS OF THE VERTICAL USE ROBOT WILL CAUSE THE AXIS TO SLIDE DOWN, CAUSING A HAZARDOUS SITUATION.

- **AFTER PRESSING THE EMERGENCY STOP BUTTON, 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 INSTALLATION BASE WHEN RELEASING THE BRAKE TO PERFORM DIRECT TEACH.**

NOTE

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

Step 1 ***Press F1 (MOTOR) in "UTILITY" mode.***

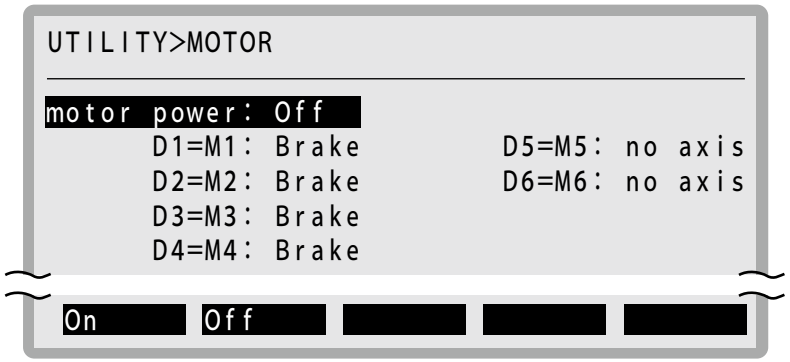
Step 2 ***Turn the motor power and servo on or off.***

Press F1 (On) to turn on the servo.

Press F2 (Off) to turn off the servo.

Press F6 (Power) to turn on the motor power supply only.

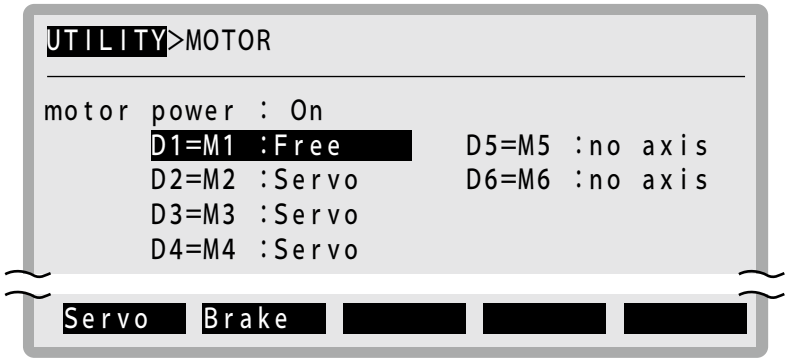
Servo on/off



Step 3 ***To set the servo of each axis to "ON", "OFF" or "FREE", select the axis with the cursor (▲ / ▼) keys.***

When setting the servo of each axis to "ON", the motor power must be turned on beforehand by the operation in step 2.

Setting the servo of each axis



Step 4 ***Set the servo status with F1 (Servo), F2 (Brake) or F8 (Free).***

14.2 Enabling/disabling the sequence execution flag

To enable or disable execution of sequence programs, proceed as follows.

NOTE

The following conditions must be satisfied before executing a sequence program.

1. An object program must be made for sequence execution.
2. Sequence execution must be enabled.
3. DI10 (Sequence control) contact point must be closed.
4. Operation must be in "AUTO" mode or "MANUAL" mode.

Step 1 ***Press F2 (SEQUENC) in "UTILITY" mode.***

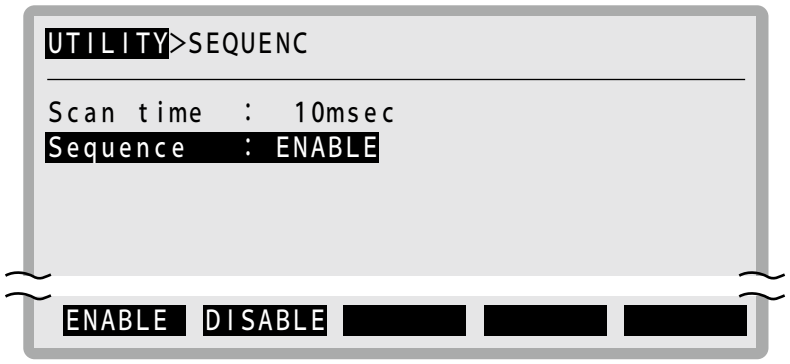
Step 2 ***Set the sequence execution flag.***

To enable execution of sequence programs, press F1 *(ENABLE).*

To disable execution of sequence programs, press F2 *(DISABLE).*

To enable DO reset during sequence program execution, press F6 *(RST.DO).*

Enabling/disabling the sequence program

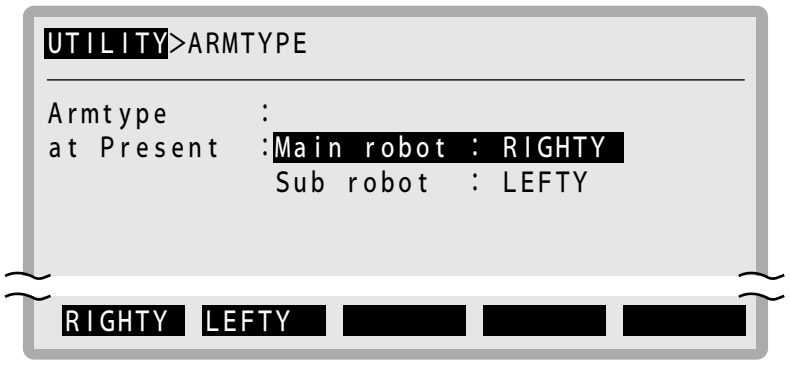


14.3 Changing the arm type

To set the hand type on SCARA robots that move using Cartesian coordinate data, follow the procedure below. The right-handed system is selected when the parameters are initialized. Arm type can be changed only for SCARA robots.

Step 1 ***Press F3 (ARMTYPE) in "UTILITY" mode.***

Main/sub robot specifications



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

Step 3 ***Press F1 (RIGHTY) or F2 (LEFTY) to set the right-handed or left-handed system.***

Step 4 ***Press ESC to exit "UTILITY" mode.***

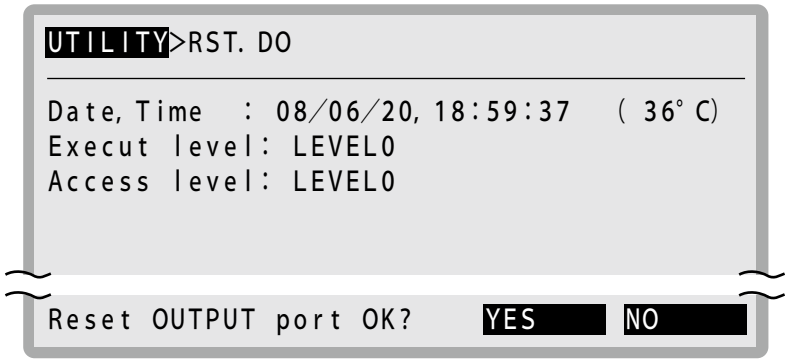
14.4 Resetting the output ports

This resets the general-purpose output ports DO2() to DO27()/MO2() to MO27()/LO0()/TO0()/SO2() to SO27()/SOW(2) to SOW(15).

Step 1 ***Press F5 (RST.DO) in "UTILITY" mode.***

A confirmation message appears on the guideline.

Resetting the output ports



Step 2 ***Press F4 (YES) to reset.***

Press F5 (NO) if not resetting.

14.5 Changing the execution level

Program execution levels can be set as shown in the table below. However, the following commands are usable only when return-to-origin is complete.

Movement commands : MOVE, MOVE2, MOVEI, MOVEI2, DRIVE, DRIVE2, DRIVEI, DRIVEI2, PMOVE, PMOVE2, PATH START

Position acquisition command : WHERE, WHERE2, WHRXY, WHRXY2

NOTE

Execution level is automatically set to "LEVEL 0" in the following cases.

1. When parameter data was damaged.
2. When system generation data was damaged.

Level	Description				
	Program execution at origin incomplete	When power is turned on		Program reset at program start	Return-to-origin signal in AUTO mode
		Mode	Program reset		
LEVEL0	Disabled	MANUAL mode	NO	NO	Invalid
LEVEL1	Enabled	MANUAL mode	NO	NO	Invalid
LEVEL2	Enabled	MANUAL mode	YES	NO	Invalid
LEVEL3	Enabled	AUTO mode	NO	NO	Invalid
LEVEL4	Enabled	AUTO mode	YES	NO	Invalid
LEVEL5	Enabled	MANUAL mode	YES	YES	Invalid
LEVEL6	Enabled	AUTO mode	YES	YES	Invalid
LEVEL7	Enabled	AUTO mode	NO	NO	Valid (Note 1)
LEVEL8	Enabled	AUTO mode	YES	YES	Valid (Note 1)

Note 1: When the DI17 (Absolute reset/Return-to-origin) is valid in "AUTO" mode, turns on during processing DO13 (Robot program-in-progress).

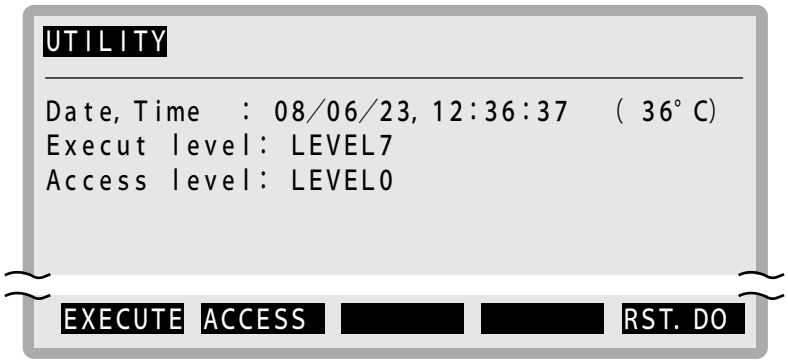
14.5.1 Changing the execution level

To change the execution level, proceed as follows.

Step1 ***Press*** UTILITY ***(*** LOWER ***+*** ESC ***) twice to enter "UTILITY" mode.***

Step2 ***Press*** F1 ***(EXECUTE).***

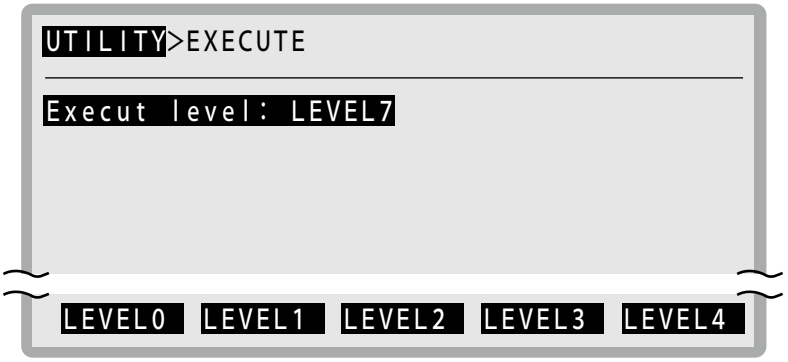
Changing the execution level (1)



Step3 ***Set the execution level.***

Press F1 *(LEVEL0) to* F9 *(LEVEL8) to set the execution level.*

Changing the execution level (2)



Step4 ***Press*** ESC ***to exit "UTILITY" mode.***

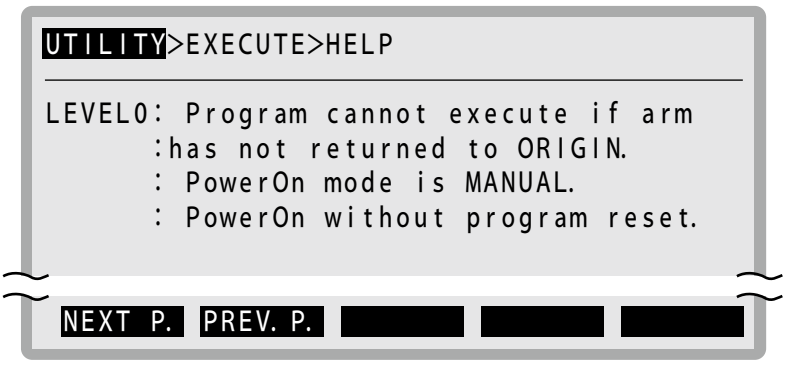
14.5.2 Displaying the help message

To refer to the help messages, press F15.

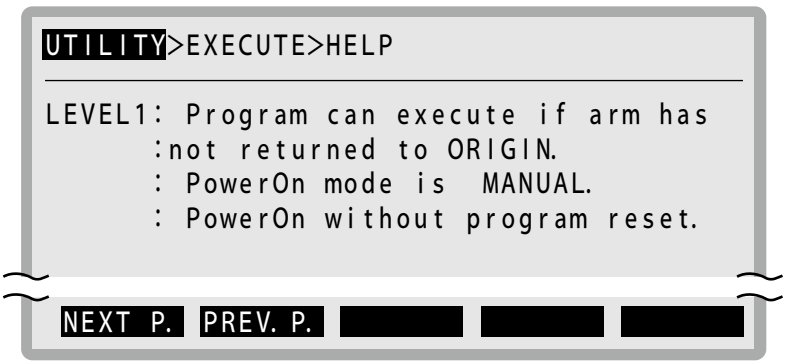
The first page of the help screen appears.

- Press F1 (NEXT P.) or cursor (▼) key to refer to the next page or press F2 (PREV. P.) or cursor (▲) key to refer to the previous page.
- Press ESC to exit the help screen.

Displaying the help message (1)



Displaying the help message (2)



14.6 Changing the access level (operation level)

Once the robot system is installed, anyone can change its program and point data. However, unauthorized changing of such data can be a source of trouble.
To prevent such problems, the robot controller can be set to operating levels that permit or prohibit changing program and point data.
The operation level can be set to any of the following levels.


NOTE

Access level is automatically set to "LEVEL 0" in the following cases.

1. When "ALL" was executed during memory initialization setting (Refer to "12.4.2 Initializing the memory".)
2. When the memory was destroyed (when "9.3: Memory destroyed" message was displayed)
3. When a program was destroyed (when "9.1: Program destroyed" message was displayed)
4. When point data was destroyed (when "9.2: Point data destroyed" message was displayed)
5. When shift data was destroyed (when "9.6: Shift data destroyed" message was displayed)
6. When hand data was destroyed (when "9.7: Hand data destroyed" message was displayed)
7. When a parameter was destroyed (when "9.4: Parameter destroyed" message was displayed)
8. When generation data was destroyed (when "9.33: Sys. generation destroyed" message was displayed)

Level	Description
LEVEL0	All operations are allowed.
LEVEL1	All data changes are prohibited. (Program changes, teaching, data deletion, data initializing, etc are prohibited.)
LEVEL2	In addition to level 1, mode selection is restricted to MANUAL and AUTO modes.
LEVEL3	In addition to level 2, mode speed changes and display of program list in AUTO mode are prohibited.

14.6.1 Changing the access level

Change the access level as needed.

NOTE

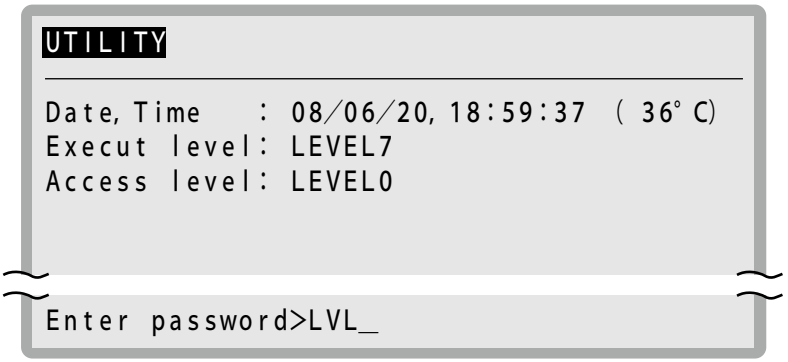
The online command (@ACCESS) from the RS-232C allows changes to the access level regardless of the password setting.

Step 1 ***Press F2 (ACCESS) in "UTILITY" mode.***

A message "Enter password" appears on the guideline.

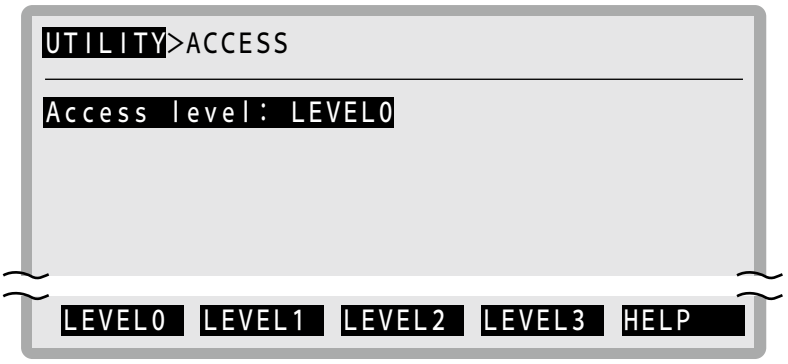
Step 2 ***Enter "LVL" here as the password and press ENTER.***

Setting the access level (1)



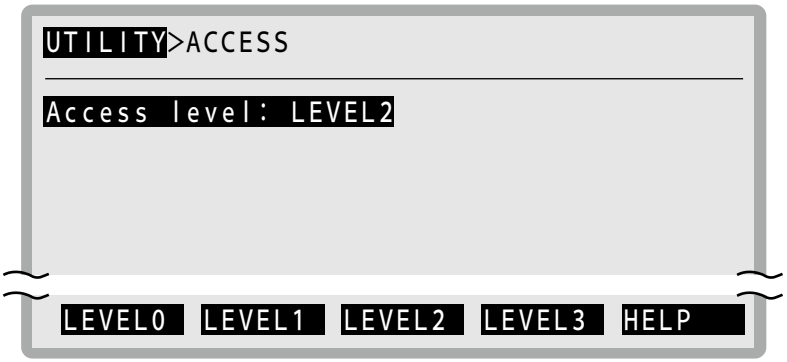
If the correct password was entered, the following screen appears.

Setting the access level (2)



Step3 ***Press F1 (LEVEL0) to F4 (LEVEL3) to set the access level.***

Setting the access level (3)



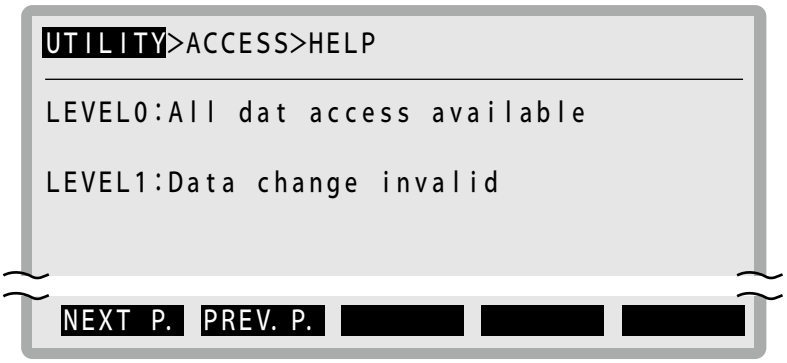
14.6.2 Displaying the help message

To refer to the help messages, press F5 (HELP).

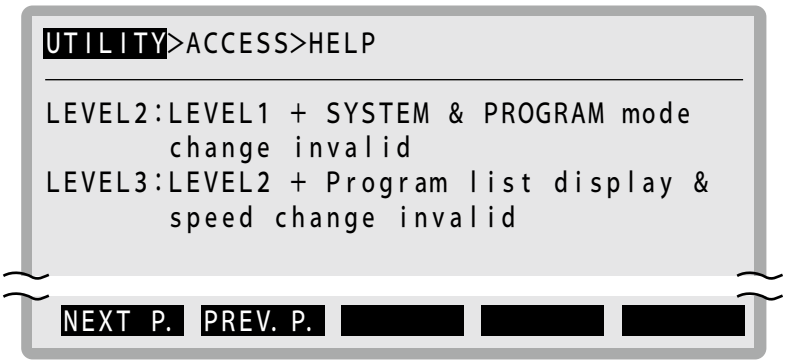
The first page of the help screen appears.

- Press F1 (NEXT P.) or cursor (▼) key to refer to the next page or press F2 (PREV. P.) or cursor (▲) key to refer to the previous page.
- Press ESC to exit the help screen.

Access level help screen (first page)



Access level help screen (second page)



Chapter 5 TWO-ROBOT SETTING

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1. Explanation of two-robot setting

1.1 Two-robot setting

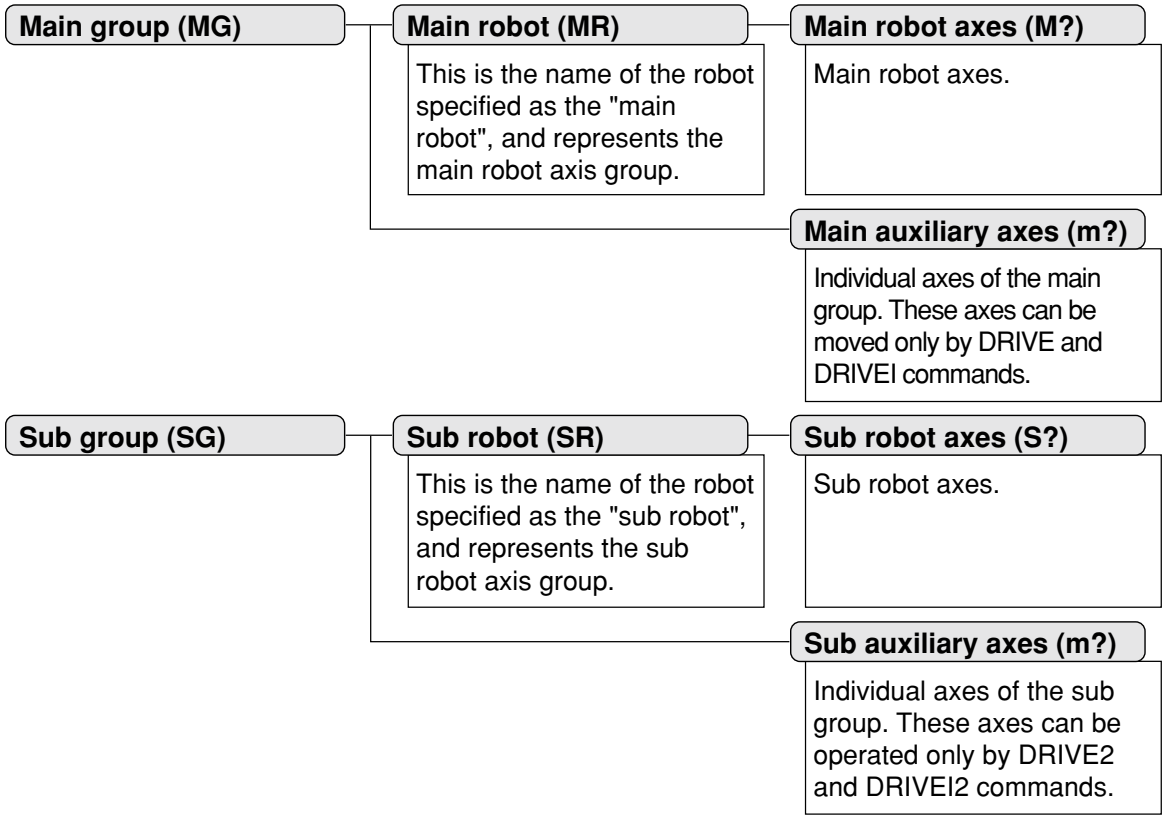
The two-robot setting refers to a configuration in which two robots are controlled by a single controller. In the two-robot setting, the multi-task function can be used to operate two robots in an asynchronous manner.

When the two-robot setting is specified, the robot axes are divided into the following groups.

- Main group
- Sub group

The above groups comprise the following axes:

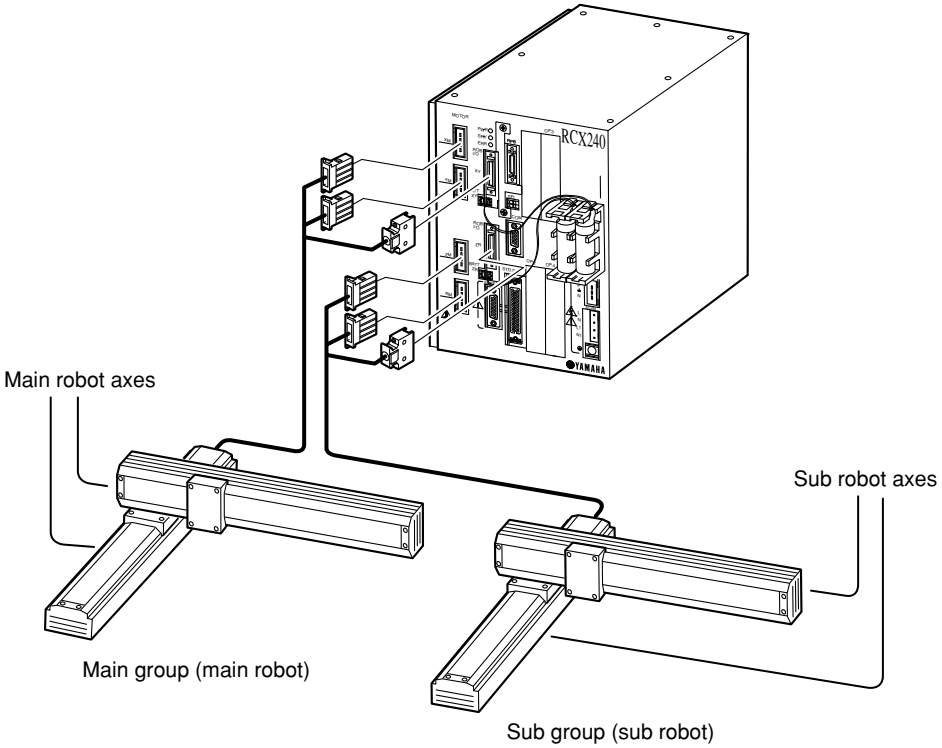
Axis configuration



Where no "main auxiliary axes" and "sub auxiliary axes" exist, the "main group = main robot", and the "sub group = sub robot".

The main auxiliary axes and sub auxiliary axes can be operated only by the DRIVE (DRIVE2) and DRIVEI (DRIVEI2) commands. The MOVE (MOVE2) and MOVEI (MOVEI2) commands are invalid for these axes.
Moreover, the usable robot language varies for each group. For details, see "3.1 Robot languages used in the two-robot setting".

Axis configuration example (RCX240, SXYx 2 axis spec. × 2 robots)

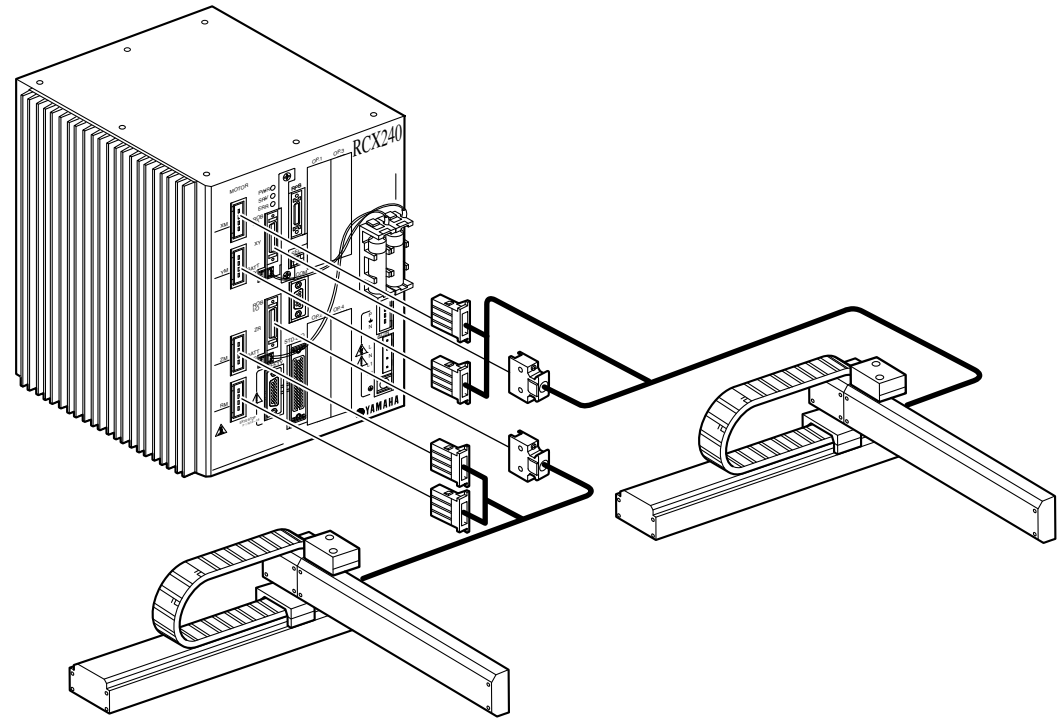


1.2 System configuration example

System configuration example

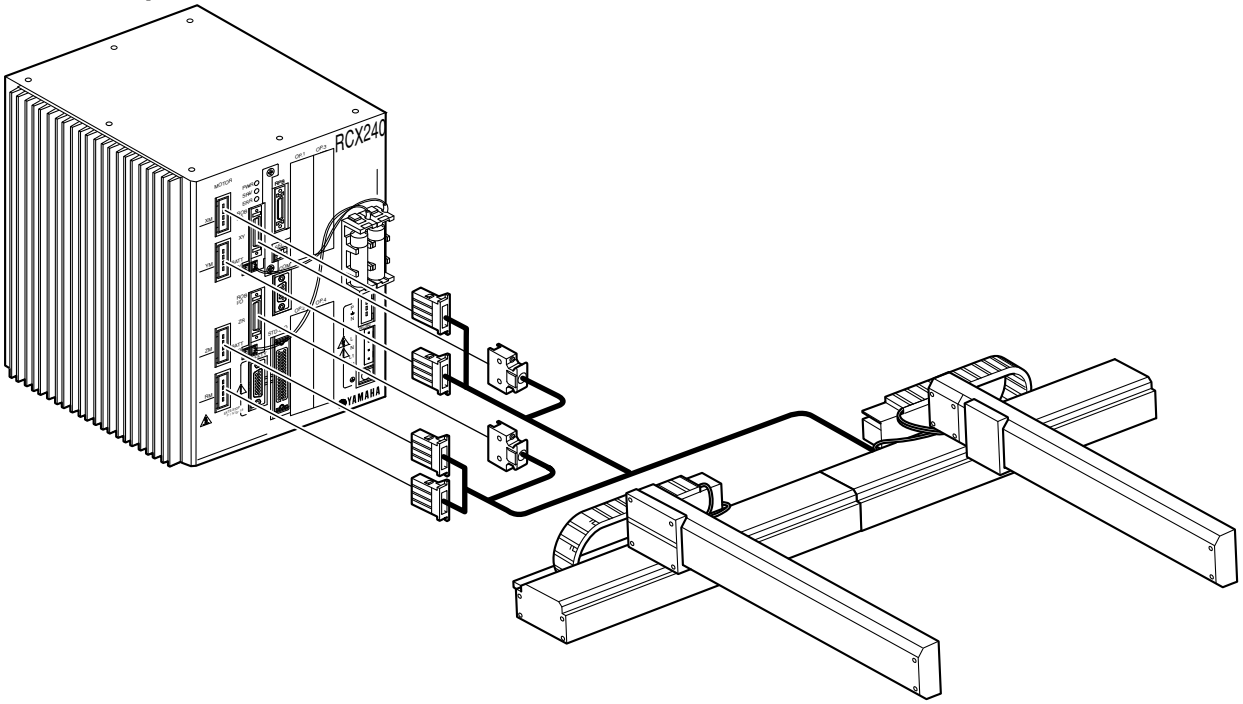
Configuration example 1

Example: SXYx + SXYx
MXYx + MXYx



Configuration example 2

Example: NXY-W



2. Operations and data when using the two-robot setting

The operations, data types and enabled functions unique to the two-robot setting are explained in this section.

This explanation consists of excerpts from Chapter 4 "OPERATION" and Chapter 10 "TROUBLESHOOTING" which relate to two-robot setting operations. Although portions of those chapters appear in this explanation, be sure to also refer to the above chapters for details.

2.1 "AUTO" mode

The robot to be operated must be selected when performing the following operations in the "AUTO" mode:

- Automatic motion speed change
- Point trace function

2.1.1 Changing the automatic movement speed

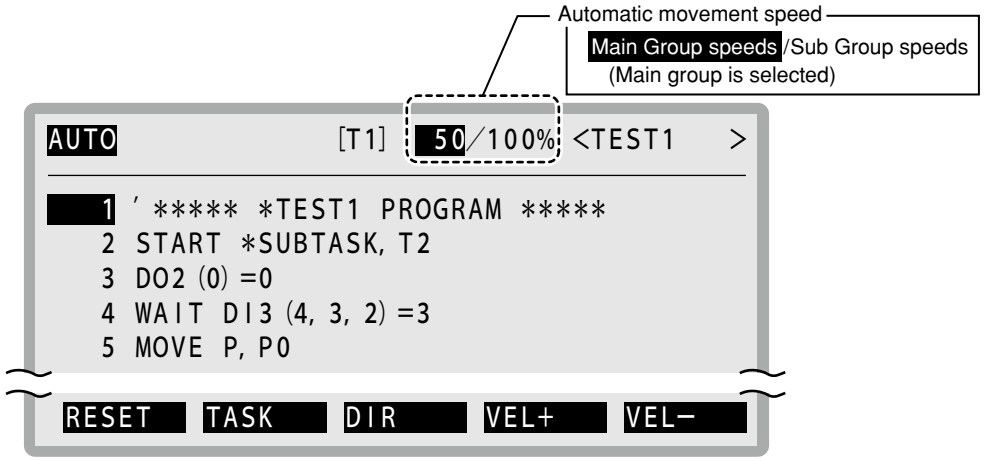
Automatic movement speeds are specified in a group-specific manner.

NOTE

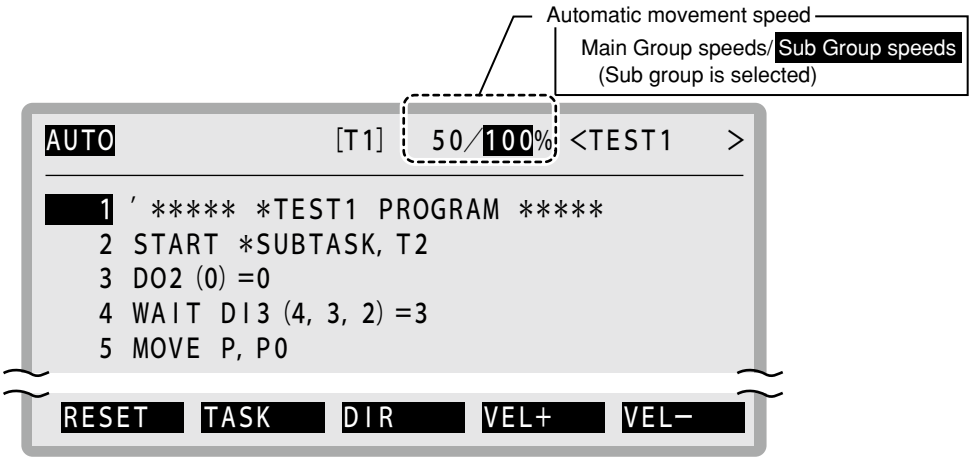
For details concerning changing the automatic movement speed, also see "9.6 Changing the automatic movement speed " in Chapter 4.

- Pressing ROBOT (LOWER + MODE) toggles between the groups (the selected group is highlighted) at the automatic movement speed display area. The highlighted speed value is the automatic movement speed for the currently selected group.

Changing the automatic movement speed (two-robot setting: Main group selected)



Changing the automatic movement speed (two-robot setting: Sub group selected)



- Use F4 (VEL+), F5 (VEL-), F9 (VEL++), F10 (VEL--) to change the speed for the currently selected group.

2.1.2 Executing the point trace

The point trace is executed in a group-specific manner.
Before executing this function, be sure to verify the currently selected group. The selected group can be changed by the procedure described below.

NOTE

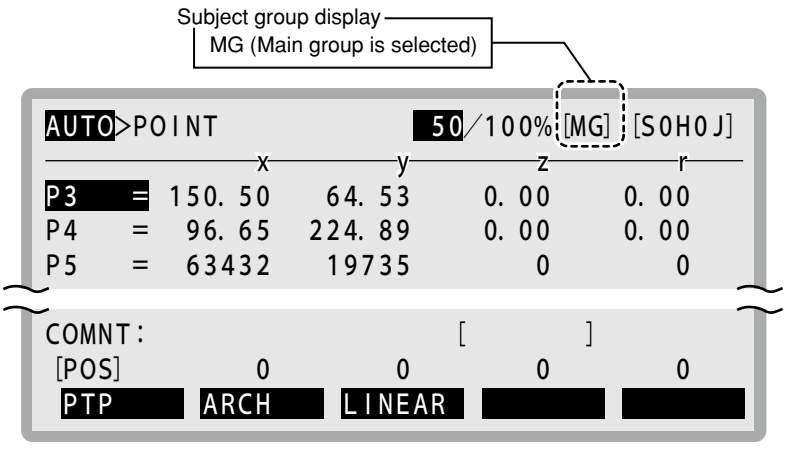
For details concerning executing the point trace, also see "9.7 Executing the point trace" in Chapter 4.

Step 1 ***In the "AUTO" mode, press F6 (Point).***

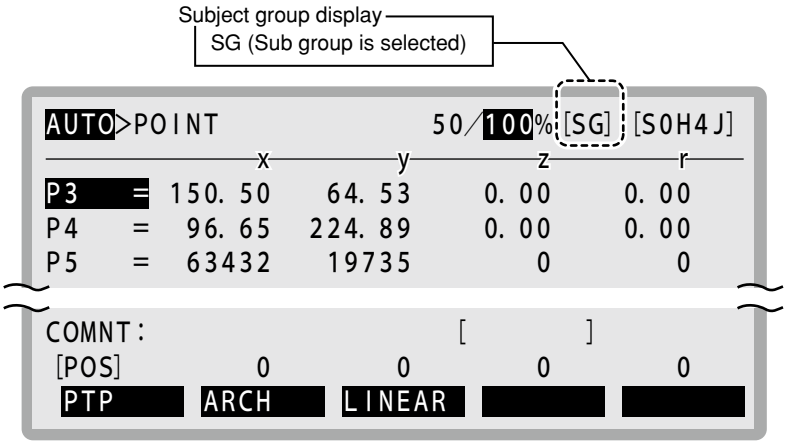
Step 2 ***Check the selected robot group.***

An "(MG)" display indicates the main group, and "(SG)" indicates the sub group. Press ROBOT (LOWER + MODE) to change the robot group. The selected group display is toggled each time the key is pressed.

Point trace screen (Two-robot setting: "Main group" selected)



Point trace screen (Two-robot setting: "Sub group" selected)



Step3 *Execute point trace.*

Select the motion mode (PTP, arch, line), then execute point trace.

WARNING

THE ROBOT STARTS TO MOVE WHEN POINT TRACE IS EXECUTED. DO NOT ENTER THE ROBOT MOVEMENT RANGE TO AVOID DANGER.

2.2 "MANUAL" mode

The robot to be operated must be selected when performing the following operations in "MANUAL" mode:

- Manual movement
- Point data input by direct teaching
- Input by point data direct teaching
- Setting the point in pallet definition by teaching
- Pallet definition by teaching
- Manual movement speed change
- Shift coordinate setting method
- Hand definition setting

Note that the two-robot setting's function key display content when an absolute reset occurs differs from that in the one-robot setting. For details, see "2.2.8 Absolute reset".

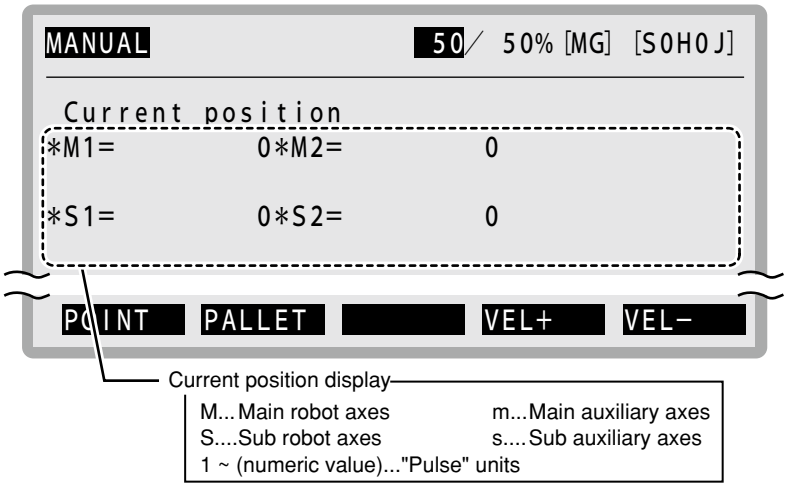
2.2.1 Current position

The robot's current position displays at the initial screen in the "MANUAL" mode. The "M" display indicates the main robot axes, and the "S" display indicates the sub robot axes. For settings with auxiliary axes, "m" indicates main auxiliary axes, and "s" indicates sub auxiliary axes.

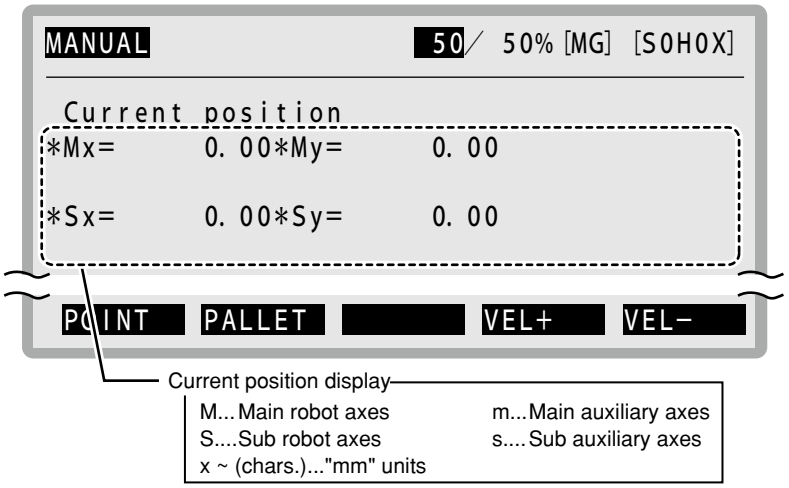
NOTE

For details regarding the current position display, also see "11. "MANUAL" mode" in Chapter 4.

"MANUAL" mode screen example ("pulse" units)



"MANUAL" mode screen example ("mm" units)



2.2.2 Manual movement

Manual movement is executed in a group-specific manner. Before executing this function, be sure to verify the currently selected group. The selected group can be changed by the procedure described below.

NOTE

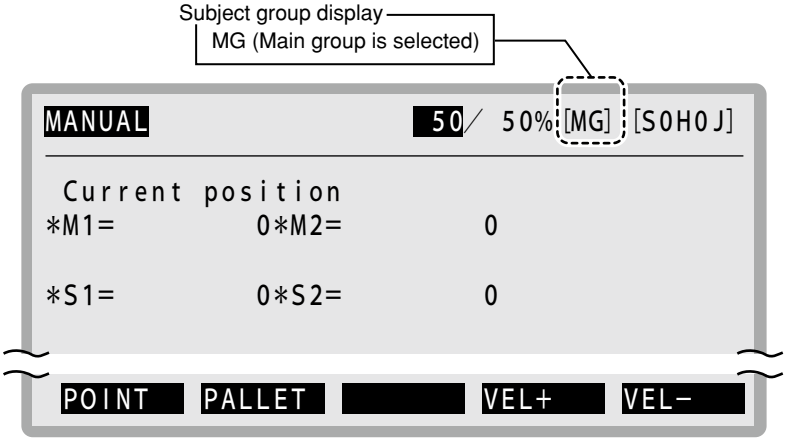
For manual movement details, also see "11.1 Manual movement" in Chapter 4.

Step 1 Check the selected robot group.

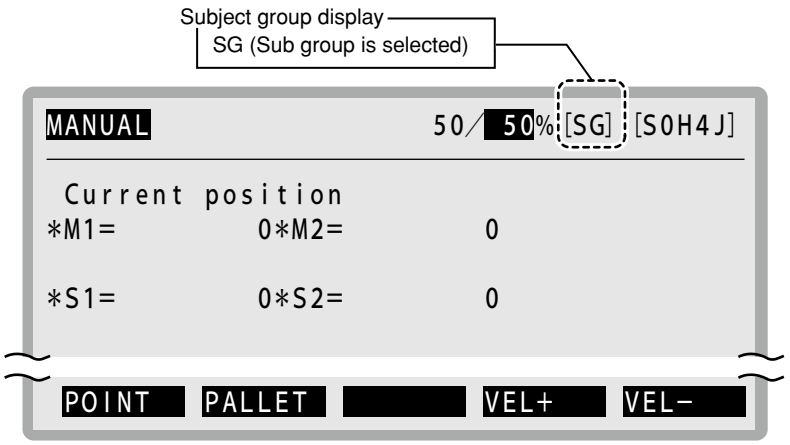
An "(MG)" display indicates the main group, and "(SG)" indicates the sub group.

Press ROBOT *(* LOWER *+* MODE *) to change the robot group. The selected group display is toggled each time the key is pressed.*

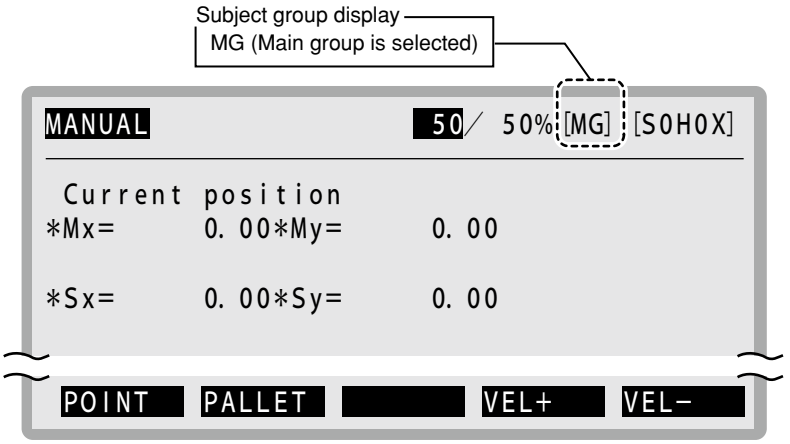
"Pulse" units (J) example (Two-robot setting: Main group selected)



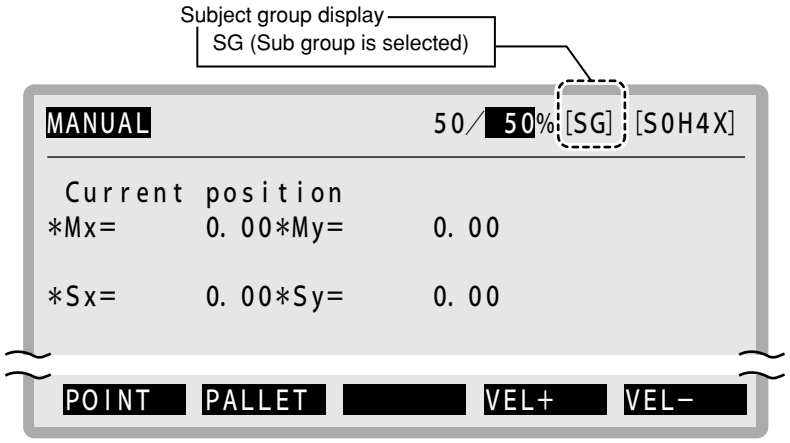
"Pulse" units (J) example (Two-robot setting: Sub group selected)



"mm" units (X) example (Two-robot setting: Main group selected)



"mm" units (X) example (Two-robot setting: Sub group selected)



Step 2 *Manually move the robot.*

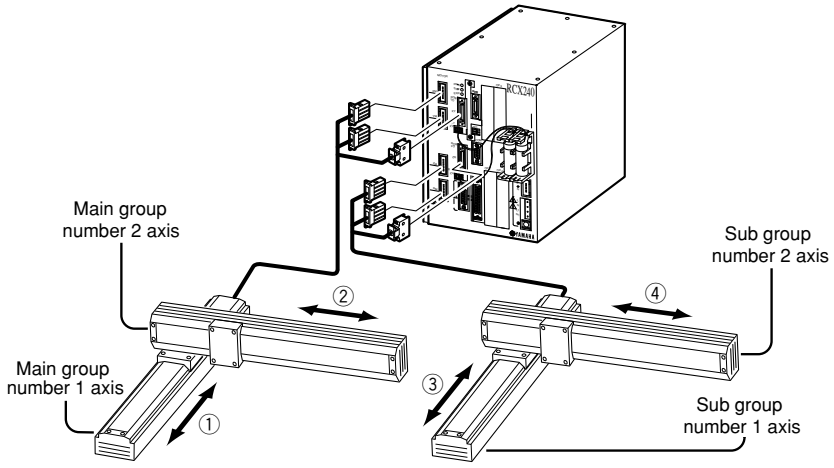
1. When return-to-origin is complete:

With the current position display in a "pulse" units (J) status, the Jog key can be pressed to move the selected group's axis which corresponds to that Jog key.
With the current position display in a "mm" units (X) status, the Jog key can be pressed to move the tip of the robot arm in the direction (Cartesian coordinates) which corresponds to that Jog key.
For axes with auxiliary axes settings, only the corresponding axes are moved.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Robot motion in "pulse" units (J) (ex)



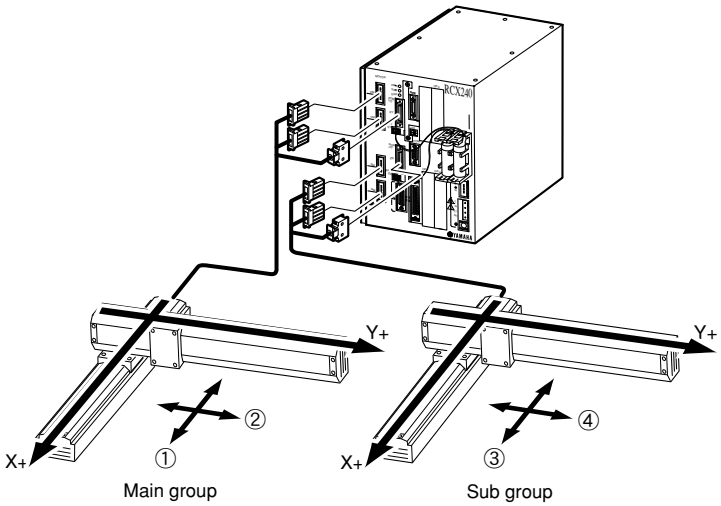
① With the main group selected, press #1+ X , X #1− to move the main group Number 1 axis.

② With the main group selected, press #2+ Y , Y #2− to move the main group Number 2 axis.

③ With the sub group selected, press #1+ X , X #1− to move the sub group Number 1 axis.

④ With the sub group selected, press #2+ Y , Y #2− to move the sub group Number 2 axis.

Robot motion in "mm" units (X) (ex)



① With the main group selected, press #1+ X , X #1− to move the tip of the robot arm in the X-direction (Cartesian coordinates).

② With the main group selected, press #2+ Y , Y #2− to move the tip of the robot arm in the Y-direction (Cartesian coordinates).

③ With the sub group selected, press #1+ X , X #1− to move the tip of the robot arm in the X-direction (Cartesian coordinates).

④ With the sub group selected, press #2+ Y , Y #2− to move the tip of the robot arm in the Y-direction (Cartesian coordinates).

2. When return-to-origin is incomplete:

With the origin position displayed in "pulse" units (J), the Jog keys can be used to move the robot in the same way when return-to-origin is complete. However, the message "0.1: Origin incomplete" appears when a jog key is pressed.
With the current position displayed in "mm" units (X), the robot cannot be moved unless return-to-origin is complete. If an attempt is made to move the robot, the display automatically changes to "pulse" units (J) and the message "0.1: Origin incomplete" then appears.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

CAUTION

If return-to-origin is incomplete, the soft limits do not work correctly.

2.2.3 Point data

When in the two-robot setting, the same point data is used by both robots.

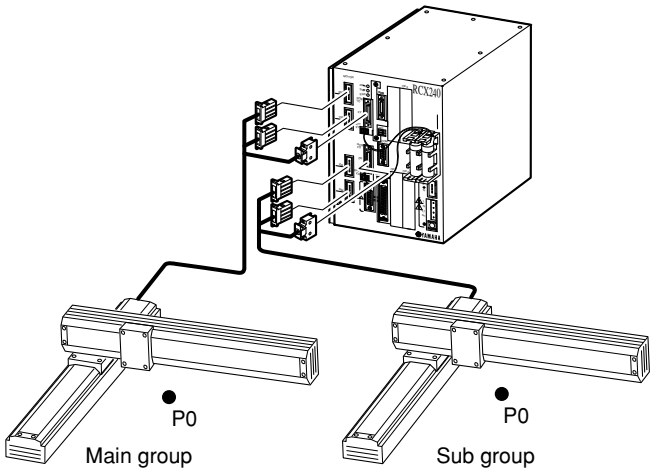
NOTE

For point data details, see "11.2 Displaying and editing point data" in Chapter 4.

[Ex] P0 = 10000 20000 0 0 0 0

If the main group uses "P0" and is selected, the above example content indicates the main group's P0 position. If the sub group uses "P0" and is selected, the content indicates the sub group's P0 position.

Two-robot setting's point data



2.2.3.1 Point data input by teaching

Point data input by direct teaching consists of registering the currently selected group's coordinate values as point data.
Before executing this function, be sure to verify the currently selected group. The selected group can be changed by the procedure described below.

NOTE

- For details concerning Point data input by direct teaching, also see "11.2.2 Point data input by teaching" in Chapter 4.
- Point data teaching cannot be performed when return-to-origin is incomplete. Perform point teaching after performing return-to-origin or absolute reset.

This explanation assumes that no auxiliary axes are set. If auxiliary axes exist, the selected group can be changed in the same manner as that given below. For details regarding the teaching procedure after the selected group has been changed, see "11.2.2 Point data input by teaching" in Chapter 4.

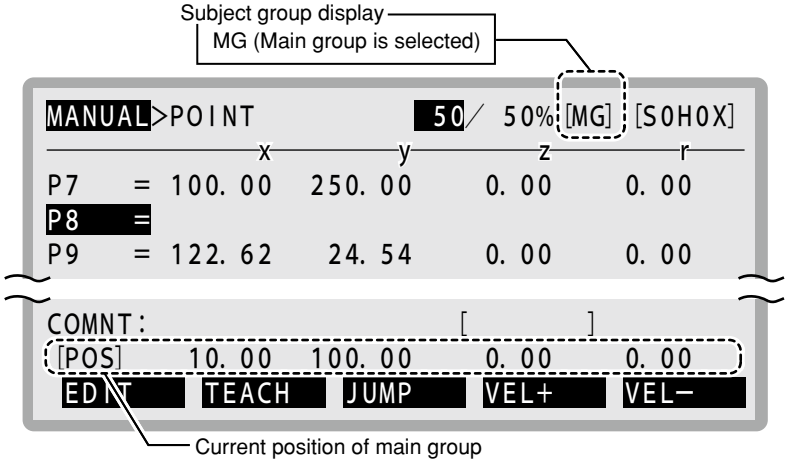
When no auxiliary axes are set:

Step 1 ***Select the "MANUAL>POINT" mode.***

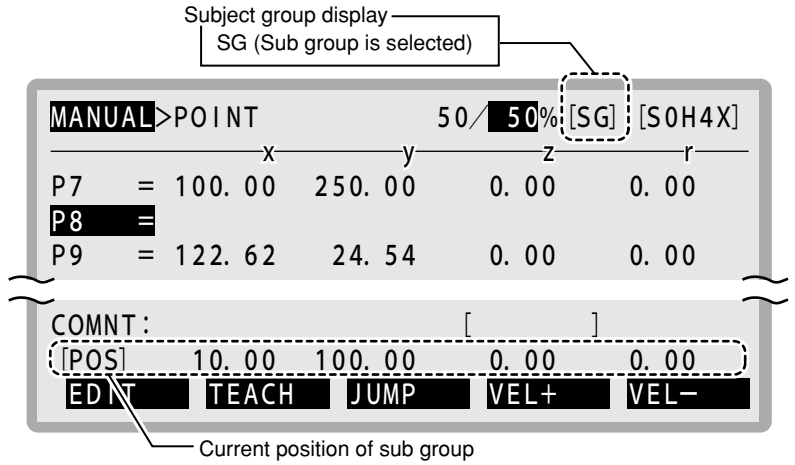
Step 2 ***Check the selected robot group.***

An "(MG)" display indicates the main group, and "(SG)" indicates the sub group. Press ROBOT *(* LOWER *+* MODE *) to change the robot group. The selected group display is toggled each time the key is pressed.*

Point data teaching screen (two-robot setting: Main group selected)



Point trace screen (two-robot setting: Sub group selected)



Step3 ***Use the cursor up/down (▲ / ▼) keys to move the cursor to the point number where an input is desired.***

Step4 ***Use the Jog key to move the robot arm.***

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

Step5 ***When the axis reaches the target point, press F2 (TEACH).***

The specified point is "taught" as the current position of the selected group. Point data teaching inputs are made in the currently selected coordinate system format.
If a point data exists for the specified point number, a confirmation message displays at the guideline when F2 (TEACH) is pressed.

To execute the teaching operation, press F4 (YES).

To abort the teaching operation, press F5 (NO).

2.2.3.2 Input by point data direct teaching

Input by point data direct teaching consists of registering the currently selected group's coordinate values as point data in the same manner as when performing teaching by using the Jog key.
Before executing this function, be sure to verify the currently selected group. The selected group can be changed by the same procedure as that described in section "2.2.3.1 Point data input by teaching".

NOTE

For details concerning input by point data direct teaching, also see "11.2.3 Point data input by direct teaching" in Chapter 4.

2.2.4 Pallet definition

When in the two-robot setting, the same pallet definition data is used by both robots.

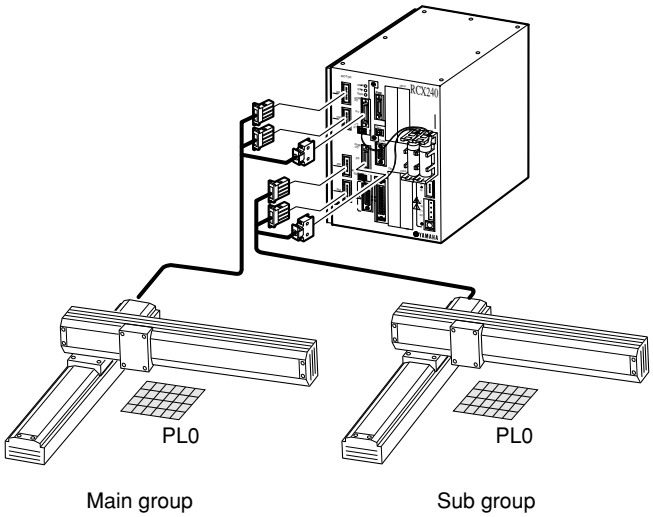
NOTE

For pallet definition details, also see "11.3 Displaying, editing and setting pallet definitions" in Chapter 4.

[Ex] For "PL0":

If the main group uses "PL0" and is selected, the "PL0" coordinates indicate the main group's coordinate position. If the sub group uses "PL0" and is selected, the "PL0" coordinates indicate the sub group's coordinate position.

Two-robot setting's pallet definition



2.2.4.1 Setting the point in pallet definition by teaching

Setting the point in pallet definition by teaching consists of registering the currently selected group's coordinates as point data.
Before executing this function, be sure to verify the currently selected group. The selected group can be changed by the same procedure as that described in section "2.2.3.1 Point data input by teaching".

NOTE

For details concerning Setting the point in pallet definition by teaching, also see "11.3.1.1.2 Setting the point in pallet definition by teaching" in Chapter 4.

2.2.4.2 Pallet definition by teaching

The "Pallet definition by teaching" function allows the pallet definition data to be specified by teaching 4 points (5 points for 3D pallets), and then specifying that pallet's number of rows/columns (rows/columns/levels for 3D pallets).
Point teaching is performed for the currently selected group, and the pallet data definition data is set based on that point data.

NOTE

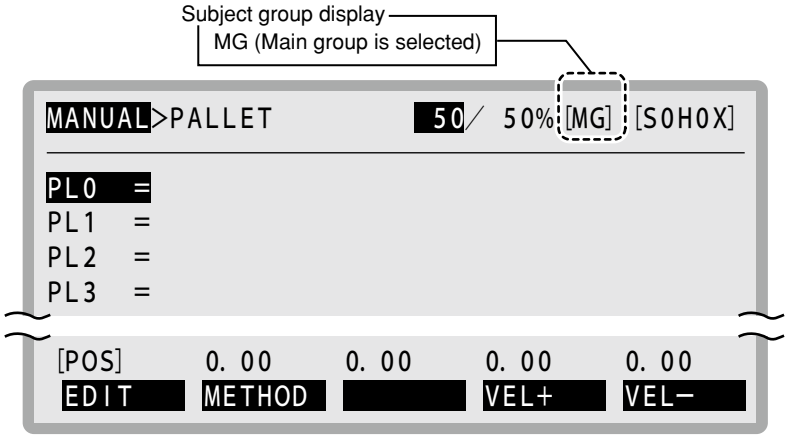
- For details concerning inputs by pallet definition setting, also see "11.3.2 Pallet definition by teaching" in Chapter 4.
- When return-to-origin is incomplete, the points in pallet definition setting cannot be input by teaching. Perform point teaching after performing return-to-origin or absolute reset.

Step 1 ***In "MANUAL>PALLET" mode, use the cursor up/down (▲ / ▼) keys to select the desired pallet number.***

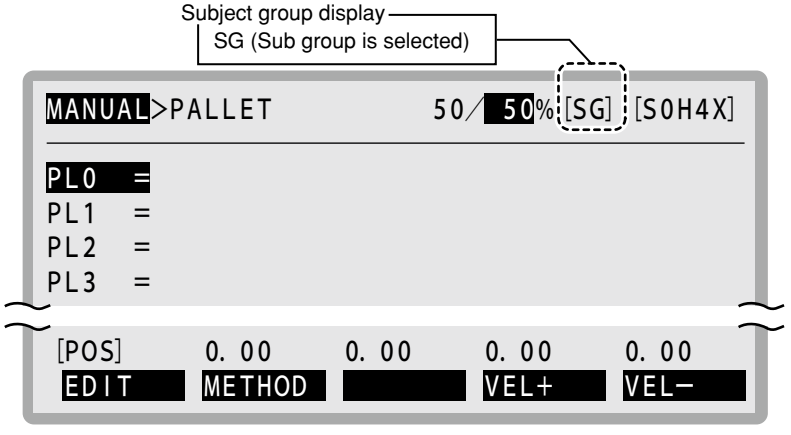
Step 2 ***Check the selected robot group.***

An "(MG)" display indicates the main group, and "(SG)" indicates the sub group.
Press ROBOT (LOWER + MODE) to change the robot group. The selected group display is toggled each time the key is pressed.

Pallet definition setting (Two-robot setting: Main group selected)



Pallet definition setting (Two-robot setting: Sub group selected)



Step3 ***Press*** F2 ***(METHOD).***

"MANUAL>PALLET>SET" mode is then entered.

Step4 ***Set the pallet definition.***

WARNING

WHEN MOVING THE ROBOT FOR PALLET DEFINITION SETTING, DO NOT ENTER THE ROBOT MOVEMENT RANGE TO AVOID DANGER.

2.2.5 Changing the manual movement speed

Manual movement speed settings are made in a group-specific manner.

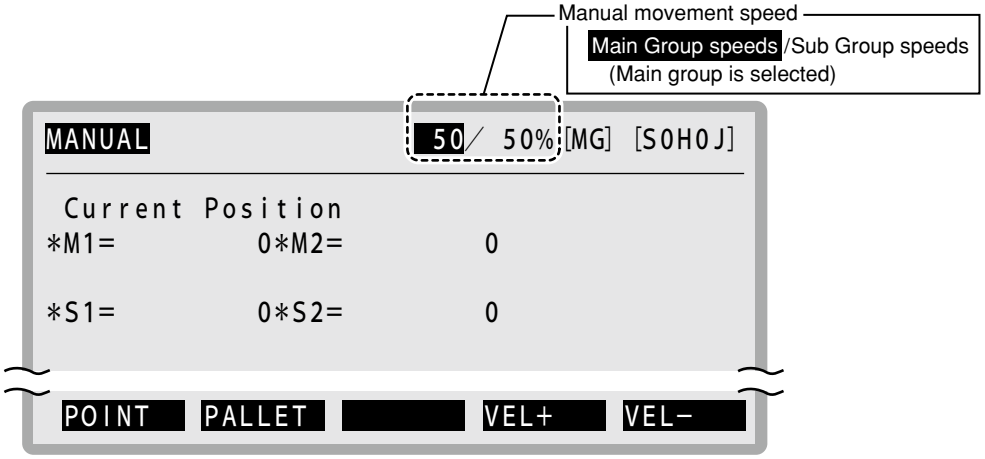
NOTE

For details concerning changing the manual movement speed, also see "11.4 Changing the manual movement speed" in Chapter 4.

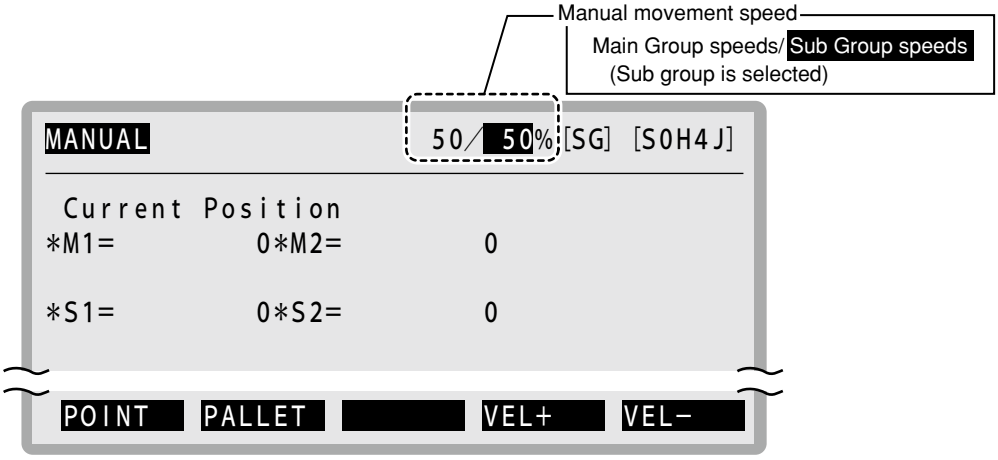
Step 1 *Check the selected robot group.*

An "(MG)" display indicates the main group, and "(SG)" indicates the sub group. Press ROBOT *(* LOWER *+* MODE *) to change the robot group. The selected group display is toggled each time the key is pressed. At the same time, the highlighted manual movement speed is also switched. The highlighted speed value is the manual movement speed for the currently selected group.*

Changing the manual movement speed (Two-robot setting: Main group selected)



Changing the manual movement speed (Two-robot setting: Sub group selected)



Step 2 *Change the speed.*

Use F4 *(VEL+),* F5 *(VEL-),* F9 *(VEL++) and/or* F10 *(VEL--) to change the speed for the currently selected group.*

2.2.6 Shift coordinates

When in the two-robot setting, the same shift data is used by both robots. However, shift numbers are specified in a robot-specific manner.
Shift coordinate data is disabled when in the "multi type robot" mode.

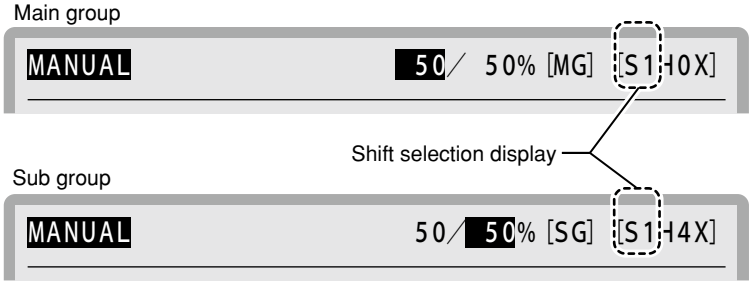
NOTE

For shift coordinate details, also see "11.5 Displaying, editing and setting shift coordinates" in Chapter 4.

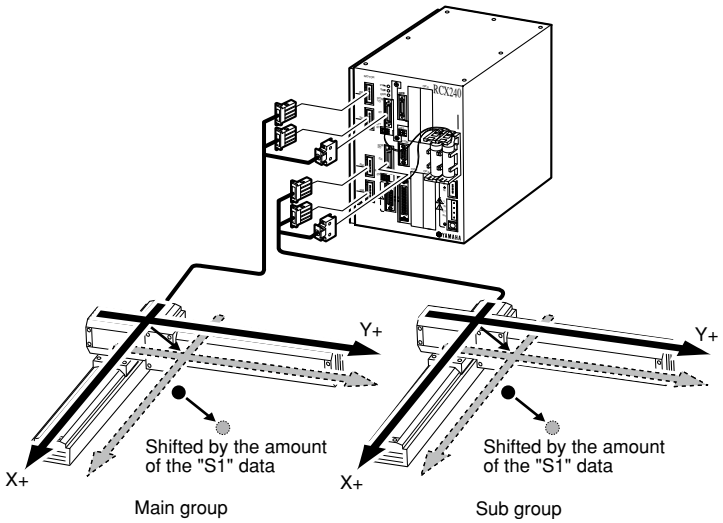
[Ex.1] S1 = 50.00 100.00 0.00 0.00

When the shift numbers at both the main group and sub group are set to "S1", the point data's operation position for each group is shifted by the amount of the "S1" data.

Two-robot setting shift coordinates



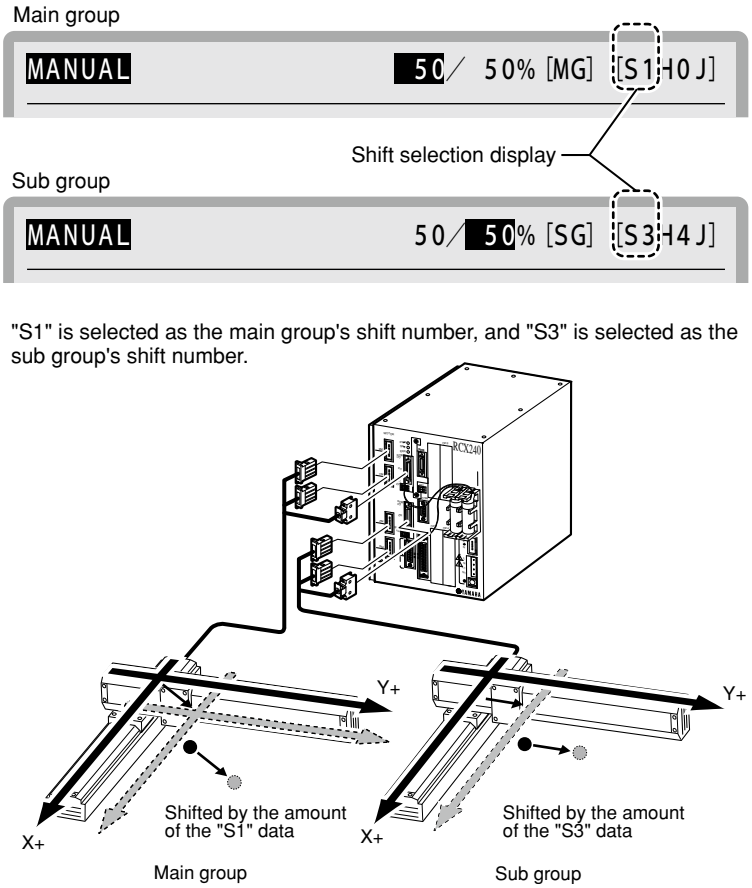
"S1" selected for both the main and sub groups.



[Ex.2] S1 = 50.00 100.00 0.00 0.00
S3 = 0.00 150.00 0.00 0.00

If the main group's shift number is set as "S1", and the sub group's shift number is set as "S3", the main group's point data operation position is shifted by the amount of the "S1" data, and the sub group's point data operation position is shifted by the amount of the "S3" data.

Two-robot setting shift coordinates



2.2.6.1 Shift coordinate setting method 1

The "Shift coordinate setting method 1" function allows shift coordinate data to be set by teaching 2 points, and then entering the coordinate direction.
Point teaching occurs for the currently selected group, and shift coordinate data is created based on that point data.

NOTE

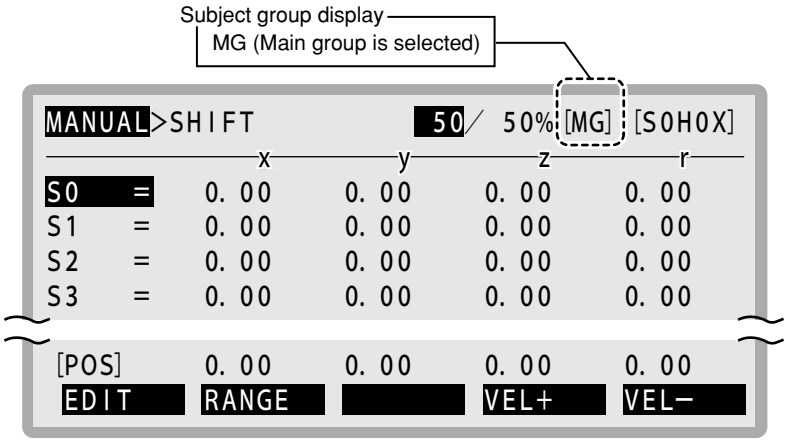
For "Shift coordinate setting method 1" details, also see "11.5.3 Shift coordinate setting method 1" in Chapter 4.

Step 1 ***In the MANUAL>SHIFT mode, use the cursor up/down (▲ / ▼) keys to select the shift coordinate number.***

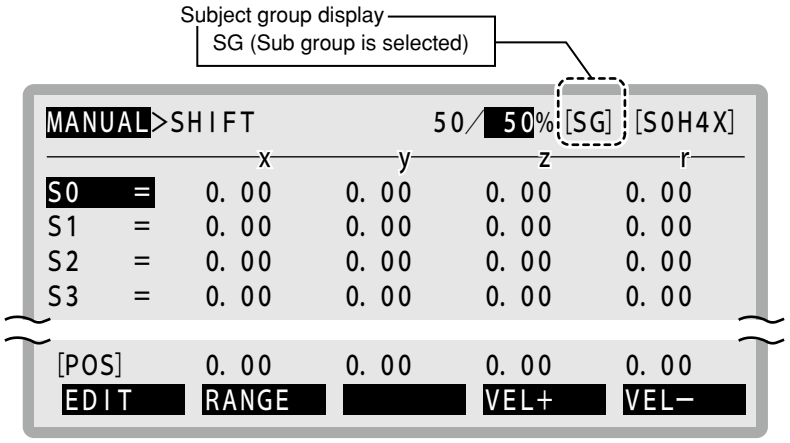
Step 2 ***Check the selected robot group.***

An "(MG)" display indicates the main group, and "(SG)" indicates the sub group.
Press ROBOT (LOWER + MODE) to change the robot group. The selected group display is toggled each time the key is pressed.

Shift coordinate setting method (Two-robot setting: Main group selected)



Shift coordinate setting method (Two-robot setting: Sub group selected)



Step3 ***Press F6 (METHOD1).***

Step4 ***Register the Shift coordinates.***

Use the Jog keys to determine teaching points 1 and 2, then select the coordinate direction to register the shift coordinates.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

Perform teaching carefully to obtain accurate teach points. Precise shift coordinates cannot be set if the teach point is inaccurate.

2.2.6.2 Shift coordinate setting method 2

The "Shift coordinate setting method 2" function allows shift coordinate data to be set by teaching 2 points, and then entering that 2-point shift coordinate value.
Point teaching occurs for the currently selected group, and shift coordinate data is created based on that point data.

NOTE

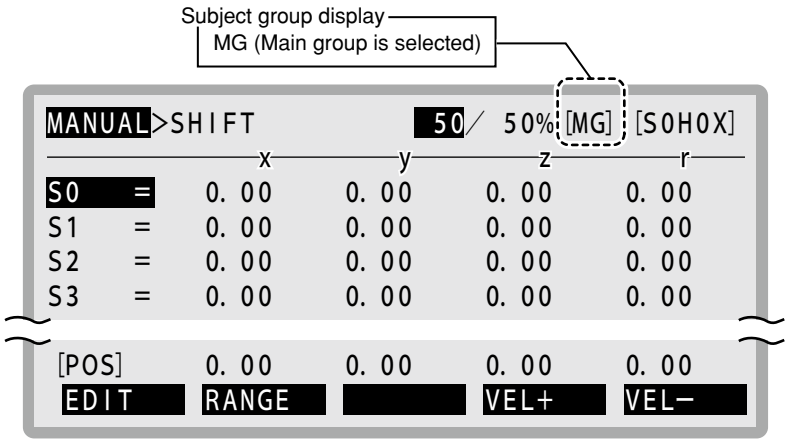
For "Shift coordinate setting method 1" details, also see "11.5.4 Shift coordinate setting method 2" in Chapter 4.

Step1 ***In the MANUAL>SHIFT mode, use the cursor up/down (▲ / ▼) keys to select the shift coordinate number.***

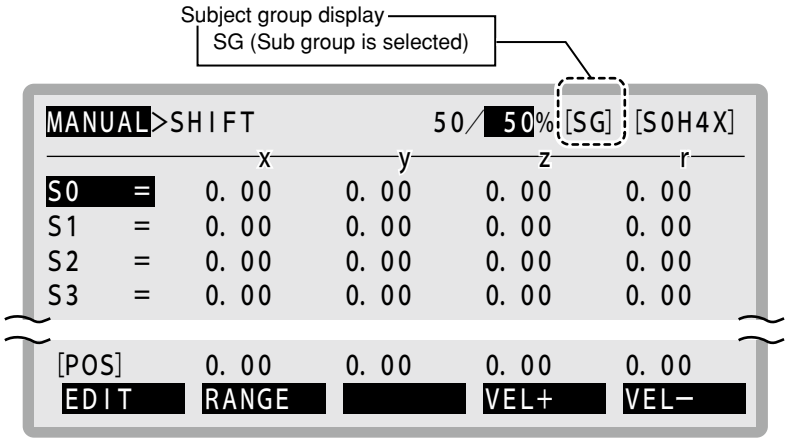
Step2 ***Check the selected robot group.***

An "(MG)" display indicates the main group, and "(SG)" indicates the sub group.
Press ROBOT (LOWER + MODE) to change the robot group. The selected group display is toggled each time the key is pressed.

Shift coordinate setting method (Two-robot setting: Main group selected)



Shift coordinate setting method (Two-robot setting: Sub group selected)



Step3 ***Press*** F7 ***(METHOD2).***

Step4 ***Enter the shift coordinates of teaching point 1.***

Use the Jog keys to determine teaching point 1, then enter the shift coordinate value of that point.

Step5 ***Determine teaching point 2 in the same manner in order to register the shift coordinates.***

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

Perform teaching carefully to obtain accurate teach points. Precise shift coordinates cannot be set if the teach point is inaccurate.

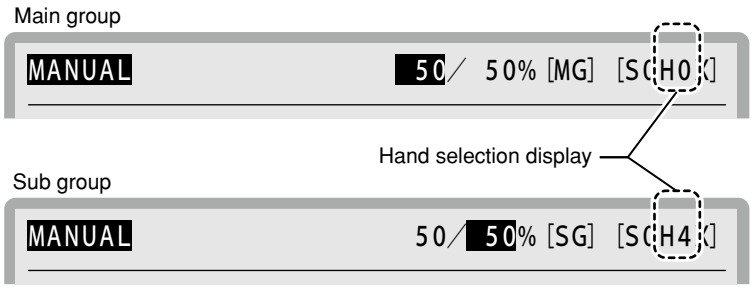
2.2.7 Hand definition

In the two-robot setting, the same hand data is used by both robots. Hand definition numbers H0 to H3 can be used at the main robot, and H4 to H7 can be used at the sub robot.
Hand definition data is disabled when in the "multi type robot" mode.

NOTE

For hand definition details, also see "11.6 Displaying, editing and setting hand definitions" in Chapter 4.

Hand definition



"H0" is selected as the main group's hand definition number, and "H4" is selected as the sub group's hand definition number.

2.2.7.1 Hand definition setting method 1

For Cartesian robots, hand definition data can be set by teaching the "non-hand work point" and "hand work point" as the same point.

NOTE

- For "hand definition setting method 1" details, also see "11.6.2 Hand definition setting method 1" in Chapter 4.
- The "hand definition setting method 1" setting is usable when the robot is equipped with a hand on the number 2 arm.
- The setting method explained here applies to Cartesian robots.

In the two-robot setting, the hand definition numbers. are determined individually for the main and sub groups. Before executing this function, be sure to verify the currently selected group. The selected group can be changed by the procedure described below.

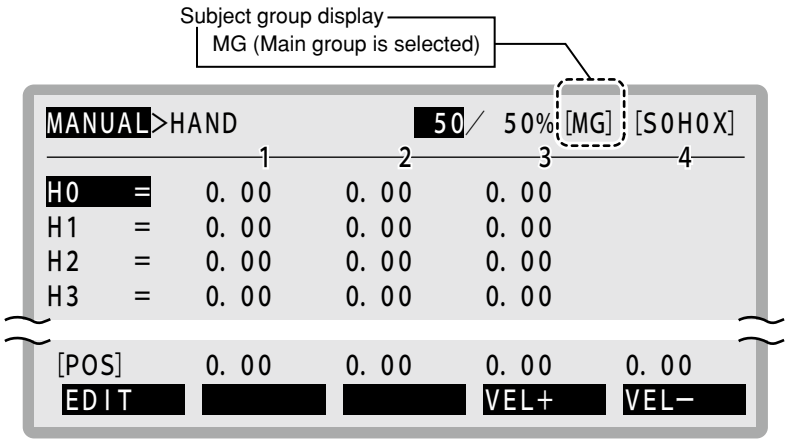
Step 1 ***In the "MANUAL" mode, press F7 (Hand).***

Establish the MANUAL>HAND mode.

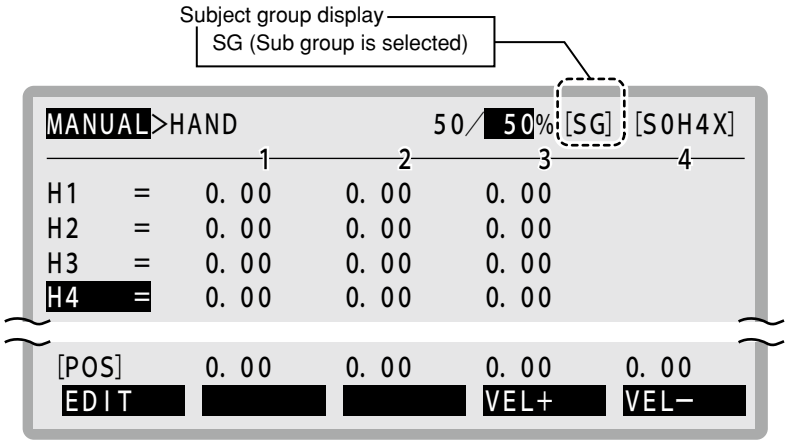
Step2 ***Check the selected robot group.***

An "(MG)" display indicates the main group, and "(SG)" indicates the sub group. Press ROBOT (LOWER + MODE) to change the robot group. The selected group display is toggled each time the key is pressed.

Hand definition setting method (Two-robot setting: Main group selected)



Shift coordinate setting method (Two-robot setting: Sub group selected)



Step3 ***Use the cursor up/down (▲ / ▼) keys to select the desired hand definition number, then press F6 (METHOD1) to change the mode.***

Step4 ***Use the Jog key to teach the non-hand work point as "Point 1".***

Step5 ***Set the hand definition.***

Teach the point that is the hand work point specified as "Point 2" in step 4, in order to set the hand definition value.

WARNING

THE ROBOT STARTS TO MOVE WHEN A JOG KEY IS PRESSED. TO AVOID DANGER, DO NOT ENTER THE ROBOT MOVEMENT RANGE.

NOTE

If teach points are not accurately determined, the hand definition will be inaccurate, so always determine these points correctly.

2.2.8 Absolute reset

The "absolute reset" function is used to teach the origin position when the motor's position sensor cannot identify the origin position (a condition hereafter referred to as "origin incomplete"). When an origin incomplete status occurs, all robot language executed motion commands are disabled. In such a case, an absolute reset must be performed.

NOTE

For "Absolute reset" details, also see "11.9 Absolute reset" in Chapter 4.

2.2.8.1 Checking absolute reset status

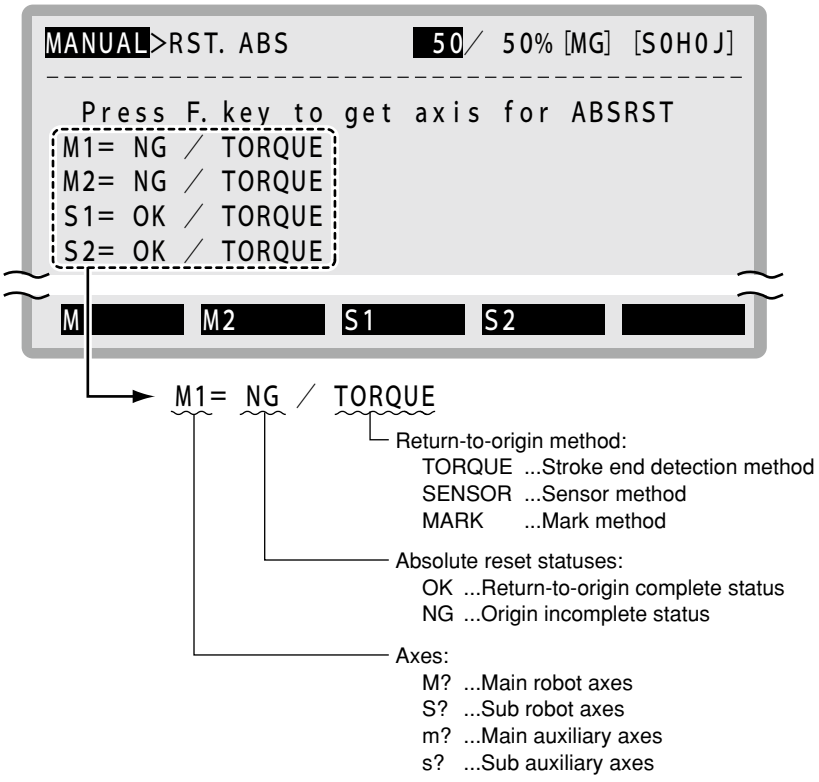
This function allows checking the absolute reset status of each axis on the controller.

NOTE

For checking absolute reset status details, also see "11.9.1 Checking absolute reset" in Chapter 4.

In "MANUAL" mode, pressing F13 (ABS.RST) displays the absolute reset status.

Checking absolute reset



* The display content varies depending on the robot and axes setting status.

2.2.8.2 Absolute reset on each axis (mark method)

This function performs an absolute reset only at the specified mark method axis. Return-to-origin methods are not possible when performing return-to-origin methods using the mark method.

NOTE

For absolute reset (mark method) on each axis, also see "11.9.2 Absolute reset on each axis" in Chapter 4.

Step 1 ***In the MANUAL>RST.ABS mode, select the axis to perform absolute reset.***

Select the axis by pressing the function key corresponding to each axis. The function key display content varies according to the robot and axes setting statuses.

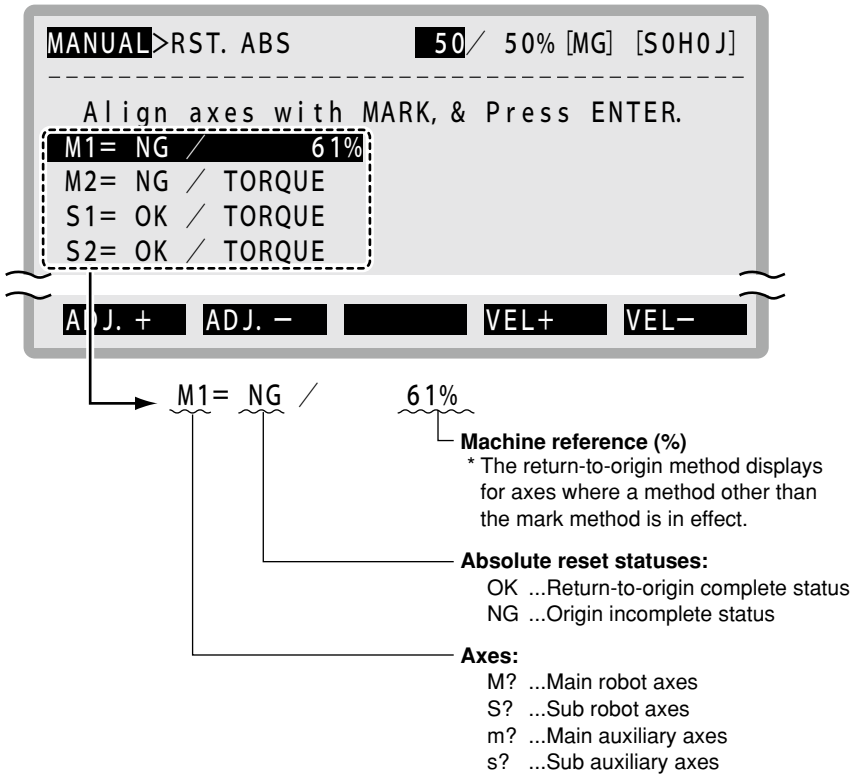
Step 2 ***Move the specified axis to a position where absolute reset can be performed.***

When in a "Servo ON" condition, use the Jog key or the F1 *(ADJ+),* F2 *(ADJ-) keys to move the specified axis to the position for an absolute reset.*
When in a "Servo OFF" condition, press the RPB's (Emergency Stop) button to establish an emergency stop status. In this status, move the specified axis in a direct manner to the position for an absolute reset.
When moving to the position for an absolute reset (in either of the above conditions), be sure that the machine reference display is within the 44 to 56 range.

WARNING

- **ROBOT MOTION OCCURS WHEN THE JOG KEY OR THE F1 (ADJ+), F2 (ADJ-) KEYS ARE PRESSED. TO ENSURE SAFETY, BE SURE TO STAY OUT OF THE ROBOT MOTION RANGE AT THIS TIME.**
- **WHEN YOU PERFORM DIRECT TEACHING, MAKE SURE THAT THE EMERGENCY STOP BUTTON IS PRESSED SO THAT THE SERVO WILL NOT TURN ON.**

Absolute reset on each axis (Mark method)



Step3 ***Press*** ENTER.

A confirmation message then appears on the guideline.

Step4 ***Press F4 (YES) to perform absolute reset.***

To abort the absolute reset operation, press F5 *(NO).*

WARNING

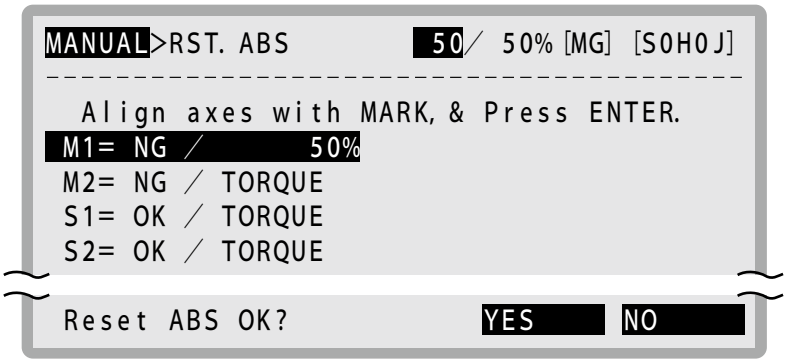
SLIGHT ROBOT MOTION OCCURS WHEN AN ABSOLUTE RESET IS PERFORMED IN A "SERVO ON" CONDITION. TO ENSURE SAFETY, BE SURE TO STAY OUT OF THE ROBOT MOTION RANGE AT THIS TIME.

CAUTION

An error message, "17.91:D?.Cannot perform ABS.reset" appears if the machine reference is not within a range of 44 to 56%. The absolute reset operation then terminates as an error.

If the robot controller is in origin incomplete due to some kind of problem perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

Absolute reset on each axis (Mark method)



Step4 ***Perform absolute reset on the other axes if necessary.***

Step5 ***Check the message line display.***

When all axes have returned to their origins, the dashed line (- - - -) on the message line changes to a solid line (——), and return-to-origin is now complete.

2.2.8.3 Absolute reset on each axis (stroke end method / sensor method)

This function performs an absolute reset only on the specified "stroke end method / sensor method" axes. When an absolute reset is performed, the "stroke end method / sensor method" axes will return to their origin positions. Be sure that a "Servo ON" status is in effect when executing an absolute reset.

NOTE

For "absolute reset on each axis (stroke end method / sensor method)" details, also see "11.9.2 Absolute reset on each axis" in Chapter 4.

Step1 ***In the MANUAL>RST.ABS mode, select the axis to perform absolute reset.***

Select the axis by pressing the function key corresponding to each axis. The function key display content varies according to the robot and axes setting statuses.
A confirmation message then appears on the guideline.

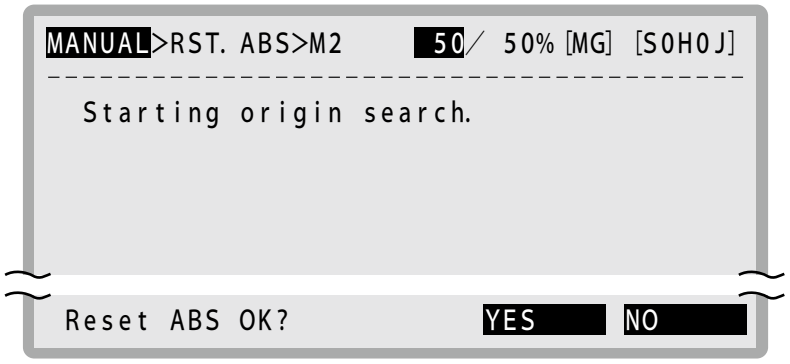
Step2 ***Press F4 (YES) to perform absolute reset.***

To abort the absolute reset operation, press F5 (NO).

WARNING

ROBOT MOTION OCCURS WHEN AN ABSOLUTE RESET IS PERFORMED. TO ENSURE SAFETY, BE SURE TO STAY OUT OF THE ROBOT MOTION RANGE AT THIS TIME.

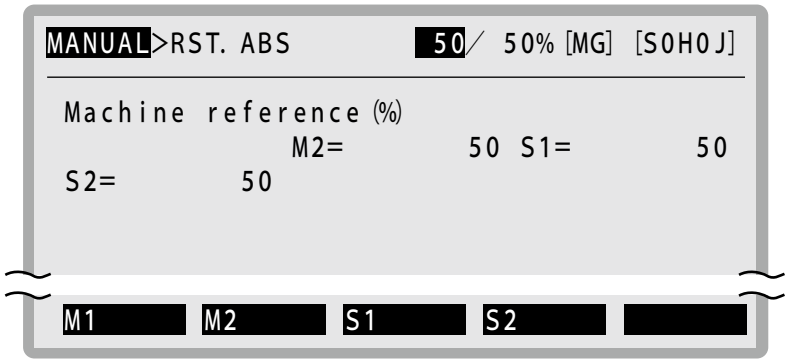
Absolute reset on each axis (Stroke end method / sensor method)



Step3 *Check the machine reference.*

When the return-to-origin is completed, the machine reference values are displayed for the "stroke end method / sensor method" axes. Make sure they are within the allowable range.

Absolute reset on each axis (Stroke end method / sensor method)



Step4 *Perform absolute reset on the other axes if necessary.*

Step5 *Check the message line display.*

When all axes have returned to their origins, the dashed line (- - - -) on the message line changes to a solid line (——), and return-to-origin is now complete.

2.2.8.4 Absolute reset on all axes

This function performs an absolute reset on all the controller axes. This absolute reset is performed in the following axis order:

① Absolute reset executed at the current position of all "mark method" axes (Steps 2 to 4).

② Absolute reset executed in accordance with the robot parameter's return-to-origin order for "stroke end method / sensor method" axes (step 5 onwards).

NOTE

For "Absolute reset on all axes" details, also see "11.9.3 Absolute reset on all axes" in Chapter 4.

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.

Step 1 ***In the MANUAL>RST.ABS mode, press*** F11 ***(ALL).***

All axes absolute reset mode is entered and the "mark method" axes are highlighted.

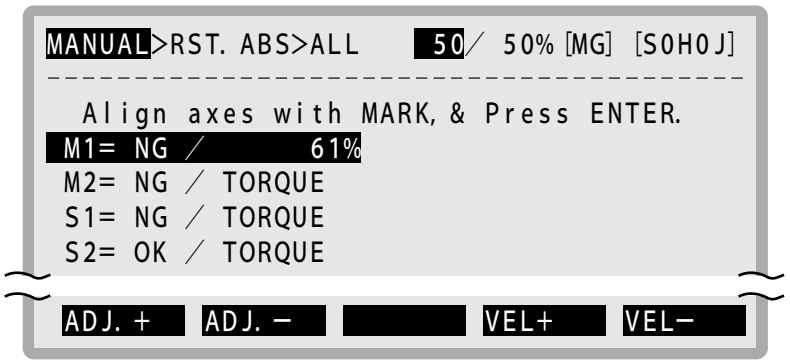
Step 2 ***Move each axis to a position where absolute reset can be performed.***

Use the cursor up/down (▲ */* ▼ *) keys to select the axis to be moved to the position where an absolute reset can be performed, then use the Jog key or* F1 *(ADJ+),* F2 *(ADJ-) to move the axis to that position.*
When moving to the position for an absolute reset, be sure that the machine reference display is within the 44 to 56 range.

WARNING

ROBOT MOTION OCCURS WHEN THE JOG KEY OR F1 (ADJ+), F2 (ADJ-) ARE PRESSED. TO ENSURE SAFETY, BE SURE TO STAY OUT OF THE ROBOT MOTION RANGE AT THIS TIME.

All axes absolute reset



Step3 ***Press*** ENTER.

A confirmation message then appears on the guideline.

Step4 ***Press F4 (YES) to perform absolute reset.***

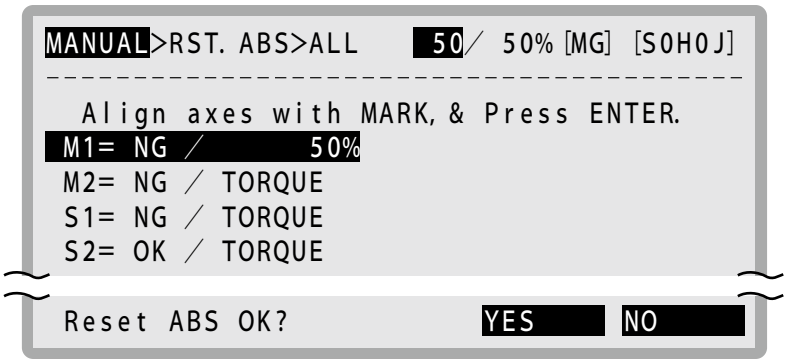
Absolute reset is performed on all "mark method" axes.

To abort the absolute reset operation, press F5 *(NO).*

WARNING

SLIGHT ROBOT MOTION OCCURS WHEN AN ABSOLUTE RESET IS PERFORMED IN A "SERVO ON" CONDITION. TO ENSURE SAFETY, BE SURE TO STAY OUT OF THE ROBOT MOTION RANGE AT THIS TIME.

All axes absolute reset



Step5 ***Check the message on the guideline.***

When the absolute reset is completed normally for all "mark method" axes, a confirmation massage appears on the guideline if "stroke end method / sensor method" axes exist.

To perform an absolute reset for the "stroke end method / sensor method" axes, press F4 *(YES) at this time.*

To abort this absolute reset operation, press F5 *(NO).*

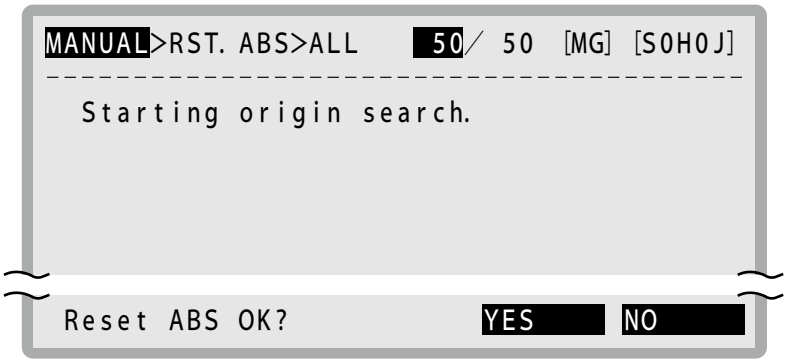
NOTE

In the two-robot setting, return-to-origin operations are performed in the main robot → sub robot order. (The axis operation order is according to the parameter setting.)

WARNING

ROBOT MOTION OCCURS WHEN AN ABSOLUTE RESET IS PERFORMED. TO ENSURE SAFETY, BE SURE TO STAY OUT OF THE ROBOT MOTION RANGE AT THIS TIME.

All axes absolute reset



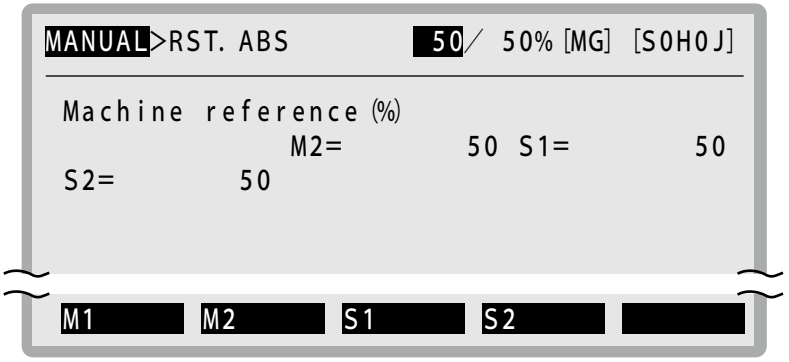
Step 6 *Check the machine reference.*

When the return-to-origin is completed, the machine reference values are displayed for the "stroke end method / sensor method" axes. Make sure they are within the allowable range.

CAUTION

If the robot controller is in origin incomplete due to some kind of problems, perform absolute reset on the axis which was unable to return to origin. After absolute reset, always check if the axis can move to the same position as before origin incomplete.

All axes absolute reset



Step 7 *Check the message line display.*

When all axes have returned to their origins, the dashed line (- - - -) on the message line changes to a solid line (——), and return-to-origin is now complete.

CAUTION

If absolute reset does not end correctly after performing absolute reset on all axes, check the return-to-origin status on each axis. Then try absolute reset on all axes once again or try absolute reset on each individual axis until you can successfully set the return-to-origin.
Return-to-origin may still be incomplete if the robot has an incremental type axis. Perform return-to-origin in this case.

2.3 "SYSTEM" mode

The "SYSTEM" mode screen format for the two-robot setting varies slightly from that of the one-robot setting.

Screen	Reference Section
SYSTEM mode initial screen	2.3.1 "SYSTEM" mode initial screen format
Robot parameters screen	2.3.2 Robot parameters screen format
Axis parameters screen	2.3.3 Axis parameters screen format

Moreover, the function key display content for the SYSTEM>OPTION mode parameters shown below differs in the two-robot and one-robot settings.

- Setting the area check output
- Double-carrier settings

For details, see "2.3.4 Setting the area check output" and "2.3.5 Double-carrier collision prevention".

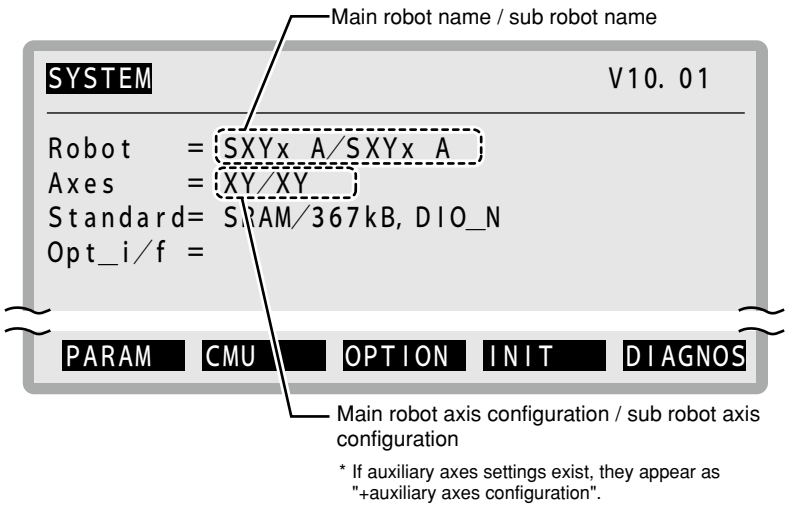
2.3.1 "SYSTEM" mode initial screen format

The "SYSTEM" mode initial screen format for the two-robot setting is shown below.

NOTE

For "SYSTEM" mode initial screen format details, also see "12. "SYSTEM" mode " in Chapter 4.

"SYSTEM" mode initial screen



* If auxiliary axes settings exist, they appear as "+auxiliary axes configuration".

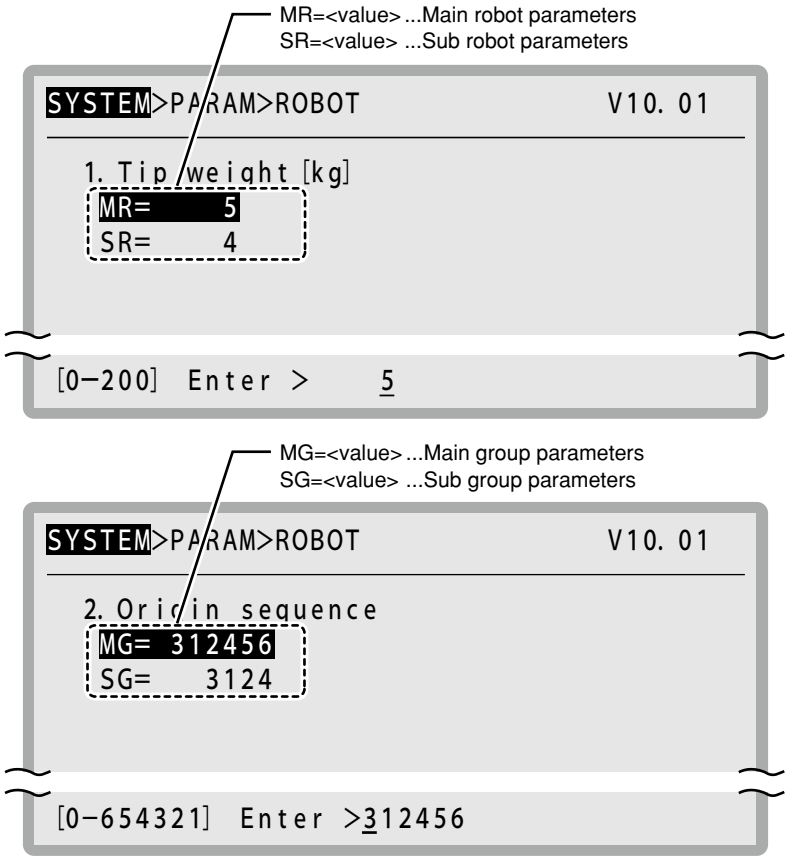
2.3.2 Robot parameters screen format

The SYSTEM>PARAM>ROBOT mode's robot parameter format for the two-robot setting is shown below.

NOTE

For "robot parameters screen format" details, also see 12.1.3 "Robot parameters" in Chapter 4.

Robot parameter setting screen



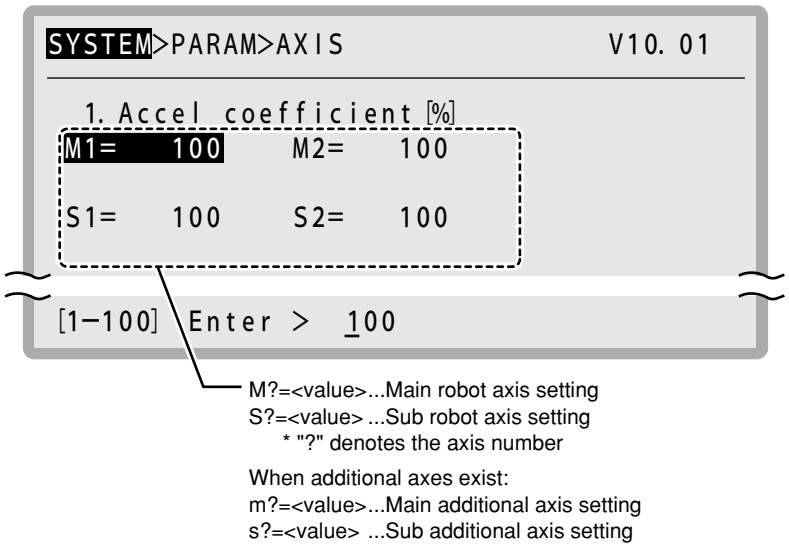
2.3.3 Axis parameters screen format

The SYSTEM>PARAM>AXIS mode's axis parameter format for the two-robot setting is shown below.

NOTE

For "axis parameter screen format" details, also see "12.1.4 Axis parameters" in Chapter 4.

Axis parameters setting screen



2.3.4 Setting the area check output

The area check output function performs area checks based on the robot's current position and the point data area specified by the area check output parameters. The check result is then output to the specified port.

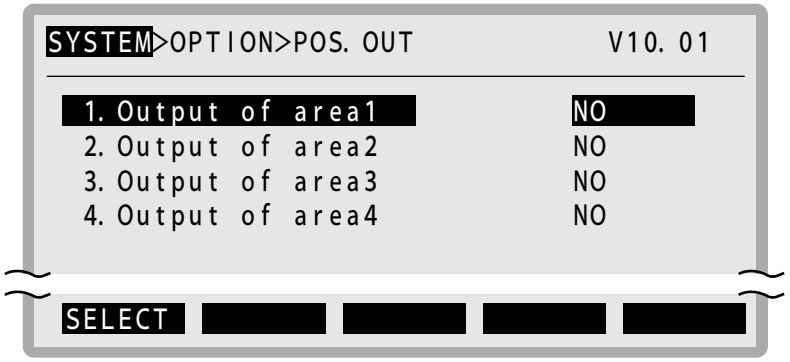
NOTE

- For "Setting the area check output" details, also see "12.3.1 Setting the area check output" in Chapter 4.
- The area check output function is disabled when in an "origin incomplete" status.

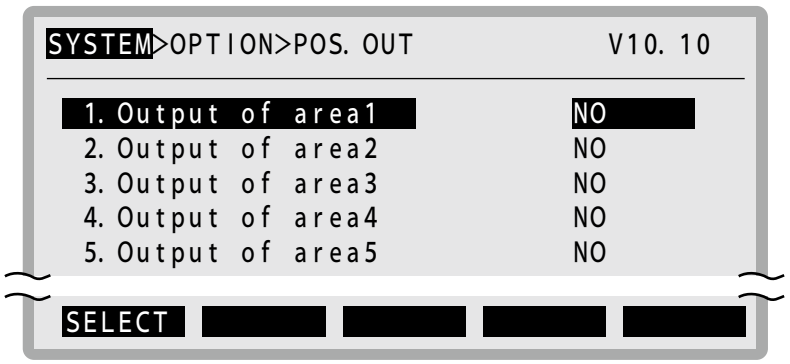
In the two-robot setting, the robot where the area check output is to be executed must be selected. All other settings are identical to those used in the one-robot setting.

Step 1 ***In the SYSTEM>OPTION>POS.OUT mode, use the cursor up/down (▲ / ▼) keys to select the area check output number, then press F1 (SELECT).***

Area check output (1) (controller prior to Ver. 10.10)

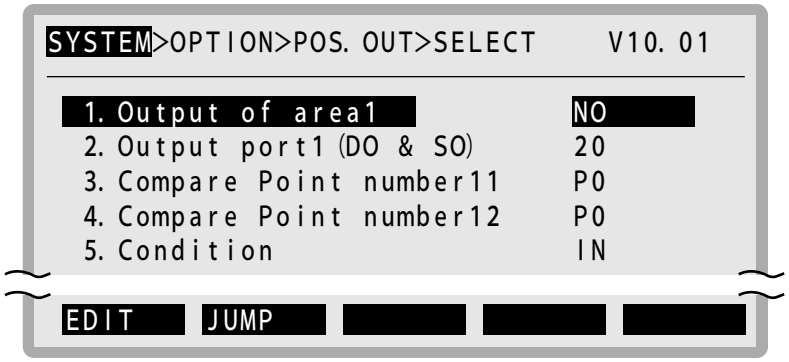


Area check output (1) (controller from Ver. 10.10 onwards)



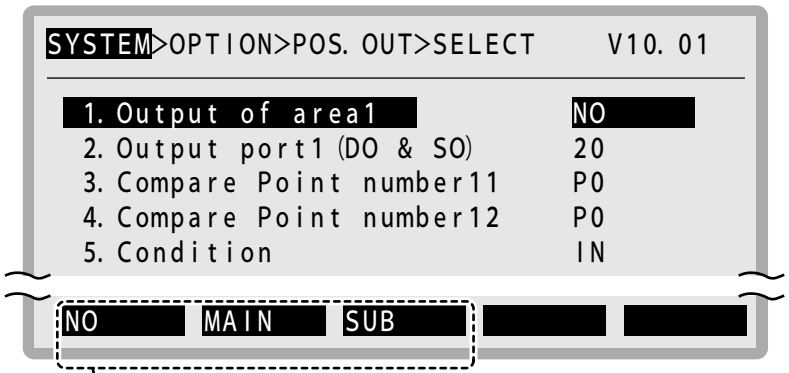
Step2 *Select "1. area check output", then press* F1 *(EDIT).*

Area check output (2)



Step3 *Press* F1 *(NO) to* F3 *(SUB) to select the robot for area check output.*

Area check output Execution robot selection



NO ...Area check output is not executed.
MAIN...Area check output is executed at the main robot (including main auxiliary axes).
SUB ...Area check output is executed at the sub robot (including sub auxiliary axes).

Step4 *Next, specify the other settings.*

2.3.5 Double-carrier collision prevention

When two carriers or arms are installed on the same axis of double-carrier type robots, this function prevents the two carriers from colliding with each other.
This function is effective on robots such as the NXY-W which have 2 arms on the same axis.

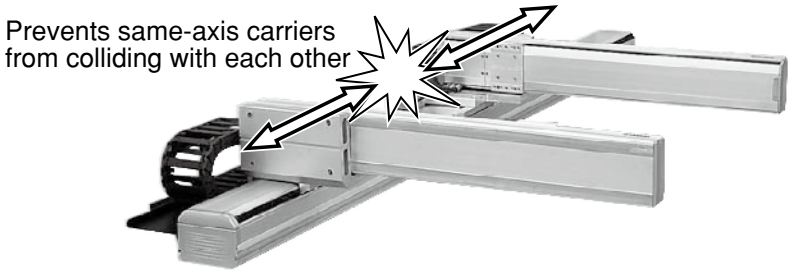
NOTE

For "Double-carrier collision prevention" details, also see "12.3.4 Double-carrier setting" is Chapter 4.

CAUTION

The double-carrier collision prevention is disabled when in an "origin incomplete" condition. Moreover, this function may fail to operate properly if the lead length and deceleration ratio settings are specified incorrectly.

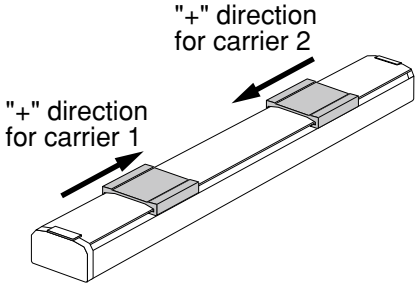
Double arm type robot



The following conditions must be satisfied in order to use the double-carrier collision prevention.

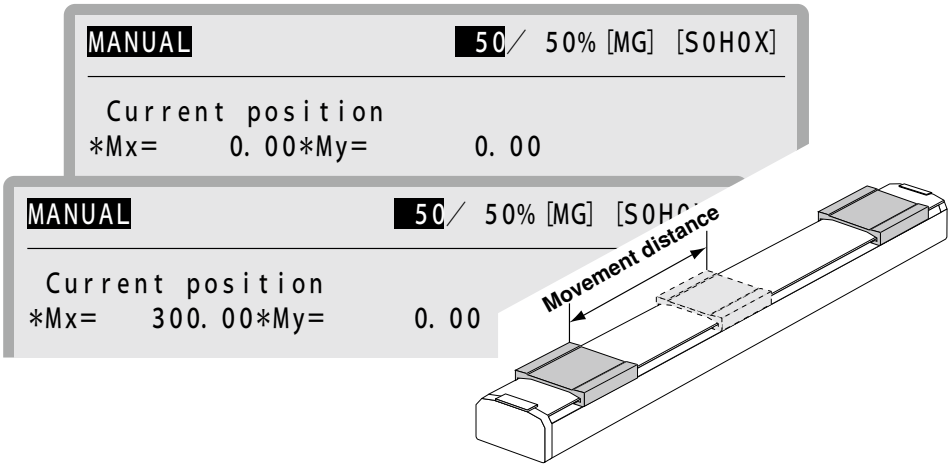
① Either of the carriers (arms) must approach the other carrier (arm) when moving in its plus direction as follows. If this is not the case, please contact your YAMAHA representative.

Double-carrier setting (1)



② Each carrier's (arm's) motion amount indicated on the RPB screen must match the actual motion amount. If the amounts do not match, please contact your Yamaha representative.

Double-carrier setting (2)



Although the following explanation applies to a double-carrier type robot, the same settings are used for a double-arm type robot.

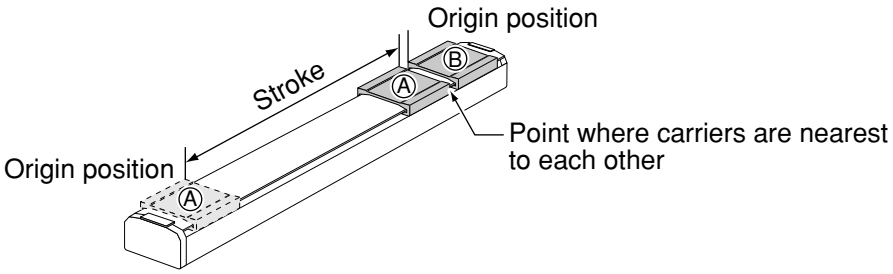
Step1 *Establish the SYSTEM>OPTION>W.CARRIER mode.*

Step2 *Specify the settings.*

1. Stroke setting

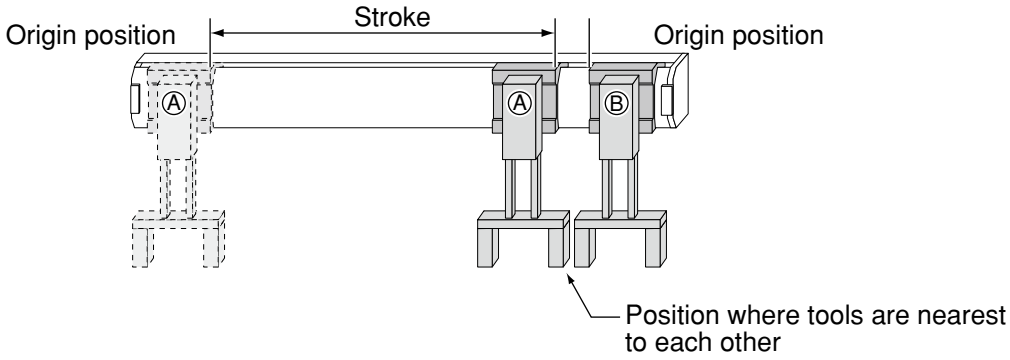
With carrier-B at its origin position, this "stroke" is the distance ("mm" units) from carrier-A's origin point, to the position where it is nearest to carrier-B.

Stroke setting (1)



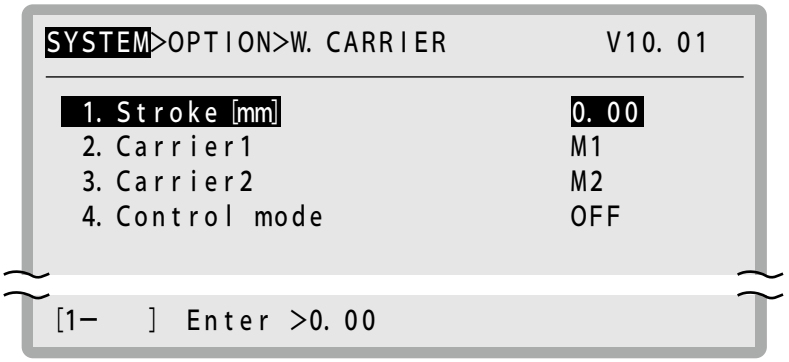
If the carriers are equipped with a tools, the stroke must be set so that the tools do not interfere with each other.

Stroke setting (2)



1. Use the cursor up/down (▲ / ▼) keys to select "1. Stroke (mm)", then press F1 (EDIT).
2. Enter the stroke value, then press ENTER.
   The stroke value is entered in "mm" units, and is valid up to the 2nd decimal position.

Stroke setting (3)



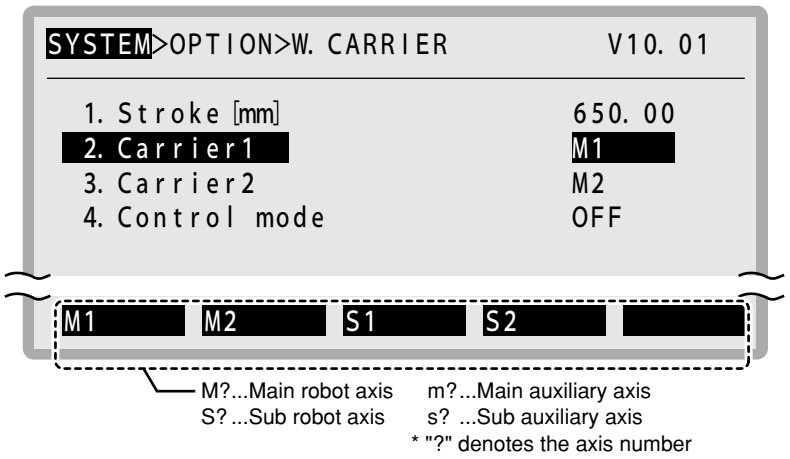
2. Carrier 1 setting

3. Carrier 2 setting

The collision prevention settings are specified in a carrier-specific manner.

1. Use the cursor up/down (▲ / ▼) keys to select "2. Carrier 1" or "3. Carrier 2", then press F1 (EDIT).
2. Use the function keys to select the carrier where the collision prevention function is to be applied.

Carrier setting



The menu content varies according to the robot and axis settings.

4. Control mode setting

These settings specify the collision prevention function's control content.

Setting	Function	
OFF	Anti-collision function is disabled.	
Warning	During Manual movement	Stops a carrier moving toward the other carrier before reaching that carrier.
	During auto operation	Program operation "error stop" occurs during auto operation when the target position of one carrier will interfere with the other carrier.
ON	During Manual movement	Stops a carrier moving toward the other carrier before reaching that carrier.
	During auto operation	If the target position of one carrier will interfere with the other carrier during auto operation, the carrier stands by until interference-free motion is possible.

* The "manual movement" and "auto operation" conditions indicated in the above table are defined as shown below

During Manual movement:

- Manual movement at RPB
- Jog and inching movement by I/O commands
- Jog and inching movement by online commands
- Jog and inching movement by remote commands

During auto operation:

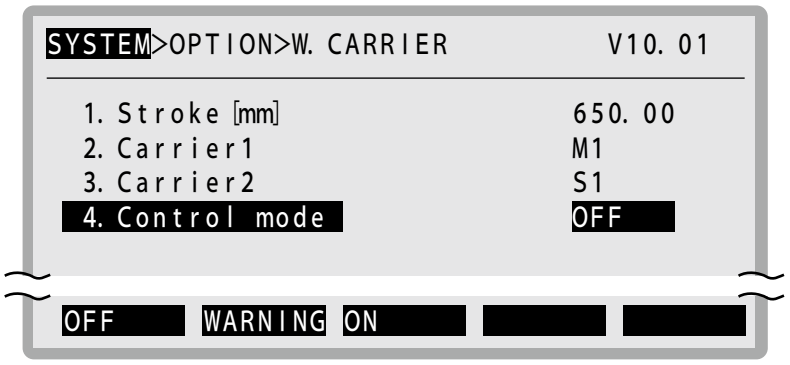
- During "AUTO" mode program operation (including "step" and "next" execution)
- MOVE, MOVEI, Pallet motion by I/O commands
- Motion by online commands executed independently by robot language (including Return-to-origin command)
- MOVE, MOVEI, DRIVE, DRIVEI, Pallet motion by remote commands
- Direct motion command execution by RPB

NOTE

- The double-carrier collision prevention is disabled when in an "origin incomplete" condition, regardless of the specified setting.
- During automatic operation with the control mode ON, operation is stopped as an error "2.27 W. carrier deadlock" error when one carrier attempts to move to a position where it will interfere with the other carrier that is ready to move.

1. Use the cursor up/down (▲ / ▼) keys to select "4. Control Mode", then press F1 (EDIT).
2. Use the function keys to select the collision prevention function's control content. Refer to the above table for menu item meanings.

Control mode setting



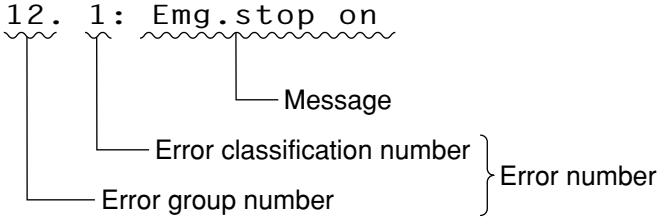
2.4 Error message displays

When an error occurs, an error message displays at the message line (2nd line) of the RPB screen.

NOTE

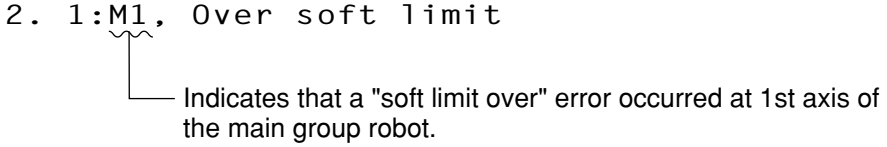
For error message details, also see "1.1 Robot controller error messages" in Chapter 10.

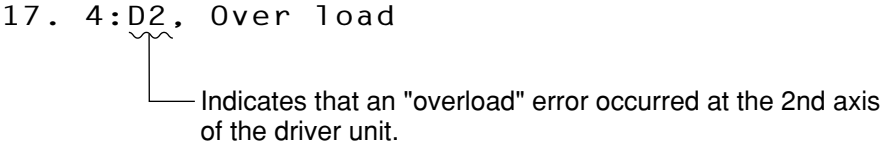
Error messages comprise the following elements.



In some cases, information indicating the error occurrence location (axis, optional unit, etc.) is added at the beginning of the error message.

M ...Main group axis number
S ...Sub group axis number
D ...Driver axis number
OP ...Option unit number





* Although axes viewed from the robot and those viewed from the driver normally correspond in a one-to-one manner, there are cases (as in systems with dual drive axes, etc.) where "axis 1" as viewed from the robot is "axis 2" as viewed from the driver.

3. Programming

3.1 Robot languages used in the two-robot setting

The commands which can be used in the robot languages for robot operation and coordinate control, etc., vary according to the group. The main commands and functions are listed below.

Type	Main Group	Sub Group
Robot operation	DRIVE, DRIVEI, MOVE, MOVEI, PMOVE, SERVO *, WAIT ARM	DRIVE2, DRIVEI2, MOVE2, MOVEI2, PMOVE2, SERVO2 *, WAIT ARM2
Coordinate control	CHANGE, HAND, LEFTY/RIGHTY, SHIFT	CHANGE2, HAND2, LEFTY2/RIGHTY2, SHIFT2
Status change	ACCEL, ARCH, ASPEED, AXWGHT, DECEL, ORGORD, OUTPOS, SPEED, TOLE, WEIGHT	ACCEL2, ARCH2, ASPEED2, AXWGHT2, DECEL2, ORGORD2, OUTPOS2, SPEED2, TOLE2, WEIGHT2
Point calculation	JTOXY, WHERE, WHRXY, XYTOJ	JTOXY2, WHERE2, WHRXY2, XYTOJ2
Parameter referencing	ACCEL, ARCH, AXWGHT, DECEL, ORGORD, OUTPOS, TOLE, WEIGHT	ACCEL2, ARCH2, AXWGHT2, DECEL2, ORGORD2, OUTPOS2, TOLE2, WEIGHT2
Status referencing	ABSRPOS, ARMCND, ARMTYPE, MCHREF	ABSRPOS2, ARMCND2, ARMTYPE2, MCHREF2
PATH control	PATH, PATH END, PATH SET, PATH START	
Torque control	DRIVE (in systems with the torque limiting option), TORQUE, TRQSTS, TRQTIME	DRIVE2 (in systems with the torque limiting option), TORQUE2, TRQSTS2, TRQTIME2

* When specifying all axes by SERVO or SERVO2, all axes in both the main and sub groups are specified.

However, the commands which can be used when performing robot motion vary depending on the axis setting status.

	Main rbot (Main robot axes)	Main auxiliary axes	Sub robot (Sub robot axes)	Sub auxiliary axes
MOVE	●	×	×	×
MOVE2	×	×	●	×
MOVEI	●	×	×	×
MOVEI2	×	×	●	×
DRIVE	●	●	×	×
DRIVE2	×	×	●	●
DRIVEI	●	●	×	×
DRIVEI2	×	×	●	●
PMOVE	●	×	×	×
PMOVE2	×	×	●	×
PATH control PATH PATH END PATH SET PATH START	●	×	×	×

NOTE

For details regarding each robot language, refer to the RCX Series Programming Manual.

MEMO

Chapter 6 PARALLEL I/O INTERFACE

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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.

CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

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 mm or more
		General-purpose : 16			
	Output	Dedicated : 11			
		General-purpose : 8			

1.1 Power supply

The standard I/O interface uses an external 24V power supply. Connect the 24V and ground terminals of the external power supply to pins 47 to 50 of the STD. DIO connector on the controller.

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 supplying an external 24VDC power supply to the standard I/O interface, invalidate the "Watch on STD. DIO DC24V" setting under "PARAM>OTHERS".
- When using the general-purpose input/output of the standard I/O interface, connect DI11 (Interlock).

1.2 Connector I/O signals

PIN	I/O No.	Signal name	Remarks
1	DI05	I/O command execution trigger	
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	Common terminals
11	DI20	General-purpose input 20	P. COM DI
12	DI21	General-purpose input 21	N. COM DI
13	DI22	General-purpose input 22	
14	DI23	General-purpose input 23	Photocoupler input
15	DI24	General-purpose input 24	
16	DI25	General-purpose input 25	NPN specifications : source type
17	DI26	General-purpose input 26	PNP specifications : sink type
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	
27	COMMON	Relay 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)	Relay output
31	DO02a	Servo ON output : contact A (normally open)	Maximum capacity of each terminal
32	DO03b	Alarm : contact B (normally closed)	(resistance load) : DC 24V, 0.5A
33	DO03a	Alarm : contact A (normally open)	Common terminal : COMMON
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
40	DO21	General-purpose output 21	NPN or PNP specifications
41	DO22	General-purpose output 22	Maximum capacity of each terminal
42	DO23	General-purpose output 23	(resistance load): 0.1A
43	DO24	General-purpose output 24	+ common terminal : DC +24V
44	DO25	General-purpose output 25	- common terminal : GND
45	DO26	General-purpose output 26	
46	DO27	General-purpose output 27	
47	DC24V	DC+24V (P.COMDI)	External power supply input
48			
49	GND	GND (N.COMDI)	
50			

CAUTION

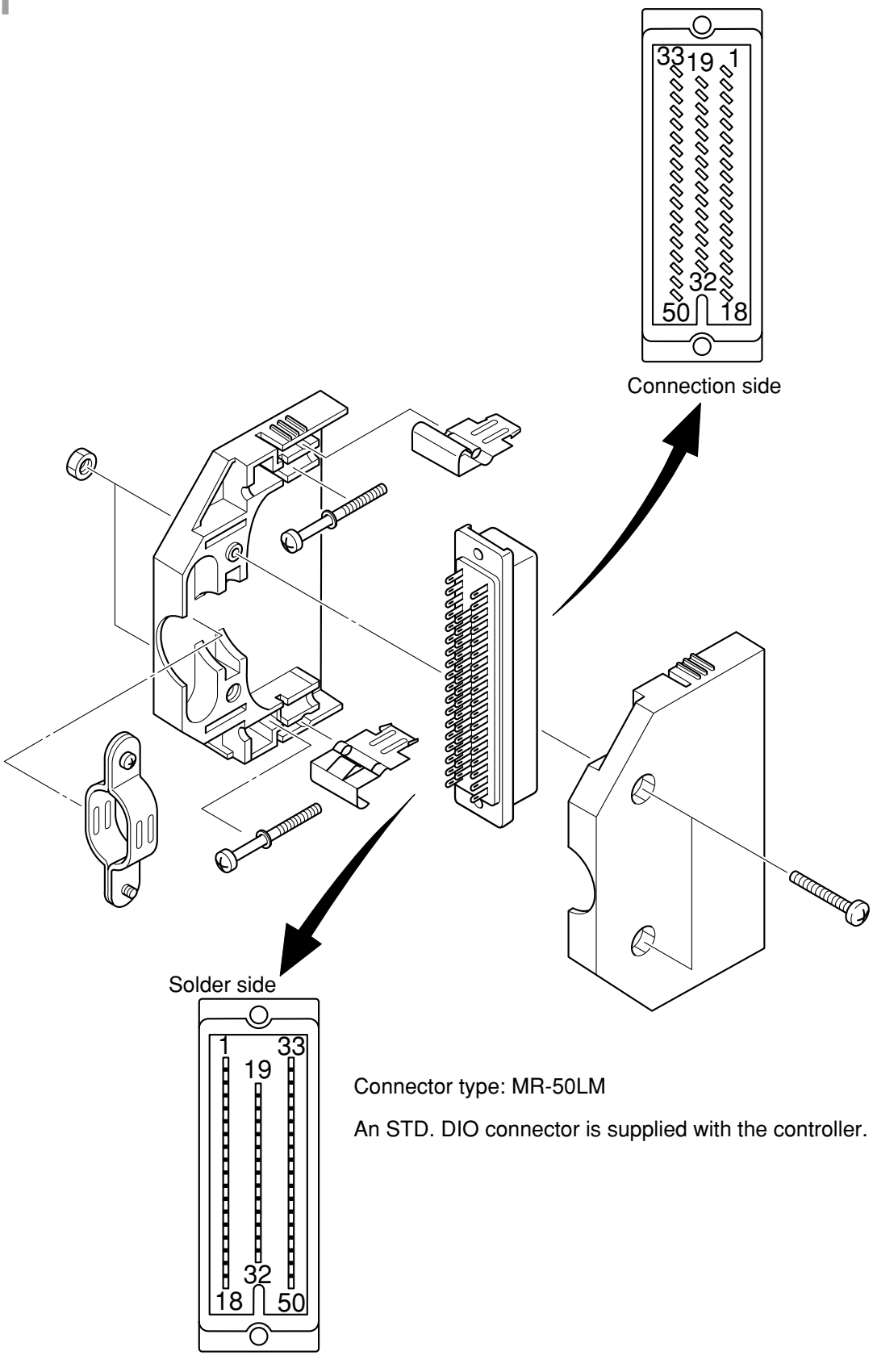
- **See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.**
- **Do not make user connections to spare I/O signal wires and I/O signal wires that are not to be used.**

NOTE

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

1.3 Connector pin numbers

STD.DIO



Connector type: MR-50LM

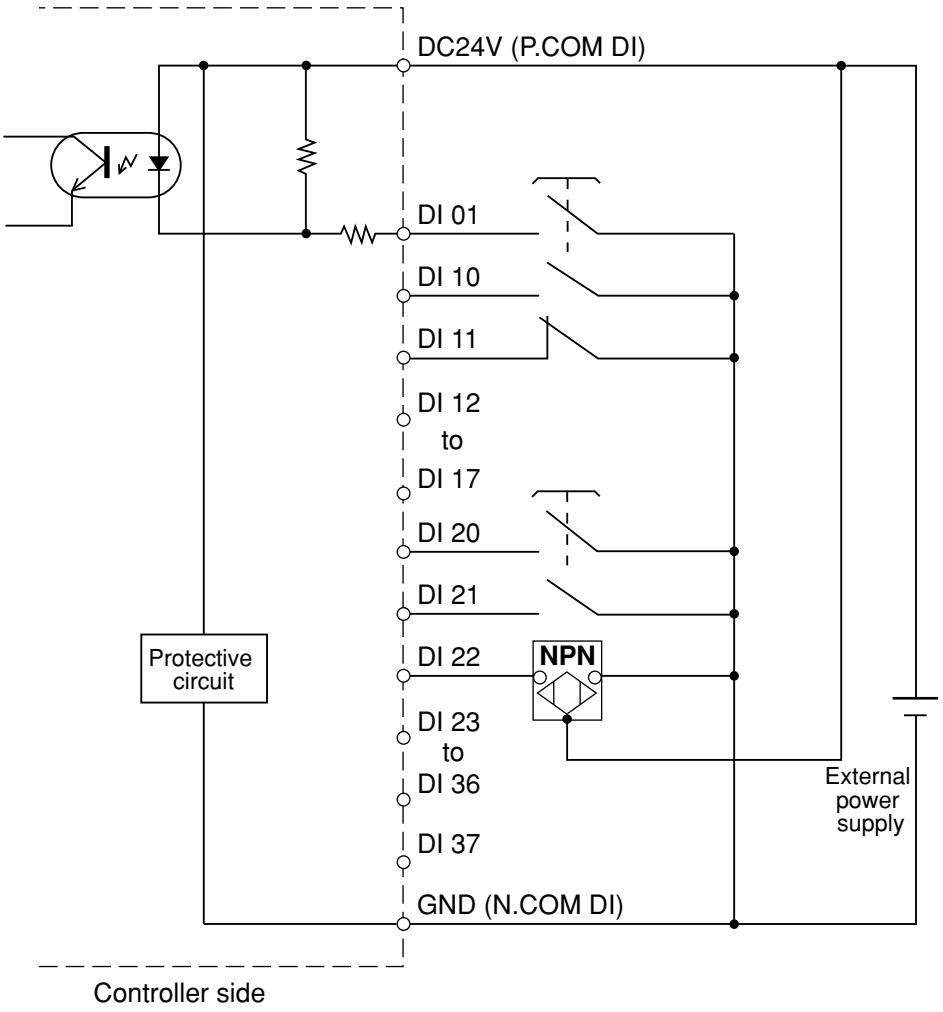
An STD. DIO connector is supplied with the controller.

1.4 Typical input signal connection

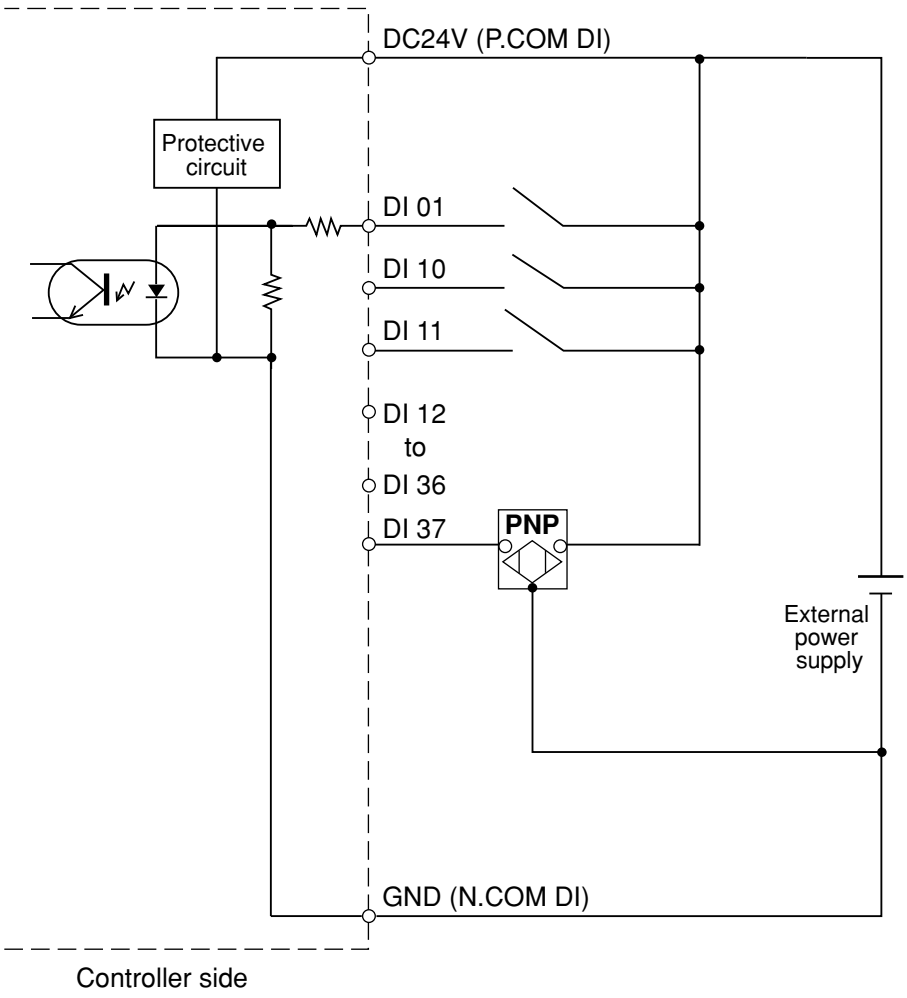
CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

NPN specifications



PNP specifications



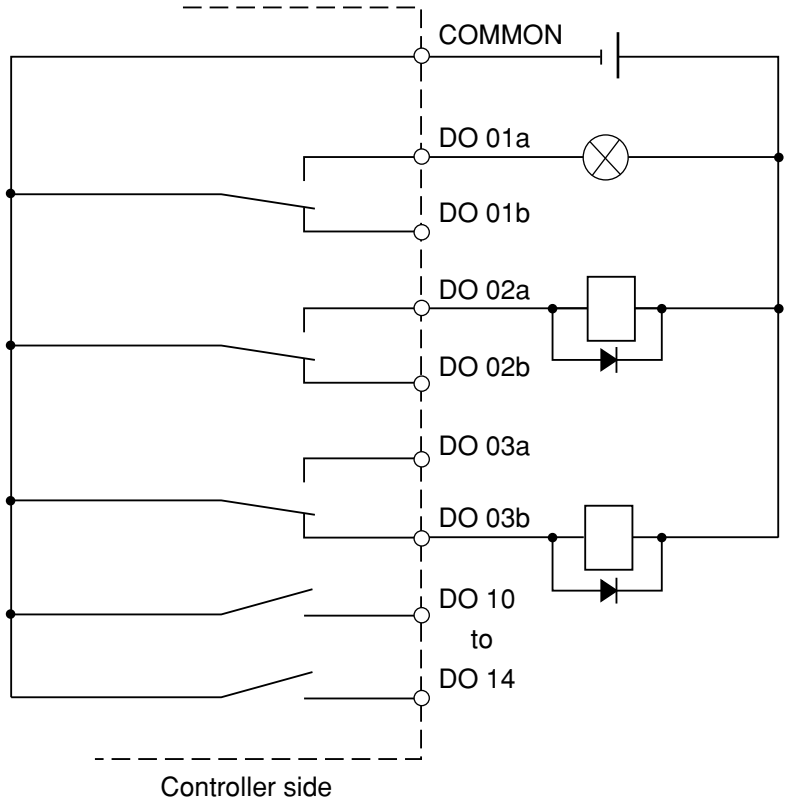
1.5 Typical output signal connection

1.5.1 Dedicated outputs

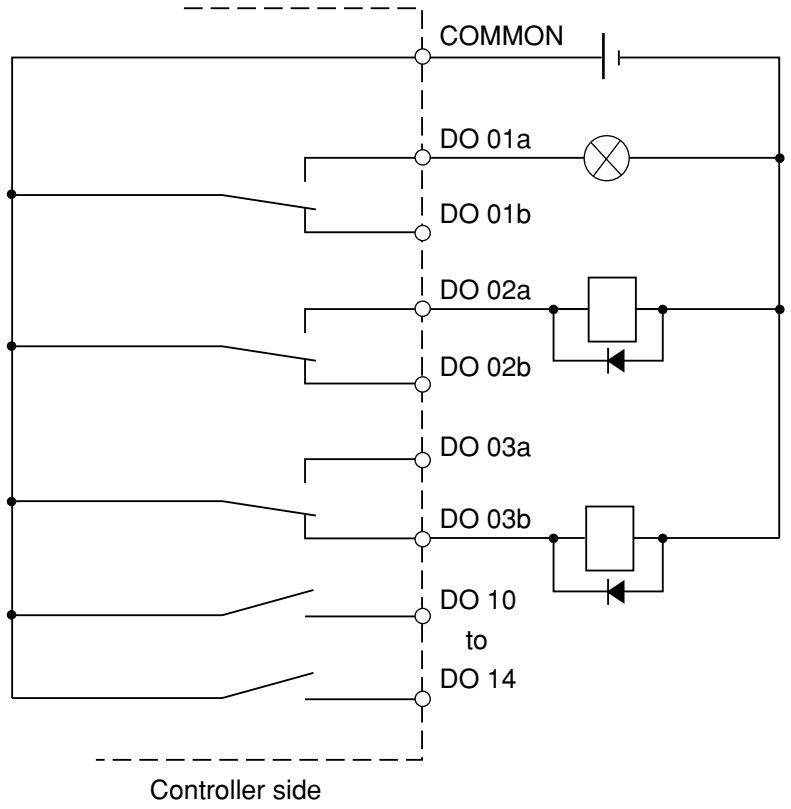
CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

NPN specifications



PNP specifications

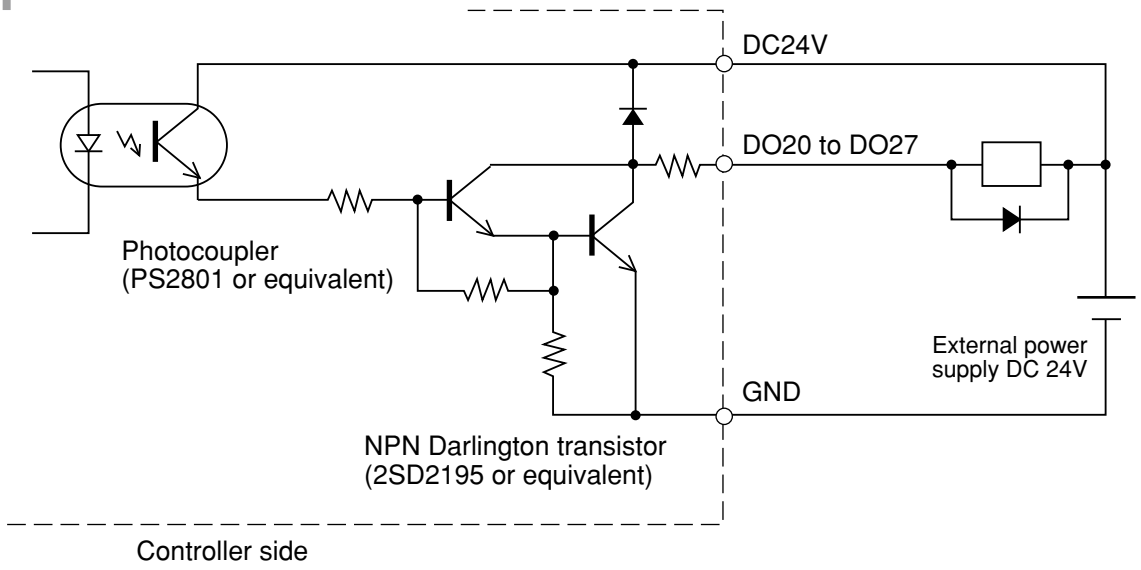


1.5.2 General-purpose outputs

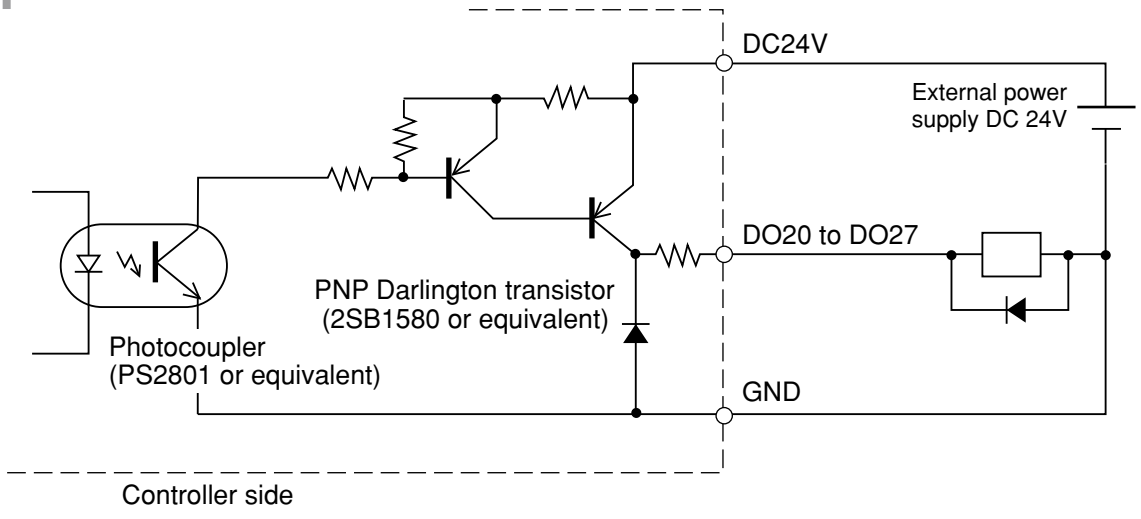
CAUTION

- **When an inductive load (solenoid, relay, etc.) is used, always connect a diode in parallel as a surge killer.**
- **Never short the DO output to DC 24V (NPN specifications) since this will damage the internal circuitry.**
- **Never short the DO output to GND (PNP specifications) since this will damage the internal circuitry.**
- **See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.**

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 at the rising edge of the signal pulse. If an alarm has been issued it is cleared.

- Input signal pulse width: 100ms minimum

NOTE

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

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 "12.1.5 Other parameters" in Chapter 4.**
- **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.

NOTE

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

5. DI12 Program start

DI12 is used to start the program.
When the DI12 contact is closed (ON) in "AUTO" mode, the robot program starts at the rising edge of the signal pulse. DO13 (Robot program-in-progress) is output when the robot program is executed.

- Input signal pulse width: 100ms minimum

NOTE

The rise of DI12 has the same function as the RUN key.

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 in the following cases:

1. "DO cond. on PGM reset / RESCDO" in Other parameters is set to "HOLD".
   (For details, see "12.1.5 Other parameters" in Chapter.)
2. A sequence program is being executed without enabling the DO reset in the sequence execution flag setting.
   (For details, see "14.2. Enabling/disabling the sequence execution flag" in Chapter 4.)

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 start at the rising edge of the signal pulse, in the return-to-origin sequence specified by parameter.
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. Use this setting only when return-to-origin signal must be input to DI17. (For example, in cases where an RCX141 or RCX221 controller was replaced by the RCX240)

NOTE

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

CAUTION

DI01, DI12, DI13, DI15, DI16 and DI17 are inoperative 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.



NOTE

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

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 switch open.
2) When a driver unit detects a serious malfunction such as an overload.
   (However does not include abnormalities from when the power is turned on.)
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.
   However, even if an alarm is turned on due to a low battery, this does not affect other conditions or execution of programs.

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.

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 executed individually.

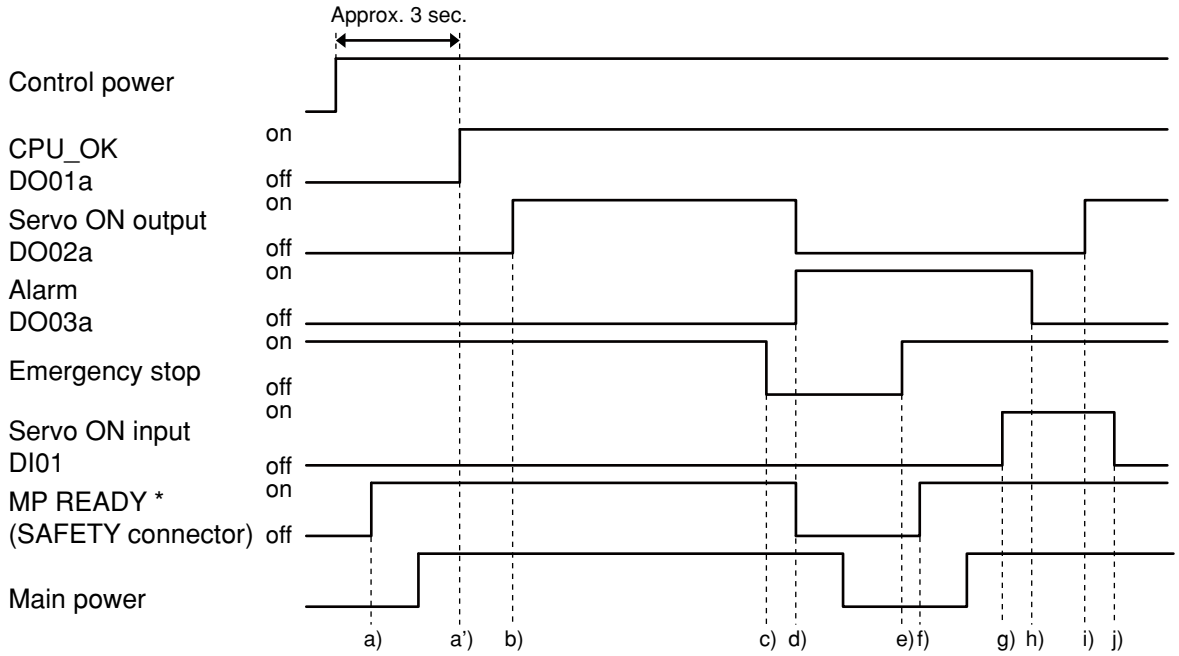
11. DO14 Program reset status output

DO14 is always on when the robot program is reset and turns off when the program starts.

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 7, "SAFETY I/O INTERFACE".

CAUTION

It will take about 3 seconds for the controller to issue the CPU_OK output 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.

Shifting to 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) Emergency stop input turns on, MP READY turns on.

g) Servo ON input turns on.

h) Alarm output turns off.

i) Servo ON output turns on.

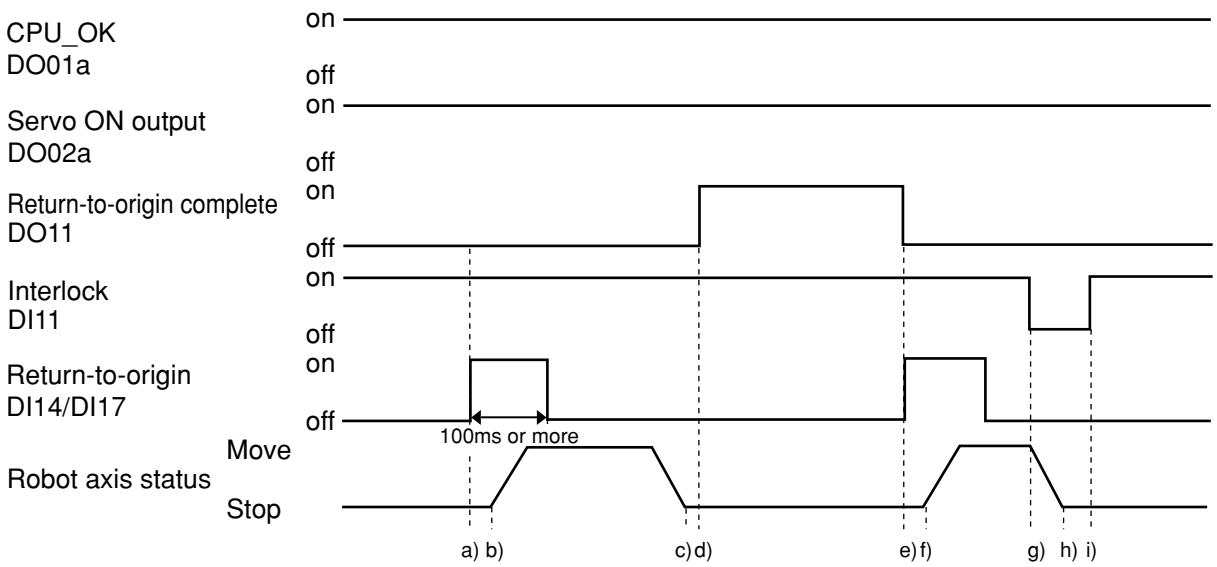
j) Servo ON input turns off after checking for servo ON output.

* If the emergency stop input contacts are open or a major error occurs when the controller power is turned on, the servo remains off. Likewise, if the “Servo on when power on” parameter is set to “INVALID”, or SAFE mode 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 signal for a minimum of 100ms.
* Supply motor power immediately when "MP READY" is turned on.

1.8.2 Return-to-origin

Return-to-origin

Conditions: MANUAL mode and servo ON



Return-to-origin processing

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.

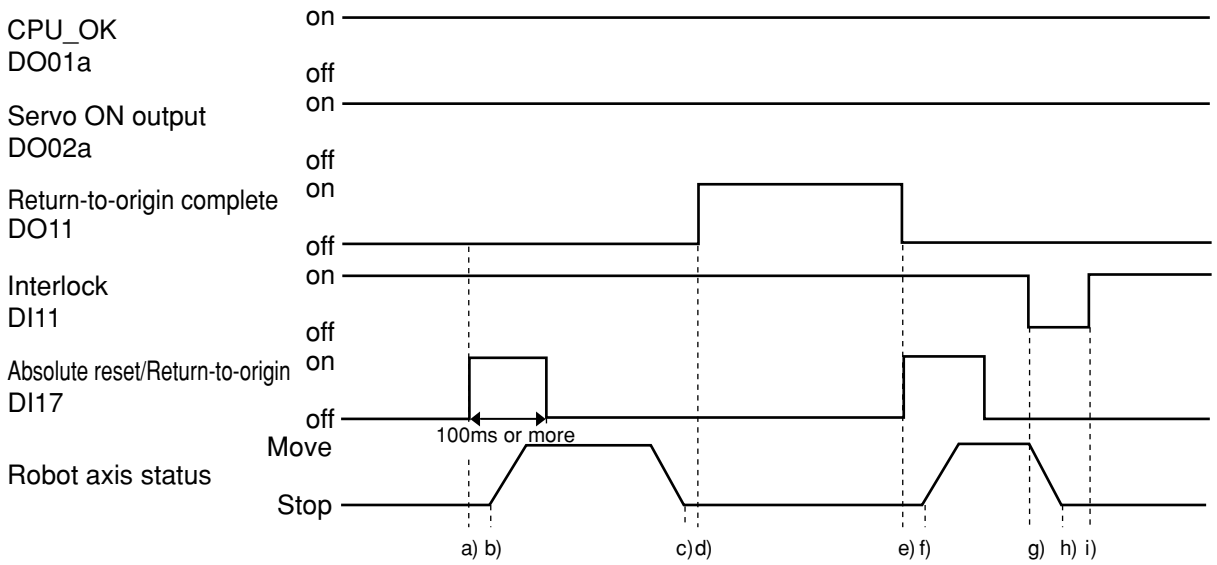
i) Interlock input turns on.

* 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 cannot be performed unless the servo is on.
* When the return-to-origin input is on, the return-to-origin complete output is off.
* 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

Conditions: MANUAL mode and servo ON



Absolute reset processing

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.

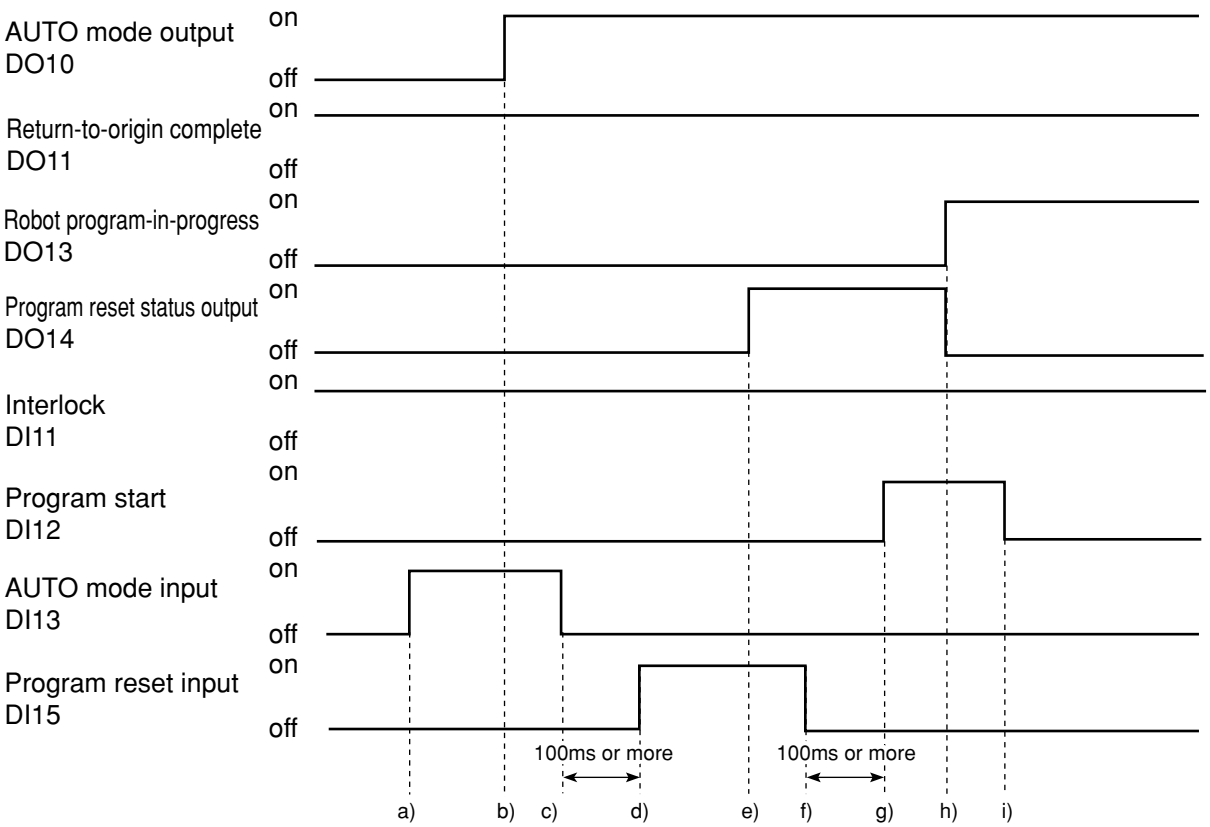
h) On-going robot axis movement stops.

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 is on until absolute reset is required.
* Absolute reset cannot be performed unless 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.

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.

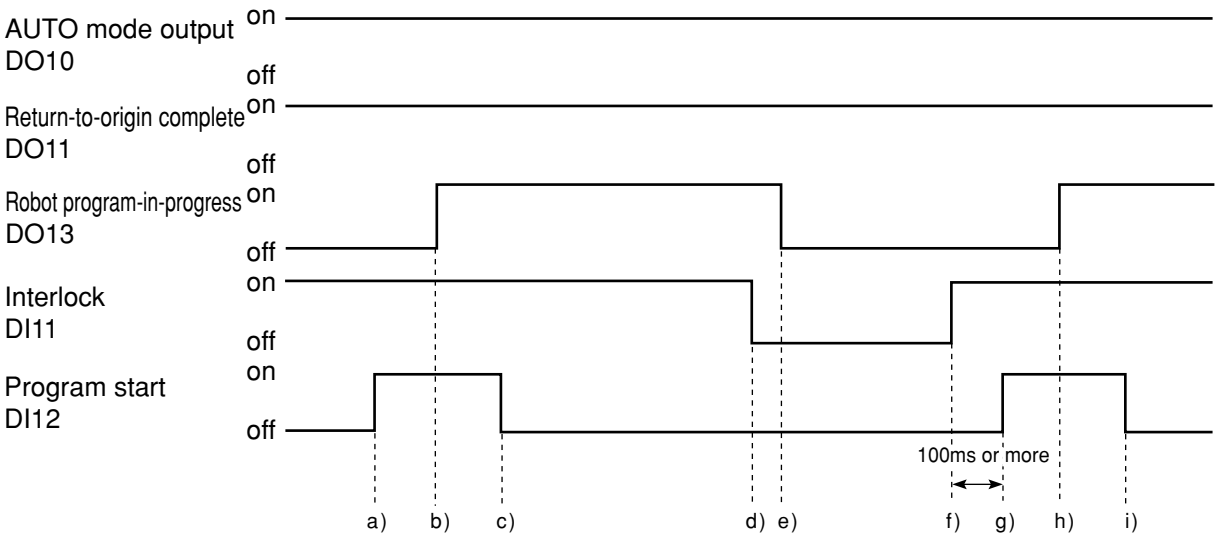
i) Program start input turns off after checking robot program-in-progress output is turned on.

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

* If the return-to-origin complete output is off, the program might not be executed, depending on the execution level setting.

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.

* Program will stop if switching to emergency 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.

CAUTION

When the program stops during execution by DI11 (Interlock) or other reasons, the program re-executes the command that has stopped. Keep this point in mind when re-executing the program with DI12 (Program start).

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 connected to components such as pushbutton switches and sensors. The user can specify these components on the robot program or sequence program.

CAUTION

If the "8. DI noise filter" parameter is set to "VALID" (refer to "12.1.5 Other parameters" in Chapter 4), 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.
The general-purpose outputs are all available to the user, and can be specified on 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.

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.

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 "12.1.5 Other parameters" in Chapter 4.)

   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, see "14.2 Enabling/disabling the sequence execution flag" in Chapter 4.)

   c) Any of the following operations was performed.

   - Compile ended successfully in "PROGRAM" mode.
   - A program was compiled in "AUTO" mode and the compile ended successfully.
   - F1 (RESET) was executed in "AUTO" mode.
   - 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.)

■ Either of the following was initialized in "SYSTEM>INIT" mode.

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

■ 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.)

■ The online commands @RESET, @INIT PGM, @INIT MEM, @INIT ALL, or @SWI were executed.

■ 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 mm 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.

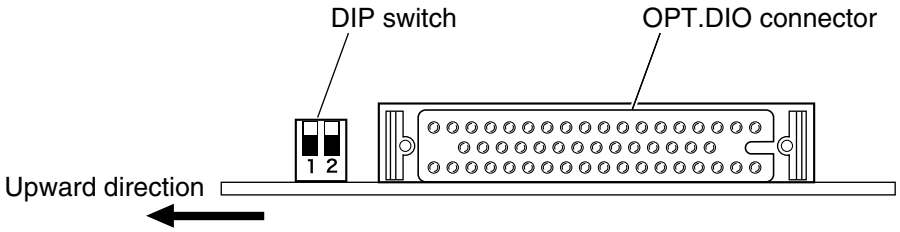
CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

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. (■ : switch lever)

DIP switch	ID	Input port No.	Output port No.
	1	DI40 to DI47 DI50 to DI57 DI60 to DI67	DO30 to DO37 DO40 to DO47
	2	DI70 to DI77 DI100 to DI107 DI110 to DI117	DO50 to DO57 DO60 to DO67
	3	DI120 to DI127 DI130 to DI137 DI140 to DI147	DO70 to DO77 DO100 to DO107
	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	
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	Common terminals:
13	DI52	DI102	DI132	DI162	Input 52	Input 102	Input 132	Input 162	+common: P. COM DI
14	DI53	DI103	DI133	DI163	Input 53	Input 103	Input 133	Input 163	- common: N. COM DI
15	DI54	DI104	DI134	DI164	Input 54	Input 104	Input 134	Input 164	Photocoupler input
16	DI55	DI105	DI135	DI165	Input 55	Input 105	Input 135	Input 165	NPN specifications : source type
17	DI56	DI106	DI136	DI166	Input 56	Input 106	Input 136	Input 166	PNP specifications : sink type
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
29	DO31	DO51	DO71	DO111	Output 31	Output 51	Output 71	Output 111	NPN or PNP specifications
30	DO32	DO52	DO72	DO112	Output 32	Output 52	Output 72	Output 112	Maximum capacity of each
31	DO33	DO53	DO73	DO113	Output 33	Output 53	Output 73	Output 113	output terminal
32	DO34	DO54	DO74	DO114	Output 34	Output 54	Output 74	Output 114	(resistance load): 100mA
33	DO35	DO55	DO75	DO115	Output 35	Output 55	Output 75	Output 115	Common terminals:
34	DO36	DO56	DO76	DO116	Output 36	Output 56	Output 76	Output 116	+ common terminal: P. COM A
35	DO37	DO57	DO77	DO117	Output 37	Output 57	Output 77	Output 117	- common terminal: N. COM A
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
39	DO41	DO61	DO101	DO121	Output 41	Output 61	Output 101	Output 121	NPN or PNP specifications
40	DO42	DO62	DO102	DO122	Output 42	Output 62	Output 102	Output 122	Maximum capacity of each
41	DO43	DO63	DO103	DO123	Output 43	Output 63	Output 103	Output 123	output terminal
42	DO44	DO64	DO104	DO124	Output 44	Output 64	Output 104	Output 124	(resistance load): 100mA
43	DO45	DO65	DO105	DO125	Output 45	Output 65	Output 105	Output 125	Common terminals:
44	DO46	DO66	DO106	DO126	Output 46	Output 66	Output 106	Output 126	+ common terminal: P. COM B
45	DO47	DO67	DO107	DO127	Output 47	Output 67	Output 107	Output 127	- common terminal: N. COM B
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.

CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

NOTE

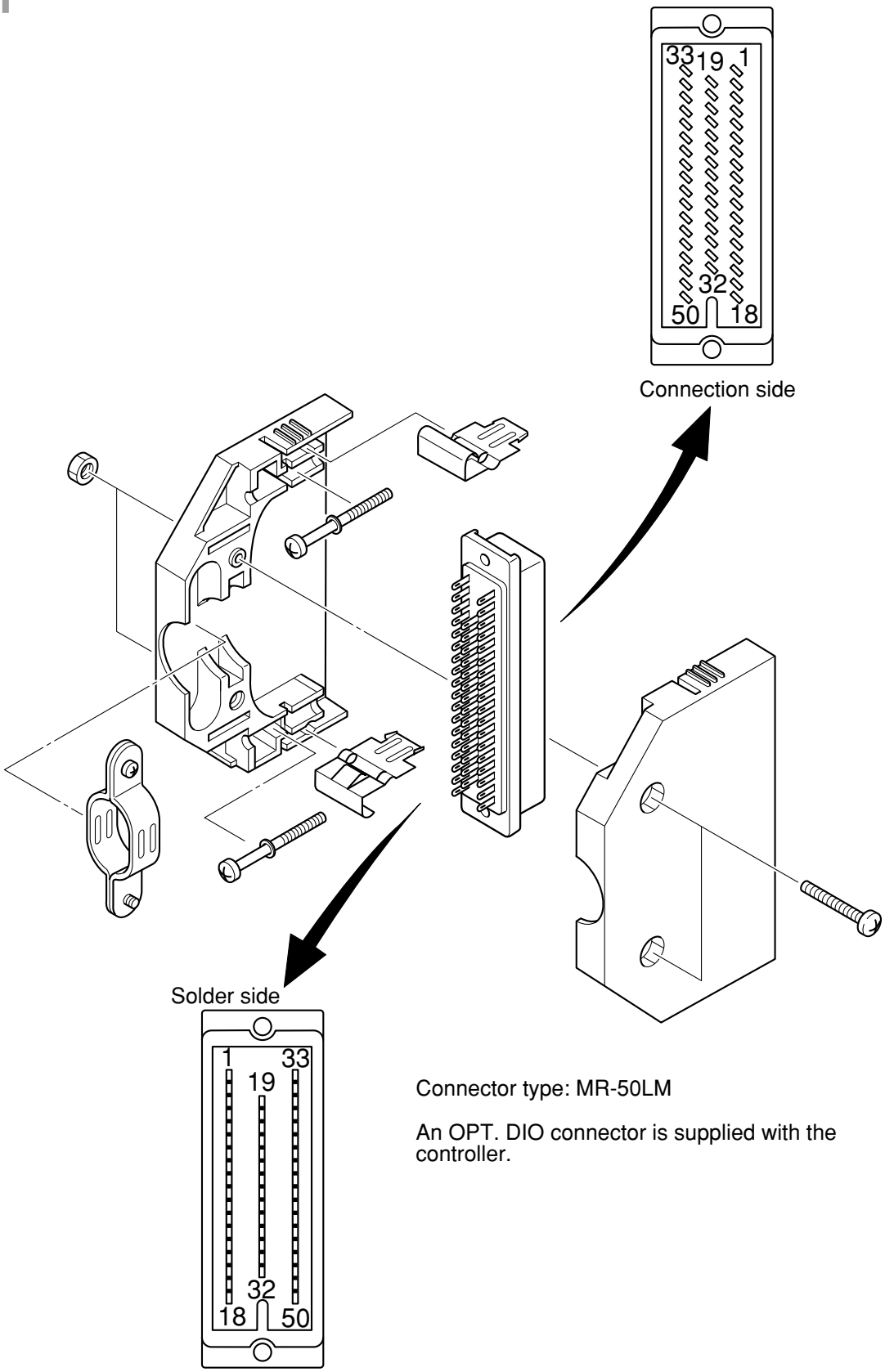
On the controllers from Ver.10.10 onwards, the area check output can be assigned to the following ports:

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

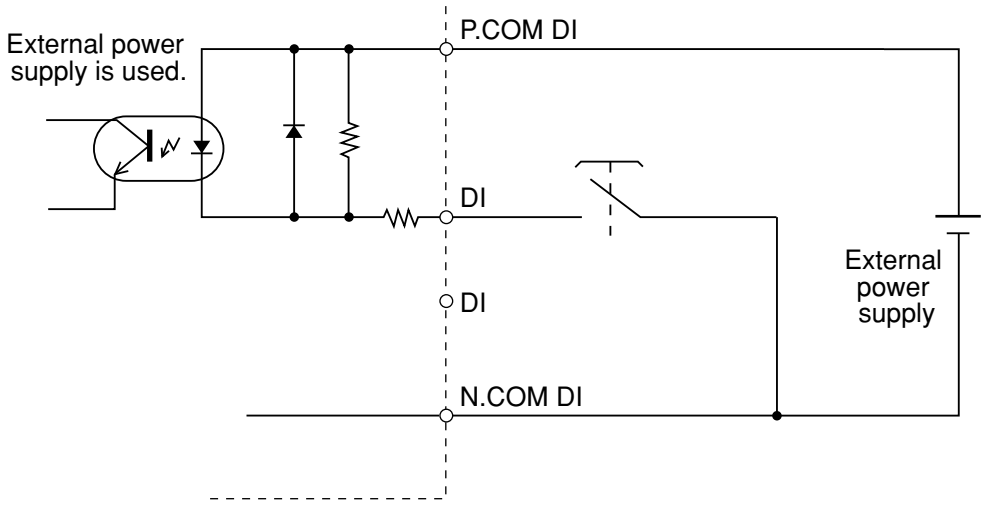


Connector type: MR-50LM

An OPT. DIO connector is supplied with the controller.

2.5 Typical input signal connection

NPN specifications

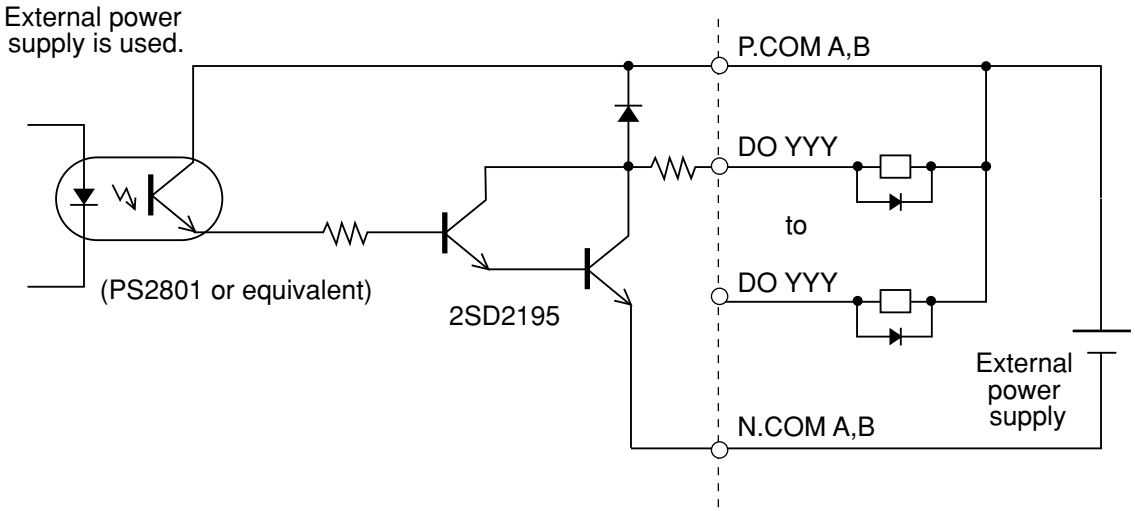


CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

2.6 Typical output signal connection

NPN specifications



2.7 General-purpose I/O signals

2.7.1 General-purpose input signals

The general-purpose inputs on the option I/O interface are all available to the user. These are connectable to pushbutton switches or sensors and can be specified for use as needed in the robot program or sequence program.

CAUTION

If the "8. DI noise filter" parameter is set to "VALID" (refer to "12.1.5 Other parameters" in Chapter 4), 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 general-purpose outputs on the option I/O interface are all available to the user. These are connectable to pushbutton switches or sensors and can be specified for use as needed in the robot program or sequence program.
All inputs are initialized (cleared) 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.)

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.

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 "12.1.5 Other parameters" in Chapter 4.)

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, see "14.2 Enabling/disabling the sequence execution flag" in Chapter 4.)

c) Any of the following operations was performed.

- Compile ended successfully in "PROGRAM" mode.
- A program was compiled in "AUTO" mode and the compile ended successfully.
- F1 (RESET) was executed in "AUTO" mode.
- 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.)
- Either of the following was initialized in "SYSTEM>INIT" mode.

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

  2.Entire memory (SYSTEM>INIT>MEMORY>ALL)
- 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.)
- The online commands @RESET, @INIT PGM, @INIT MEM, @INIT ALL, or @SWI were executed.
- The HALT statement was executed in the program.

3. Ratings

CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

1. Input

■ NPN specifications

Method	DC input (positive common type) Photocoupler insulation method
Input power	24V DC ±10%, 7mA/point
Load	ON voltage: 20.0V min (1.5mA) OFF 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 protective circuit is activated, it is not possible to restore the 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.

MEMO

Chapter 7 SAFETY I/O INTERFACE

Contents

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1.5	Dedicated input signal connections	7-8
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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.
The input signal is from hereon referred to as DI and the output signal as DO.

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

1.1 Power

The emergency stop input utilizes 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

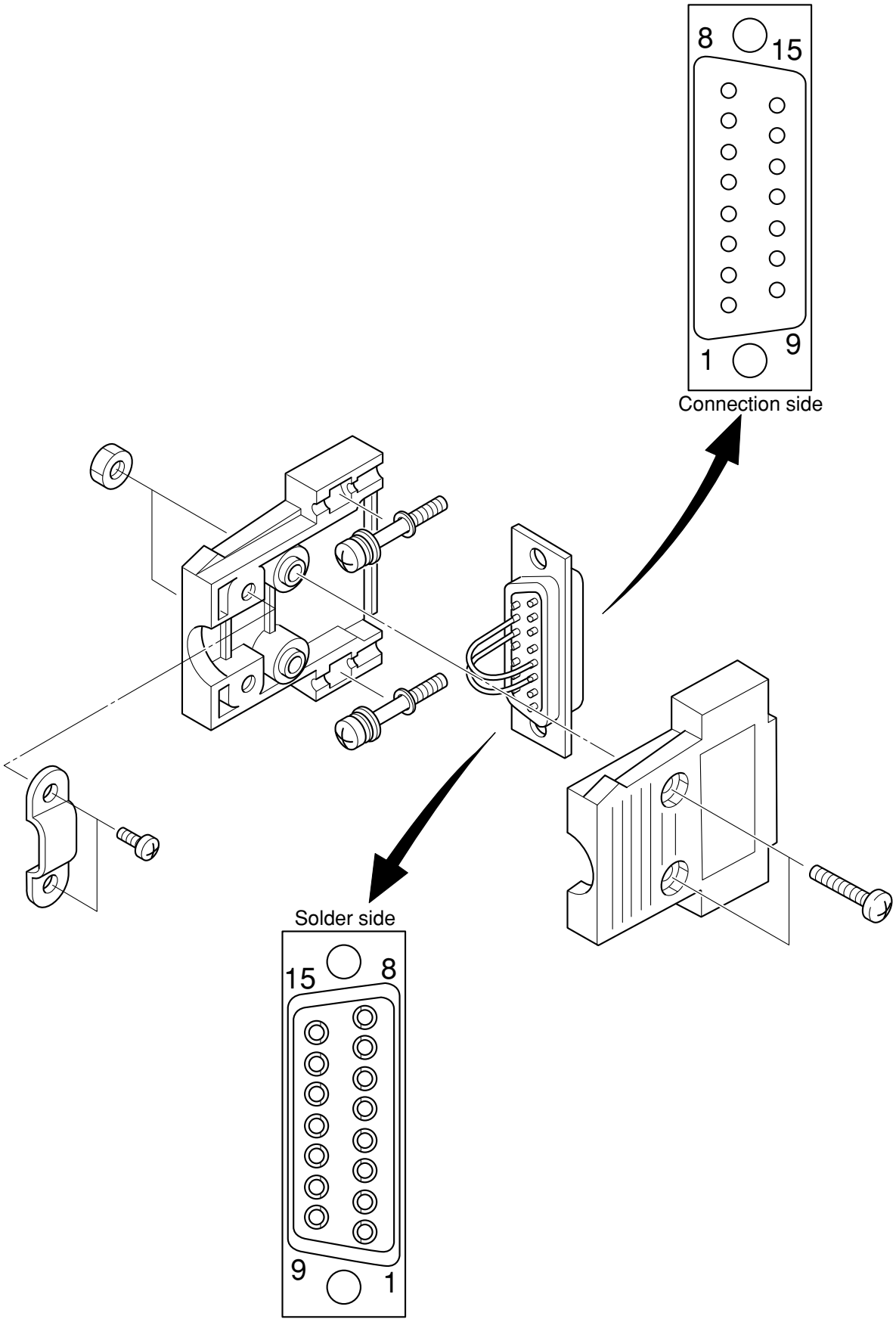
PIN	I/O No.	Name	Remarks
1	DI02	SERVICE mode	NPN/PNP specs conform to STD. DIO settings. Common terminal: P. COM / N. COM
2	MP READY	Motor power ready	
3	E-STOPIN1	Emergency stop input 1	
4	E-STOPIN2	Emergency stop input 2	
5	E-STOPIN3	Emergency stop input 3	Usable only when enable switch compatible programming box is used. (RPB-E)
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	DC+24V 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 pins to make an interlock circuit to ensure the system including the robot controller operates safely.**
- **Do not connect an external DC 24V to E-STOP24V.**
- **NPN and PNP specifications are each defined in " 7. I/O connections" in Chapter 3.**
- **Do not connect any external signals to the reserved terminals.**
- **When using DI02 and MP READY, supply power to the DC24V and GND terminals of STD.DIO.**
- **Maximum output current for MP READY is 100mA.**

1.3 Connector terminal numbers

Connector exploded view



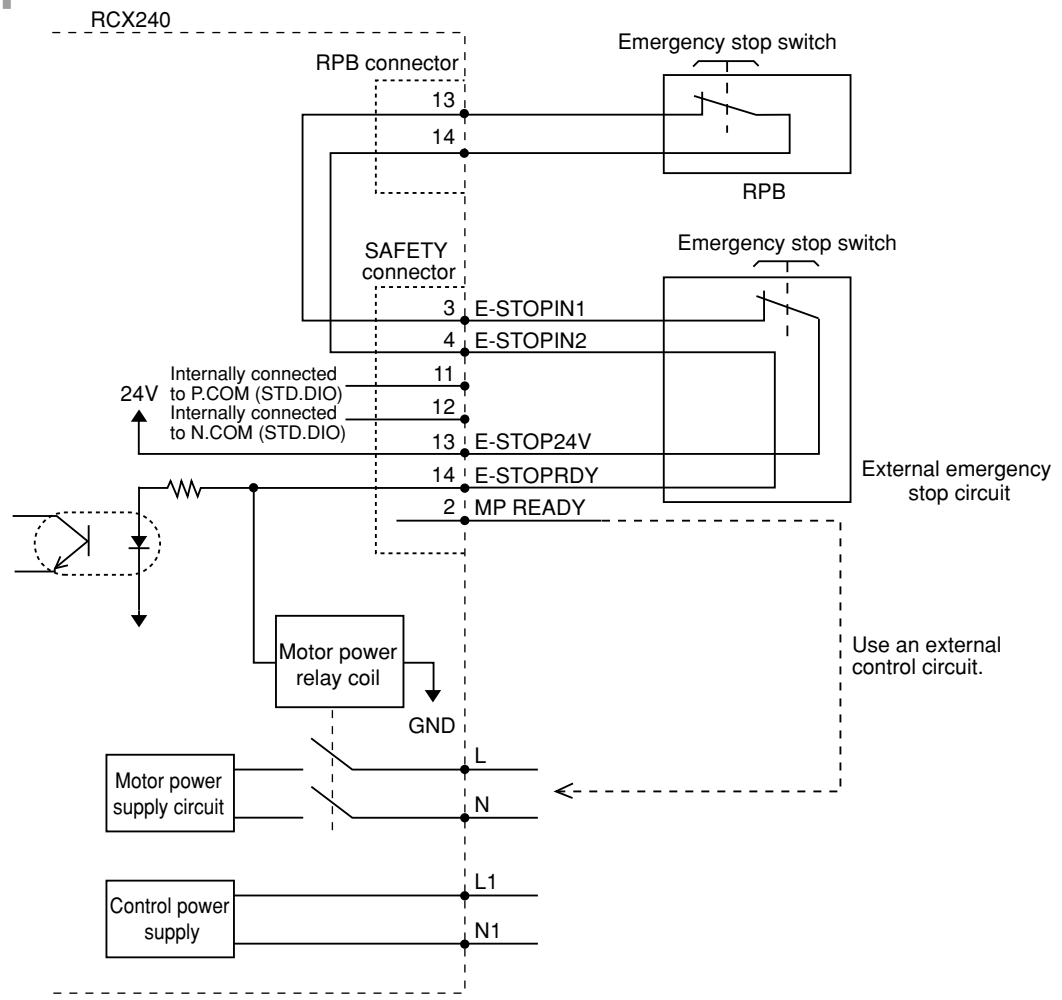
1.4 Emergency stop input signal connections

■ Connections using the standard RPB programming box with external emergency stop circuit

CAUTION

External emergency stop and the RPB 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.

Connections using the standard RPB programming box with external emergency stop circuit



Operation description:

- The RPB emergency stop switch and external emergency stop switch are connected in series.
  a. In normal operation, E-STOP24V is connected to E-STOPRDY via the RPB emergency stop 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 RPB and SAFETY connector are removed.
- Pins 13 and 14 on the RPB connector are shorted in the RPB 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.

CAUTION

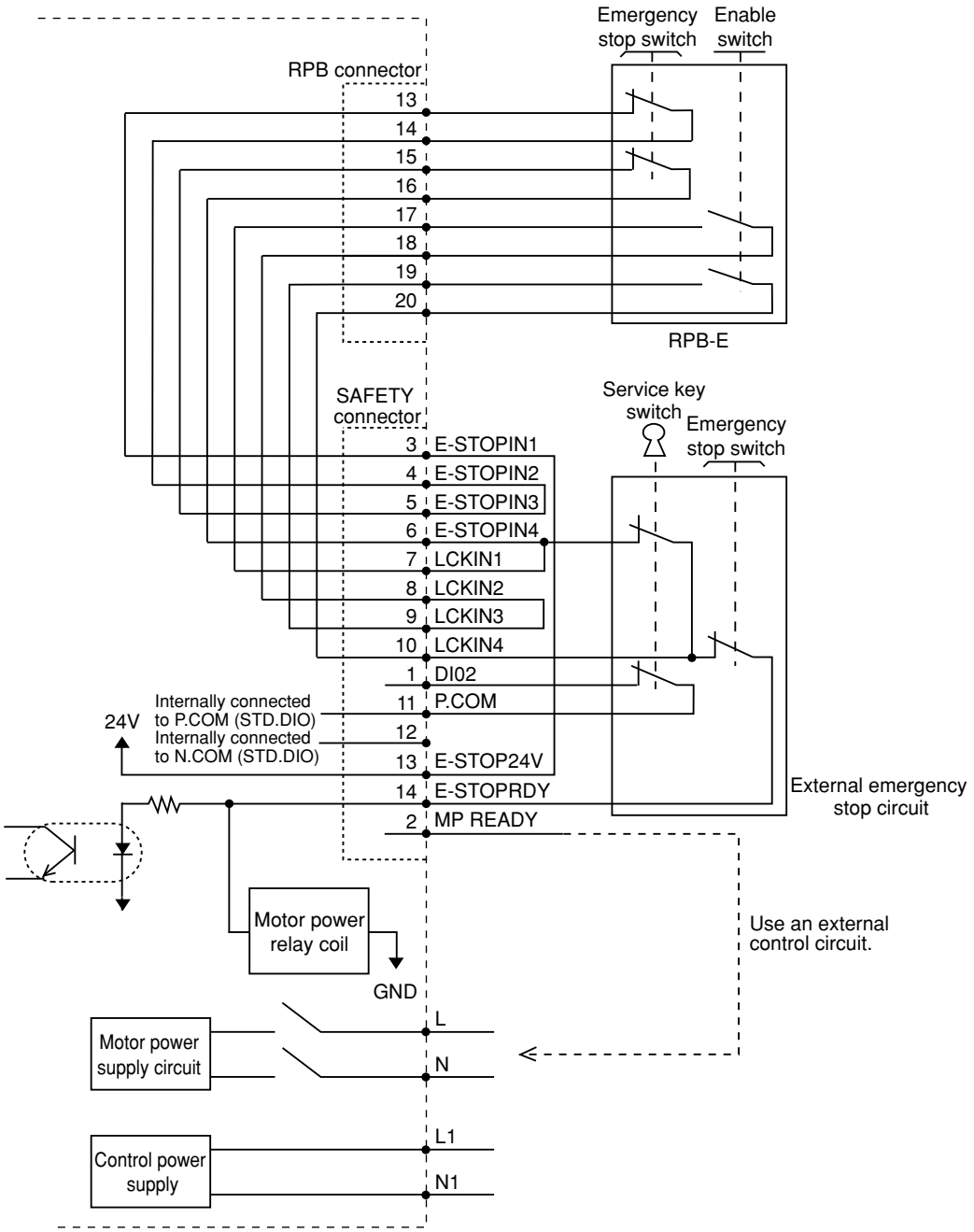
- **E-STOPRDY requires at least 100mA for the relay and photocoupler drive current.**
- **Do not use E-STOP24V for anything other than emergency stop.**

■ Connections using the RPB-E (RPB compatible with an enable switch) with external emergency stop circuit

CAUTION

External emergency stop and the RPB 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.

Connections using the RPB-E (RPB compatible with an enable switch) with external emergency stop circuit (PNP specifications)



Operation description:

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

1. When the service key switch contact is close:

The enable switch is inoperable at this point.

a. In normal operation, E-STOP24V is connected to E-STOPRDY via the RPB-E emergency stop 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 RPB-E 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 at this point.

a. In normal operation, E-STOP24V is connected to E-STOPRDY via the RPB-E emergency stop switch, 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 RPB-E and SAFETY connector are removed.

- Pins 13 and 14, pins 15 and 16, pins 17 and 18, and pins 19 and 20 on the RPB connector are shorted in the RPB 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.

1.5 Dedicated input signal connections

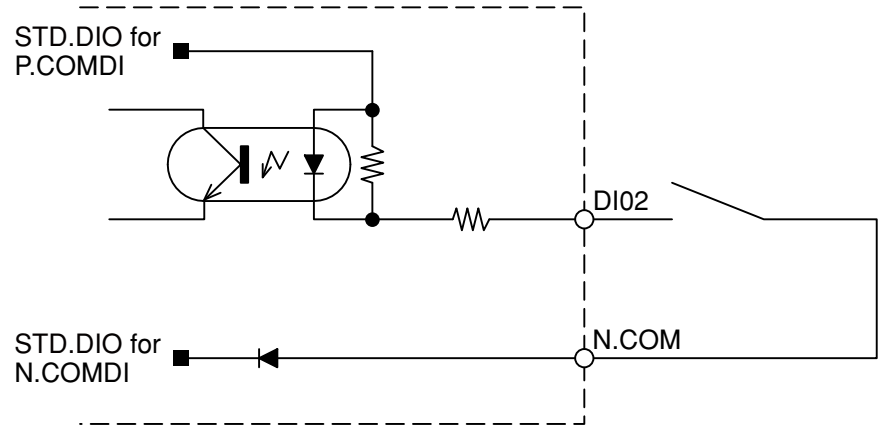
CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

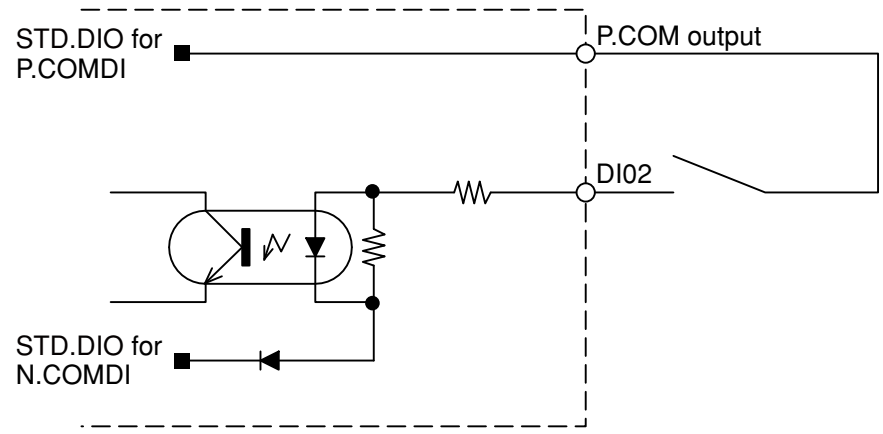
NOTE

Connect DC 24V and ground for STD. DIO.

NPN specifications



PNP specifications



1.6 Input signal description

CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

1. SERVICE mode input (DI02)

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 " with the operation level, operating speed limit, and excusive control of the operating devices specified by the "SERVICE" mode parameters.

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).)

If the SERVICE mode input is changed, the program being executed will pause or ongoing robot jog movement will pause.

NOTE

- NPN and PNP specifications are determined by the STD. DIO setting.
- Robot controllers with SAFE mode enabled will always be in service mode when an external 24V is not supplied to STD. DIO. 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 when making the interlock circuit to ensure 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) allows turning on the servo power supply. 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 RPB-E (RPB compatible with an enable switch) is used.

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

Enable switch inputs are used when making the interlock circuit to ensure 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 RPB-E (RPB compatible with an enable switch) is used.

1.7 Dedicated output signal connections

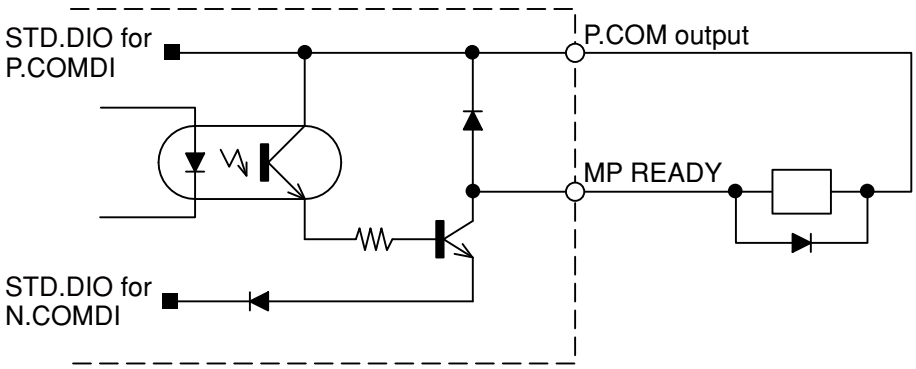
CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

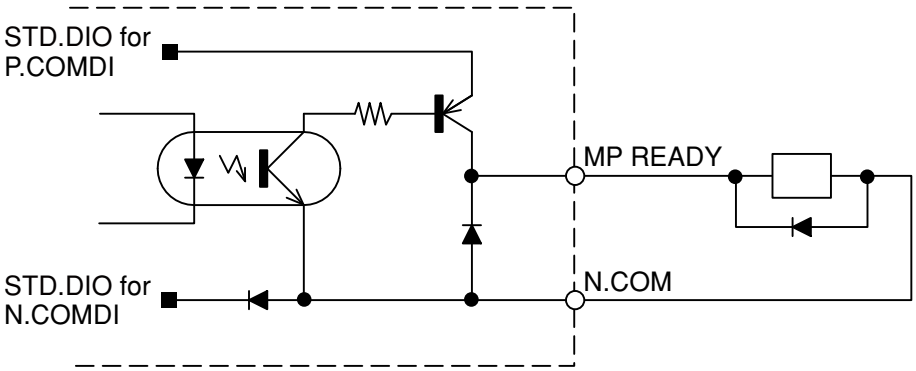
NOTE

Connect DC 24V and ground for STD. DIO.

NPN specifications



PNP specifications



1.8 Meaning of output signals

1. MP READY

CAUTION

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.

This output signal turns on when the controller is ready to receive the main power input from an external device. This output is on before the servo turns on.
This signal turns off if an internal error occurs or the emergency stop input signal turns off. Supply this output to a PLC or external device to allow it to determine the on/off conditions of the main power supply.
Maximum output current is 100mA.

Chapter 8 RS-232C INTERFACE

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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 in a variety of applications.

(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 can be performed from an external device just by turning on power to the robot controller.

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

There are 2 types of robot controller communication modes, "ONLINE" and "OFFLINE".

(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).

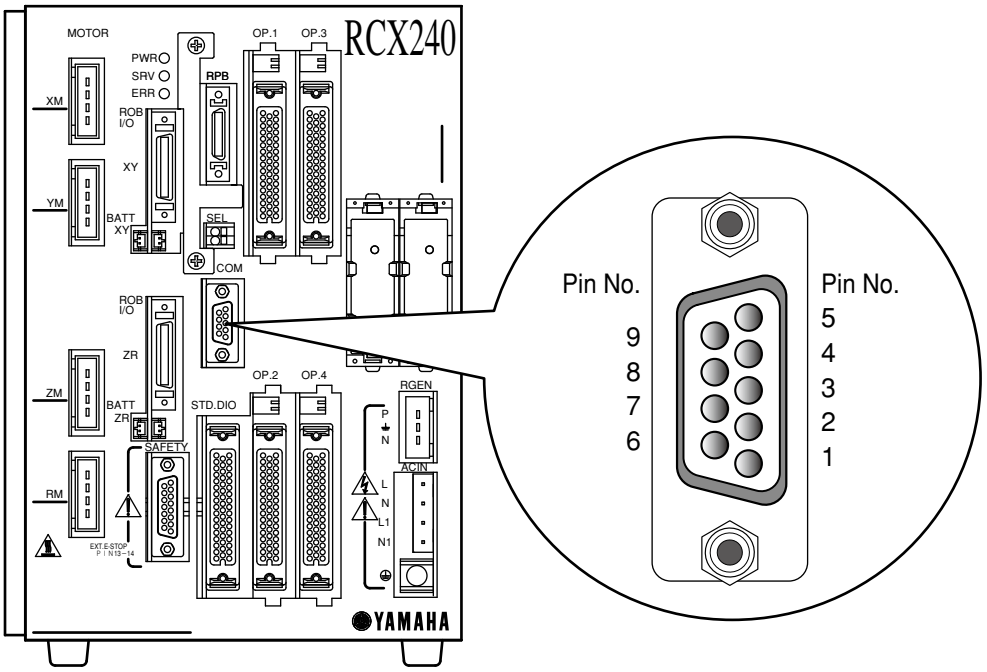
For detailed information on ONLINE commands, refer to the programming manual.

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



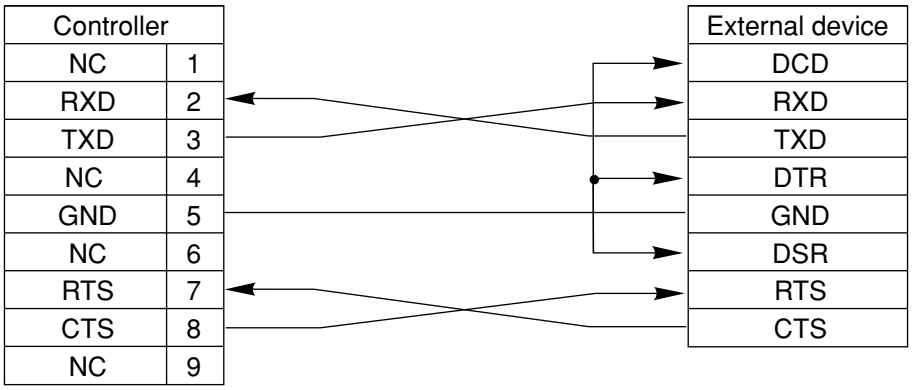
Specifications of the RS-232C interface connector installed on the robot controller are shown below.

1. A D-SUB 9-pin female connector is installed on the robot controller, so use a connection cable with a D-SUB 9-pin male connector.
2. Pin arrangement of D-SUB 9-pin connector is as follows.

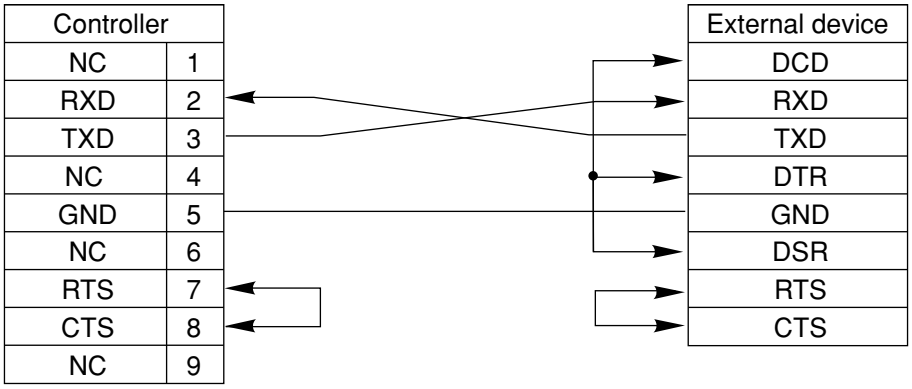
Pin No.	Name	Description	Input/output
1	NC	Not used	
2	RXD	Receive data	Input
3	TXD	Send data	Output
4	NC	Not used	
5	GND	Ground	
6	NC	Not used	
7	RTS	Request to send	Output
8	CTS	Permission to send	Input
9	NC	Not used	

3. Connection cable examples

a. Cable capable of hardware busy control



b. Cable not using control wires



* For signal wire layout on the external device, refer to the instruction manual for that device.

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, XOFF and RST are used to notify the other party that this end is busy.

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,
   - 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.

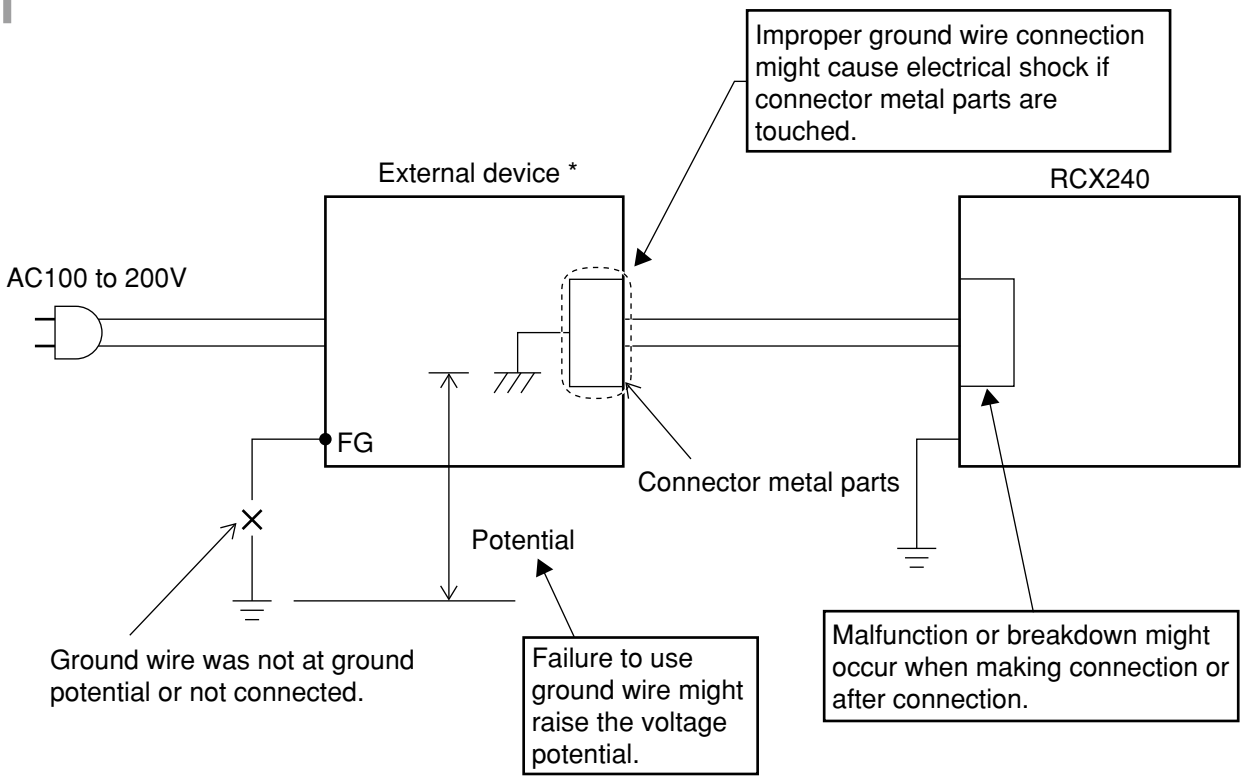
3) When the external device does not support handshake protocols (BUSY control, XON/XOFF control), the data processing speed becomes slower than the communication speed, causing a communication error. In this case, take countermeasures such as reducing the communication speed (baud rate).

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) There is no response to external transmission 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 type and its 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 or protective ground terminal, make sure that its structure is designed to protect from electrical shock.

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				—	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 RPB.

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

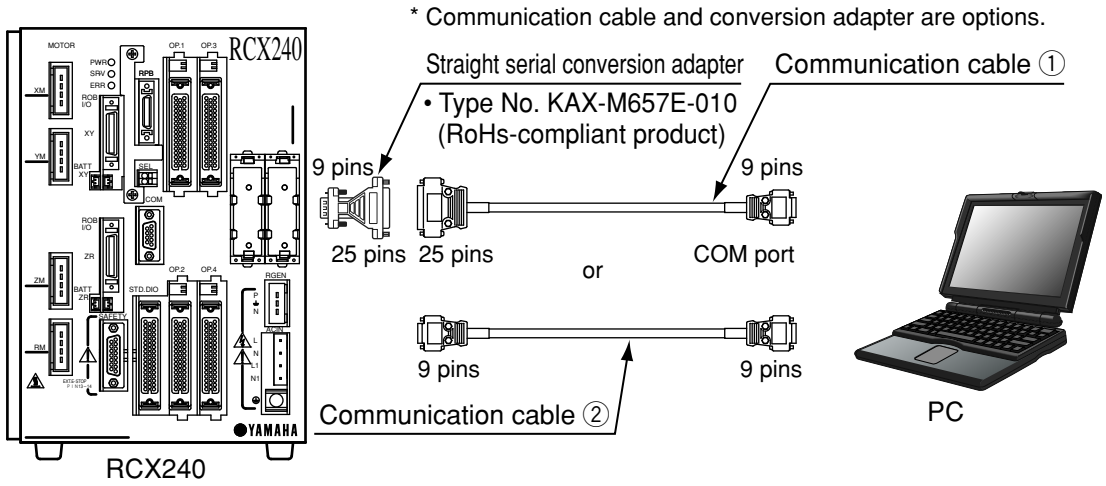
Note 5: TAB is replaced with one space.

3.6 Connecting to a PC

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

1) Using the PC's COM port

COM port



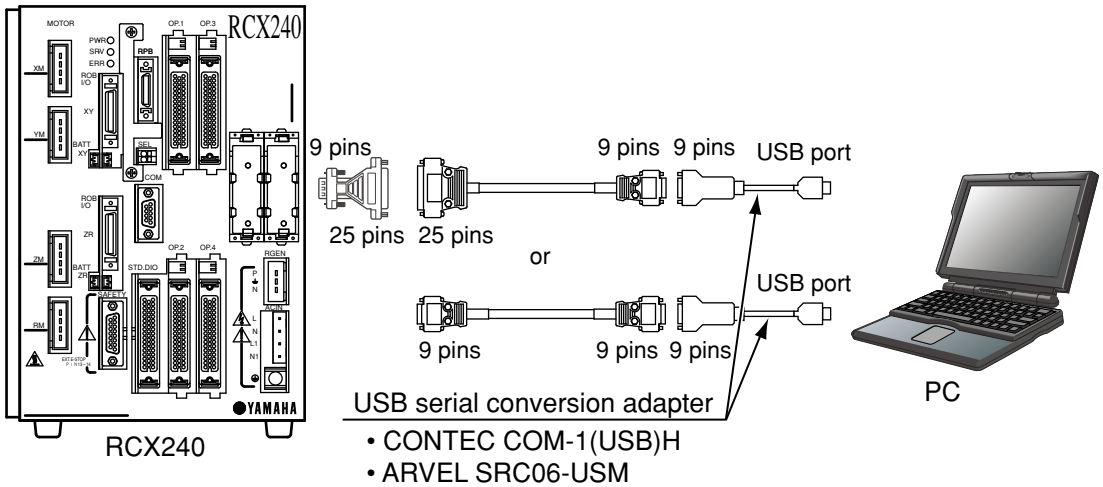
Communication cable		Length	Cable type No.
①	25 pins ↔ 9 pins	3.5m	KR7-M538F-100
		5m	KR7-M538F-300
②	9 pins ↔ 9 pins	3.5m	KAS-M538F-000
		5m	KAS-M538F-100

CAUTION

There is no problem with reversing the communication cable connections by attaching the straight serial conversion adapter to the PC.

2) Using the PC's USB port

USB port



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 9 Periodic inspection

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2. Periodic inspection 9-1

2.1 Daily inspection 9-1

2.2 Three-month inspection 9-2

3. Replacing the fan filter 9-3

4. Maintenance parts 9-4

1. Before beginning work

Periodic inspection and maintenance are essential to ensure safe and efficient operation of YAMAHA robots. This chapter describes periodic inspection for the controller. Before beginning work, read the precautions in this chapter and also in Chapter 1,"Using the robot safety", and follow the instructions.

2. Periodic inspection

2.1 Daily inspection

The following inspection must be performed every day before and after operating the robot.

1. Inspection to be performed with the controller power turned off

WARNING

- **TURN OFF THE CONTROLLER POWER SWITCH ON THE CONTROL PANEL OR THE PRIMARY POWER SOURCE.**
- **PLACE A SIGN "WORK IN PROGRESS" IN ORDER TO KEEP OTHER PERSONS FROM OPERATING THE CONTROLLER POWER SWITCH.**

Check the following points.

Check points	Check items
Ground terminal	Check the terminal for looseness. Tighten if loose.
Power supply connector	Check the power supply connector for looseness. Securely connect if loose.
Power cable	Check if the power cable is securely connected to the power supply connector. Securely connect the cable if not properly connected.
Robot cable	Check if the robot cable is securely connected to the controller. Securely connect the cable if not properly connected.
Cables	Check for scratches, excessive bending, and loose connectors.

2. Inspection to be performed with the controller power turned on

WARNING

- Before turning on the controller power, check that no one is within the safety enclosure.
- Place a sign "Work in progress" in order to keep other persons from operating the controller, programming box, and control panel.
- Perform inspection from outside the safety enclosure.

Check the following points from outside the safety enclosure.

Check points	Check items
Safety enclosure	Check if the safety enclosure is in place. Check if emergency stop is triggered when the door or gate is opened.
Emergency stop device	Check if emergency stop is triggered when the device is activated.
Mode selector device	Check if the mode is properly switched when the device is activated.
Robot movement	Check for abnormal movement, vibration, and noise.

2.2 Three-month inspection

The following inspection must be performed every 3 months.

1. Inspection to be performed with the controller power turned off

WARNING

- **TURN OFF THE CONTROLLER POWER SWITCH ON THE CONTROL PANEL OR THE PRIMARY POWER SUPPLY.**
- **PLACE A SIGN "WORK IN PROGRESS" IN ORDER TO KEEP OTHER PERSONS FROM OPERATING THE CONTROLLER POWER SWITCH.**

Check the following points.

Check points	Check items
Power supply connector	Check the power supply connector for looseness.
Power cable	Check if the power cable is securely connected to the power supply connector.
Robot cable	Check if the robot cable is securely connected to the controller.
Cables	Check for scratches, excessive bending, and loose connectors.
Fan filter	Check the fan filter for dust and damage. For how to inspect the filter, see the next section "3. Replacing the fan filter".

3. Replacing the fan filter

Check the fan filter installed on the rear of the controller for dust and damage.

WARNING

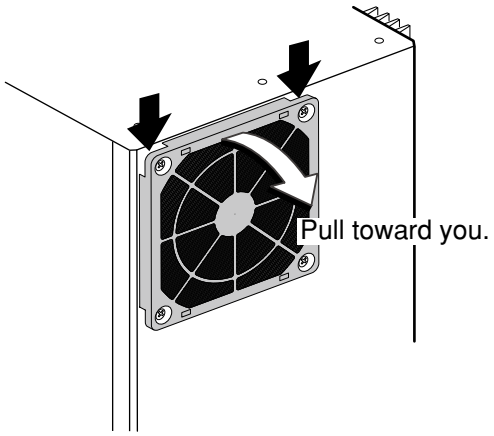
Before beginning work, turn off the controller power switch on the control panel or the primary power source.

Step 1 *Remove the filter cover.*

The filter cover is attached to the controller by four latches.

Place your fingers on the top two corners of the filter cover and pull the cover toward you to remove it.

Remove the filter cover



Step 2 *Check the fan filter for dust accumulation and damage.*

If the fan filter is dirty or damaged, then replace it with a new one.

Step 3 *Reattach the filer cover.*

After attaching the filter cover, make sure the four latches of the filter cover are securely fitted in place.

4. Maintenance parts

■ Parts subject to wear

Part name	Part No.	Remarks
Absolute battery	KAS-M53G-10	3.6V, 2700mAH
Fan filter	KX0-M427G-00	5 filters per pack

■ Parts subject to we

Part name	Part No.	Remarks
Absolute battery case	KBG-M5395-00	

Chapter 10 SPECIFICATIONS

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3.1 RCX240 external view 10-4

4. RPB basic specifications and external view 10-7

1. Controller basic specifications

1.1 RCX240 basic specifications

Item		RCX240	RCX240S
Basic specifications	Applicable robots	YAMAHA single-axis robots, linear single-axis robots, Cartesian robots, SCARA robots (except YK120X and YK150X), P&P robots	
	Connected motor capacity	1600W or less (in total for 4 axes)	800W or less (in total for 4 axes)
	Power capacity	2500VA	1500VA
	Dimensions	W180 × H250 × D235 (main unit)	
	Weight	6.5kg (main unit)	
	Power supply voltage	Single phase 200 to 230V AC ±10%, 50/60Hz	
Axis control	No. of axes	4 axes maximum (simultaneous control: 4 axes)	
	Drive method	AC full digital servo	
	Position detection method	Resolver or 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 during program execution)	
	Acceleration/ deceleration setting	Automatic acceleration setting by robot model and tip weight parameter Setting by accel coefficient and decel. rate parameters (1% steps) (Can be changed by programming.) Zone control (Optimum speed setting matching SCARA robot arm position)	
Programming	Program language	YAMAHA BASIC 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 maximum number of points 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)	
	System backup (Internal memory backup)	Lithium battery (service life about 4 years at 0 to 40°C)	
	Internal flash memory	512KB (“ALL” data only)	

Item			RCX240	RCX240S
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 RPB-E is used)	
		Output	Motor power ready output	
	Break output		Relay contact	
	Origin sensor input		Connectable to 24V DC B-contact (normally closed) sensor	
	External communications		RS-232C : 1 channel (D-SUB 9-pin female connector) RS-422 : 1 channel (for RPB only)	
	Regenerative unit connection		RGEN connector	
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, compatible with 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		RPB, RPB-E	
	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	RGU-2
	PC software		VIP+, VIP	

CAUTION

- **Specifications and appearance are subject to change without prior notice.**
- **See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.**

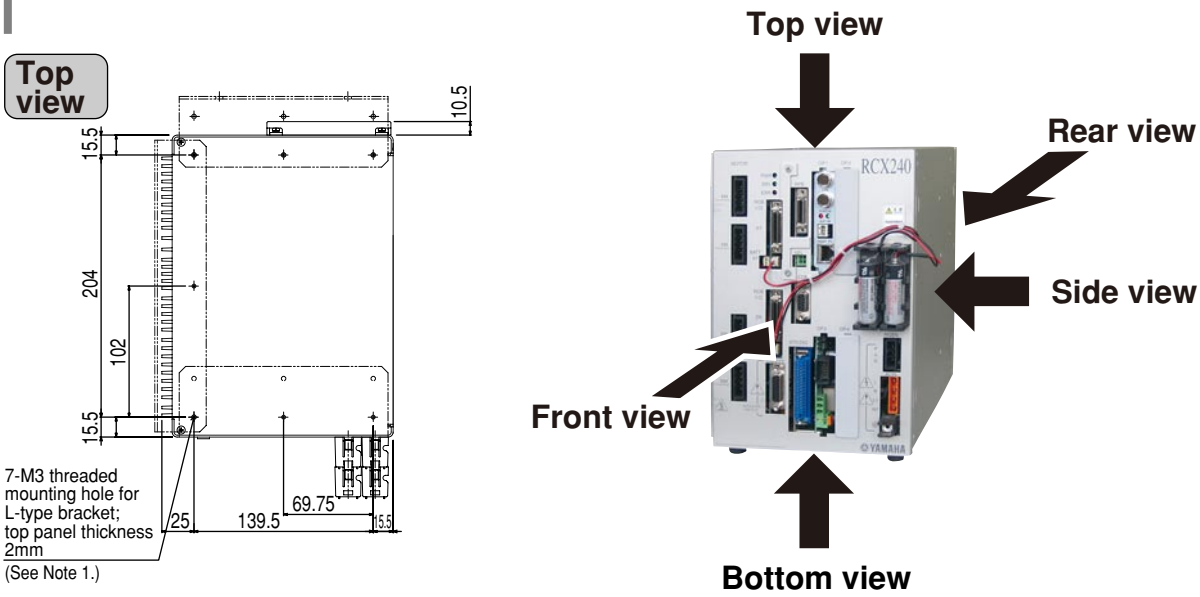
2. Controller basic functions

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	10ms intervals
Program break points	4 points maximum

3. Robot controller external view

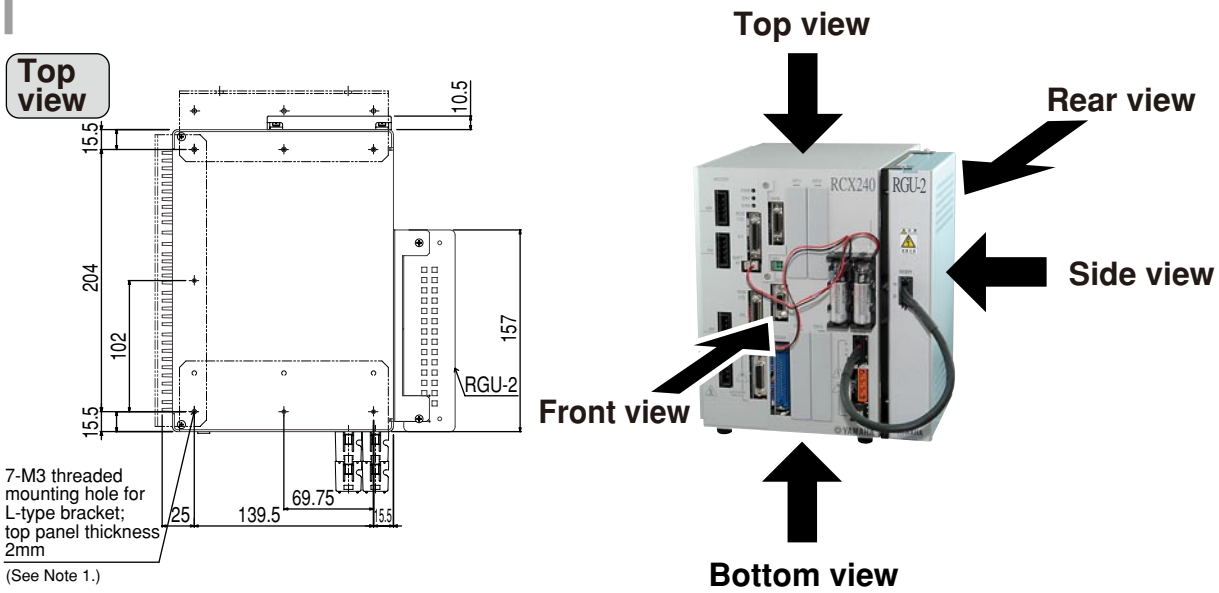
3.1 RCX240 external view

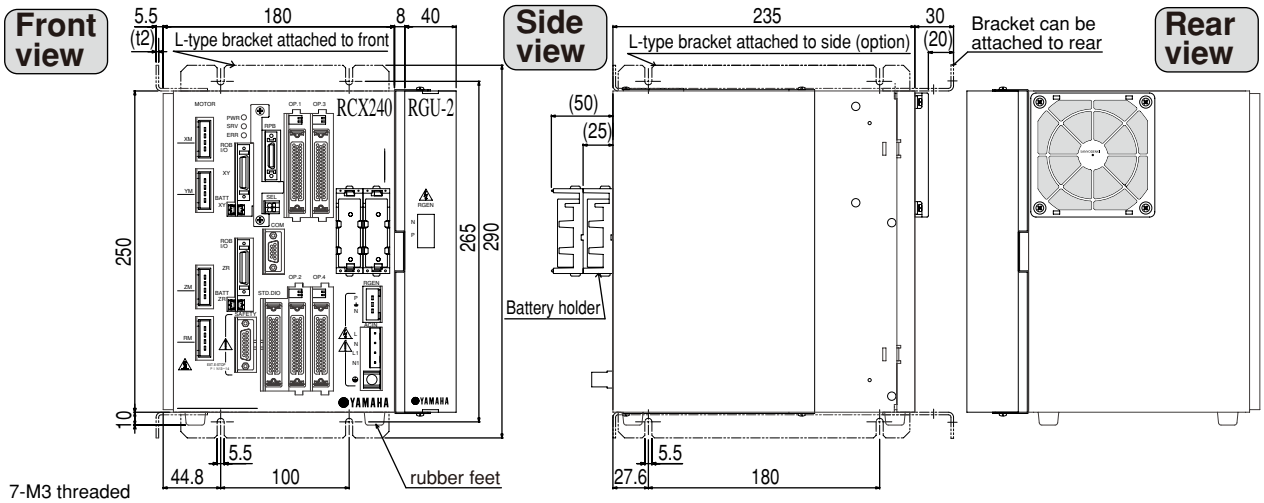
Standard RCX240/RCX240S

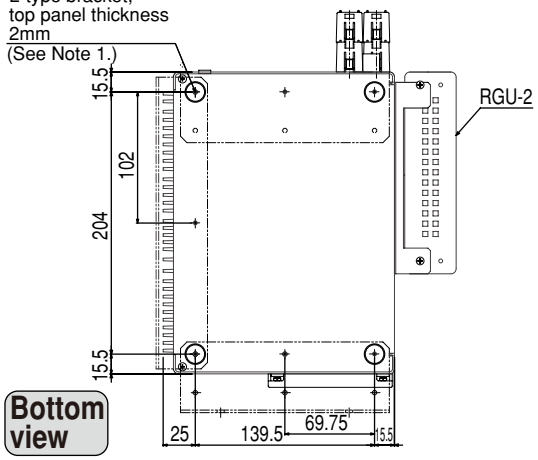


Note 1: When installing this controller using the supplied L-type brackets, remove the rubber feet on the bottom plate.

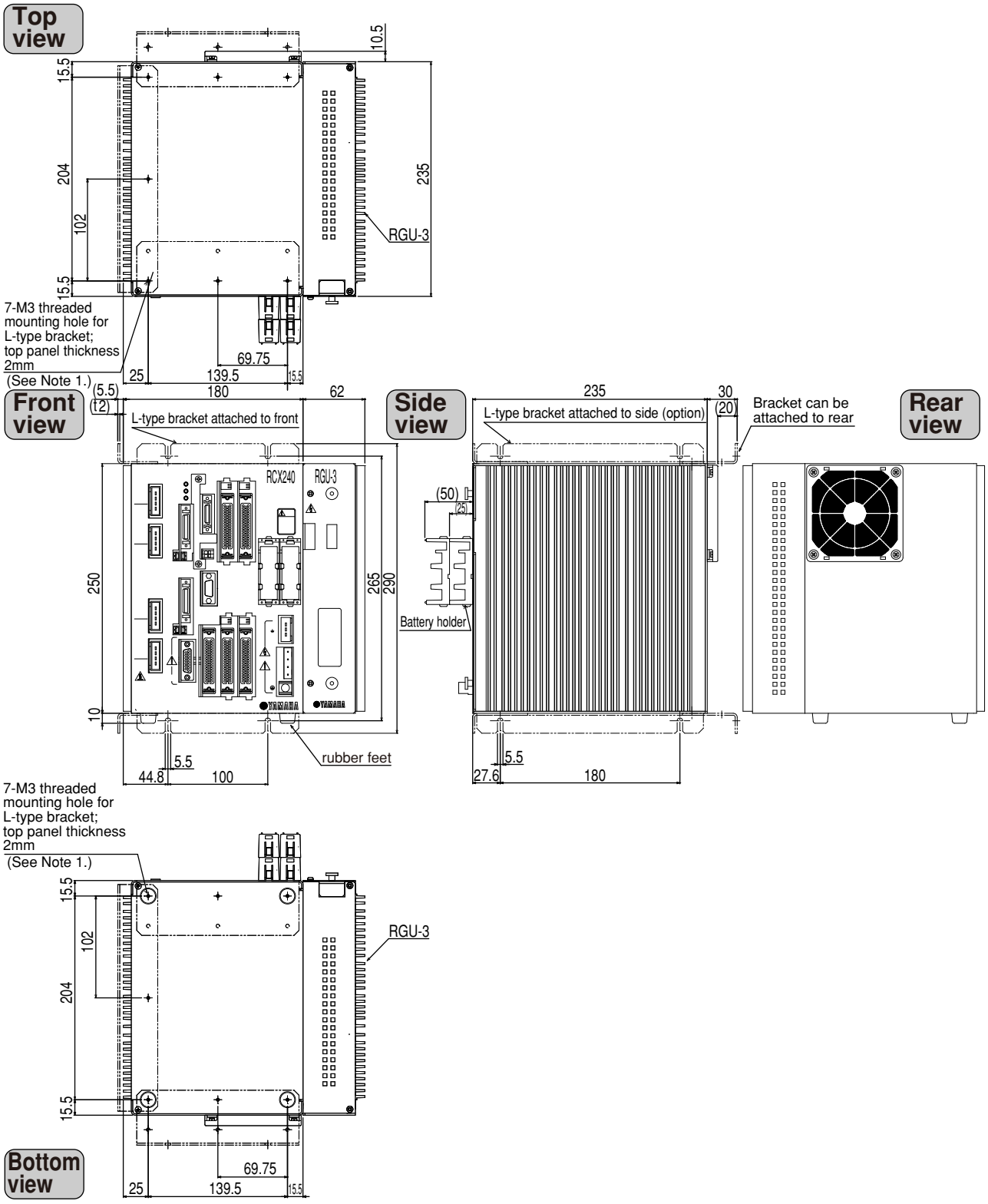
RCX240/RCX240S with RGU-2 option installed







RCX240 with RGU-3 option installed

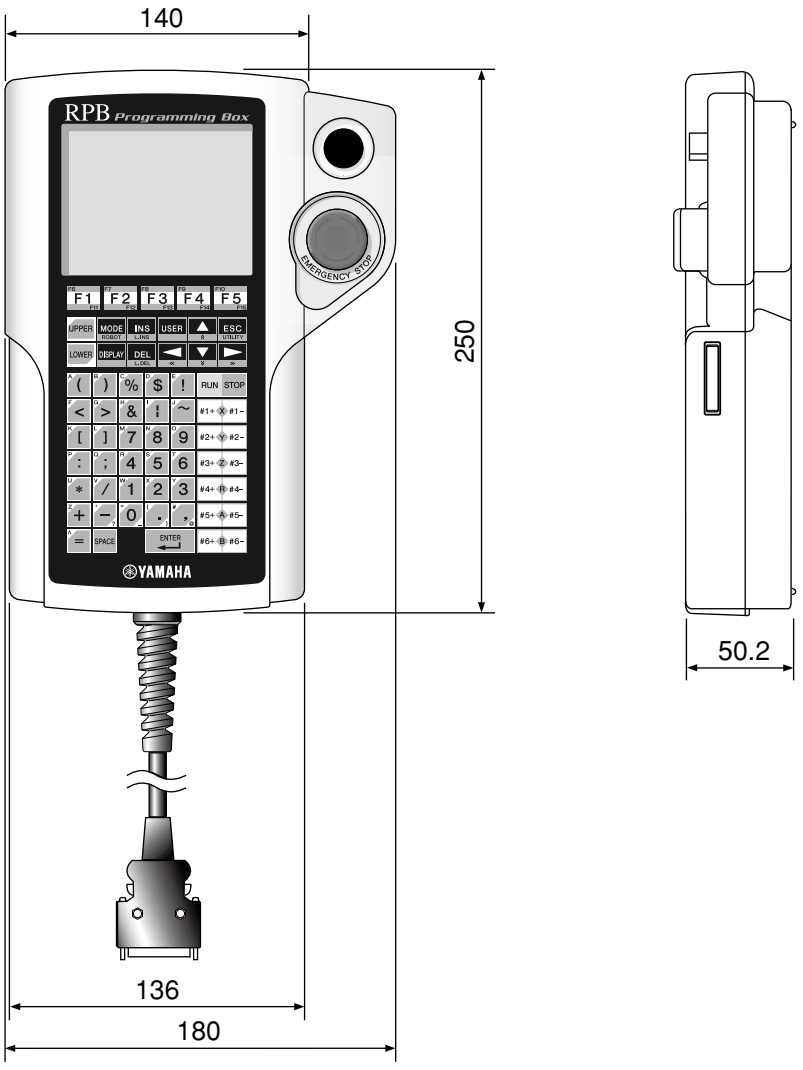


4. RPB basic specifications and external view

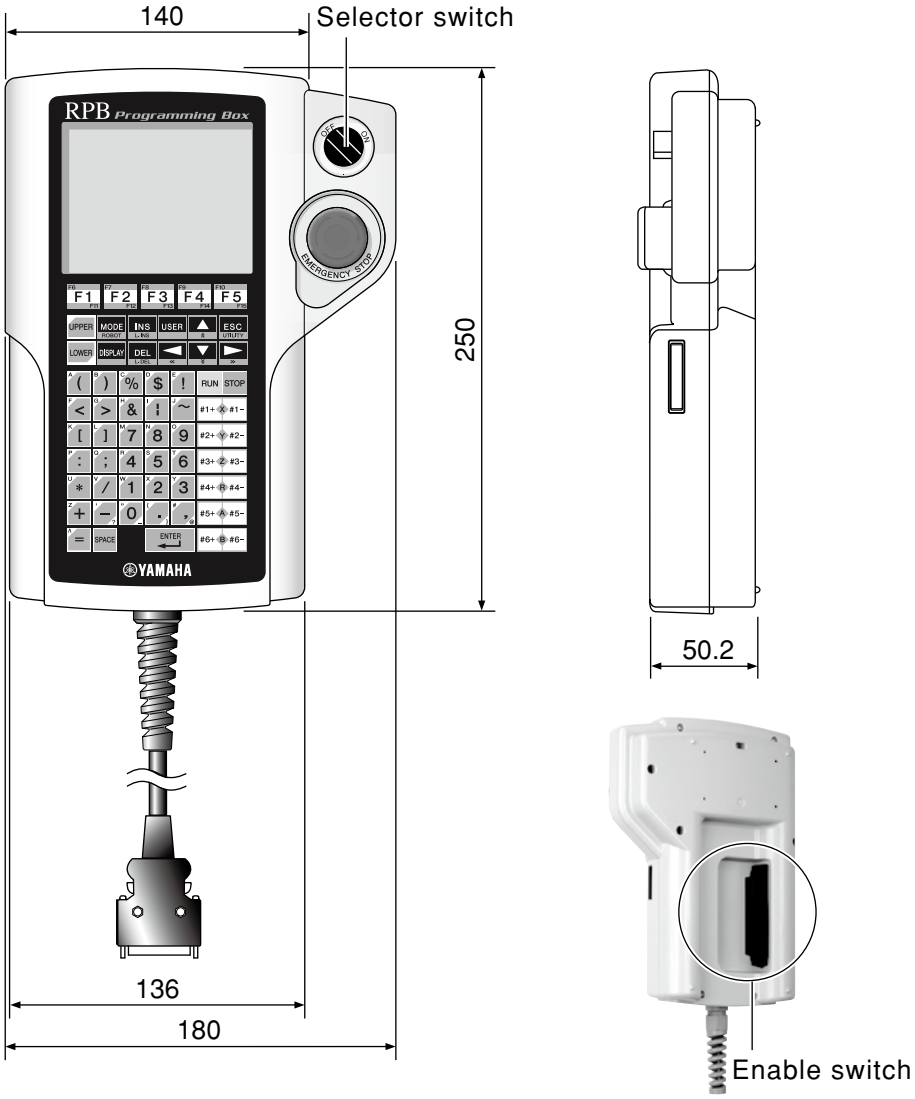
RPB basic specifications and external view

Item	RPB	RPB-E
Display screen	Liquid crystal display (40 characters × 15 lines)	
Emergency stop button	Normally-closed contract (with lock function)	
Enable switch	Not provided	3-position type
Power	DC+12V	
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	600g (excluding cable)	630g (excluding cable)

RPB external view



RPB-E external view



TROUBLESHOOTING

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A

1. Error messages

1.1 Robot controller error messages

When an error occurs, an error message appears on the message line (2nd line) of the RPB screen. The error messages and their explanations are given below.

NOTE

Please contact your YAMAHA representative if the recommended countermeasures fail to prevent a given error from recurring.

[Error message display format]

Error messages display at the top of the screen.

Error group number
Error category number } Error number
Error message

12.1 : EMG.STOP ON

Code : ＊＊＊＊ —— Error codes are expressed as hexadecimal values.
Dedicated output : ＊＊＊＊ —— Refer to "(2) Dedicated output status".

Meaning/Cause	Action
＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊	＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊＊

Indicates the error meaning and cause.

Indicates how to cancel the error status, and countermeasures for preventing the error from recurring.

* In some cases information about the error occurrence location (axis, optional unit, etc.) is inserted at the beginning of the error message.

Error number: [<occurrence location>] Error message

M …Main group axis number
S …Sub group axis number
D …Driver axis number
OP …Optional unit slot number

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 configuration is normally 1-to-1 as viewed from both the robot and the driver, there are cases (in a dual drive axis system, etc.) where the axis configuration may appear as 1 axis when viewed from the robot, but 2 axes when viewed from the driver.

A

(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]	RPB errors
[14]	RS-232C communication errors
[15]	Memory card errors
[16]	(Not used)
[17]	Motor control errors
[18]	(Not used)
[19]	YC-Link (SR1) related error
[20]	iVY system errors
[21]	Major software errors
[22]	Major hardware errors
[26]	Alarm messages (major errors) that occurred in electrical gripper
[27]	Error messages that occurred in electrical gripper



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.

  DO 01a (CPU OK) = OFF
  DO 02a (SERVO ON) = OFF
  DO 03a (ALARM) = ON

*2 ... Driver stop

- Turn the power ON again to reset.

  DO 02a (SERVO ON) = OFF
  DO 03a (ALARM) = ON

*3 ... Servo stop

- Turn the power ON again in "UTILITY" mode to reset.

  DO 02a (SERVO ON) = OFF
  DO 03a (ALARM) = ON

(3) "Alarm message" that occurred in electric gripper

When an alarm message of error group No. 26 (Alarm messages (major errors) that occurred in electrical gripper) appears, the electric gripper enters the following status.

- Origin incomplete
- Servo OFF

To recover from the alarm state, do the following:

1. Eliminate the cause of the alarm.
2. Reset the emergency stop flag.
3. Turn all axes' servo on.
4. Perform return-to-origin for the electric gripper where the alarm occurred.

For more details, refer to the YAMAHA electric gripper YRG series user's manual.

A

[0] Warnings and messages

0.0 : Undefined error

Code : &H0000

Meaning/Cause	Action
Undefined system error.	Contact our company.

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	Action
a. Return-to-origin is incomplete because absolute reset has not been performed or return-to-origin has not been performed when both absolute and incremental type axes exist. So you ... • cannot execute programs and commands. • cannot perform point teaching. • cannot perform manual Cartesian movement (mm units). 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.)	Perform absolute reset or return-to-origin so that "origin complete" status is set.

0.2 : Running

Code : &H0002

Meaning/Cause	Action
Program or command is running.	—

A

0.3 : Program terminated by "HALT"

Code : &H0003

Meaning/Cause	Action
Program execution was terminated by a HALT command.	—

0.4 : Compiling

Code : &H0004

Meaning/Cause	Action
Robot language compiling (making an object program) is in progress.	—

0.5 : Busy

Code : &H0005

Meaning/Cause	Action
Data is being saved on a memory card or internal ROM.	—

0.6 : Program suspended by "HOLD"

Code : &H0006

Meaning/Cause	Action
Program execution was interrupted by a HOLD command.	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	Action
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.	Turn the controller on again.

0.8 : Try again

Code : &H0008

Meaning/Cause	Action
Operation failed.	Try again.

A

0.9 : Arrived at breakpoint

Code : &H0009

Meaning/Cause	Action
Break point was reached during program execution.	—

0.10 : INC. motor disconnected

Code : &H000A

Meaning/Cause	Action
Return-to-origin command was attempted on an absolute axis or an axis that does not exist.	1. Select the correct axis. 2. Check the system generation data.

0.11 : ABS. motor disconnected

Code : &H000B

Meaning/Cause	Action
Absolute reset was attempted on an incremental type axis or semi-absolute type axis, or an axis that does not exist.	1. Specify the correct axis. 2. Check the system generation data.

0.14 : Stop executed

Code : &H000E

Meaning/Cause	Action
Stop was commanded while executing a direct command so operation was stopped.	—

0.15 : Can't execute while servo on

Code : &H000F

Meaning/Cause	Action
Writing in "ALL" or "PRM" files was attempted during servo-on. "ALL" or "PRM" files cannot be written in servo-on.	Turn off the servo before writing files.

0.16 : Changed SERVICE mode input

Code : &H0010

Meaning/Cause	Action
Status of service mode inputs (DI02, SI02) was changed.	—

A

0.17 : Can't edit while STD.DIO DC24V on

Code : &H0011

Meaning/Cause	Action
Setting to disable the DC 24V monitoring function of STD.DIO was attempted even though DC 24V was being supplied at STD.DIO connector. (Monitor function cannot be disabled while DC 24V is being supplied to STD. DIO.)	To disable the monitor function, change the parameter after first stopping the DC 24V supply.

0.18 : Gripper not included in Origin

Code : &H0012

Meaning/Cause	Action
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	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	Action
Power was turned on and CPU operation commenced.	—

1.32 : CPU Normal start

Code : &H0120

Meaning/Cause	Action
Start-up checks and initialization ended and controller operation started.	—

1.33 : ABS.Backup start

Code : &H0121

Meaning/Cause	Action
Power was cut off so backup of robot position data commenced.	—

A

1.34 : ABS.Backup fin

Code : &H0122

Meaning/Cause	Action
Finished making backup of robot position data during power cutoff.	—

[2] Robot operating area errors

2.1 : Over soft limit

Code : &H0201

Meaning/Cause	Action
Soft limit value preset in the parameter for operation position was exceeded.	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	Action
Setting of standard coordinates is incomplete.	1. Set the standard coordinates. 2. Set the parameter arm length and offset pulse.

2.3 : Coordinate cal. failed

Code : &H0203

Meaning/Cause	Action
a. Preset calculation for setting standard coordinates is not functioning. b. Operating position exceeded the operating area range.	1. Set the standard coordinates correctly. 2. Change operating position to within operating area.

2.5 : Shift cal. failed

Code : &H0205

Meaning/Cause	Action
Calculating for setting shift coordinates failed.	Set shift coordinates correctly.

2.6 : Hand cal. failed

Code : &H0206

Meaning/Cause	Action
Calculation for setting hand definition failed.	Set hand definition correctly.

2.7 : Illegal Pallet parameter

Code : &H0207

Meaning/Cause	Action
Calculation for setting pallet definition failed.	Set pallet definition correctly.

2.8 : Movable range cal. failed

Code : &H0208

Meaning/Cause	Action
a. Calculation of movement path failed. b. Current position is not within movement range.	1. Change to a correct movement point. 2. Change current position to within movement range.

2.9 : Overlap soft limit

Code : &H0209

Meaning/Cause	Action
On SCARA robots, 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.	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	Action
Area is outside the movable range of movement path.	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	Action
Shift coordinate range ? value was exceeded.	1. Change the operating position of ? value to within the shift coordinates range. 2. Change shift coordinates range ? value.

A

2.17 : Arch condition bad

Code : &H0211

Meaning/Cause	Action
On SCARA robots and XY robots, arch motion is not used on X and Y axes when arch position data is in mm units. On SCARA robots, arch motion is not used on X and Y axes when target position data is in mm units.	Change to correct arch motion command.

2.18 : RIGHTY now selected

Code : &H0212

Meaning/Cause	Action
On SCARA type robots, the arm will now use the right-handed system for starting Cartesian movement.	—

2.19 : LEFTY now selected

Code : &H0213

Meaning/Cause	Action
On SCARA type robots, arm will now use the left-handed system for starting Cartesian movement.	—

2.20 : Illegal hand type

Code : &H0214

Meaning/Cause	Action
An R-axis hand definition was attempted on a robot not having an R-axis.	1. Change to Y-axis hand definition. 2. Do not use a hand definition.

2.22 : Arm length is 0

Code : &H0216

Meaning/Cause	Action
When arm length setting is 0 on SCARA type robots, movement on Cartesian coordinates was attempted.	1. Set standard coordinates. 2. Set the arm length parameter.

2.23 : Cannot move (RIGHTY to LEFTY)

Code : &H0217

Meaning/Cause	Action
Interpolation movement shifting from the right-handed system to the left-handed system was executed with a SCARA robot.	Check the current hand system and point data hand system flag.

2.24 : Cannot move (LEFTY to RIGHTY)

Code : &H0218

Meaning/Cause	Action
Interpolation movement shifting from the left-handed system to the right-handed system was executed with a SCARA robot.	Check the current hand system and point data hand system flag.

2.25 : Cannot use TOOL coord.

Code : &H0219

Meaning/Cause	Action
Failed to select tool coordinates could because no hand data has been entered.	Set the hand data.



NOTE

An R-axis unit must be installed to a SCARA or Cartesian robot. Set the hand data while a hand or gripper is attached to the tip of the R-axis.

2.26 : Collision in W. carrier

Code : &H021A

Meaning/Cause	Action
Failed to move the double-carrier axis, because one carrier will interfere with the other carrier.	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.

A

2.27 : W. carrier deadlock

Code : &H021B

Meaning/Cause	Action
Failed to move the double carrier axis and a deadlock occurred, because the target positions of both carriers will interfere with each other.	Check the robot program.

[3] Program file operating errors

3.1 : Too many programs

Code : &H0301

Meaning/Cause	Action
Making of a new program was attempted after number of programs exceeded 100.	Make a new program after deleting an unnecessary program. (Make a backup if necessary.)

3.2 : Program already exists

Code : &H0302

Meaning/Cause	Action
An attempt to make/copy/transmit (by using SEND command) a new program with a name already registered was attempted.	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	Action
A registered program of the specified name does not exist.	Correctly enter a registered program name.

3.4 : Writing prohibited

Code : &H0304

Meaning/Cause	Action
The specified program is write protected.	Use a program that is not write protected.

3.5 : File type error

Code : &H0305

Meaning/Cause	Action
Software error occurred.	Contact our company with relevant information.

3.6 : Too many breakpoints

Code : &H0306

Meaning/Cause	Action
Setting of break point exceeding 4 points was attempted.	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	Action
Break point was not found during search.	Set a break point if needed.

3.9 : Cannot find strings

Code : &H0309

Meaning/Cause	Action
Could not find specified character string during search.	If needed change the character string and try searching again.

3.10 : Object program doesn't exist

Code : &H030A

Meaning/Cause	Action
The object program name is not registered.	Make an object program.

3.11 : Cannot use function

Code : &H030B

Meaning/Cause	Action
Unable to execute or unneeded hierarchy was selected.	—

3.12 : Cannot overwrite

Code : &H030C

Meaning/Cause	Action
In AUTO mode or PROGRAM mode, overwrite of a program being selected cannot be made by communication with a program of the same name.	1. Change the mode. 2. Change the program name.

A

3.13 : Changing data prohibited

Code : &H030D

Meaning/Cause	Action
Data cannot be changed because access level is not at 0.	Set the access level to 0.

3.14 : Cannot use mode

Code : &H030E

Meaning/Cause	Action
Specified mode cannot be changed because access level is set to level 2 or level 3.	Change the access level to 0 or 1.

3.15 : Illegal password

Code : &H030F

Meaning/Cause	Action
There is a mistake in the password entry.	Enter the correct password.

3.16 : Cannot reset ABS

Code : &H0310

Meaning/Cause	Action
Failed to perform absolute reset or return-to-origin correctly.	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	Action
Currently selected program cannot be deleted.	1. Cancel deletion of program. 2. Change the specified program.

3.18 : Duplicated Breakpoint

Code : &H0312

Meaning/Cause	Action
Setting of breakpoint was attempted on line already set with breakpoints.	To set the breakpoint, specify a line where breakpoints have not yet been set.

A

[4] Data entry and edit errors

4.1 : Point number error

Code : &H0401

Meaning/Cause	Action
A point number was entered exceeding P9999.	Input a correct point number.

4.2 : Input format error

Code : &H0402

Meaning/Cause	Action
Wrong format was used to enter the data.	Use the correct data format.

4.3 : Undefined pallet

Code : &H0403

Meaning/Cause	Action
Specified pallet is undefined.	1. Change the specified pallet. 2. Define the pallet.

4.4 : Undefined robot number

Code : &H0404

Meaning/Cause	Action
Specified robot number does not exist.	Enter a correct robot number.

4.5 : Undefined axis number

Code : &H0405

Meaning/Cause	Action
Specified axis number does not exist.	Enter a correct axis number.

4.6 : Invalid input number

Code : &H0406

Meaning/Cause	Action
Invalid data was entered. a. Invalid data was entered as the area check output port number for area check output. b. The same port number was set for “G1 status output (DO & SO)” and “G2 status output (DO & SO)” of electric gripper.	1. Enter a usable port number. 2. Enter different port numbers.

A

4.7 : Invalid input axis

Code : &H0407

Meaning/Cause	Action
Axis defined as "no axis" was selected as a double carrier axis.	Select an axis that is not defined as "no axis".

[5] Robot language syntax (compiling) errors

5.1 : Syntax error

Code : &H0501

Meaning/Cause	Action
Syntax error found in program.	Change to the correct syntax.

5.2 : Data error

Code : &H0502

Meaning/Cause	Action
Data entered in wrong format.	Input the data in the correct format.

5.3 : Number error

Code : &H0503

Meaning/Cause	Action
a. Mistake in the number entry. b. Expression value is wrong.	1. Change to the correct number. 2. Change to the correct value.

5.4 : Bit number error

Code : &H0504

Meaning/Cause	Action
Specified bit number is not within 0 to 7.	Change to the correct bit number.

5.5 : Port number error

Code : &H0505

Meaning/Cause	Action
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.	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	Action
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).	1. Change to the correct number of digits (places).
e. Cartesian coordinate point data has more than 3 decimal places.	2. Specify the Cartesian coordinate point data of up to 2 decimal places.

5.7 : Illegal axis name

Code : &H0507

Meaning/Cause	Action
Robot axis name is wrong.	Change to the correct axis name.

5.8 : Illegal order

Code : &H0508

Meaning/Cause	Action
Wrong bit specified for input/output port.	Change to ascending order starting from right.

5.10 : Too many characters

Code : &H050A

Meaning/Cause	Action
a. Character string was defined in excess of 75 characters. b. Addition to the character string total exceeds 75 characters.	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	Action
a. Parenthesis was used 6 times or continuously in an expression. b. Overflow in stack area for compiling/ execution.	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)

A

5.13 : Illegal variable

Code : &H050D

Meaning/Cause	Action
A variable other than a global variable was used in SEND/@READ/@WRITE commands.	Change to a global variable.

5.14 : Type mismatch

Code : &H050E

Meaning/Cause	Action
a. Expression does not match on both sides. b. Prohibited type constant/variable/ expression was used.	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	Action
Variable names for NEXT statement and corresponding FOR statement do not match.	Change so that FOR statement variable names match with NEXT statement variable names.

5.16 : WEND without WHILE

Code : &H0510

Meaning/Cause	Action
There is no WHILE statement corresponding to the WEND statement.	1. Delete the WEND statement. 2. Add a WHILE statement corresponding to the WEND statement.

5.17 : WHILE without WEND

Code : &H0511

Meaning/Cause	Action
There is no WEND statement corresponding to WHILE statement.	1. Delete the WHILE statement. 2. Add a WEND statement corresponding to the WHILE statement.

5.18 : NEXT without FOR

Code : &H0512

Meaning/Cause	Action
a. There is no FOR statement corresponding to NEXT statement. b. NEXT command was executed without executing FOR command.	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	Action
There is no NEXT statement corresponding to FOR statement.	1. Delete the FOR statement. 2. Add a NEXT statement corresponding to the FOR statement.

5.20 : ENDIF without IF

Code : &H0514

Meaning/Cause	Action
There is no IF statement corresponding to ENDIF statement.	1. Delete the ENDIF statement. 2. Add an IF statement corresponding to the ENDIF statement.

5.21 : ELSE without IF

Code : &H0515

Meaning/Cause	Action
There is no IF statement corresponding to ELSE statement.	1. Delete the ELSE statement. 2. Add an IF statement corresponding to the ELSE statement.

5.22 : IF without ENDIF

Code : &H0516

Meaning/Cause	Action
There is no ENDIF statement corresponding to IF statement.	1. Delete the IF statement. 2. Add an ENDIF statement corresponding to the IF statement.

5.23 : ELSE without ENDIF

Code : &H0517

Meaning/Cause	Action
There is no ENDIF statement corresponding to ELSE statement.	1. Delete the ELSE statement. 2. Add an ENDIF statement corresponding to the ELSE statement.

A

5.24 : END SUB without SUB

Code : &H0518

Meaning/Cause	Action
a. There is no SUB statement corresponding to END SUB statement. b. END SUB command was executed without SUB command.	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	Action
There is no END SUB statement corresponding to SUB statement.	1. Delete the SUB statement. 2. Add an END SUB statement corresponding to the SUB statement.

5.26 : Duplicated variable

Code : &H051A

Meaning/Cause	Action
Two or more array variables were defined for the same name.	Delete a definition statement for the array variables with the same name.

5.27 : Duplicated identifier

Code : &H051B

Meaning/Cause	Action
Two or more identifiers were defined for the same name.	Define another identifier.

5.28 : Duplicated label

Code : &H051C

Meaning/Cause	Action
Two or more of the same labels were defined.	Define another label.

5.29 : Undefined array

Code : &H051D

Meaning/Cause	Action
Assignment/reference was made for undefined array.	Define the undefined array.

5.30 : Undefined identifier

Code : &H051E

Meaning/Cause	Action
An undefined identifier was used.	Define an identifier for undefined identifier.

5.31 : Undefined label

Code : &H051F

Meaning/Cause	Action
Reference made to undefined label.	Set definition for undefined label.

5.32 : Undefined user function

Code : &H0520

Meaning/Cause	Action
Undefined function was called.	Set definition for undefined function.

5.34 : Too many dimensions

Code : &H0522

Meaning/Cause	Action
An array exceeding 3 dimensions was defined.	Change array to within 3 dimensions.

5.35 : Dimension mismatch

Code : &H0523

Meaning/Cause	Action
The number of array dimensions does not match that defined by the DIM statement.	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	Action
The number of SUB statement arguments does not correspond to the CALL statement.	Make the number of SUB statements correspond to the CALL statement.

A

5.37 : Specification mismatch

Code : &H0525

Meaning/Cause	Action
Cannot execute command under present robot specifications.	Change command for execution.

5.38 : Illegal option

Code : &H0526

Meaning/Cause	Action
Error is present in command option.	Change to a correct option.

5.39 : Illegal identifier

Code : &H0527

Meaning/Cause	Action
Reserved word was used as an identifier.	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	Action
Cannot execute command within procedure (from SUB to END SUB statements).	Delete command that cannot be executed within procedure.

5.41 : Illegal command outside proce.

Code : &H0529

Meaning/Cause	Action
Command cannot be executed outside of procedure (between SUB to END SUB statements).	Delete command that cannot be executed outside of procedure.

5.42 : Illegal command inside IF

Code : &H052A

Meaning/Cause	Action
Cannot execute command between IF to ENDIF statements. (Command can be executed for one IF statement line.)	Delete command that cannot be executed between IF to ENDIF statements.

5.43 : Illegal direct

Code : &H052B

Meaning/Cause	Action
Independent execution of command is impossible.	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	Action
Command cannot use an external label.	1. Change to an internal label. 2. Change execution command.

5.45 : Illegal program name

Code : &H052D

Meaning/Cause	Action
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.	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	Action
Number of identifiers exceeded 500.	Ensure the number of identifiers is within 500 items.

5.47 : CASE without SELECT

Code : &H052F

Meaning/Cause	Action
There is no SELECT statement corresponding to CASE statement.	1. Delete the CASE statement. 2. Add a SELECT statement corresponding to the CASE statement.

A

5.48 : END SELECT without SELECT

Code : &H0530

Meaning/Cause	Action
There is no SELECT statement corresponding to END SELECT statement.	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	Action
There is no END SELECT statement corresponding to SELECT statement.	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	Action
There is no END SELECT statement corresponding to CASE statement.	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	Action
Cannot execute command statement between SELECT and CASE statements.	Delete the command statement between SELECT and CASE statements.

5.52 : Command doesn't exist

Code : &H0534

Meaning/Cause	Action
Line does not have a command statement.	1. Add a command statement. 2. Delete the line that does not have a command statement.

5.53 : Compile failure

Code : &H0535

Meaning/Cause	Action
Error occurred in software	Report details of error to our company.

5.54 : ELSEIF without IF

Code : &H0536

Meaning/Cause	Action
There is no IF statement corresponding to ELSEIF statement.	1. Delete the ELSEIF statement. 2. Add an IF statement corresponding to the ELSEIF statement.

5.55 : ELSEIF without ENDIF

Code : &H0537

Meaning/Cause	Action
There is no ENDIF statement corresponding to ELSEIF statement.	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	Action
Execution of a non-supported or non-executable command was attempted.	Change to a command that can be executed.

6.2 : Illegal function call

Code : &H0602

Meaning/Cause	Action
The expression "ON <expression> GOTO"/"ON <expression> GOSUB" command was a negative value.	Change <expression> to a positive value.

6.3 : Division by 0

Code : &H0603

Meaning/Cause	Action
A command to divide by 0 (÷ 0) was attempted.	Change from the divide by 0 command.

6.4 : Point doesn't exist

Code : &H0604

Meaning/Cause	Action
Assignment/movement/reference to an undefined point was attempted.	Define the point.

A

6.5 : Coordinate type error

Code : &H0605

Meaning/Cause	Action
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.	1. Change to same coordinate system. 2. Change to Cartesian coordinate system.

6.6 : Subscript out of range

Code : &H0606

Meaning/Cause	Action
A subscript of an array variable has exceeded the range defined in DIM statement.	Change the subscript of array variable to within the defined range.

6.7 : RETURN without GOSUB

Code : &H0607

Meaning/Cause	Action
RETURN command was executed without executing the GOSUB command.	Confirm execution of GOSUB command.

6.8 : END SUB without CALL

Code : &H0608

Meaning/Cause	Action
END SUB command was executed without executing CALL command.	Confirm execution of SUB command.

6.9 : EXIT SUB without CALL

Code : &H0609

Meaning/Cause	Action
EXIT SUB command was executed without executing CALL command.	Confirm execution of SUB command.

6.10 : SUSPEND without START

Code : &H060A

Meaning/Cause	Action
SUSPEND command was executed for a task not executed by START command.	Confirm execution of START command.

6.11 : CUT without START

Code : &H060B

Meaning/Cause	Action
CUT command was executed for a task not executed by START command.	Confirm execution of START command.

6.12 : RESTART without START

Code : &H060C

Meaning/Cause	Action
RESTART command was executed for a task not executed by START command.	Confirm execution of START command.

6.13 : RESTART without SUSPEND

Code : &H060D

Meaning/Cause	Action
RESTART command was executed for a task not executed by SUSPEND command.	Confirm execution of SUSPEND command.

6.14 : Task number error

Code : &H060E

Meaning/Cause	Action
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.	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	Action
START command was executed for a task currently in operation.	Delete START command.

6.16 : Task suspending

Code : &H0610

Meaning/Cause	Action
START or SUSPEND command was executed for a task in pause (suspend) condition.	Delete START or SUSPEND command.

A

6.17 : Illegal command in error routine

Code : &H0611

Meaning/Cause	Action
Command which could not be executed was attempted within an error processing routine.	Delete the command which could not be executed.

6.18 : EXIT FOR without FOR

Code : &H0612

Meaning/Cause	Action
EXIT FOR command was executed without executing FOR command.	Confirm execution of FOR command.

6.19 : SUB without CALL

Code : &H0613

Meaning/Cause	Action
SUB command was executed without executing CALL command.	Confirm execution of CALL command.

6.20 : Not execute CALL

Code : &H0614

Meaning/Cause	Action
CALL command was not executed.	Confirm execution of CALL command.

6.21 : Same point exists

Code : &H0615

Meaning/Cause	Action
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.	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	Action
3 points of an MOVE C command were placed on a straight line.	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	Action
MOVE C command radius is less than 1mm.	Change MOVE C command to 1mm or more for circular arc radius.

6.24 : Circular arc radius too large

Code : &H0618

Meaning/Cause	Action
MOVE C command radius exceeded 5000mm (5 meters).	Change MOVE C command to within 5000mm (5 meters) for circular arc radius.

6.25 : Too low speed

Code : &H0619

Meaning/Cause	Action
Specified speed was too low so movement time exceeded 300 seconds. Maximum movement time is 300 seconds.	Increase the specified speed.

6.26 : No sufficient memory for OUT

Code : &H061A

Meaning/Cause	Action
Failed to run an OUT command due to insufficient memory caused by multiple OUT commands that were run in succession.	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	Action
Any of PATH L, PATH C and PATH END was executed without executing PATH SET.	First execute PATH SET when setting a path.

6.28 : PATH without END

Code : &H061C

Meaning/Cause	Action
PATH START was executed without executing PATH END.	Execute PATH END to end the path setting and then execute PATH START.

A

6.29 : No PATH data

Code : &H061D

Meaning/Cause	Action
No path is set for PATH motion.	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	Action
The number of PATH motion paths has exceeded 300.	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	Action
Robot's current position is not the start position of PATH motion.	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	Action
Cannot execute PATH motion. a. Acceleration zone distance is too short. b. Speed is too high in the position where the direction changes.	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	Action
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.	First perform absolute reset on the axes whose return-to-origin method is set to "Mark".

A

6.34 : MARK method is not allowed

Code : &H0622

Meaning/Cause	Action
Return-to-origin was attempted with an ORIGIN statement or dedicated input while the return-to-origin method for an incremental mode axis or semi-absolute mode axis is set to "Mark".	Return-to-origin on the incremental mode axis or semi-absolute mode axis cannot be performed by the mark method. Change the return-to-origin method.

6.35 : Expression value error

Code : &H0623

Meaning/Cause	Action
The expression value is other than -1 and 0 even though conditional expression is a numeric expression.	1. Set the expression value correctly. 2. Change the "TRUE condition" parameter setting.

[9] Memory errors

9.1 : Program destroyed

Code : &H0901

Meaning/Cause	Action
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.	1. Delete that program during selection. 2. Initialize the program data.

9.2 : Point data destroyed

Code : &H0902

Meaning/Cause	Action
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.	Initialize the point data.

9.3 : Memory destroyed

Code : &H0903

Meaning/Cause	Action
Error or malfunction occurred in the memory.	Initialize memory.

A

9.4 : Parameter destroyed

Code : &H0904

Meaning/Cause	Action
Part or all of the parameter data has been destroyed.	Initialize the parameter data.

9.5 : Illegal object code

Code : &H0905

Meaning/Cause	Action
An object program has been destroyed.	Compile and make an object program.

9.6 : Shift data destroyed

Code : &H0906

Meaning/Cause	Action
Part or all of the shift data has been destroyed.	Initialize the shift data.

9.7 : Hand data destroyed

Code : &H0907

Meaning/Cause	Action
Part or all of the hand data has been destroyed.	Initialize the hand data.

9.8 : POS.OUT data destroyed

Code : &H0908

Meaning/Cause	Action
Part or all of the POS.OUT data was destroyed.	Initialize the POS.OUT data.

9.9 : Pallet data destroyed

Code : &H0909

Meaning/Cause	Action
Part or all of the pallet definition data was destroyed.	Initialize the pallet definition data.

9.31 : Memory full

Code : &H091F

Meaning/Cause	Action
No available space in the program/point data area.	Delete unnecessary programs/points.

9.32 : Object memory full

Code : &H0920

Meaning/Cause	Action
Object program size exceeded the upper limit.	Compress the source program size, so that the object program size is smaller.

9.33 : Sys. generation destroyed

Code : &H0921

Meaning/Cause	Action
Part or all of the system generation data has been destroyed.	Remake the system generation data correctly.

9.34 : Sys. generation mismatch

Code : &H0922

Meaning/Cause	Action
Mistake made in specifying the robot type/axis number of system generation data.	Redo the system generation correctly.

9.35 : Program too big

Code : &H0923

Meaning/Cause	Action
Source program size exceeded the permissible size.	Compress the source program size.

9.36 : Task data destroyed

Code : &H0924

Meaning/Cause	Action
Part or all of the data used in a task has been destroyed.	Reset the program.

9.37 : Object program destroyed

Code : &H0925

Meaning/Cause	Action
Part or all of an object program has been destroyed.	Make the object program again.

A

9.38 : Sequence object memory full

Code : &H0926

Meaning/Cause	Action
Sequence object program exceeded its memory capacity.	Compress the source size of sequence program, so that the object program size is reduced.

9.39 : Sequence object destroyed

Code : &H0927

Meaning/Cause	Action
Part or all of the sequence object program has been destroyed.	Make the sequence object program again.

9.40 : Cannot found sequence object

Code : &H0928

Meaning/Cause	Action
No sequence object program.	Make the sequence object program.

9.41 : Local variable memory full

Code : &H0929

Meaning/Cause	Action
Number of local variables defined within subroutine has exceeded upper limit.	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	Action
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.	–

9.51 : Gripper origin data destroyed

Code : &H0933

Meaning/Cause	Action
Part or all of the data saved after completion of the return-to-origin of the electric gripper was destroyed.	Perform the return-to-origin of the electric gripper.

A

[10] System setting or hardware errors

10.1 : Robot disconnected

Code : &H0A01

Meaning/Cause	Action
Axis control was attempted with "no axis" specified for all axes of system generation.	Re-perform the system generation.

10.3 : D.unit disconnected

Code : &H0A03

Meaning/Cause	Action
Manual movement was attempted on the axis that is not specified.	Do not perform any axis-related operation.

10.6 : DRIVER.unit version mismatch

Code : &H0A06

Meaning/Cause	Action
Driver unit version does not match the CPU unit.	Make sure the CPU unit and driver unit versions match each other.

10.7 : CPU.unit version mismatch

Code : &H0A07

Meaning/Cause	Action
CPU unit version does not match the CPU.	Make sure the CPU unit and driver unit versions match each other.

10.8 : Cannot set auxiliary axis

Code : &H0A08

Meaning/Cause	Action
Setting of axis that cannot be set as an auxiliary axis was attempted. The following axes cannot be set as an auxiliary axis. • SCARA type robot axes • X and Y axes except on MULTI type robots	1. Do not set an auxiliary axis. 2. Change the axis setting.

A

10.9 : Cannot set no axis

Code : &H0A09

Meaning/Cause	Action
A no-axis setting was attempted on an axis which cannot accept it. The following axes cannot be set to no-axis. • X and Y axes except on MULTI type robots	1. Do not make a no-axis setting. 2. Change the axis setting.

10.10 : Cannot change axis

Code : &H0A0A

Meaning/Cause	Action
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	1. Do not change that axis. 2. Change a different axis.

10.13 : Cannot set Dualdrive

Code : &H0A0D

Meaning/Cause	Action
A dual drive setting was attempted on an axis that cannot be set to dual drive.	1. Do not set to dual drive. 2. Change the axis setting.

10.14 : Undefined parameter found

Code : &H0A0E

Meaning/Cause	Action
a. Undefined, wrong parameter data was written because controller data from different controller version was used. b. Parameter name is wrong.	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	Action
An attempt was made to set a YC-Link for an axis that is set to dual drive.	1. Do not set the YC-Link. 2. Change the axis setting.

10.17 : Cannot set Gripper

Code : &H0A11

Meaning/Cause	Action
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.	1. Do not set the gripper for such axis. 2. Change the setting axis.

10.18 : Cannot change auxiliary axis

Code : &H0A12

Meaning/Cause	Action
It was attempted to reset the auxiliary axis setting of the gripper set axis.	Do not reset the auxiliary axis setting.

10.19 : CPU soft version mismatch

Code : &H0A13

Meaning/Cause	Action
Combination of CPU board and software is wrong.	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	Action
a. System backup battery voltage is low. b. System backup battery is disconnected from CPU board.	1. Replace system backup battery. 2. Connect system backup battery securely to CPU board.

A

10.22 : STD.DIO DC24V power low

Code : &H0A16

Meaning/Cause	Action
a. DC 24V not supplied to STD.DIO connector. b. Drop in DC 24V being supplied for STD.DIO. c. STD.DIO connector is not connected.	1. Supply DC 24V 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 DC 24V supply. 4. If STD.DIO is not used, make the "Watch on STD.DIO DC 24V" parameter invalid in SYSTEM>PARAM>OTHER mode.

10.26 : Gripper software version mismatch

Code : &H0A1A

Meaning/Cause	Action
Software for gripper option board is incorrect.	Use the same software for 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	Action
a. Emergency stop button was pressed. b. Emergency stop terminals on SAFETY connector are open (emergency stop status). c. RPB or terminator are not connected to RPB connector. d. SAFETY connector is not connected.	1. Release the RPB emergency stop button. 2. Close the emergency stop terminals on SAFETY connector. 3. Connect RPB or terminator to RPB connector. 4. Attach the SAFETY connector.

A

12.2 : Interlock on

Code : &H0C02

Meaning/Cause	Action
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. DC 24V not supplied to STD.DIO connector. d. STD.DIO connector is not connected.	1. Cancel the interlock signal, and execute program or move axis. 2. Supply DC 24V to STD.DIO connector. 3. Connect the STD.DIO connector. 4. Disable the "Watch on STD.DIO DC24V" parameter when not using STD.DIO.

12.3 : Arm locked

Code : &H0C03

Meaning/Cause	Action
Movement of an arm was attempted while the arm lock variable LO was ON.	Clear the arm lock variable LO.

12.11 : CC-Link communication error

Code : &H0C0B

Meaning/Cause	Action
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.	1. Check for a break, misconnection or wiring error in CC-Link cable. 2. Check the station No. and communication baud rate setting. 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	Action
a. Error in CC-Link system communications due to noise pickup, etc. b. Master station sequencer (PLC) power is turned off or has stopped operating.	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.

A

12.16 : DeviceNet link error

Code : &H0C10

Meaning/Cause	Action
a. Error in cable for DeviceNet system.	1. Check for a break, misconnection or wiring error in DeviceNet cable, and check the specifications (cable length, etc.)
b. The DeviceNet system's MacID or communication speed setting is incorrect.	2. Check the MacID and communication speed settings.
c. No power supplied for communication.	3. Check whether the communication power is supplied.
d. The master PLC's power is turned off, has stopped operating, is not operating correctly or is damaged.	4. Check whether the master PLC is operating correctly.
e. Breakdown in DeviceNet compatible unit.	5. Replace the DeviceNet compatible unit.

12.17 : DeviceNet hardware error

Code : &H0C11

Meaning/Cause	Action
Breakdown in DeviceNet compatible unit.	Replace the DeviceNet compatible unit.

12.18 : Incorrect DeviceNet setting

Code : &H0C12

Meaning/Cause	Action
The MacID or communication speed setting is incorrect.	Check the MacID and communication speed settings.

12.19 : DeviceNet link error(Explicit)

Code : &H0C13

Meaning/Cause	Action
The DeviceNet board was reset by an Explicit message request (Reset request to Identity Obj) from the client (master PLC).	

12.21 : PROFIBUS link error

Code : &H0C15

Meaning/Cause	Action
a. Error in cable for PROFIBUS system.	1. Check for a break, misconnection or wiring error in PROFIBUS cable, and check the specifications (cable length, etc.)
b. The PROFIBUS system's station address setting is incorrect.	2. Check the station address settings.
c. The master station PLC power is turned off, or the PLC has stopped operating or is not operating correctly, or is broken.	3. Check whether the master station PLC is operating correctly. 4. Check the hardware configuration settings.
d. Breakdown in PROFIBUS compatible unit.	5. Replace the PROFIBUS compatible unit.

12.22 : PROFIBUS hardware error

Code : &H0C16

Meaning/Cause	Action
Breakdown in PROFIBUS compatible unit.	Replace the PROFIBUS compatible unit.

12.31 : DI DC24V disconnected

Code : &H0C1F

Meaning/Cause	Action
a. DC 24V not being supplied to DI section of OPT.DIO unit. b. Drop in DC 24V supply voltage to DI section of OPT.DIO unit. c. OPT.DIO connector is not connected.	1. Supply DC 24V to DI section of OPT.DIO. 2. Check for short, breakage or wiring error in OPT.DIO connector. 3. Check if a sufficient DC 24V is supplied to DI section of OPT.DIO unit.

12.32 : DO1 DC24V disconnected

Code : &H0C20

Meaning/Cause	Action
a. DC 24V not being supplied to DO1 section of OPT.DIO unit. b. Drop in DC 24V supply voltage to DO1 section of OPT.DIO unit. c. OPT.DIO connector is not connected.	1. Supply DC 24V 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 DC 24V supply to handle.

A

12.33 : DO2 DC24V disconnected

Code : &H0C21

Meaning/Cause	Action
a. DC 24V not being supplied to DO2 section of OPT.DIO unit. b. Drop in DC 24V supply voltage to DO2 section of OPT.DIO unit. c. OPT.DIO connector is not connected.	1. Supply DC 24V 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 DC 24V supply to handle.

12.34 : POS.OUT Point not exist

Code : &H0C22

Meaning/Cause	Action
Comparison point data does not exist.	Set comparison point data correctly.

12.35 : POS.OUT Point unit error

Code : &H0C23

Meaning/Cause	Action
Comparison points 1 and 2 do not use the same unit system.	Change them to the same unit system.

12.41 : EtherNet link error

Code : &H0C29

Meaning/Cause	Action
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.	 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	Action
Breakdown in EtherNet compatible unit.	Replace the EtherNet compatible unit.

12.70 : Incorrect option setting

Code : &H0C46

Meaning/Cause	Action
a. Error in DIP switch setting on option unit. b. Mismatched option units have been installed. c. Cannot identify the installed option unit.	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	Action
The remote command or command data is incorrect.	Check the remote command or command data.

12.80: Incorrect Indiv. Origin setting

Code : &H0C50

Meaning/Cause	Action
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.	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	Action
The same port number was set for the other parameters "G1 status output (DO & SO)" and "G2 status output (DO & SO)".	Set different port numbers for the other parameters "G1 status output (DO & SO)" and "G2 status output (DO & SO)".

A

[13] RPB errors

13.1 : RPB communication error

Code : &H0D01

Meaning/Cause	Action
Error occurred in communication with RPB.	1. Install the RPB correctly. 2. Replace the RPB. 3. Replace the controller.

13.2 : RPB parity error

Code : &H0D02

Meaning/Cause	Action
Abnormal data was entered in communication with RPB.	1. Install the RPB correctly. 2. Install the RPB in a good operating environment. (Do not install near sources of noise.)

13.11 : RPB version mismatch

Code : &H0D0B

Meaning/Cause	Action
RPB version does not match the controller, and connection refused.	Use an RPB version that matches the controller.

13.12 : RPB system error

Code : &H0D0C

Meaning/Cause	Action
Error occurred in communication with RPB.	1. Replace the RPB. 2. Replace the controller.

[14] RS-232C communication errors

14.1 : Communication error

Code : &H0E01

Meaning/Cause	Action
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.	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.

A

14.2 : Parity error

Code : &H0E02

Meaning/Cause	Action
During external communication via the RS-232C, an error occurred.	Check the communication parameter settings.

14.11 : Receive buffer overflow

Code : &H0E0B

Meaning/Cause	Action
Communication receive buffer exceeded permissible capacity.	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	Action
Could not sent data from controller because receive prohibit status of other party continued for more than 10 seconds.	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	Action
a. Off-line command character string in 1 line exceeded 80 letters. b. Command statement created with a remote command exceeded 80 letters.	1. Limit number of characters in 1 line for an off-line 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	Action
a. Character string in 1 line exceeded 75 letters. b. CR code (0Dh) was not added at end of line.	1. Limit number of characters in 1 line to 75 letters. 2. Add a CR code at the end of a single line.

A

14.22 : No start code (@)

Code : &H0E16

Meaning/Cause	Action
Starting code "@" was not added at beginning of single line in an on-line command.	Add starting code "@" at the beginning of on-line command.

14.23 : Illegal command,Operating

Code : &H0E17

Meaning/Cause	Action
During data editing, an on-line command was executed.	After completing data edit, execute an on-line command.

14.24 : Illegal command,Running

Code : &H0E18

Meaning/Cause	Action
During program run, a non-executable on-line command was attempted.	After stopping the program, execute the on-line system command which could not previously be executed.

14.25 : Illegal command in this mode

Code : &H0E19

Meaning/Cause	Action
Cannot execute the specified online command in the current mode.	1. Stop the online command. 2. Change the mode.

14.26 : Illegal command,SERVICE mode

Code : &H0E1A

Meaning/Cause	Action
Unable to execute since operation is in SERVICE mode.	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	Action
Communication port not specified.	Contact our company with details on this problem.

A

[15] Memory card errors

15.1 : Invalid file attribute

Code : &H0F01

Meaning/Cause	Action
a. Directory was accessed. b. Read/write protected file was accessed.	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	Action
Writing was attempted on a write protected file.	1. Change to another file. 2. Change to a file not write protected.

15.3 : Same file name already exists

Code : &H0F03

Meaning/Cause	Action
File name change was attempted but the same file name already exists.	Change it to an unused file name.

15.4 : File doesn't exist

Code : &H0F04

Meaning/Cause	Action
Loading of file was attempted but file name does not exist.	Change to a file name that currently exists.

15.11 : Directory full

Code : &H0F0B

Meaning/Cause	Action
The file storage capacity was exceeded.	1. Use a new memory card. 2. Change the directory to save. 3. Delete unnecessary files.

15.12 : Disk full

Code : &H0F0C

Meaning/Cause	Action
Write failed. No space is available on memory card. (File contents cannot be guaranteed.)	1. Use a new memory card. 2. Delete unnecessary files.

A

15.13 : Unformatted media

Code : &H0F0D

Meaning/Cause	Action
a. Memory card was not formatted. b. Wrong memory card format.	1. Format correctly. 2. Replace memory card backup battery.

15.14 : Media protected

Code : &H0F0E

Meaning/Cause	Action
Cannot write. Memory card has been set to write protect.	1. Change to allow writing. 2. Use another memory card.

15.15 : Media type mismatch

Code : &H0F0F

Meaning/Cause	Action
Memory card is unusable.	Replace the memory card.

15.16 : Media data destroyed

Code : &H0F10

Meaning/Cause	Action
All or part of data stored on memory card is damaged.	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	Action
Memory card not inserted correctly in slot.	Insert the memory card correctly. unit.

15.23 : Aborted

Code : &H0F17

Meaning/Cause	Action
STOP key was pressed during reading/ writing from or into memory card, and the operation halted.	—

A

15.24 : Media hardware error

Code : &H0F18

Meaning/Cause	Action
a. Memory card is defective b. Error occurred in controller.	1. Replace the memory card. 2. Replace the controller.

15.27 : Data read error

Code : &H0F1B

Meaning/Cause	Action
Failed to load file.	1. Try to reload the file. 2. Replace the memory card. 3. Replace the controller.

15.28 : Data write error

Code : &H0F1C

Meaning/Cause	Action
Failed to write file.	1. Try rewriting the file. 2. Replace the memory card. 3. Replace the controller.

15.29 : Timeout error

Code : &H0F1D

Meaning/Cause	Action
Failed to load/write file.	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	Action
Error occurred in software for driver unit.	Contact our company with details of the problem.

A

17.2 : Watchdog error (DRIVER)

Code : &H1102

Dedicated output : *2

Meaning/Cause	Action
a. Malfunction occurred in driver unit due to external noise. b. Controller is defective.	1. Turn the power on again. 2. Replace the controller.

17.3 : Over current

Code : &H1103

Dedicated output : *2

Meaning/Cause	Action
a. Short in motor cable. b. Malfunction occurred in motor.	1. Replace the motor cable. 2. Replace the motor.

17.4 : Over load

Code : &H1104

Dedicated output : *2

Meaning/Cause	Action
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.	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 DC 24V from SAFETY connector as power source for external loads.

17.5 : Over heat

Code : &H1105

Dedicated output : *2

Meaning/Cause	Action
Temperature in power module of driver unit exceeded 80°C.	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.

A

17.6 : P.E.counter overflow

Code : &H1106

Dedicated output : *2

Meaning/Cause	Action
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.	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 DC 24V from SAFETY connector as power source for driving external loads.

17.9 : Command error

Code : &H1109

Dedicated output : *2

Meaning/Cause	Action
Driver cannot identify commands from CPU.	Check the versions of the CPU unit and driver unit.

17.10 : Feedback error 1

Code : &H110A

Dedicated output : *2

Meaning/Cause	Action
Wiring of motor cable or ROB I/O cable is incorrect.	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	Action
Motor cable is broken.	Replace the motor cable or encoder cable.

A

17.16 : Over velocity 1

Code : &H1110

Dedicated output : *2

Meaning/Cause	Action
Axis movement speed exceeded the limit during linear interpolation, circular interpolation or manual orthogonal movement.	1. Reduce the acceleration. 2. Reduce the speed.

17.17 : Mode error

Code : &H1111

Dedicated output : *2

Meaning/Cause	Action
Driver unit is in abnormal control mode status.	Contact our company with details on the problem.

17.18 : DPRAM data error

Code : &H1112

Dedicated output : *2

Meaning/Cause	Action
2 tries at loading the dual port RAM failed.	Contact our company with details on the problem.

17.19 : Coord. value error

Code : &H1113

Dedicated output : *2

Meaning/Cause	Action
Error occurred during linear interpolation, circular interpolation or manual orthogonal movement.	Contact our company with details on the problem.

17.20 : Motor type error

Code : &H1114

Meaning/Cause	Action
A motor type unidentifiable by drive unit was selected.	1. Redo the system generation. 2. Replace the controller.

17.21 : Bad origin sensor

Code : &H1115

Meaning/Cause	Action
a. Origin sensor is defective. b. Origin sensor wiring is broken.	1. Replace the origin sensor. 2. Replace the ROB I/O cable.

A

17.22 : Bad PZ

Code : &H1116

Meaning/Cause	Action
a. Motor is defective. b. Resolver signal wire is broken.	1. Replace the motor. 2. Replace the ROB I/O cable.

17.28 : Dual P.E. counter overflow

Code : &H111C

Meaning/Cause	Action
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.	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	Action
Cannot perform positioning.	1. Turn the power off and then on again. 2. Replace the controller.

17.31 : Servo off

Code : &H111F

Meaning/Cause	Action
Movement command was attempted in servo OFF state.	Change status to servo ON.

17.33 : Busy now

Code : &H1121

Dedicated output : *2

Meaning/Cause	Action
a. Servo-Off command was attempted while the driver was stopped. b. Return-to-origin command was attempted before manual movement was complete.	1. Turn off the power to the controller and then turn it back on. 2. Wait until the command has finished.

A

17.34 : Servo on failed

Code : &H1122

Meaning/Cause	Action
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.	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	Action
The weight (sum of work weight + axis weight) on a particular robot axis exceeded the maximum payload of that axis.	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	Action
Servo-OFF processing failed because the drive unit had been stopped.	Turn the power off and then on again.

17.40 : Torque mode now

Code : &H1128

Meaning/Cause	Action
Manual movement attempted while in torque mode.	Cancel the torque mode.

17.73 : Resolver wire breakage

Code : &H1149

Meaning/Cause	Action
a. Resolver signal wire is broken. b. Motor malfunction occurred. c. Controller malfunction occurred.	1. Replace the ROB I/O cable. 2. Replace the motor. 3. Replace the controller.

17.78 : Power module error

Code : &H114E

Meaning/Cause	Action
a. Power module overheated. b. Power module/motor drew excessive current.	Lighten the load on the robot.

A

17.81 : ABS.battery wire breakage

Code : &H1151

Meaning/Cause	Action
a. Absolute battery cable is broken. b. Absolute battery cable is not connected. c. Drop in absolute battery voltage.	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	Action
a. Readout check of resolver electrical angle information failed twice. b. Over-acceleration occurs due to collision, etc.	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	Action
Backup position information did not match the resolver angle information when robot position information was recalculated at controller startup.	Perform absolute reset.

17.84 : Over velocity 2

Code : &H1154

Meaning/Cause	Action
Movement speed is too high during power-off of the controller.	Perform absolute reset.

17.85 : Backup position data error 2

Code : &H1155

Meaning/Cause	Action
Failed to read out the robot position data during start-up of the controller.	Perform absolute reset.

17.90 : DRIVE2 module type error

Code : &H115A

Meaning/Cause	Action
Motor specifications do not match current sensor specifications.	1. Replace the controller. 2. Redo the system generation.

A

17.91 : Cannot perform ABS.reset

Code : &H115B

Meaning/Cause	Action
Absolute reset was attempted at a position where absolute reset cannot be performed.	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	Action
a. Resolver signal line was disconnected or broken while power to the controller was cut off. (Same as when robot I/O connector is removed.) b. The controller was restarted, after resolver signal line was disconnected while the power was on. (Same as when robot 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.)	Perform absolute reset.

17.93 : Position backup counter overflow

Code : &H115D

Meaning/Cause	Action
Position information lost when motor speed (rotation) exceeded 4096 when controller power was cut off.	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, the port set by the "Battery alarm output port (DO & SO)" parameter turns on.

Meaning/Cause	Action
Battery for retaining absolute data is low or not installed.	1. Replace battery. 2. Install battery.

A

17.99 : Pole Search Error

Code : &H1163

Meaning/Cause	Action
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.	 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	Action
Power is not supplied to the controller cooling fan. a. An open-circuit fault occurred in the cable for the controller cooling fan. b. The ROB I/O cable has short-circuited. c. The controller has failed. An abnormal condition occurred in the controller cooling fan. d. The controller cooling fan has failed. e. The controller has failed.	 1. Replace the cable for the controller cooling fan. 2. Replace the ROB I/O cable. 3. Replace the controller. 4. Replace the controller cooling fan. 5. Replace the controller.

[19] YC-Link (SR1) related error

19.1 : OVER LOAD

Code : &H1301

Meaning/Cause	Action
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.	1. Reduce the load on the motor. Correct the payload or acceleration parameter. 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.

A

19.2 : OVER CURRENT

Code : &H1302

Meaning/Cause	Action
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.	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	Action
a. Ambient temperature around the controller is above 40°C. b. Excessive load on motor. c. Cooling fan stopped working. d. Thermal sensor failed.	1. Correct the ambient conditions so that temperature is below 40°C. 2. Lower the load on the motor. 3. Replace the controller. 4. Replace the controller.

19.4 : POWER DOWN

Code : &H1304

Meaning/Cause	Action
a. AC power line voltage is less than 80V. b. Momentary power outage occurred.	1. Use the correct AC line voltage. 2. Reset the alarm to resume operation.

19.5 : BATT.LOW-VOLTAGE

Code : &H1305

Meaning/Cause	Action
a. Battery connection is incorrect. b. Battery voltage is lower than specified.	1. Connect the battery correctly. 2. Replace the battery.

19.6 : 24V POWER OFF

Code : &H1306

Meaning/Cause	Action
Internal 24V circuit failure. Controller board failed.	Replace the controller.

19.7 : P.E. COUNTER OVER

Code : &H1307

Meaning/Cause	Action
Deviation counter error.	—

19.11 : SYSTEM FAULT

Code : &H130B

Meaning/Cause	Action
a. Driver was not recognized correctly at power-on. b. External noise has disrupted software program. c. RS-232C receiving buffer has overflown.	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	Action
a. Origin sensor connection is incorrect. b. Origin sensor wire broke or sensor became defective. c. Origin sensor dog (target) is not properly adjusted.	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	Action
a. Position detector failure. b. Phase Z detection error.	1. Replace the motor or robot. 2. Connect the ROB I/O cable correctly. Replace the ROB I/O cable.

19.14 : FEEDBACK ERROR 1

Code : &H130E

Meaning/Cause	Action
a. Controller position detection circuit failed. b. Position detector (motor) failed.	1. Replace the controller. 2. Replace the motor.

19.15 : FEEDBACK ERROR 2

Code : &H130F

Meaning/Cause	Action
a. ROB I/O cable connection is incorrect. b. ROB I/O cable broke.	1. Connect the ROB I/O cable correctly. 2. Replace the ROB I/O cable.

A

19.16 : ABNORMAL VOLTAGE

Code : &H1310

Meaning/Cause	Action
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.	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	Action
Controller board failed.	Replace the controller.

19.18 : FEEDBACK ERROR 3

Code : &H1312

Meaning/Cause	Action
Motor drive parts are mechanically locked.	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	Action
a. External noise has disrupted software program. b. CPU failure or malfunction.	1. Check the environment for noise. 2. Replace the controller.

19.21 : BAD NETWORK

Code : &H1315

Meaning/Cause	Action
a. Poor connection of communication cable b. Open-circuit fault of communication cable	1. Connect the communication cable securely. 2. Replace the communication cable.

19.23 : ABS.BAT.L-VOLTAGE

Code : &H1317

Meaning/Cause	Action
Absolute battery voltage is less than 3.1V.	Replace the absolute battery.

19.24 : ABS.DATA ERROR

Code : &H1318

Meaning/Cause	Action
Absolute search for "semi-absolute" ended abnormally.	Register the correct stroke length (PRM102). Initialize the parameters.

19.26 : FEEDBACK ERROR 4

Code : &H131A

Meaning/Cause	Action
a. Motor cable connection is incorrect. b. Motor cable broke or failed. c. Motor failed. d. Controller board failed.	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	Action
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.	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	Action
a. Poor connection of communication cable b. Open-circuit fault of communication cable c. Data destruction due to external noise	1. Connect the communication cable correctly. 2. Replace the communication cable. 3. Check the ambient conditions.

A

19.29 : NET DATA ERROR

Code : &H131D

Meaning/Cause	Action
Data destruction due to external noise	Check the ambient conditions.

19.32 : 12V POWER OFF

Code : &H1320

Meaning/Cause	Action
Internal 12V circuit failure Controller board failed.	Replace the controller.

19.33 : MAIN POWER OFF

Code : &H1321

Meaning/Cause	Action
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.	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	Action
a. AC line voltage is low. b. Power supply voltage setting (200V/100V) is incorrect.	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	Action
Driver board connection failure	Replace the controller.

19.40 : ABS.OS ERROR

Code : &H1328

Meaning/Cause	Action
—	—

A

19.41 : ABS.RO ERROR

Code : &H1329

Meaning/Cause	Action
ROB I/O cable broke during power-off.	—

19.42 : ABS.RE ERROR

Code : &H132A

Meaning/Cause	Action
ROB I/O cable broke during power-on.	—

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	Action
Absolute battery voltage is less than 2.5V.	Replace the absolute battery.

[20] iVY system errors

20.0 : Vision not installed

Code : &H1400

Meaning/Cause	Action
No robot vision function settings.	Check to see if the iVY board is properly connected.

20.1 : Vision init. error

Code : &H1401

Meaning/Cause	Action
Error occurred during iVY board initial processing.	Contact your YAMAHA representative, and provide the error condition details.

A

20.2 : Vision control mode error

Code : &H1402

Meaning/Cause	Action
Vision system robot language commands and parameter changes, etc., are not possible in the "Host PC" vision control mode.	Switch to the "Controller" vision control mode.

20.3 : Vision camera disconnected

Code : &H1403

Meaning/Cause	Action
Camera recognition problem.	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	Action
"Undefined" error occurred at iVY board.	Contact your YAMAHA representative, and provide the error condition details.

20.5 : Vision not ready

Code : &H1405

Meaning/Cause	Action
iVY board startup is in progress.	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	Action
Hardware error occurred at the iVY board.	Contact your YAMAHA representative, and provide the error condition details.

20.8 : Vision calibration error

Code : &H1408

Meaning/Cause	Action
Error occurred during camera calibration.	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	Action
Switching to the "Host PC" vision control mode is not possible during camera calibration.	Switch the mode after camera calibration is completed.

20.10 : Vision calibration not set

Code : &H140A

Meaning/Cause	Action
Incorrect calibration number specified.	1. Change the specified calibration number. 2. Perform a camera calibration setting operation.

20.11 : Vision calib. data type error

Code : &H140B

Meaning/Cause	Action
Mismatch between calibration data and the robot configuration.	1. Check the specified calibration number. 2. Specify the calibration setting operation again.

20.12 : Vision calib. data destroyed

Code : &H140C

Meaning/Cause	Action
Calibration data error occurred.	Contact your YAMAHA representative, and provide the error condition details.

20.13 : Vision no pattern data

Code : &H140D

Meaning/Cause	Action
No model has been registered for the specified model number.	1. Change the specified model number. 2. Register the model.

A

20.14 : Vision trigger timeout

Code : &H140E

Meaning/Cause	Action
Trigger timeout occurred.	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	Action
iVY board's disk is full.	Delete unnecessary image data from the iVY board.

20.16 : Vision parameter error

Code : &H1410

Meaning/Cause	Action
Incorrect parameter value specified.	Change the specified parameter value.

20.17 : Vision search timeout

Code : &H1411

Meaning/Cause	Countermeasure
Search ended due to timeout.	Change the timeout setting for the specified model.

20.50 : V_Plus not installed

Code : &H1432

Meaning/Cause	Countermeasure
No settings are made for the lighting control function and/or conveyor tracking function.	Check whether the lighting control board and tracking board are correctly connected.

20.51 : V_Plus Watchdog error

Code : &H1433

Meaning/Cause	Action
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.	Perform a restart power. If the restart fails to restore a normal condition, check the board connection condition and the board recognition at the RPB.

A

20.52 : V_Plus counter wire breakage

Code : &H1434

Meaning/Cause	Action
Disconnected encoder input cable detected.	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	Countermeasure
Tracking was attempted during tracking.	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	Countermeasure
A command that should be executed during tracking was executed while tracking is not in progress.	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	Countermeasure
The CTDRIVE statement was executed for the robot with no Z-axis.	Change the main robot setting to a robot with the third axis.

20.56 : V_Plus parameter error

Code : &H1438

Meaning/Cause	Countermeasure
The lighting control board parameter and/or tracking board parameter are incorrect.	Initialize the parameters and set them correctly.

20.57 : V_Plus calibration not set

Code : &H1439

Meaning/Cause	Countermeasure
Conveyor calibration data is not set.	Set the conveyor calibration data and re-execute calibration.

A

20.58 : V_Plus out of Tracking work area

Code : &H143A

Meaning/Cause	Countermeasure
Tracking was attempted after the first point data in the position monitoring array has passed the work area.	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	Countermeasure
Tracking was attempted while no data is registered in the position monitoring array.	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	Action
Software error occurred.	Contact our company with details of this problem.

21.2 : System error (srvmod)

Code : &H1502

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

21.3 : System error (TaskID)

Code : &H1503

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

A

21.4 : System error (drcom)

Code : &H1504

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

21.5 : System error (drmod)

Code : &H1505

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

21.6 : System error (Gen.Data)

Code : &H1506

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

21.10 : Watchdog error (CPU)

Code : &H150A

Dedicated output : *1

Meaning/Cause	Action
a. CPU malfunctioned due to external noise. b. Controller is defective.	1. Turn the power off and then on again. 2. Replace the controller.

21.11 : System error (EmgHalt)

Code : &H150B

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

21.12 : System error (RTOS)

Code : &H150C

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

A

21.13 : System error (CRFPOS)

Code : &H150D

Meaning/Cause	Action
Current position of driver does not match the instructed position.	1. Replace the driver. 2. Replace the controller.

21.14 : DPRAM error (PTP data)

Code : &H150E

Meaning/Cause	Action
Failed to write PTP command data into driver.	1. Replace the driver. 2. Replace the controller.

21.15 : System error (Gripper)

Code : &H150F

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

21.41 : System error (EXCEPTION)

Code : &H1529

Meaning/Cause	Action
Software error occurred.	Contact our company with details of this problem.

[22] Major hardware errors

22.1 : AC power low

Code : &H1601

Dedicated output : *1

Meaning/Cause	Action
a. AC supply voltage dropped below 85% of rated voltage. b. Power source has insufficient capacity.	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.

A

22.3 : DC24V power low

Code : &H1603

Dedicated output : *1

Meaning/Cause	Action
a. DC 24V power supply malfunctioned and the voltage dropped.	1. Replace the controller.
b. Electromagnetic brake for vertical axis is defective.	2. Replace the vertical axis electromagnetic brake.
c. Wiring for electromagnetic brake of vertical axis is wrong.	3. Replace the ROB I/O cable.
d. Short in DC 24V for safety connector.	4. Check the SAFETY connector wiring.

22.9 : Abnormal over voltage

Code : &H1609

Meaning/Cause	Action
a. Output voltage for motor power supply exceeded 420 volts.	1. Check the power supply voltage.
b. Regenerative unit not connected to controller.	2. Connect the regenerative unit.
c. Regenerative unit safety device triggered due to temperature rise (120°C or more) in regeneration damping resistor.	3. Lower the robot operating duty.
d. Cable connecting regenerative unit and controller is defective.	4. Replace the RGEN cable.
e. Regenerative unit is defective.	5. Replace the regenerative unit.
f. Safety connector is used incorrectly.	6. Do not supply DC 24V to SAFETY connector from external source.

22.10 : Abnormal drop in voltage

Code : &H160A

Meaning/Cause	Action
a. Output voltage for motor power supply dropped below 140V.	1. Check the power supply voltage.
b. Power supply has insufficient capacity.	2. Check if supply voltage drops during robot operation. 3. Lower the robot duty cycle.
c. Vertical axis electromagnetic brake is defective.	4. Replace the vertical axis electromagnetic brake.
d. SAFETY connector is used incorrectly.	5. Do not supply DC 24V to SAFETY connector from external source. 6. Do not use DC 24V from SAFETY connector as power source for driving external loads.

A

22.12 : Abnormal temperature

Code : &H160C

Dedicated output : *1

Meaning/Cause	Action
Controller internal temperature rose to 60°C or more.	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	Action
Could not acquire access rights to dual port RAM.	Replace the controller.

22.14 : Abnormal DRIVER unit error

Code : &H160E

Dedicated output : *1

Meaning/Cause	Action
Error occurred in hardware.	Contact our company with details of the problem.

22.20 : DRIVER unit disconnected

Code : &H1614

Dedicated output : *1

Meaning/Cause	Action
a. CPU unit could not recognize driver unit. b. Dual port RAM is defective.	Replace the controller.

22.30 : DRIVER unit abnormality

Code : &H161E

Dedicated output : *1 or *2

Meaning/Cause	Action
a. Wrong DIP switch setting on drive unit. b. Drive unit not operating correctly. c. Dual port RAM is defective.	Replace the controller.

22.40 : PCMCIA interface overtime

Code : &H1628

Dedicated output : *1

Meaning/Cause	Action
Failed to acquire access privilege for PCMCIA interface.	1. Replace the PCMCIA interface driver. 2. Replace the controller.

22.41 : OPT.1 interface overtime

Code : &H1629

Dedicated output : *1

Meaning/Cause	Action
Failed to acquire access privilege for interface with option board connected to option slot 1.	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	Action
Failed to acquire access privilege for interface with option board connected to option slot 2.	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	Action
Failed to acquire access privilege for interface with option board connected to option slot 3.	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	Action
Failed to acquire access privilege for interface with option board connected to option slot 4.	1. Replace the option board connected to option slot 4. 2. Replace the controller.

A

22.45 : DRIVER interface overtime

Code : &H162D

Dedicated output : *1

Meaning/Cause	Action
Failed to acquire access privilege for interface with driver.	1. Replace the driver. 2. Replace the controller.

22.50 : YC-Link disconnect

Code : &H1632

Meaning/Cause	Action
The secondary station connection test failed at primary station startup. a. The secondary station power is OFF.	1. Configure so that the secondary station power switches ON before or simultaneously with the primary station power ON.
b. The YC-link communication cable and terminal resistor are disconnected.	2. Verify that the YC-link cable and the terminal resistor are connected.
c. The secondary station's "station No." setting is incorrect.	3. Check the station No. settings.

22.51 : YC-Link error

Code : &H1633

Meaning/Cause	Action
The secondary station failed to start properly. a. Secondary station communication failure.	Verify that the YC-link cable and the terminal resistor are connected.

22.52 : YC-Link type error

Code : &H1634

Meaning/Cause	Action
Mismatch between the secondary station specifications and the setting. a. The secondary station controller (SR1) specifications (SR1-X/SR1-P) or the current sensor specifications have been changed (controller was replaced).	1. Check the connected SR1 type, and the current sensor specifications. 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	Action
Mismatch between the secondary station robot No. and the setting. a. The secondary station controller setting was changed, or the controller was replaced.	1. Verify that the correct SR1 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	Action
Mismatch between the secondary station parameter and the setting. a. The secondary station parameter setting was changed, or the controller was replaced.	1. Verify that the correct SR1 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	Action
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.	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	Action
The secondary station is in emergency stop.	Release the secondary station emergency stop.

22.70 : Gripper disconnect

Code : &H1646

Meaning/Cause	Action
It was attempted to execute a gripper dedicated robot language command even though the gripper option was not set.	Set the gripper option.

A

22.71 : Gripper timeout error

Code : &H1647

Meaning/Cause	Action
Execution of the command sent to the gripper control board ended due to timeout.	Contact our company with details of this problem.

22.72 : Gripper cannot get error

Code : &H1648

Meaning/Cause	Action
It was failed to obtain the error that occurred in the gripper main body.	Contact our company with details of this problem.

22.73 : Gripper not initialized

Code : &H1649

Meaning/Cause	Action
The gripper initial setting was not complete.	Execute the initial setting of the gripper axis using the generation.

22.74 : Gripper DC24V power low

Code : &H164A

Meaning/Cause	Action
The DC24V power voltage of the gripper dropped.	Check the DC24V power voltage.

[26] Alarm messages (major errors) that occurred in electrical gripper

26.1 : Gripper Over load

Code : &H1A01

Meaning/Cause	Action
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.	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	Action
The motor overcurrent occurred. a. The motor cable was short-circuited.	1. Inspect the electric continuity of the motor cable. If any fault is found, replace the motor.
b. The gripper control board was faulty.	2. Replace the gripper control board.
c. The parameter was faulty.	3. Initialize the parameters.

26.3 : Gripper Machine reference over

Code : &H1A03

Meaning/Cause	Action
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 RCX240 controller was replaced. d. The CPU software version for the RCX240 controller was changed.	1. Perform the return-to-origin again.
e. Struck an obstacle while returning to the origin point.	2. Remove the obstacle and perform the return-to-origin again.
f. The encoder Z-phase had faulty wiring or malfunctioned. g. The gripper drive section or transmission section malfunctioned.	3. Replace the gripper main body.

26.4 : Gripper Power supply voltage low

Code : &H1A04

Meaning/Cause	Action
The DC power voltage dropped to 80% or less of the rated value.	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	Action
a. Mechanical lock occurred in the gripper drive part.	1. Check the gripper drive part for mechanical lock.
b. The motor cable had faulty wiring or incorrect wiring.	2. Check the motor and encoder cable connections.
c. The parameter was faulty.	3. Initialize the parameters.

A

26.7 : Gripper Internal fault

Code : &H1A07

Meaning/Cause	Action
Error occurred inside the gripper control board.	Contact our company with details of this problem.

26.8 : Gripper 24V Power off

Code : &H1A08

Meaning/Cause	Action
a. DC24V power cable was not connected. b. DC24V power was not supplied. c. DC24V power cable had faulty wiring.	1. Check the DC24V power cable connection. 2. Check the DC24V power. 3. Check the DC24V power cable.

26.9 : Gripper System fault 1

Code : &H1A09

Meaning/Cause	Action
The software entered the runaway status due to external noise.	Contact our company with details of this problem.

26.10 : Gripper Feedback error 1

Code : &H1A0A

Meaning/Cause	Action
a. The finger overrun the software limit due to external force. b. The encoder counting was incorrect due to external noise.	1. Turn on the power to check that no external force is applied. After that, perform the return-to-origin. 2. Contact our company with details of this problem.

26.11 : Gripper Feedback error 2

Code : &H1A0B

Meaning/Cause	Action
a. The encoder cable has faulty wiring. b. The guide block was locked.	1. Check the encoder cable connections. 2. Unlock the guide block.

26.12 : Gripper Abnormal voltage

Code : &H1A0C

Meaning/Cause	Action
a. The power voltage increased by regeneration. b. The DC24V power voltage was incorrect.	1. Decrease the duty of the mechanism part. 2. Check the capacity of the DC24V 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	Action
The software entered the runaway status due to external noise.	Contact our company with details of this problem.

26.14 : Gripper Feedback error 3

Code : &H1A0E

Meaning/Cause	Action
The motor cable had faulty wiring or incorrect wiring.	Check the motor cable connections.

[27] Error messages that occurred in electrical gripper

27.32 : Gripper Soft limit over

Code : &H1B20

Meaning/Cause	Action
The operation position exceeded the software limit set by the parameter.	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	Action
The return-to-origin was not performed.	Perform the return-to-origin to put the gripper in the return-to-origin completion status.

A

27.36 : Gripper Servo off

Code : &H1B24

Meaning/Cause	Action
A movement command was executed in the servo off status.	Turn on the servo.

27.37 : Gripper Interlock

Code : &H1B25

Meaning/Cause	Action
It was attempted to execute a program or move an axis in the interlock status.	Reset the interlock and execute the program or move the axis.

27.50 : Gripper Data error

Code : &H1B32

Meaning/Cause	Action
The option data, such as movement command to be sent to the gripper control board exceeded the input range.	Restart the system generation.

27.51 : Gripper type error

Code : &H1B33

Meaning/Cause	Action
It was attempted to initialize with an unspecified actuator type.	Enter a correct value for the gripper axis number.

27.52 : Gripper Internal failure

Code : &H1B34

Meaning/Cause	Action
a. The DC24V power was not turned on. b. An error occurred in the gripper control board.	1. Check the DC24V power. 2. Contact our company with details of this problem.

1.2 RPB error messages

When a hardware error or a software error occurs in the RPB, the following messages are highlighted (shown with reversed background) on the guideline of the lowest line of the screen.

RPB TRAP!!

Contents : Undefined operation code was executed.
Cause : A hardware error occurred.
Action : Replace the RPB.

RPB Receive Error!! (Data Register Full)

Contents : Data receive register is full.
Cause : A hardware error occurred.
Action : Replace the RPB.

RPB 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 RPB cable.
3. Replace the RPB.

RPB 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 RPB cable.

RPB Receive Error!! (Framing Error)

Contents : Framing error occurred during communication.
Cause : Malfunction occurred due to noise.
Action : Separate equipment away from noise source.

RPB 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 RPB.
2. Replace the controller.

RPB 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 RPB cable.
2. Replace the RPB.
3. Replace the controller.

RPB 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 RPB cable.
2. Replace the RPB.
3. Replace the controller.

RPB 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 RPB cable.
2. Replace the controller.

RPB 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 RPB cable.
2. Replace the controller.

RPB Memory Error!! (DATA Write Error)

Contents : Internal memory is defective.
Cause : Internal memory circuit is defective.
Action : Replace the RPB.

RPB 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 RPB.
2. Replace the controller.

A

2. Troubleshooting

2.1 When trouble occurs

Please contact our company 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:RCX240 + regenerative unit • Robot model name + serial No. example:YK250X • 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 RPB 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. • RPB operating status example: Keys won't function Response after pressing key is slow Only the emergency stop switch 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 RPB is connected, the error message appearing on the screen is a valuable source of information for troubleshooting.

A

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 RPB

Step 1 ***Press the F5 (DIAGNOS) key in "SYSTEM" mode.***

Step 2 ***Check the controller error status or error history.***

To check controller error status, press the F1 (DIAGNOS) key.

A maximum of 12 error histories are displayed.

To check a particular error history, press the F2 (HISTORY) key.

A maximum of 500 error histories can be checked.

2.2.2 Acquiring information from the RS-232C

Step 1 ***Connect the robot controller to the PC with the RS-232C cable.***

Step 2 ***Set the communication conditions.***

Step 3 ***Send the command.***

Send "@READ LOG" from the PC to receive the internal error history in the robot 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 RPB display.	• RPB not connected. • Wrong RPB connection. • RPB malfunctioning. • Problem in controller internal power supply.	• Check RPB connector. • Check how RPB connector is inserted. • Replace RPB and check operation.	• Plug in RPB connector correctly. • Replace the RPB. • Replace the controller.
3	Controller turns on but "ERR" LED on front panel lights up.	• Now in emergency stop.	• Connect the RPB and check the error history. • Check the DI00 (Emergency stop input) status on the RPB display screen.	• Release RPB emergency stop switch. • Insert RPB connector. • Connect the emergency stop terminal of SAFETY connector.
		• Error of error group No. 17 occurred.	• Connect the RPB and check the error history.	• 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 RPB and check the error history.	• Check the cause from the error information. • Eliminate the cause of the error.

A

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 DC 24V is supplied. • Check the DI11 (Interlock) status on the RPB display screen.	• Connect the standard I/O interface connector for interlock signal. • Connect the DC 24V power supply. • Disable interlock signal with the parameter.
		• Robot is in emergency stop.	• Connect the RPB and check error. information. • Check the DI00 (Emergency stop input) status on the RPB display screen.	• Release RPB emergency stop switch. • Plug in RPB connector. • Connect RPB emergency stop terminal of SAFETY connector.
		• Error occurred.	• Connect the RPB and check error info • 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 RPB 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.

	Symptom	Possible cause	Check items	Corrective action
3	Position deviation occurred. • There are 2 main types of position deviation. 1.Electrical position deviation 2.Mechanical position deviationIn 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.	• 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 robot I/O cable.	• Ground the robot and controller. • Isolate from noise sources around robot. • Isolate from noise sources around robot 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.

A

3. I/O operation

	Symptom	Possible cause	Check items	Corrective action
1	Won't operate even when dedicated input signal is supplied.	• No DC24V supply.	• Check that DC 24V is supplied from standard I/O interface connector. • Check DI04 on RPB screen.	• Supply DC 24V.
		• 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 RPB and check robot settings in SYSTEM mode. • 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 DC24V supply.	• Check that DC 24V is supplied from standard I/O interface connector. • Check DI04 on RPB screen.	• Supply DC 24V.
		• 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 RPB and check robot settings in SYSTEM mode. • 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 DC24V supply.	• Check that DC 24V is supplied from standard. I/O interface connector. • Check DI04 on RPB screen. • Check that DC 24V is supplied for option I/O interface.	• Supply DC 24V.
		• 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 RPB and 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.

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Revision record

Manual version	Issue date	Description
Ver. 2.00	Dec. 2009	Addition and correction of explanations in "Chapter 1 Using the Robot Safely". Correction of connection example in "Chapter 7 SAFETY I/O interface". Correction of the table in "Chapter 9 Specifications". Clerical error corrections, etc.
Ver. 2.01	Mar. 2010	Addition and correction of explanations in Chapter 1 "2. Particularly important cautions". Addition of explanations on installation location. Clerical error corrections, etc.
Ver. 2.02	Aug. 2010	Addition of communication mode parameter to Ethernet option board parameter. Addition of parameters regarding YRG series to other parameters. Addition of error messages. Clerical error corrections, etc.
Ver. 2.03	Jan. 2011	Chapter 1 "8. Freeing a person caught by the robot" was added. Supplemental remarks regarding installation was added. The description regarding "Warranty" was changed. Clerical error corrections, etc.
Ver. 2.04	Jun. 2011	Addition of "Manual move mode" to Other parameters. Some error messages were added and changed, etc.
Ver. 2.05	Dec. 2011	Error messages "[26] Alarm messages (major errors) that occurred in electrical gripper" and "[27] Error messages that occurred in electrical gripper" were added or changed. A description of electric grippers was added. Drawing of "4.1 Power supply connection example" in Chapter 3 was changed. Descriptions of "1.8.2 Return-to-origin" and "1.8.3 Absolute reset" in Chapter 6 were changed, etc.
Ver. 2.06	Jul. 2012	“[4] Maximum speed setting” and “[5] Duty” were added to the section on “Before using the controller”. “17. DO cond. on PGM reset / RESCDO” was added to “12. SYSTEM mode” in Chapter 4. “Load” and “Residual voltage” were added to “3. Ratings” in Chapter 6. The description regarding "Warranty" was changed. Conforms to the contents of the RCX240 user’s manual Ver. 1.00 and RCX240 operation manual Ver. 1.00.

User's Manual

4-axis Robot Controller

RCX240

Jul. 2012
Ver. 2.06

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