Introduction

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

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

Refer to the "Programming Manual" for detailed information on robot programs.
Safety precautions (Be sure to read before using)

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. Warning and caution items listed in this manual relate to YAMAHA robot controllers. When this robot controller is used in a robot controller system, please take appropriate safety measures as required by the user’s individual system.

This manual classifies safety caution items and operating points into the following levels, along with symbols for signal words “WARNING”, “CAUTION” and “NOTE”.

**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 software.

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

Note that the items classified into “CAUTION” might result in serious injury depending on the situation or environmental conditions. So always comply with CAUTION and WARNING instructions since these are essential to maintain safety.

Keep this manual carefully so that the operator can refer to it when needed. Also make sure that this manual reaches the end user.

When installing the RCX141 robot controller, please take into account all the instructions and precautions described in Chapter 3, "Installation".
[System design safety points]

**WARNING**
- Refer to this manual for details on the operating status of the robot controller and to related instruction manuals. Design and configure the system including the robot controller so that it will always work safely.
- The robot controller has an emergency stop terminal to trigger emergency stop. Using this terminal, prepare a physical interlock circuit so that the system including the robot controller will work safely.

**CAUTION**
- Do not bundle control lines or communication cables together or in close contact with the robot controller main circuit or power lines. As a general rule, separate them by at least 100mm. Noise in the main circuit or power lines may cause faulty operation or malfunctions.
- Data (programs, point data, etc.) stored in the robot controller is not guaranteed to be unchanged, so be sure to back it up onto an external storage device.

[Installation safety points]

**WARNING**
- Securely install the connectors into the robot controller, and when wiring the connectors, make the crimp, press-contact or solder connections correctly using the tool specified by the manufacturer.
- Always shut off all phases of the power supply externally before starting installation or wiring work. Failure to shut off all phases could lead to electrical shocks or product damage.

**CAUTION**
- Use the robot controller within the environment specifications listed in this manual. Using the controller in an environment outside the specification range could lead to electrical shocks, fires, malfunctions, product damage or lower performance.
- Never directly touch the conductive sections or electronic components other than the rotary switches and DIP switches on the outside panel of the robot controller.
- Securely attach each connector cable connector into the receptacles or sockets. Poor connections will cause faulty operation or malfunctions.

[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 could lead to electrical shocks or product damage.
- Always attach the terminal cover (supplied) before turning on the power to the robot controller after installation and wiring work are complete. Failure to attach the terminal cover could lead to fire, electrical shock, product damage or malfunctions.

**CAUTION**
- Tighten the terminal screws within the specified torque ranges. A loose terminal screw could lead to short-circuit, faulty operation or malfunctions. However, if the terminal screw is too tight, short-circuit, faulty operation or malfunctions could also occur due to screw damage.
- Make sure that no foreign matter such as cutting chips or wire scraps do not enter the robot controller.
- 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 might damage the connector or cables, and poor cable contact may lead to faulty operation or malfunctions.
- When disconnecting the cable, 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 lead to faulty operation or malfunctions.
[Start-up and maintenance safety points]

**WARNING**
- Only personnel trained in safety and robot operation may operate it.
- Never allow anyone to enter the robot movement range when the robot controller is turned on. Serious accidents including fatal injury or death might otherwise result.
- This robot controller is not designed to be explosion-proof. Do not use it in locations exposed to inflammable gases, gasoline or solvent that could cause explosion or fire.
- Do not touch any electrical terminal while power is supplied to the robot controller. This might cause electrical shocks, faulty operation or malfunctions.
- Always shut off all phases of the power supply externally before cleaning or tightening the terminal screws. Failure to shut off all phases could lead to electrical shocks, product damage or malfunctions. A loose screw could lead to parts dropping out, short circuits or malfunctions. If the screw is too tight, short circuits or malfunctions could also occur due to screw damage.
- Never disassemble or modify the robot controller. This may lead to breakdowns, malfunctions, injury or fire.
- Always shut off all phases of the power supply externally before installing or removing an option board. Failure to shut off all phases could lead to breakdowns or malfunctions.
- When using ferrite cores for noise elimination, fit them to the power cable as close to the robot controller as possible to prevent faulty operation or malfunctions due to noise.
- When performing maintenance of the robot controller under instructions from the YAMAHA or YAMAHA sales dealer, turn off the robot controller and wait for at least 30 minutes. Some components in the robot controller may be hot or still retain a high voltage shortly after operation, so burns or electrical shocks may occur if those parts are touched.

[Precautions for disposal]

**CAUTION**
- When disposing of this product discard it as industrial waste.

[Other precautions]

**CAUTION**
- Please note that the state of California USA has legal restrictions on the handling of manganese dioxide lithium batteries. See the following website for more information:
  http://www.dtsc.ca.gov/hazardouswaste/perchlorate

This manual does not constitute a concession of rights or a guarantee of industrial rights. Please acknowledge that we bear no liability whatsoever for conflicts with industrial rights arising from the contents of this manual.

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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 may cause abnormal robot operation (vibration, noise) when the power is turned on.

[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.

[2] 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
Refer to “4. Connecting to the power” in Chapter 3, “Installation”.

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 compatibility, 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.
Contents

Chapter 1 Safety
1. Safety ........................................................................................................ 1-1
   1.1 Safety precautions during robot operation ........................................... 1-2
   1.2 Safety precautions during maintenance ............................................... 1-2
   1.3 Motor overload precautions ................................................................ 1-2
   1.4 Warning labels .................................................................................... 1-3
   1.5 Warning marks .................................................................................. 1-3
2. Warranty .................................................................................................... 1-4
3. Operating environment ............................................................................... 1-5

Chapter 2 System overview
1. System overview ........................................................................................ 2-1
   1.1 Main system configuration ................................................................ 2-1
   1.2 Axis definition for the RCX141 .......................................................... 2-3
2. Part names and functions ........................................................................ 2-4
   2.1 RCX141 (Maximum number of axes: 4 axes) ...................................... 2-4
3. Controller system .................................................................................... 2-5
4. Optional devices ...................................................................................... 2-6
   4.1 MPB programming box ...................................................................... 2-6
   4.2 Expansion I/O board ......................................................................... 2-6
   4.3 Regenerative unit ............................................................................. 2-6
5. Basic sequence from installation to operation ........................................ 2-7

Chapter 3 Installation
1. Unpacking .................................................................................................. 3-1
   1.1 Packing box ...................................................................................... 3-1
   1.2 Unpacking ......................................................................................... 3-1
2. Installing the robot controller .................................................................. 3-2
   2.1 Installation ....................................................................................... 3-2
   2.2 Installation methods ......................................................................... 3-3
3. Connector names ...................................................................................... 3-5
4. Connecting to the power ......................................................................... 3-6
   4.1 AC200 to 230V single-phase specifications ...................................... 3-6
   4.2 Power capacity ................................................................................ 3-6
   4.3 Installing an external leakage breaker .............................................. 3-8
   4.4 Installing a circuit protector .............................................................. 3-8
   4.5 Installing a current control switch ..................................................... 3-8
5. Connecting the robot cables ..................................................................... 3-9
6. Connecting the MPB programming box ................................................. 3-10
7. I/O connections ....................................................................................... 3-11
8. Connecting a host computer .................................................................... 3-12
Chapter 4 Operation

1. Operation overview.................................................................4-1

2. The RCX robot controller ...................................................4-2
   2.1 Part names ........................................................................... 4-2
   2.2 Main functions ..................................................................... 4-2

3. MPB programming box .........................................................4-3
   3.1 Part names ........................................................................... 4-3
   3.2 Main functions ..................................................................... 4-4
   3.3 Connection to the robot controller ................................. 4-5

4. Turning power on and off ......................................................4-6

5. Operation keys ........................................................................4-7
   5.1 MPB screen ............................................................... 4-7
   5.2 Operation key layout .................................................. 4-8
   5.3 Basic key operation ................................................ 4-9
   5.4 Function keys ............................................................. 4-10
   5.5 Control keys ............................................................... 4-12
   5.6 Data keys ....................................................................... 4-14
   5.7 Other keys ....................................................................... 4-14

6. Emergency stop ......................................................................4-15
   6.1 Emergency stop reset .................................................. 4-16

7. Mode configuration ...............................................................4-18
   7.1 Basic operation modes ................................................ 4-18
   7.2 Other operation modes ................................................ 4-19
   7.3 Mode hierarchy ............................................................... 4-20

8. “SERVICE” mode .................................................................4-24
   8.1 Operation device .......................................................... 4-24
   8.2 Prohibition of “AUTO” mode operation ..................... 4-24
   8.3 Hold-to-Run function .................................................... 4-24
   8.4 Limitations on robot operating speed ......................... 4-24

9. “AUTO” mode ....................................................................4-25
   9.1 Automatic operation ..................................................... 4-28
   9.2 Stopping the program .................................................... 4-29
   9.3 Resetting the program ................................................... 4-30
   9.4 Switching task display ................................................... 4-32
   9.5 Switching the program ................................................... 4-33
10. "PROGRAM" mode ................................................................. 4-46

10.1 Scrolling a program listing ................................................. 4-47
10.2 Program editing ................................................................. 4-48
  10.2.1 Cursor movement ........................................................ 4-50
  10.2.2 Insert/Overwrite mode switching ................................. 4-50
  10.2.3 Inserting a line ............................................................ 4-51
  10.2.4 Deleting a character .................................................... 4-51
  10.2.5 Deleting a line ............................................................. 4-52
  10.2.6 User function key display .......................................... 4-52
  10.2.7 Quitting program editing ............................................ 4-53
  10.2.8 Specifying the copy/cut lines ...................................... 4-53
  10.2.9 Copying the selected lines ......................................... 4-53
  10.2.10 Cutting the selected lines .......................................... 4-54
  10.2.11 Pasting the data ....................................................... 4-54
  10.2.12 Backspace ............................................................... 4-54
  10.2.13 Line jump .................................................................. 4-55
  10.2.14 Searching a character string ..................................... 4-56
10.3 Directory ............................................................................. 4-57
  10.3.1 Cursor movement ........................................................ 4-58
  10.3.2 Registering a new program name ............................... 4-58
  10.3.3 Directory information display .................................... 4-59
  10.3.4 Copying a program ..................................................... 4-60
  10.3.5 Erasing a program ..................................................... 4-61
  10.3.6 Renaming a program .................................................. 4-62
  10.3.7 Changing the program attribute ............................... 4-63
  10.3.8 Displaying object program information ..................... 4-63
  10.3.9 Creating a sample program automatically ................. 4-64
10.4 Compiling .......................................................................... 4-66
10.5 Line jump and character string search ............................... 4-67
10.6 Registering user function keys .......................................... 4-67
10.7 Resetting an error in the selected program ....................... 4-70

11. "MANUAL" mode ................................................................. 4-71

11.1 Manual movement ........................................................... 4-74
11.2 Displaying and editing point data .................................... 4-77
  11.2.1 Point data input and editing ....................................... 4-78
    11.2.1.1 Restoring point data ............................................ 4-79
  11.2.2 Point data input by teaching ..................................... 4-80
  11.2.3 Point data input by direct teaching ............................ 4-84
  11.2.4 Point jump display .................................................... 4-84
  11.2.5 Copying point data .................................................... 4-85
  11.2.6 Erasing point data .................................................... 4-86
  11.2.7 Point data trace ....................................................... 4-87
11.3 Displaying, editing and setting pallet definitions .......................... 4-95
11.3.1 Editing pallet definitions ......................................................... 4-97
  11.3.1.1 Point setting in pallet definition ............................................. 4-98
  11.3.1.1.1 Editing the point in pallet definition ...................................... 4-99
  11.3.1.1.2 Setting the point in pallet definition by teaching .................. 4-99
  11.3.2 Pallet definition by teaching .................................................. 4-100
  11.3.3 Copying a pallet definition ..................................................... 4-102
  11.3.4 Deleting a pallet definition .................................................... 4-103
11.4 Changing the manual movement speed ...................................... 4-104
11.5 Displaying, editing and setting shift coordinates ......................... 4-105
  11.5.1 Editing shift coordinates ........................................................ 4-108
  11.5.1.1 Restoring shift coordinates .................................................. 4-109
  11.5.2 Editing the shift coordinate range .......................................... 4-109
  11.5.2.1 Restoring a shift coordinate range ........................................ 4-111
  11.5.3 Shift coordinate setting method 1 .......................................... 4-111
  11.5.4 Shift coordinate setting method 2 .......................................... 4-113
11.6 Displaying, editing and setting hand definitions ......................... 4-115
  11.6.1 Editing hand definitions ....................................................... 4-121
  11.6.1.1 Restoring hand definitions .................................................... 4-122
  11.6.2 Hand definition setting method 1 .......................................... 4-122
11.7 Changing the display units ....................................................... 4-124
11.8 Return-to-origin ......................................................................... 4-125
  11.8.1 Return-to-origin operation ...................................................... 4-125
  11.8.2 Semi-absolute ......................................................................... 4-127
  11.8.3 Return-to-origin procedure .................................................... 4-129
11.9 Setting the standard coordinates ............................................... 4-130
  11.9.1 Setting the standard coordinates by 4-point teaching ............... 4-133
  11.9.2 Setting the standard coordinate by 3-point teaching ............... 4-135
  11.9.3 Setting the standard coordinates by simple teaching .............. 4-137
11.10 Executing the user function keys ............................................. 4-139
12. “SYSTEM” mode ....................................................................... 4-140
  12.1 Parameters ............................................................................. 4-142
  12.1.1 Robot parameters ................................................................. 4-144
  12.1.2 Axis parameters ..................................................................... 4-149
  12.1.3 Other parameters ................................................................. 4-165
  12.1.4 Parameters for option boards ................................................ 4-175
    12.1.4.1 Option DIO setting .............................................................. 4-176
    12.1.4.2 Serial I/O setting .............................................................. 4-177
    12.1.4.3 Setting the network parameters ........................................... 4-179
  12.2 Communication parameters .................................................... 4-181
  12.3 OPTION parameters ............................................................... 4-187
    12.3.1 Setting the area check output ............................................... 4-188
    12.3.2 Setting the “SERVICE” mode .............................................. 4-193
     12.3.2.1 Saving the “SERVICE” mode parameters .......................... 4-198
     12.3.2.2 Help display in “SERVICE” mode .................................... 4-198
    12.3.3 SIO settings ......................................................................... 4-199
    12.3.4 Double-carrier setting ........................................................ 4-202
     12.3.4.1 Before using a double-carrier .......................................... 4-202
     12.3.4.2 Setting the double-carrier parameters ............................... 4-203
  12.4 Initialization ........................................................................... 4-206
Chapter 5  Parallel I/O interface

1. Standard I/O interface overview .................................. 5-1
   1.1 Power supply .................................................. 5-1
   1.2 Connector I/O signals ....................................... 5-2
   1.3 Connector pin numbers ....................................... 5-3
   1.4 Typical input signal connection ............................ 5-4
   1.5 Typical output signal connection .......................... 5-5
       1.5.1 Dedicated outputs .................................... 5-5
       1.5.2 General-purpose outputs ............................ 5-6
   1.6 Dedicated input signal description ........................ 5-7
   1.7 Dedicated output signal description ..................... 5-9
   1.8 Dedicated I/O signal timing chart ......................... 5-11
       1.8.1 Controller power ON, servo ON and emergency stop 5-11
       1.8.2 Return-to-origin ....................................... 5-12
       1.8.3 Switching to AUTO mode, program reset and execution 5-13
       1.8.4 Stopping due to program interlocks ................ 5-14
   1.9 General-purpose I/O signals ............................... 5-15
       1.9.1 General-purpose input signals ..................... 5-15
       1.9.2 General-purpose output signals ................... 5-15
       1.9.3 General-purpose output signal reset (off) ....... 5-15

2. Option I/O interface overview ................................. 5-16
   2.1 ID settings ................................................... 5-17

12.5 Self diagnosis .................................................. 4-212
   12.5.1 Controller check ........................................ 4-212
   12.5.2 Error history display .................................... 4-213
   12.5.3 Displaying the total operation time ................... 4-214
   12.5.4 System error details display ........................... 4-214

12.6 Backup processes .............................................. 4-215
   12.6.1 Internal flash ROM ..................................... 4-215
       12.6.1.1 Loading files ....................................... 4-216
       12.6.1.2 Saving files ......................................... 4-217
       12.6.1.3 Initializing the files ................................. 4-217

13. “MONITOR” mode ................................................. 4-218

14. “UTILITY” mode .................................................. 4-221
   14.1 Canceling emergency stop; Motor power and servo on/off 4-222
       14.1.1 Canceling emergency stop ......................... 4-222
       14.1.2 Motor power and servo on/off .................... 4-223
   14.2 Enabling/disabling the sequence execution flag ........ 4-224
   14.3 Changing the arm type ..................................... 4-225
   14.4 Resetting the output ports ................................. 4-226
   14.5 Changing the execution level ............................. 4-227
       14.5.1 Changing the execution level ..................... 4-228
       14.5.2 Displaying the Help message ...................... 4-229
   14.6 Changing the access level (operation level) ........... 4-230
       14.6.1 Entering the password ............................... 4-230
       14.6.2 Changing the access level ......................... 4-231
       14.6.3 Displaying the Help message ...................... 4-231
2. Troubleshooting ................................................................. 9-50

2.1 When trouble occurs ...................................................... 9-50

2.2 Acquiring error information ............................................ 9-51
  2.2.1 Acquiring information from the MPB ......................... 9-51
  2.2.2 Acquiring information from the RS-232C ..................... 9-51

2.3 Troubleshooting checkpoints .......................................... 9-52
1. Safety

Please observe all safety rules and cautions to ensure safe and correct use of the YAMAHA robot. Also, bear in mind that not all safety items can be listed in detail, so that accurate judgment by the operator or service personnel is essential for operating the robot and controller safely.

Industrial robots are highly programmable, mechanical devices that provide a large degree of freedom for performing various manipulative tasks. To ensure safe and correct of YAMAHA industrial robots, carefully read this manual and FOLLOW THE WARNINGS, CAUTIONS AND INSTRUCTIONS in this chapter. Failure to take necessary safety measures or mishandling may result in trouble or damage to the robot and injury to personnel (robot operator or service personnel) including fatal accidents.

Particularly important safety items and operation points are identified in this manual by the following symbols and signal words.

⚠️ **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 software.

💡 **NOTE**

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

To install, operate or adjust the YAMAHA robot or controller safely and correctly, always follow the instructions explained in this manual by using either of the following methods.

1. Install, operate or adjust the robot or controller while referring to the contents of this manual.
2. Install, operate or adjust the robot or controller while viewing the contents of the CD-ROM version manual on your computer screen.
3. Install, operate or adjust the robot or controller while referring to a printout of the necessary pages from the CD-ROM version manual.
1. Safety

1.1 Safety precautions during robot operation

a. The robot must be operated by a person who has received the proper training on safety and operation from YAMAHA or an authorized YAMAHA sales dealer.

b. During operation of the robot, be sure to stay out of the work area of the robot manipulator. Install a safeguard enclosure to keep others away from the work area or provide a gate interlock using an area sensor that triggers emergency stop when someone enters the work area.

c. This robot controller is not designed to be explosion-proof. Do not use the controller and robot in locations exposed to inflammable gases, gasoline or solvent that could cause explosion or fire.

1.2 Safety precautions during maintenance

a. Never disassemble the robot or controller. In cases where you have to replace or repair parts used in the robot or controller, first consult with us and then follow the instructions we provide.

b. Before beginning maintenance for the robot or controller, be sure to turn off the power to the controller. Even after turning off the controller, there are some parts in the controller which are still hot or at a high voltage. Always wait for at least 30 minutes after the controller is turned off.

1.3 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. If any abnormality is found during operation, stop the controller and contact us for corrective action.
1.4 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.

a. “Electric Hazard” label

![Electric Hazard]

This label warns you of possible electrical shock. Do not touch the terminal strip and connectors to avoid electrical shock.

b. “Read Instruction Manual” label

![Read Instruction Manual]

This label means that important information you must know is described in the manual. When in particular connecting a power supply to the robot controller, read this manual carefully and follow the instructions. Connectors have a particular orientation, so insert each connector in the correct direction.

1.5 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.

a. “Electric Hazard” mark

![Electric Hazard]

This mark warns you of possible electrical shock. Do not touch the terminal block and connectors to avoid electrical shock.

b. “CAUTION” mark

![CAUTION]

This mark indicates that important information you must know is described in the manual. When in particular connecting a power supply to the robot controller, read this manual carefully and follow its instructions. Connectors have a particular orientation, so insert each connector in the correct direction.
2. Warranty

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

**Warranty description:**
If a failure or breakdown occurs due to defects in materials or workmanship in the genuine parts constituting this YAMAHA robot and/or related product within the warranty period, then YAMAHA will repair or replace those parts free of charge (hereafter called "warranty repair").

**Warranty Period:**
The warranty period ends when any of the following applies:

1. After 18 months (one and a half year) have elapsed from the date of shipment
2. After one year has elapsed from the date of installation
3. After 2,400 hours of operation

**Exceptions to the Warranty:**
This warranty will not apply in the following cases:

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

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

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

YAMAHA MOTOR CO., LTD. MAKES NO OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. THE WARRANTY SET FORTH ABOVE IS EXCLUSIVE AND IS IN LIEU OF ALL EXPRESSED OR IMPLIED WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES ARISING FROM A COURSE OF DEALING OR USAGE OF TRADE. YAMAHA MOTOR CO., LTD. MAKES NO WARRANTY WHATSOEVER WITH REGARD TO ACCESSORIES OR PARTS NOT SUPPLIED BY YAMAHA MOTOR CO., LTD.
3. Operating environment

Operating temperature
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
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
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
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 excessive shocks to the robot controller. Install the robot controller in a location that is not subject to vibrations.

Atmosphere (gas, etc.)
Do not install the robot controller in locations where conductive dust particles, hydrogen sulfide gas or sulfurous acid gas are present. Such an atmosphere may cause the components to erode or poor installation. If such dust particles or gases are generated at the current location, then installing the robot controller in an air-conditioned or cooled housing is recommended.

Installation location
Always install the robot controller indoors, at a height of less than 1000 meters above sea level.
This robot controller is neither dust-proof nor water-proof. Do not install it in locations exposed to oil mist, cutting fluids or cleaning agents.
Chapter 2  System overview

Contents

1. System overview ................................................................. 2-1
   1.1 Main system configuration ............................................. 2-1
   1.2 Axis definition for the RCX141 ...................................... 2-3

2. Part names and functions .................................................... 2-4
   2.1 RCX141 (Maximum number of axes: 4 axes) .................... 2-4

3. Controller system ............................................................... 2-5

4. Optional devices ............................................................... 2-6
   4.1 MPB programming box ................................................. 2-6
   4.2 Expansion I/O board .................................................... 2-6
   4.3 Regenerative unit ....................................................... 2-6

5. Basic sequence from installation to operation ..................... 2-7
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 : YK400X

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

Fig. 2-1-1 System for controlling one robot
Configuration 2: System for controlling one robot and auxiliary axes

Example: MXYx+MR12T+MR12T

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

Fig. 2-1-2 System for controlling one robot and auxiliary axes
1.2  Axis definition for the RCX141

Axis definitions for the YAMAHA RCX141 robot controller are shown below.

Robot controller (RC)

Main group (MG)  Main robot (MR)  Main robot axis (M?)

Subgroup (SG)  Sub robot (SR)  Sub robot axis (S?)

Main robot auxiliary axis (m?)

Sub robot auxiliary axis (s?)

Robot controller ............... Indicates the entire robot controller and controls a maximum of 4 axes.
The letters “RC” are displayed on the MPB.

Main group .................... Indicates the main robot and main auxiliary axes and has a maximum of 4 axes.
The letters “MG” are displayed on the MPB.

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 MPB.

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 MPB. (?=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 MPB. (?=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 MPB.

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 MPB.

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 MPB. (?=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 MPB. (?=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. Part names and functions

2.1 RCX141 (Maximum number of axes: 4 axes)
3. Controller system

The basic block diagram of the RCX robot controller system is shown below.

Fig. 2-3-1
4. Optional devices

4.1 MPB programming box

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

Fig. 2-4-1

4.2 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. A maximum of 4 expansion I/O boards can be installed.

4.3 Regenerative unit

A regenerative unit may be required depending on the robot type or application.
5. Basic sequence from installation to operation

The basic sequence from installation to actual operation is shown below. Refer to this sequence to use the RCX141 safely, correctly and effectively. Before beginning the work, read this user's manual thoroughly.

<table>
<thead>
<tr>
<th>Installation, connection and wiring</th>
<th>[Basic procedure]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install the controller.</td>
<td></td>
</tr>
<tr>
<td>• Make cable and connector connections.</td>
<td></td>
</tr>
<tr>
<td>• Ground the controller.</td>
<td></td>
</tr>
<tr>
<td>• Configure an emergency stop circuit.</td>
<td></td>
</tr>
<tr>
<td>When a serial I/O board is added:</td>
<td></td>
</tr>
<tr>
<td>Set the station number, communication speed, etc. (Setup depends on the serial I/O type.)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check that the wiring and supply voltage are correct and then turn power on.</td>
</tr>
<tr>
<td>Check that no alarm is issued after turning power on.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot type check</td>
</tr>
<tr>
<td>Check that the robot type setting in the controller matches the robot that is actually connected.</td>
</tr>
<tr>
<td>Parameter initial setting</td>
</tr>
<tr>
<td>Set the following parameters to optimize the robot operation.</td>
</tr>
<tr>
<td>• Tip weight (workpiece weight + tool weight):</td>
</tr>
<tr>
<td>* Set the &quot;Axis tip weight&quot; parameter if the robot is set to &quot;MULTI&quot; or has an auxiliary axis.</td>
</tr>
<tr>
<td>* Soft limits (movement range)</td>
</tr>
<tr>
<td>* Before determining soft limit positions by jog movement, return-to-origin must first be complete.</td>
</tr>
<tr>
<td>* Always set this parameter when using the robot for the first time. After that, change it as needed.</td>
</tr>
<tr>
<td>Return-to-origin</td>
</tr>
<tr>
<td>Perform return-to-origin to teach the origin position to the controller.</td>
</tr>
<tr>
<td>* Always perform return-to-origin when using the robot for the first time. After that, reperform it when the controller power is turned on before starting robot operation or when the origin position becomes indefinite (return-to-origin incomplete).</td>
</tr>
<tr>
<td>For SCARA robots:</td>
</tr>
<tr>
<td>Set the reference coordinates (XY coordinate system with the X-axis rotation center set as the origin).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter setting</td>
</tr>
<tr>
<td>Set parameters according to the operation conditions.</td>
</tr>
<tr>
<td>Point data editing</td>
</tr>
<tr>
<td>Create or edit point data according to the robot operation.</td>
</tr>
<tr>
<td>Programming</td>
</tr>
<tr>
<td>Create programs according to the robot operation.</td>
</tr>
<tr>
<td>* Programming is unnecessary if not using a program such as in operation with I/O commands.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trial operation/Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check that the safety devices such as an emergency stop circuit function correctly.</td>
</tr>
<tr>
<td>Make a trial run using step operation and make adjustment as needed.</td>
</tr>
<tr>
<td>Start operation.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Refer to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 3 1. Unpacking</td>
</tr>
<tr>
<td>10. Precautions for cable routing and installation</td>
</tr>
<tr>
<td>Chapter 4 4. Turning power on and off</td>
</tr>
<tr>
<td>Chapter 3 11. Checking the robot controller operation</td>
</tr>
<tr>
<td>Chapter 4 12. &quot;SYSTEM&quot; mode</td>
</tr>
<tr>
<td>(Robot type can be checked on the initial screen in SYSTEM mode.)</td>
</tr>
<tr>
<td>12.1.1 Robot parameters</td>
</tr>
<tr>
<td>• Tip weight</td>
</tr>
<tr>
<td>12.1.2 Axis parameters</td>
</tr>
<tr>
<td>• + Soft limit</td>
</tr>
<tr>
<td>• - Soft limit</td>
</tr>
<tr>
<td>• Axis tip weight</td>
</tr>
<tr>
<td>11.8 Return-to-origin</td>
</tr>
<tr>
<td>11.9 Setting the standard coordinates</td>
</tr>
<tr>
<td>Chapter 4 12.1 Parameters</td>
</tr>
<tr>
<td>11.2 Displaying and editing point data</td>
</tr>
<tr>
<td>11.3 Displaying, editing and setting pallet definitions</td>
</tr>
<tr>
<td>10. &quot;PROGRAM&quot; mode</td>
</tr>
<tr>
<td>See the programming manual for information about the programming language.</td>
</tr>
<tr>
<td>Chapter 4 9.2 Stopping the program</td>
</tr>
<tr>
<td>9.12 Executing the next step</td>
</tr>
<tr>
<td>Chapter 4 9.1 Automatic operation</td>
</tr>
<tr>
<td>9.6 Changing the automatic movement speed</td>
</tr>
</tbody>
</table>
Chapter 3  Installation

Contents

1. Unpacking ................................................................. 3-1
   1.1 Packing box ......................................................... 3-1
   1.2 Unpacking ........................................................... 3-1

2. Installing the robot controller ............................... 3-2
   2.1 Installation ........................................................... 3-2
   2.2 Installation methods ............................................ 3-3

3. Connector names ................................................. 3-5

4. Connecting to the power ...................................... 3-6
   4.1 AC200 to 230V single-phase specifications .......... 3-6
   4.2 Power capacity ................................................... 3-6
   4.3 Installing an external leakage breaker ................. 3-8
   4.4 Installing a circuit protector .............................. 3-8
   4.5 Installing a current control switch .................... 3-8

5. Connecting the robot cables .................................. 3-9

6. Connecting the MPB programming box ................. 3-10

7. I/O connections .................................................... 3-11

8. Connecting a host computer ................................. 3-12

9. Connecting a regenerative unit ............................... 3-13

10. Precautions for cable routing and installation .... 3-14
    10.1 Wiring methods ................................................ 3-14
    10.2 Precautions for installation ............................ 3-15
    10.3 Methods of preventing malfunctions .............. 3-15

11. Checking the robot controller operation .......... 3-16
    11.1 Cable connection ............................................. 3-16
    11.2 Emergency stop input signal connection ............ 3-17
    11.3 Operation check ............................................. 3-17
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.

Fig. 3-1-1 Unpacking

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD. DIO connector</td>
<td>1</td>
</tr>
<tr>
<td>MPB terminator</td>
<td>1</td>
</tr>
<tr>
<td>L-type bracket set for front and rear panels</td>
<td>1</td>
</tr>
<tr>
<td>SAFETY connector</td>
<td>1</td>
</tr>
<tr>
<td>Connector guard for COM connector</td>
<td>1</td>
</tr>
<tr>
<td>CD-ROM manual</td>
<td>1</td>
</tr>
<tr>
<td>MPB programming box</td>
<td>1</td>
</tr>
<tr>
<td>OPT. DIO connectors</td>
<td>4 Max.</td>
</tr>
<tr>
<td>L-type brackets for side panel</td>
<td>2</td>
</tr>
<tr>
<td>Connector labels</td>
<td>4 Max.</td>
</tr>
<tr>
<td>RGU-2 connection cable</td>
<td>1</td>
</tr>
</tbody>
</table>

**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.
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

![Fig. 3-2-1]

**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. 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.
5. 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.
6. Do not install the controller in locations where the ambient temperature may rise higher than the rated temperature.
7. 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.

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)

   Fig. 3-2-2-1

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

   Fig. 3-2-2-2

**CAUTION**
The L-type brackets have mounting holes in two different positions. Use the holes that best match the equipment layout.
3. Installing the robot controller

⚠️ CAUTION
- When attaching the L-type brackets to the rear of the controller, provide a clearance of at least 30mm between the rear panel and wall or other objects.
- The L-type brackets have mounting holes in two different position. Use the holes that best match the equipment layout.

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

Fig. 3-2-3

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

Fig. 3-2-4

L-type bracket part No. (single item)

<table>
<thead>
<tr>
<th></th>
<th>Standard (for front and rear)</th>
<th>Option (for side)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>KX0-M410H-003</td>
<td>KX0-M410H-102</td>
</tr>
</tbody>
</table>

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.

**Fig. 3-3-1 RCX connectors**

<table>
<thead>
<tr>
<th>Connector name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>XM/YM/ZM/RM</td>
<td>Connectors for servomotor drive.</td>
</tr>
<tr>
<td>ROB I/O [XY/ZR]</td>
<td>Connectors for servomotor feedback and sensor signals.</td>
</tr>
<tr>
<td>SAFETY</td>
<td>Input/output connector for safety function such as emergency stop.</td>
</tr>
<tr>
<td>MPB</td>
<td>Connector for MPB.</td>
</tr>
<tr>
<td>COM</td>
<td>RS-232C interface connector.</td>
</tr>
<tr>
<td>STD.DIO</td>
<td>Connector for dedicated input/output and standard general-purpose input/output.</td>
</tr>
<tr>
<td>OP.1-4</td>
<td>Connectors attached to optional expansion I/O boards.</td>
</tr>
<tr>
<td>REGN [P/N]</td>
<td>Connector for regenerative unit.</td>
</tr>
<tr>
<td>AC IN [L/N]</td>
<td>Terminal block for power cable. Use ring-tongue terminals to make connections.</td>
</tr>
</tbody>
</table>

**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

Connect ring-tongue terminals to the power cable and screw them to the terminal block on the front panel of the controller as shown below.

4.1 AC200 to 230V single-phase specifications

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Wiring</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>AC IN</td>
<td>Hot</td>
</tr>
<tr>
<td>N</td>
<td>AC IN</td>
<td>Neutral (cold)</td>
</tr>
<tr>
<td>☀</td>
<td>Earth</td>
<td>Grounding resistance 100 ohms or less</td>
</tr>
</tbody>
</table>

Wiring thickness 2.0mm² or more
Tightening torque 1.4Nm

Fig. 3-4-1 Terminal block (AC 200 to 230V specifications)

4.2 Power capacity

The required power capacity depends on the robot model and the number of axes to be controlled. Prepare a suitable power supply while referring to the tables below.

(1) When connected to SCARA robot

<table>
<thead>
<tr>
<th>Robot model</th>
<th>Power capacity (VA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>YK180X, 220X</td>
<td>500</td>
</tr>
<tr>
<td>YK250XH, 350XH, 400XH</td>
<td>1000</td>
</tr>
<tr>
<td>YK250XCH, 350XCH, 400XCH</td>
<td>1500</td>
</tr>
<tr>
<td>YK500XC, 600XC</td>
<td>1700</td>
</tr>
<tr>
<td>YK700XC, 800XC, 1000XC</td>
<td>2000</td>
</tr>
<tr>
<td>YK800XGH, 700XG, 800XG, 900XG, 1000XG, 1200X</td>
<td>2500</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Axis current sensor value</th>
<th>Power capacity (VA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-axis</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>600</td>
</tr>
<tr>
<td>10</td>
<td>800</td>
</tr>
<tr>
<td>20</td>
<td>1100</td>
</tr>
<tr>
<td>10</td>
<td>1000</td>
</tr>
<tr>
<td>20</td>
<td>1300</td>
</tr>
<tr>
<td>20</td>
<td>1700</td>
</tr>
</tbody>
</table>

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

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.

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.

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.
4. Connecting to the power

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

<table>
<thead>
<tr>
<th>Axis current sensor value</th>
<th>Power capacity (VA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-axis</td>
<td>Y-axis</td>
</tr>
<tr>
<td>05</td>
<td>05</td>
</tr>
<tr>
<td>10</td>
<td>05</td>
</tr>
<tr>
<td>20</td>
<td>05</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
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<td>20</td>
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<td>20</td>
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</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Axis current sensor value</th>
<th>Power capacity (VA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-axis</td>
<td>Y-axis</td>
</tr>
<tr>
<td>05</td>
<td>05</td>
</tr>
<tr>
<td>10</td>
<td>05</td>
</tr>
<tr>
<td>20</td>
<td>05</td>
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<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>
4. Connecting to the power

4.3 Installing an external leakage breaker

To ensure safety, a leakage breaker must be installed in the power supply connection section of the robot controller. 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 (\(I_{\Delta n}\)). (Check the leakage breaker manufacturer’s data sheets to select the optimum product compatible with inverters.)

<table>
<thead>
<tr>
<th>Leakage current</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCX141 4mA(MAX)</td>
</tr>
</tbody>
</table>

4.4 Installing a circuit protector

To ensure safety, a circuit protector must be installed in the power supply connection section of the robot controller. 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

<table>
<thead>
<tr>
<th>Rated current</th>
<th>Operating characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCX141 20A</td>
<td>Slow type with inertia delay</td>
</tr>
<tr>
<td></td>
<td>(300% 2 sec. 1000% 0.01 sec.)</td>
</tr>
</tbody>
</table>

4.5 Installing a current control switch

When controlling the power on/off of the robot controller from an external device such as a PLC, a current control switch (contactor, breaker, etc.) may be used. In this case, the current control switch usually creates a large on/off surge current. To minimize this on/off surge current, surge killers must be installed for surge absorption. Connect a surge killer in parallel with and close to each contact of the current control switch.

Recommended surge killer:
Okaya Electric XE1201, XE1202, RE1202 or equivalent

Example
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.

Fig. 3-5-1 Robot cable connection to RCX controller

**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 robot cable connectors (XM and YM, ZM and RM, ROB I/O XY and ROB I/O ZR) have an identical shape. Do not confuse these cable connectors when making connections. A misconnection will cause the robot to malfunction.
- Keep robot cables separate from the robot controller power connection lines and other equipment power lines. Using them in close contact with lines carrying power 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.
6. Connecting the MPB programming box

As shown in the figure below, the MPB should be connected to the MPB connector on the front panel of the robot controller. If not connecting the MPB, plug an MPB terminator (supplied as an accessory) into the MPB connector.

Fig. 3-6-1 MPB programming box connection

⚠️ CAUTION
Use caution since the MPB connector must be connected in the correct direction. Connecting in the wrong direction may cause faulty operation or breakdowns. Emergency stop in the robot controller is triggered when the MPB is disconnected from the robot controller, because a B-contact (normally closed) type emergency stop button is provided on the MPB. So be sure to plug the MPB terminator (supplied as an accessory) into the MPB connector on the robot controller when not connecting the MPB.
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 5, “Parallel I/O interface” or see Chapter 6, “SAFETY I/O interface”.

The following describes terms used in the manual.

a. 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).

b. 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).
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 between the COM connector on the front of the robot controller and the RS-232C port of the computer.

For more detailed information on the RS-232C interface, see “RS-232C Interface” in Chapter 7.

**NOTE**

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

---

**Fig. 3-8-1 Host computer connection**

![Host computer connection diagram](image-url)
9. Connecting a regenerative unit

When a regenerative unit (RGU-2) is required, connect it between the RGEN connector on the front panel of the controller and the RGEN connector on the RGU-2 regenerative unit, by using the cable that comes with the regenerative unit.

**NOTE**
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 robot controller.
- To prevent electrical shocks, never touch the RGEN terminals when power is supplied to the robot controller.

**CAUTION**
Always securely connect the cable. Poor connections or contact failure may cause malfunctions.
10. Precautions for cable routing and installation

10.1 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.

1) Keep the I/O cables, 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 I/O cable, communication 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.

Fig. 3-10-1
10.2 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.

10.3 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.

Example of surges absorber

For inductive motor

- Single-phase motor
- 3-phase motor

A: Surge killer (Okaya Electric Industries CRE-50500, 3CRE-50500 or equivalent)

For solenoid valve, solenoid

- DC type
- AC type

B: Diode, varistor, CR elements
C: Varistor, CR elements
11. Checking the robot controller operation

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

11.1 Cable connection

Fig. 3-11-1
11.2 Emergency stop input signal connection

CAUTION
External emergency stop and the MPB 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.

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

11.3 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.

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 MPB and take corrective action according to the description given in Chapter 9, “Troubleshooting”.

• The emergency stop button on the MPB is connected to the controller through the SAFETY connector.
Chapter 4  Operation

Contents

1. Operation overview ................................................................. 4-1
2. The RCX robot controller ........................................................... 4-2
   2.1 Part names ................................................................. 4-2
   2.2 Main functions .......................................................... 4-2
3. MPB programming box .............................................................. 4-3
   3.1 Part names ................................................................. 4-3
   3.2 Main functions .......................................................... 4-4
   3.3 Connection to the robot controller ................................. 4-5
4. Turning power on and off ......................................................... 4-6
5. Operation keys ........................................................................ 4-7
   5.1 MPB screen ................................................................. 4-7
   5.2 Operation key layout ................................................... 4-8
   5.3 Basic key operation ..................................................... 4-9
   5.4 Function keys ............................................................ 4-10
   5.5 Control keys .............................................................. 4-12
   5.6 Data keys ................................................................. 4-14
   5.7 Other keys ................................................................. 4-14
6. Emergency stop ....................................................................... 4-15
   6.1 Emergency stop reset ................................................... 4-16
7. Mode configuration ................................................................. 4-18
   7.1 Basic operation modes .................................................. 4-18
   7.2 Other operation modes ................................................ 4-19
   7.3 Mode hierarchy .......................................................... 4-20
8. “SERVICE” mode .................................................................... 4-24
   8.1 Operation device .......................................................... 4-24
   8.2 Prohibition of “AUTO” mode operation ......................... 4-24
   8.3 Hold-to-Run function ................................................... 4-24
   8.4 Limitations on robot operating speed ............................ 4-24
9. “AUTO” mode ........................................................................... 4-25
  9.1 Automatic operation ................................................................. 4-28
  9.2 Stopping the program ............................................................... 4-29
  9.3 Resetting the program ............................................................. 4-30
  9.4 Switching task display .............................................................. 4-32
  9.5 Switching the program ............................................................. 4-33
  9.6 Changing the automatic movement speed ............................... 4-34
  9.7 Executing the point trace ......................................................... 4-34
    9.7.1 PTP motion mode ............................................................... 4-36
    9.7.2 ARCH motion mode ......................................................... 4-38
    9.7.3 Linear interpolation motion mode ....................................... 4-40
  9.8 Direct command execution ...................................................... 4-42
  9.9 Break point ............................................................................. 4-43
    9.9.1 Setting break points .......................................................... 4-43
    9.9.2 Deleting break points ....................................................... 4-44
  9.10 Executing a step ..................................................................... 4-45
  9.11 Skipping a step ....................................................................... 4-45
  9.12 Executing the next step .......................................................... 4-45

10. “PROGRAM” mode .................................................................... 4-46
  10.1 Scrolling a program listing ..................................................... 4-47
  10.2 Program editing ..................................................................... 4-48
    10.2.1 Cursor movement ............................................................. 4-50
    10.2.2 Insert/Overwrite mode switching ....................................... 4-50
    10.2.3 Inserting a line ................................................................. 4-51
    10.2.4 Deleting a character ......................................................... 4-51
    10.2.5 Deleting a line ................................................................. 4-52
    10.2.6 User function key display ................................................ 4-52
    10.2.7 Quitting program editing .................................................. 4-53
    10.2.8 Specifying the copy/cut lines .............................................. 4-53
    10.2.9 Copying the selected lines ................................................ 4-53
    10.2.10 Cutting the selected lines ............................................... 4-54
    10.2.11 Pasting the data ............................................................. 4-54
    10.2.12 Backspace ....................................................................... 4-55
    10.2.13 Line jump ....................................................................... 4-55
    10.2.14 Searching a character string .......................................... 4-56
  10.3 Directory .............................................................................. 4-57
    10.3.1 Cursor movement ............................................................. 4-58
    10.3.2 Registering a new program name ...................................... 4-58
    10.3.3 Directory information display .......................................... 4-59
    10.3.4 Copying a program .......................................................... 4-60
    10.3.5 Erasing a program ............................................................ 4-61
    10.3.6 Renaming a program ........................................................ 4-62
    10.3.7 Changing the program attribute ....................................... 4-63
    10.3.8 Displaying object program information ............................. 4-63
    10.3.9 Creating a sample program automatically ........................ 4-64
  10.4 Compiling ............................................................................. 4-66
  10.5 Line jump and character string search .................................... 4-67
  10.6 Registering user function keys ............................................... 4-67
  10.7 Resetting an error in the selected program ............................. 4-70
11. “MANUAL” mode ................................................................. 4-71
  11.1 Manual movement ............................................................. 4-74
  11.2 Displaying and editing point data ...................................... 4-77
    11.2.1 Point data input and editing ........................................ 4-78
      11.2.1.1 Restoring point data ................................................. 4-79
    11.2.2 Point data input by teaching ....................................... 4-80
    11.2.3 Point data input by direct teaching .............................. 4-84
    11.2.4 Point jump display ..................................................... 4-84
    11.2.5 Copying point data ..................................................... 4-85
    11.2.6 Erasing point data ..................................................... 4-86
    11.2.7 Point data trace ......................................................... 4-87
    11.2.8 Point comment input and editing .................................. 4-88
      11.2.8.1 Point comment input and editing .............................. 4-89
      11.2.8.2 Point data input by teaching .................................. 4-89
      11.2.8.3 Jump to a point comment ........................................ 4-90
      11.2.8.4 Copying a point comment ....................................... 4-91
      11.2.8.5 Erasing point comments ........................................ 4-92
      11.2.8.6 Point comment search ............................................ 4-93
    11.2.9 Point data error reset ................................................ 4-94
  11.3 Displaying, editing and setting pallet definitions ............... 4-95
    11.3.1 Editing pallet definitions ........................................... 4-97
      11.3.1.1 Point setting in pallet definition .............................. 4-98
        11.3.1.1.1 Editing the point in pallet definition .................. 4-99
        11.3.1.1.2 Setting the point in pallet definition by teaching .... 4-99
      11.3.2 Pallet definition by teaching ..................................... 4-100
    11.3.3 Copying a pallet definition ........................................ 4-102
    11.3.4 Deleting a pallet definition ........................................ 4-103
  11.4 Changing the manual movement speed .............................. 4-104
  11.5 Displaying, editing and setting shift coordinates .............. 4-105
    11.5.1 Editing shift coordinates .......................................... 4-108
      11.5.1.1 Restoring shift coordinates .................................... 4-109
    11.5.2 Editing the shift coordinate range ............................. 4-109
      11.5.2.1 Restoring a shift coordinate range .......................... 4-111
    11.5.3 Shift coordinate setting method 1 .............................. 4-111
    11.5.4 Shift coordinate setting method 2 .............................. 4-113
  11.6 Displaying, editing and setting hand definitions ............... 4-115
    11.6.1 Editing hand definitions ........................................... 4-121
      11.6.1.1 Restoring hand definitions .................................... 4-122
    11.6.2 Hand definition setting method 1 ............................... 4-122
  11.7 Changing the display units ............................................. 4-124
  11.8 Return-to-origin ........................................................... 4-125
    11.8.1 Return-to-origin operation ......................................... 4-125
    11.8.2 Semi-absolute ......................................................... 4-127
    11.8.3 Return-to-origin procedure ........................................ 4-129
  11.9 Setting the standard coordinates .................................... 4-130
    11.9.1 Setting the standard coordinates by 4-point teaching ... 4-133
    11.9.2 Setting the standard coordinate by 3-point teaching ....... 4-135
    11.9.3 Setting the standard coordinates by simple teaching ...... 4-137
  11.10 Executing the user function keys .................................... 4-139

12. “SYSTEM” mode ............................................................... 4-140
  12.1 Parameters ................................................................. 4-142
    12.1.1 Robot parameters ..................................................... 4-144
    12.1.2 Axis parameters ....................................................... 4-149
    12.1.3 Other parameters ..................................................... 4-165
    12.1.4 Parameters for option boards ..................................... 4-175
      12.1.4.1 Option DIO setting ................................................. 4-176
12.1.4.2 Serial I/O setting ................................................................. 4-177
12.1.4.3 Setting the network parameters ........................................ 4-179

12.2 Communication parameters .................................................... 4-181

12.3 OPTION parameters ............................................................... 4-187
  12.3.1 Setting the area check output .............................................. 4-188
  12.3.2 Setting the “SERVICE” mode .............................................. 4-193
    12.3.2.1 Saving the “SERVICE” mode parameters ..................... 4-198
    12.3.2.2 Help display in “SERVICE” mode ............................... 4-198
  12.3.3 SIO settings .................................................................... 4-199
  12.3.4 Double-carrier setting ....................................................... 4-202
    12.3.4.1 Before using a double-carrier ..................................... 4-202
    12.3.4.2 Setting the double-carrier parameters ....................... 4-203

12.4 Initialization ........................................................................... 4-206
  12.4.1 Initializing the parameters .................................................. 4-207
  12.4.2 Initializing the memory ...................................................... 4-208
  12.4.3 Initializing the communication parameters ....................... 4-209
  12.4.4 Clock setting .................................................................... 4-210
  12.4.5 System generation ............................................................ 4-211

12.5 Self diagnosis ......................................................................... 4-212
  12.5.1 Controller check ............................................................... 4-212
  12.5.2 Error history display ....................................................... 4-213
  12.5.3 Displaying the total operation time .................................. 4-214
  12.5.4 System error details display .............................................. 4-214

12.6 Backup processes ................................................................. 4-215
  12.6.1 Internal flash ROM ............................................................ 4-215
    12.6.1.1 Loading files ............................................................. 4-216
    12.6.1.2 Saving files ............................................................. 4-217
    12.6.1.3 Initializing the files .................................................. 4-217

13. “MONITOR” mode ................................................................. 4-218

14. “UTILITY” mode ..................................................................... 4-221
  14.1 Canceling emergency stop; Motor power and servo on/off .... 4-222
    14.1.1 Canceling emergency stop .............................................. 4-222
    14.1.2 Motor power and servo on/off ...................................... 4-223
  14.2 Enabling/disabling the sequence execution flag .................... 4-224
  14.3 Changing the arm type ........................................................ 4-225
  14.4 Resetting the output ports .................................................... 4-226
  14.5 Changing the execution level ................................................ 4-227
    14.5.1 Changing the execution level ........................................ 4-228
    14.5.2 Displaying the Help message ........................................ 4-229
  14.6 Changing the access level (operation level) ......................... 4-230
    14.6.1 Entering the password .................................................. 4-230
    14.6.2 Changing the access level ............................................. 4-231
    14.6.3 Displaying the Help message ......................................... 4-231
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.

**NOTE**
- Refer to Chapter 5 for Parallel I/O interface.
- Refer to Chapter 6 for SAFETY I/O interface.
- Refer to Chapter 7 for RS-232C interface.

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

*Fig. 4-1-1 Operation overview*

MPB is used for
- robot operation
- programming
- teaching
- parameter input, etc.

- Used for input/output of emergency stop signal, enable switch signal, etc.
- Used for basic input/output operations.
- Used to supply power to the controller.
- Used for communication through RS-232C.

This chapter mainly explains how to operate the MPB programming box.
2. The RCX robot controller

2.1 Part names

Controller front panel

Fig. 4-2-1 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. MPB connector: .. Connects to the MPB programming box.

6. COM connector: .. Connects to an external device via the RS-232C interface. (D-SUB 9P female connector)
3. MPB programming box

The MPB is connected to the robot controller and allows you to edit or execute robot programs.

3.1 Part names

Fig. 4-3-1 MPB programming box

1. Display (liquid crystal screen)
2. Sheet key
3. Emergency stop button
4. MPB connector
5. UPPER button
6. LOWER button
7. Display contrast adjustment trimmer (side of MPB)
3.2 Main functions

1. Display (liquid crystal screen)
   This is a liquid crystal display (LCD) with 40 characters × 8 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 3 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. MPB connector
   Use this connector to connect the MPB to the robot controller.

5. UPPER button
   This button has the same function as the [UPPER] sheet key.

6. LOWER button
   This button has the same function as the [LOWER] sheet key.

7. LCD contrast adjustment trimmer (side of MPB)
   This adjusts the contrast of the liquid crystal display. Turning to the right increases the sharpness of the displayed characters.
3.3 Connection to the robot controller

Connect the MPB programming box to the MPB 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 MPB 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.

---

**Fig. 4-3-2 Robot controller connection**
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.

1) Connect the MPB to the MPB connector on the front panel of the robot controller.

2) Supply the power to the AC IN terminal on the front panel of the robot controller. The “PWR” LED lights up and the “MANUAL” mode screen appears. (After the “PWR” LED is lit, it will take a maximum of 3 seconds for the controller to operate normally.)

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

4) After the power is turned on, return-to-origin must be performed before starting robot operation. Then start the robot operation. Refer to “11.8 Return-to-origin” in this chapter for how to perform return-to-origin.

---

**CAUTION**

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

**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 return-to-origin. Refer to “12. “SYSTEM” mode” in Chapter 4 for detailed information.
- If an error message “battery degradation” 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.

Fig. 4-4-1 “MANUAL” mode screen

<table>
<thead>
<tr>
<th>MANUAL</th>
<th>50%[MR][SOH0J]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current position</td>
<td></td>
</tr>
<tr>
<td>M1= 0</td>
<td>*M2= 0</td>
</tr>
<tr>
<td>*M4= 0</td>
<td></td>
</tr>
</tbody>
</table>

POINT  PALLETT  VEL+  VEL-
5. Operation keys

5.1 MPB screen

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

1) System line (1st line)

The current mode and its hierarchy are displayed on the 1st line at the top left of the screen. Fig. 4-5-1 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.

<table>
<thead>
<tr>
<th>Display Type</th>
<th>Status Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dashed line</td>
<td>Return-to-origin incomplete.</td>
</tr>
<tr>
<td>Solid line</td>
<td>Return-to-origin complete.</td>
</tr>
<tr>
<td>Double-solid line</td>
<td>Program is being executed.</td>
</tr>
<tr>
<td>&quot;@ &quot; mark in 2nd column</td>
<td>Online command is being executed through RS-232C interface. Changes to a dot ( . ) when the command ends.</td>
</tr>
<tr>
<td>&quot;s &quot; mark in 1st column</td>
<td>Sequence program is being executed.</td>
</tr>
</tbody>
</table>

3) Data area (3rd to 7th lines)

Various types of data and editing information are displayed on the 3rd to 7th lines. These lines scroll to the right and left to show up to 80 characters per line.

4) Guideline (Bottom line)

The bottom line (8th 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.

Fig. 4-5-1 MPB screen example
5. Operation keys

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

Fig. 4-5-2 Sheet key layout
5.3 Basic key operation

1) Each operation key has 3 different functions as shown below.

   Use the UPPER or LOWER key as needed to enable various functions.

   **Fig. 4-5-3 Key configuration**

   ![Key configuration diagram]

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

<table>
<thead>
<tr>
<th>Shift</th>
<th>Example of key input</th>
<th>Input data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><img src="UPPER+Shift1" alt="Example 1" /></td>
<td>“#”</td>
</tr>
<tr>
<td></td>
<td>Shift 1: Use a key while holding down the UPPER key.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><img src="Shift2" alt="Example 2" /></td>
<td>“,”</td>
</tr>
<tr>
<td></td>
<td>Shift 2: Use a key without holding down the UPPER and LOWER keys.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td><img src="LOW+Shift3" alt="Example 3" /></td>
<td>“@”</td>
</tr>
<tr>
<td></td>
<td>Shift 3: Use a key while holding down the LOWER key.</td>
<td></td>
</tr>
</tbody>
</table>
## 5.4 Function keys

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

<table>
<thead>
<tr>
<th>Function key</th>
<th>Selected menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 1&lt;sub&gt;1&lt;/sub&gt;</td>
<td>(F 1) POINT</td>
</tr>
<tr>
<td>F 2&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(F 2) PALLET</td>
</tr>
<tr>
<td>F 3&lt;sub&gt;3&lt;/sub&gt;</td>
<td>(F 3) ORIGIN</td>
</tr>
<tr>
<td>F 4&lt;sub&gt;4&lt;/sub&gt;</td>
<td>(F 4) VEL +</td>
</tr>
<tr>
<td>F 5&lt;sub&gt;5&lt;/sub&gt;</td>
<td>(F 5) VEL -</td>
</tr>
<tr>
<td>UPPER + F 1&lt;sub&gt;1&lt;/sub&gt;</td>
<td>(F 6) SHIFT</td>
</tr>
<tr>
<td>UPPER + F 2&lt;sub&gt;2&lt;/sub&gt;</td>
<td>(F 7) HAND</td>
</tr>
<tr>
<td>UPPER + F 3&lt;sub&gt;3&lt;/sub&gt;</td>
<td>(F 8) UNITCHG</td>
</tr>
<tr>
<td>UPPER + F 4&lt;sub&gt;4&lt;/sub&gt;</td>
<td>(F 9) VEL ++</td>
</tr>
<tr>
<td>UPPER + F 5&lt;sub&gt;5&lt;/sub&gt;</td>
<td>(F10) VEL --</td>
</tr>
<tr>
<td>LOWER + F 5&lt;sub&gt;15&lt;/sub&gt;</td>
<td>(F15) COORDI</td>
</tr>
</tbody>
</table>
Relation of function keys to menus

Fig. 4-5-4 Function keys and menus

<table>
<thead>
<tr>
<th>MANUAL</th>
<th>50%[MG][SOHOJ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current position</td>
<td>Manual</td>
</tr>
<tr>
<td>M1= 0</td>
<td>*M2= 0</td>
</tr>
<tr>
<td>M4= 0</td>
<td></td>
</tr>
</tbody>
</table>

POINT PALLEr ORIGIN VEL+ VEL-

[F1] [F2] [F3] [F4] [F5]

SHIFT HAND UNITCHG VEL++ VEL--

[F6] [F7] [F8] [F9] [F10] ...

UPPER

COORDI

[F11] [F12] [F13] [F14] [F15] ...

LOWER

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

Pressing the UPPER key switches to function keys [F6] to [F10], and pressing the LOWER key switches to function keys [F11] to [F15].

NOTE
From hereon, when the [F6] to [F10] keys are mentioned, it means to press the [F1] to [F5] keys while holding down the UPPER key or UPPER button on the side of the MPB.
Likewise, when the [F11] to [F15] keys are mentioned, it means to press the [F1] to [F5] keys while holding down the LOWER key or LOWER button on the side of the MPB.
5. Operation keys

5.5 Control 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.

2. **Extended function keys**

   - **USER**: Calls up the function key assigned by the user.
   - **ROBOT**: Switches robots.
   - **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.
   - **>>**: Switches to the next screen.
   - **<<**: Switches to the left-hand screen.
   - **>>**: Switches to the right-hand screen.
5. Operation keys

(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.

LINE: Inserts one line at the cursor position.

L.DEL: Deletes one line at the cursor position.

(6) Jog keys

START: Starts operation.
   This key is valid only during “AUTO” mode or point trace.

STOP: Stops operation.
   After the START key has been pressed in “AUTO” mode, the STOP key is valid during program execution, direct command execution, point trace execution and return-to-origin or absolute search operation.

NOTE: The #1+ to #6- keys are hereafter called the Jog keys.
The Jog keys are enabled in “MANUAL” mode.

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

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

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

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

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

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

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

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

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

#5-: Moves axis 5 in the - direction.
5. Operation keys

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

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 9</td>
<td>Enters numbers.</td>
</tr>
<tr>
<td>A to Z</td>
<td>Enters alphabetic characters.</td>
</tr>
<tr>
<td>SPACE</td>
<td>Inserts spaces.</td>
</tr>
</tbody>
</table>

(2) Symbol keys

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>( )</td>
<td>%</td>
</tr>
<tr>
<td>!</td>
<td>~</td>
</tr>
<tr>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

5.7 Other keys

(1) Enter key

: 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

(1) Pressing this key selects shift 1 for key operation.

(2) Pressing this key 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 MPB. Pressing the emergency stop button cuts off power to the robot to stop operation. A message as shown below appears on the MPB screen. The highlighted display for the mode name is cancelled during emergency stop.

![Fig. 4-6-1 Emergency stop](image)

**NOTE**
Besides the emergency stop button on the MPB, an external dedicated input (emergency stop) terminal is provided in the SAFETY connector. Refer to Chapter 6 for details.
6.1 Emergency stop reset

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

1) Cancel the emergency stop button on the MPB.
   Emergency stop is released by turning the emergency stop button clockwise.

2) Press the [LOWER] key while holding down the [UTILITY] key.
   The screen switches to “UTILITY” mode and the message “Cancel emergency flag?” appears.

   ![](Fig. 4-6-2 Emergency stop reset (1))

   | Cancel emergency flag? | YES | NO |

3) Press the [F 4] (YES) key.
   The following screen appears.

   ![](Fig. 4-6-3 Emergency stop reset (2))

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

4) Press the [F 1] (MOTOR) key.
   The following screen appears.

   ![](Fig. 4-6-4 “UTILITY>MOTOR” mode (1))

**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 6.
- 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 reperforming return-to-origin.

• 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 6.
• 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 reperforming return-to-origin.

• 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 6.
• 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 reperforming return-to-origin.
5) Press the [F 1](On) key 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.

6) Press the [ESC] key to return to the previous mode.
7. Mode configuration

The robot operation mode consists of the following modes.

```
<table>
<thead>
<tr>
<th>Basic operation modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;SERVICE&quot; mode</td>
</tr>
<tr>
<td>&quot;AUTO&quot; mode</td>
</tr>
<tr>
<td>&quot;MANUAL&quot; mode</td>
</tr>
<tr>
<td>&quot;PROGRAM&quot; mode</td>
</tr>
<tr>
<td>&quot;SYSTEM&quot; mode</td>
</tr>
</tbody>
</table>
```

 "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 and other modes with the function keys.

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

(1) “SERVICE” mode

“SERVICE” mode is used to perform maintenance work using the MPB 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) OFF. The following functions are selected in “SERVICE” mode.

1. Robot is controlled only by MPB 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.

(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 MPB screen.

(4) “MANUAL” mode
Select this mode to move the robot manually or perform point teaching. Return-to-origin or absolute search operation and manual movement can be executed only in this mode.
Operable tasks in this mode differ depending on the parameter settings in “SERVICE” mode.

(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
Use this mode to monitor the robot controller I/O status or task status on the MPB screen. Use the DISPLAY key 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 the UTILITY key to select this mode.

NOTE
- Return-to-origin can be performed only in “MANUAL” mode.
- “AUTO” mode may be selected depending on the execution level when the robot controller is turned on.
7. Mode configuration

7.3 Mode hierarchy

Robot operation is mainly performed by pressing the function keys to select the desired mode from the menu. (Refer to the “Mode hierarchy diagram” described later.) When the controller is turned on, the “MANUAL” mode menu first appears on the screen. Pressing the [MODE] key displays the 4 basic modes on the guideline (bottom line) of the screen as shown below.

Fig. 4-7-1 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 \( F_1 \), \( F_2 \), \( F_3 \) and \( F_4 \) from the left.

For example, when the \( F_1 \) (AUTO) key is pressed, “AUTO” mode is entered.

Fig. 4-7-2 “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 \( F_1 \) to \( F_{15} \). (See Fig. 4-7-4.)
7. Mode configuration

Functions are switched with the **UPPER** and **LOWER** shift keys. The menu display changes while this shift key is pressed.

![Fig. 4-7-3 Shift keys](image)

**NOTE**

- When the data is being edited such as in “EDIT” mode, the **MODE** key is inoperative. After pressing the **ESC** key to return the mode hierarchy, press the **MODE** key.
- 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 **F 2** (PROGRAM) from the first hierarchy menu, **F 3** (DIR) from the second hierarchy menu and **F 7** (ERASE) from the third hierarchy menu.

The “^” mark at the left end on the guideline shows that the **UPPER** key is pressed, while the “▼” mark shows that the **LOWER** key is pressed.

Some submenus have other menus for accessing the next hierarchical mode. For example, pressing the **F 8** key in “AUTO” mode while holding down the **UPPER** key, 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 the **ESC** key.

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.

Refer to “Mode hierarchy diagram” on the next page for the entire mode hierarchy.
7. Mode configuration

Mode hierarchy diagram

- F1 AUTO
  - F1 RESET
  - F2 TASK
  - F3 DIR
  - F4 VEL+
  - F5 VEL-
  - F6 POINT
  - F7 DIRECT
  - F8 BREAK
  - F9 VEL++
  - F10 VEL--
  - F11 STEP
  - F12 SKIP
  - F13 NEXT

- F2 PROGRAM
  - F1 EDIT
    - F1 SELECT
    - F2 COPY
    - F3 CUT
    - F4 PASTE
    - F5 BS
    - F6 JUMP
    - F7 FIND
    - F8 FIND+
    - F9 FIND-
    - F11 TRACE
    - F12 COMMENT
    - F13 ERR.RST
    - F14 AXIS
    - F15 PASSWD
    - F16 AXIS
    - F17 COORDI
  - F2 TEACH
  - F3 JUMP
  - F4 VEL+
  - F5 VEL-
  - F6 COPY
  - F7 ERASE
  - F8 UNITCHG
  - F9 VEL++
  - F10 VEL--
  - F11 MODIFY
  - F12 OBJECT
  - F13 ERR.RST

- F3 DIR
  - F1 EDIT
    - F1 SELECT
    - F2 COPY
    - F3 CUT
    - F4 PASTE
    - F5 BS
    - F6 JUMP
    - F7 FIND
    - F8 FIND+
    - F9 FIND-
    - F11 TRACE
    - F12 COMMENT
    - F13 ERR.RST
    - F14 AXIS
    - F15 PASSWD
    - F16 AXIS
    - F17 COORDI
  - F1 POINT
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
      - F11 MODIFY
      - F12 OBJECT
      - F13 ERR.RST

- F4 VEL+
  - F2 METHOD
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
      - F11 MODIFY
      - F12 OBJECT
      - F13 ERR.RST
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
        - F11 MODIFY
        - F12 OBJECT
        - F13 ERR.RST

- F5 VEL-
  - F2 METHOD
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
      - F11 MODIFY
      - F12 OBJECT
      - F13 ERR.RST
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
        - F11 MODIFY
        - F12 OBJECT
        - F13 ERR.RST
  - F1 POINT
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
  - F6 SHIFT
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
  - F7 HAND
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
  - F8 UNITCHG
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
  - F9 VEL++
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
  - F10 VEL--
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
    - F3 METHOD2
      - F1 EDIT
        - F1 UNDO
        - F2 TEACH
        - F3 JUMP
        - F4 VEL+
        - F5 VEL-
        - F6 COPY
        - F7 ERASE
        - F8 UNITCHG
        - F9 VEL++
        - F10 VEL--
  - F15 COORDI
    - F1 EDIT
      - F1 UNDO
      - F2 TEACH
      - F3 JUMP
      - F4 VEL+
      - F5 VEL-
      - F6 COPY
      - F7 ERASE
      - F8 UNITCHG
      - F9 VEL++
      - F10 VEL--
8. "SERVICE" mode

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

8.1 Operation device

If operation from a device other than the MPB is permitted, the operator using the MPB may be exposed to hazardous situations. For example:
1. When a dedicated DI start signal is turned ON without the MPB operator knowing about it.
2. When an external device runs a robot operation command through the RS-232C interface without the MPB operator knowing about it.

To prevent this kind of accident in "SERVICE" mode, only the MPB 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 MPB 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 MPB 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.
9. “AUTO” mode

“AUTO” mode executes robot language programs and related tasks.

The initial “AUTO” mode screens are shown in Fig. 4-9-1 and Fig. 4-9-2.

**Fig. 4-9-1 “AUTO” mode (one-robot setting)**

<table>
<thead>
<tr>
<th>Mode hierarchy</th>
<th>Task display</th>
<th>Program name</th>
<th>Message line</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO</td>
<td>T1</td>
<td>TEST1</td>
<td></td>
</tr>
</tbody>
</table>

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.
   When two robots are specified, two speeds are displayed for “[main group] / [sub group]”, 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.

**Fig. 4-9-2 “AUTO” mode (two-robot setting)**

<table>
<thead>
<tr>
<th>Mode hierarchy</th>
<th>Task display</th>
<th>Program name</th>
<th>Message line</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTO</td>
<td>T1</td>
<td>TEST1</td>
<td></td>
</tr>
</tbody>
</table>

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.
   When two robots are specified, two speeds are displayed for “[main group] / [sub group]”, with the currently selected group highlighted.

4. **Program name**
   Shows the program name currently selected.
9. “AUTO” mode

- **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.

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

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

- **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. When return-to-origin is not complete, the message “Origin incomplete” appears. In such a case, refer to “11.8 Return-to-origin” in Chapter 4. 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.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key</td>
<td></td>
<td>Scrolls the program listing.</td>
</tr>
<tr>
<td>(↑/↓)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page key</td>
<td></td>
<td>Switches to other screens.</td>
</tr>
<tr>
<td>(.AddListener)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>RESET</td>
<td>Resets the program.</td>
</tr>
<tr>
<td>F2</td>
<td>TASK</td>
<td>Changes the program listing according to each task.</td>
</tr>
<tr>
<td>F3</td>
<td>DIR</td>
<td>Changes the current program.</td>
</tr>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases automatic movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases automatic movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F6</td>
<td>POINT</td>
<td>Moves to the specified point number position.</td>
</tr>
<tr>
<td>F7</td>
<td>DIRECT</td>
<td>Executes a command statement written on one line.</td>
</tr>
<tr>
<td>F8</td>
<td>BREAK</td>
<td>Sets a break point.</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases automatic movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases automatic movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decrements.</td>
</tr>
<tr>
<td>F11</td>
<td>STEP</td>
<td>Executes one line of the command statement.</td>
</tr>
<tr>
<td>F12</td>
<td>SKIP</td>
<td>Advances to the next line without executing the current command statement.</td>
</tr>
<tr>
<td>F13</td>
<td>NEXT</td>
<td>Executes one line of the command statement. (Sub-routines are executed at a time.)</td>
</tr>
<tr>
<td>ROBOT</td>
<td></td>
<td>Switches the selected robot group.</td>
</tr>
<tr>
<td>(LOWER MODE)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9. “AUTO” mode

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.

[Procedure]

Press the [START] key in “AUTO” mode.

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.

Fig. 4-9-3 Automatic operation in progress

WARNING

- Upon pressing the [START] key, 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.

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.

NOTE

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

The following keys are enabled during automatic operation.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases automatic movement speed for the selected robot group in 5% increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases automatic movement speed for the selected robot group in 5% decrements.</td>
</tr>
<tr>
<td>ROBOT (LOWER + MODE)</td>
<td></td>
<td>Switches the selected robot group.</td>
</tr>
</tbody>
</table>
9.2 Stopping the program

[Procedure]

1) Press the [STOP] key during program execution to stop the program.

   Fig. 4-9-4 Program stop screen

   ![Program stop screen]

<table>
<thead>
<tr>
<th>AUTO</th>
<th>[T1] 100% &lt;TEST1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>RESET</td>
<td>TASK DIR VEL+</td>
</tr>
<tr>
<td></td>
<td>VEL-</td>
</tr>
</tbody>
</table>

   [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.

2) Press the [ESC] key to display the program listing.

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

3) Press the [START] key to re-execute the program.
9. “AUTO” mode

9.3 Resetting the program

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

[Procedure]

Fig. 4-9-5 Program reset

<table>
<thead>
<tr>
<th>AUTO</th>
<th>[T1] 100% &lt;TEST1 &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>***** TEST1 PROGRAM *****</td>
</tr>
<tr>
<td>2</td>
<td>START *SUBTASK,T2</td>
</tr>
<tr>
<td>3</td>
<td>D02(0)=0</td>
</tr>
<tr>
<td>4</td>
<td>WAIT D13(4,3,2)=3</td>
</tr>
<tr>
<td>5</td>
<td>MOVE P,P0</td>
</tr>
<tr>
<td>RESET TASK</td>
<td>DIR VEL+ VEL-</td>
</tr>
</tbody>
</table>

When the program “_SELECT” does not exist:

1) Press the F1 (RESET) key in “AUTO” mode.

2) Press the F4 (YES) key.

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

Fig. 4-9-6 Program reset

<table>
<thead>
<tr>
<th>AUTO</th>
<th>[T1] 50% &lt;TEST1 &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>*ST:</td>
</tr>
<tr>
<td>2</td>
<td>MOVE P, P0</td>
</tr>
<tr>
<td>3</td>
<td>MOVE P, P1</td>
</tr>
<tr>
<td>4</td>
<td>MOVE P, P2</td>
</tr>
<tr>
<td>5</td>
<td>GOTO *ST</td>
</tr>
<tr>
<td>Reset program OK?</td>
<td>YES</td>
</tr>
</tbody>
</table>

NOTE

The output is also reset when the program is reset. However, the output will not be reset when a sequence program is being executed without selecting “RST.DO” in the sequence execution “ENABLE/DISABLE” flag setting.

The output is also reset when the program is reset. However, the output will not be reset when a sequence program is being executed without selecting “RST.DO” in the sequence execution “ENABLE/DISABLE” flag setting.
When the program “-_SELECT_” exists:

1) Press the [F 1] (RESET) key in “AUTO” mode. The following message appears on the guideline when “-_SELECT_” exists among the programs. Press the [F 4] (YES) key to reset the selected program by switching it to “-_SELECT_”, or press the [F 5] (NO) key to just reset the current program.

![Fig. 4-9-7 Program reset]

<table>
<thead>
<tr>
<th>AUTO</th>
<th>[T1] 50% &lt;TEST1 &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>*ST:</td>
</tr>
<tr>
<td>2</td>
<td>MOVE P, P0</td>
</tr>
<tr>
<td>3</td>
<td>MOVE P, P1</td>
</tr>
<tr>
<td>4</td>
<td>MOVE P, P2</td>
</tr>
<tr>
<td>5</td>
<td>GOTO *ST</td>
</tr>
</tbody>
</table>

Change to _SELECT_ OK? YES NO

2) When the [F 5] (NO) key is pressed in Step 1), the following message then appears on the guideline. Press the [F 4] (YES) key to reset the current program, or press the [F 5] (NO) key to cancel the reset.

![Fig. 4-9-8 Program reset]

<table>
<thead>
<tr>
<th>AUTO</th>
<th>[T1] 50% &lt;TEST1 &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>*ST:</td>
</tr>
<tr>
<td>2</td>
<td>MOVE P, P0</td>
</tr>
<tr>
<td>3</td>
<td>MOVE P, P1</td>
</tr>
<tr>
<td>4</td>
<td>MOVE P, P2</td>
</tr>
<tr>
<td>5</td>
<td>GOTO *ST</td>
</tr>
</tbody>
</table>

Reset program OK? YES NO

**NOTE**
The output is also reset when the program is reset. However, the output will not be reset when a sequence program is being executed without selecting “RST.DO” in the sequencer execution “ENABLE/DISABLE” flag setting.
9. “AUTO” mode

9.4 Switching task display

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

[Procedure]

1) Press the [STOP] key during program execution to stop the program.

2) Press the [ESC] key to display the program listing.
   The pointer indicates the next command line number to be executed in the current task.

   ![Fig. 4-9-9 Main task (T1) display]
   AUTO [T1] 100% <TEST1 >
   5 MOVE P,P0
   6 *L1:
   7 MOVE P,P1
   8 MOVE P,P2
   9 GOTO *L1
   RESET TASK DIR VEL+ VEL-

3) Press the [F 2] (TASK) key to select a lower-order task program.
   Each time the [F 2] (TASK) key 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.

   ![Fig. 4-9-10 Sub task (T2 to T8) display]
   AUTO [T2] 100% <TEST1 >
   11 WAIT DI2(0)=1
   12 DO2(1)=1
   13 DELAY 1000
   14 DO2(1)=0
   15 WAIT DI2(0)=0
   RESET TASK DIR VEL+ VEL-
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.

[Procedure]

1) Press the F 3 (DIR) key in “AUTO” mode.
   Program information appears. A pointer is displayed on the line number of the program which is currently selected.

2) Use the cursor (↑/↓) keys to select the desired program and press the ESC key.
   The selected program will automatically be compiled and an object program file made.

---

**NOTE**

The output is also reset when the program is reset. However, the output will not be reset when a sequence program is being executed without selecting “RST.DO” in the sequencer execution “ENABLE/DISABLE” flag setting.
9. “AUTO” mode

### 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%.

**[Procedure]**

1) Press the \[F 4\] (VEL+) or \[F 5\] (VEL-) key in “AUTO” mode to change the speed in steps.

   Each time the \[F 4\] (VEL+) or \[F 5\] (VEL-) key is pressed, the speed changes in steps of 1% → 5% → 20% → 50% → 100%.

   The maximum motor speed is set at 100%.

2) Press the \[F 9\] (VEL++) or \[F 10\] (VEL--) key to change the speed gradually.

   Each time the \[F 9\] (VEL++) or \[F 10\] (VEL--) key 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 (Linear interpolation motion at the sub robot is not supported in controller versions prior to Ver. 8.64.)

**[Procedure]**

1) Press the \[F 6\] (POINT) key in “AUTO” mode.

   The screen switches to “AUTO>POINT” mode and the point data appears as shown below.

   ![Fig. 4-9-12 Point trace screen (with no auxiliary axis)](image)

   - The “[RIGHTY]” message on the first line appears only when a SCARA robot is selected.
   - The “[LEFTY]” message on the sixth 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.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑ / ↓)</td>
<td>Switches the point number and scrolls the screen.</td>
<td></td>
</tr>
<tr>
<td>Page key (〈 / 〉)</td>
<td>Switches to other screens.</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>PTP/ARCH/LINEAR</td>
<td>Switches the trace movement mode.</td>
</tr>
<tr>
<td>F2</td>
<td>A.POS</td>
<td>Specifies the arch position during ARCH motion mode.</td>
</tr>
<tr>
<td>F3</td>
<td>JUMP</td>
<td>Displays the specified point data.</td>
</tr>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases automatic movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases automatic movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td>F6</td>
<td>A.AXIS+</td>
<td>Moves the arch axis to the right during ARCH motion mode.</td>
</tr>
<tr>
<td>F7</td>
<td>A.AXIS-</td>
<td>Moves the arch axis to the left during ARCH motion mode.</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Switches the units for indicating the current position to “mm/pulse”.</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases automatic movement speed for the selected robot group in 1% increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases automatic movement speed for the selected robot group in 1% decrements.</td>
</tr>
<tr>
<td>F11</td>
<td>MODIFY</td>
<td>Switches to the point data editing screen in “MANUAL” mode.</td>
</tr>
<tr>
<td>F14</td>
<td>AXIS←</td>
<td>Moves the cursor to the left to select another axis.</td>
</tr>
<tr>
<td>F15</td>
<td>AXIS→</td>
<td>Moves the cursor to the right to select another axis.</td>
</tr>
<tr>
<td>ROBOT (LOWER + MODE)</td>
<td>Switches the selected robot group.</td>
<td></td>
</tr>
</tbody>
</table>

### F11 (MODIFY) key

Pressing the [F 11](MODIFY) key 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 the [F 11](TRACE) key again.
9. “AUTO” mode

9.7.1 PTP motion mode

1. When no auxiliary axis is specified:

[Procedure]

1) Press the \textbf{F 1} key in “AUTO>POINT” mode to display a screen like that shown below, then press the \textbf{F 1} (PTP) key to select the PTP motion mode.

\begin{verbatim}
Auto>Point [Righty] 50/100% [MG][SOHOJ]
\end{verbatim}

\begin{verbatim}
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   ARCH   LINEAR
\end{verbatim}

2) Use the cursor (\uparrow/\downarrow) keys to select the point number to be checked.

\begin{verbatim}
Auto>Point [Righty] 50/100% [MG][SOHOJ]
\end{verbatim}

\begin{verbatim}
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-
\end{verbatim}

3) Press the \textbf{START} key, and the robot moves by PTP motion to the specified point position. The trace speed is one tenth 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 the \textbf{STOP} key.

\textbf{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.

\textbf{WARNING}

Upon pressing the \textbf{START} key, the robot starts to move. To avoid danger, do not enter the robot movement range.
2. When auxiliary axis is specified:

[Procedure]

1) Press the \[F 1\] key in “AUTO>POINT” mode to display a screen like that shown below, then press the \[F 1\] (PTP) key.

Fig. 4-9-15 Point trace screen in PTP motion mode (with auxiliary axis)

<table>
<thead>
<tr>
<th>AUTO&gt;POINT [RIGHTY] 50/100% [MG][SOHOJ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x        y        z        r</td>
</tr>
<tr>
<td>P3 = 150.50 64.53 21.78 -45.14</td>
</tr>
<tr>
<td>P4 = 96.65 -224.89 43.31 28.79</td>
</tr>
<tr>
<td>P5 = -63432 19735 6243 22642</td>
</tr>
<tr>
<td>COMNT : [LEFTY] [POS] 0 0 0 0</td>
</tr>
<tr>
<td>PTP ARCH LINEAR</td>
</tr>
</tbody>
</table>

2) Use the cursor (↑/↓) keys and \[F 14\] (AXIS←) or \[F 15\] (AXIS→) key so that the point value of the robot axis to be checked is highlighted.

To perform trace for the robot main axes:

Fig. 4-9-16 Point trace screen in PTP motion mode (with auxiliary axis)

<table>
<thead>
<tr>
<th>AUTO&gt;POINT [RIGHTY] 50/100% [MG][SOHOJ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x        y        z        r</td>
</tr>
<tr>
<td>P3 = 150.50 64.53 21.78 -45.14</td>
</tr>
<tr>
<td>P4 = 96.65 -224.89 43.31 28.79</td>
</tr>
<tr>
<td>P5 = -63432 19735 6243 22642</td>
</tr>
<tr>
<td>COMNT : [LEFTY] [POS] 0 0 0 0</td>
</tr>
<tr>
<td>PTP ARCH LINEAR</td>
</tr>
</tbody>
</table>

To perform trace for the auxiliary axis:

Fig. 4-9-17 Point trace screen in PTP motion mode (with auxiliary axis)

<table>
<thead>
<tr>
<th>AUTO&gt;POINT [RIGHTY] 50/100% [MG][SOHOJ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x        y        z        r</td>
</tr>
<tr>
<td>P3 = 150.50 64.53 21.78 -45.14</td>
</tr>
<tr>
<td>P4 = 96.65 -224.89 43.31 28.79</td>
</tr>
<tr>
<td>P5 = -63432 19735 6243 22642</td>
</tr>
<tr>
<td>COMNT : [LEFTY] [POS] 0 0 0 0</td>
</tr>
<tr>
<td>PTP ARCH LINEAR</td>
</tr>
</tbody>
</table>

3) Press the \[START\] key, and the robot moves by PTP motion to the specified point position. The trace speed is one tenth 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 the \[STOP\] key.
9. “AUTO” mode

9.7.2 ARCH motion mode

1. When no auxiliary axis is specified:

[Procedure]

1) Press the [F 1] key in “AUTO>POINT” mode to display a screen like that shown below, then press the [F 2] (ARCH) key.

![Fig. 4-9-18 Point trace screen in ARCH motion mode (with no auxiliary axis)](image)

<table>
<thead>
<tr>
<th>AUTO&gt;POINT [RIGHTY] 50/100% [MG][SOHOJ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x—— y—— z—— r———</td>
</tr>
<tr>
<td>P3 = 150.50  64.53  21.78  -45.14</td>
</tr>
<tr>
<td>P4 = 96.65  -224.89  43.31  28.79</td>
</tr>
<tr>
<td>P5 = -63432  19735  6243  22642</td>
</tr>
<tr>
<td>COMNT :</td>
</tr>
<tr>
<td>[POS] 0 0 0 0</td>
</tr>
<tr>
<td>PTP ARCH LINEAR</td>
</tr>
</tbody>
</table>

2) Press the [F 6] (A.AXIS+) or [F 7] (A.AXIS-) to select the axis to move by arch motion.

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

![Fig. 4-9-19 Point trace screen in ARCH motion mode (with no auxiliary axis)](image)

<table>
<thead>
<tr>
<th>AUTO&gt;POINT [RIGHTY] 50/100% [MG][SOHOJ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x—— y—— ARCH(z)—— r———</td>
</tr>
<tr>
<td>P3 = 150.50  64.53  21.78  -45.14</td>
</tr>
<tr>
<td>P4 = 96.65  -224.89  43.31  28.79</td>
</tr>
<tr>
<td>P5 = -63432  19735  6243  22642</td>
</tr>
<tr>
<td>COMNT :</td>
</tr>
<tr>
<td>[POS] 0 0 0 0</td>
</tr>
<tr>
<td>ARCH A.POS JUMD VEL+ VEL–</td>
</tr>
</tbody>
</table>

3) Press the [F 2] (A.POS) key and set the arch motion position.

![Fig. 4-9-20 Point trace screen in ARCH motion mode (with no auxiliary axis)](image)

<table>
<thead>
<tr>
<th>AUTO&gt;POINT [RIGHTY] 50/100% [MG][SOHOJ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x—— y—— ARCH(z)—— r———</td>
</tr>
<tr>
<td>P3 = 150.50  64.53  21.78  -45.14</td>
</tr>
<tr>
<td>P4 = 96.65  -224.89  43.31  28.79</td>
</tr>
<tr>
<td>P5 = -63432  19735  6243  22642</td>
</tr>
<tr>
<td>COMNT :</td>
</tr>
<tr>
<td>[POS] 0 0 0 0</td>
</tr>
<tr>
<td>Enter ARCH data&gt; 20000</td>
</tr>
</tbody>
</table>

4) 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.](image)

![WARNING
Upon pressing the [START] key, the robot starts to move. To avoid danger, do not enter the robot movement range.](image)

5) Press the [START] key to move the robot by arch motion to the specified point position.

The trace speed is one tenth 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 the [STOP] key.
2. When auxiliary axis is specified:

[Procedure]

1) Press the \[F \ 1\] key in “AUTO>POINT” mode to display a screen like that shown below, then press the \[F \ 2\] (ARCH) key.

Settings in steps 2) and 3) are not required when performing point trace using an auxiliary axis.

Fig. 4-9-21 Point trace screen in ARCH motion mode (with auxiliary axis)

2) Press the \[F \ 6\] (A.AXIS+) or \[F \ 7\] (A.AXIS -) to select the axis to move by arch motion.

The selected axis is indicated on the message line, for example “ARCH(z)” as shown below.

Fig. 4-9-22 Point trace screen in ARCH motion mode (with auxiliary axis)

3) Press the \[F \ 2\] (A.POS) key and set the arch motion position.

Fig. 4-9-23 Point trace screen in ARCH motion mode (with auxiliary axis)

4) Use the cursor (↑/↓) keys and \[F \ 14\] (AXIS←) or \[F \ 15\] (AXIS→) key so that the point value of the robot axis to be checked is highlighted.

5) Press the \[START\] key to move the robot by arch motion to the specified point position. (The auxiliary axis moves by PTP.) The trace speed is one tenth 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 the \[STOP\] key.

\[NOTE\]

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.

\[WARNING\]

Upon pressing the \[START\] key, the robot starts to move. To avoid danger, do not enter the robot movement range.
9. “AUTO” mode

9.7.3 Linear interpolation motion mode

1. When no auxiliary axis is specified:

[Procedure]

1) Press the \[ F 1 \] key in “AUTO>POINT” mode to display a screen like that shown below, then press the \[ F 3 \] (LINEAR) key.

![Fig. 4-9-24 Point trace screen in linear interpolation motion mode (with no auxiliary axis)](image)

2) Use the cursor (↑/↓) keys to select the point number to be checked.

![Fig. 4-9-25 Point trace screen in linear interpolation motion mode (with no auxiliary axis)](image)

3) Press the \[ START \] key to move the robot by linear interpolation motion to the specified point position. The trace speed is one tenth 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 the \[ STOP \] key.

**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.
- Linear interpolation motion at the sub robot is not supported in controller versions prior to Ver. 8.64.

**WARNING**
Upon pressing the \[ START \] key, the robot starts to move. To avoid danger, do not enter the robot movement range.
2. When auxiliary axis is specified:

[Procedure]

1) Press the \( F_1 \) key in “AUTO>POINT” mode to display a screen like that shown below, then press the \( F_3 \) (LINEAR) key.

![Fig. 4-9-26 Point trace screen in linear interpolation motion mode (with auxiliary axis)](auto-point-screen.png)

\[
\begin{align*}
P_3 &= 150.50 \quad 64.53 \quad 21.78 \quad -45.14 \\
P_4 &= 96.65 \quad -224.89 \quad 43.31 \quad 28.79 \\
P_5 &= -63432 \quad 19735 \quad 6243 \quad 22642 \\
\text{COMNT} &= \text{[LEFTY]} \\
[\text{POS}] &= 0 \quad 0 \quad 0 \quad 0 \\
\text{PTP ARCH LINEAR} &= \text{LINEAR JUMP VEL+ VEL-}
\end{align*}
\]

2) Use the cursor (↑/↓) keys and \( F_{14} \) (AXIS←) or \( F_{15} \) (AXIS→) key so that the point value of the robot axis to be checked is highlighted.

To perform trace for the robot main axes:

![Fig. 4-9-27 Point trace screen in linear interpolation motion mode (with auxiliary axis)](auto-point-screen-mains.png)

![Fig. 4-9-28 Point trace screen in linear interpolation motion mode (with auxiliary axis)](auto-point-screen-aux.png)

3) Press the \( \text{START} \) key to move the robot by linear interpolation motion to the specified point position. (The auxiliary axis moves by PTP.) The trace speed is one tenth 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 the \( \text{STOP} \) key.

**WARNING**

Upon pressing the \( \text{START} \) key, the robot starts to move. To avoid danger, do not enter the robot movement range.

**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.
- Linear interpolation motion at the sub robot is not supported in controller versions prior to Ver. 8.64.
9.8 Direct command execution

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

**Procedure**

1) Press the \[ F 7 \] (DIRECT) key 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.

   **Fig. 4-9-29 Direct command execution**

   ![Auto Direct Command Execution](image)

   **NOTE**

   The following command statements can be executed directly:

   - 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.

2) Enter one line of the command statement.

3) Press the \[ \text{key} \] key to execute the command you have just entered.
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 the START key is pressed.

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td></td>
<td>Specifies the break point and scrolls the screen.</td>
</tr>
<tr>
<td>Page key (_PAGE/<em>PAGE</em>)</td>
<td></td>
<td>Switches the page display.</td>
</tr>
<tr>
<td>F1</td>
<td>SET</td>
<td>Sets the break point.</td>
</tr>
<tr>
<td>F2</td>
<td>CANCEL</td>
<td>Deletes the break point.</td>
</tr>
<tr>
<td>F3</td>
<td>SEARCH</td>
<td>Searches for the line set with the break point.</td>
</tr>
<tr>
<td>F6</td>
<td>JUMP</td>
<td>Shows the program listing from specified line.</td>
</tr>
<tr>
<td>F7</td>
<td>FIND</td>
<td>Specifies the character string to be found.</td>
</tr>
<tr>
<td>F8</td>
<td>FIND+</td>
<td>Finds the specified character string searching backwards from the cursor position.</td>
</tr>
<tr>
<td>F9</td>
<td>FIND-</td>
<td>Finds the specified character string searching forwards from the cursor position.</td>
</tr>
</tbody>
</table>

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.

[Procedure]

1) Press the F8 (BREAK) key in “AUTO” mode to switch to “AUTO>BREAK” mode.

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

3) Press the F1 (SET) key.

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

Fig. 4-9-30 Break point setting

<table>
<thead>
<tr>
<th>AUTO&gt;BREAK</th>
<th>[T1] 100% &lt;TEST1 &gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &quot;***** TEST1 PROGRAM *****&quot;</td>
<td></td>
</tr>
<tr>
<td>2 START *SUBTASK,T2</td>
<td></td>
</tr>
<tr>
<td>3 DO2(0)=0</td>
<td></td>
</tr>
<tr>
<td>4 BWAIT DI3(4,3,2)=3</td>
<td></td>
</tr>
<tr>
<td>5 MOVE P,P0</td>
<td></td>
</tr>
<tr>
<td>SET CANCEL SEARCH</td>
<td></td>
</tr>
</tbody>
</table>
9.9.2 Deleting break points

Break points can be deleted. Press the [F 3] (SEARCH) key as needed to find a break point that was set.

[Procedure]

1) Use the cursor (↑/↓) keys to select the line number where the break point is set.

2) Press the [F 2] (CANCEL) key.
   The “B” mark disappears and the break point is canceled.

3) To find the line number on which another break point was set, press the [F 3] (SEARCH) key.
   This function makes it easier to find a break point that you want to delete.

NOTE

• Up to 4 break points can be set in one program. These 4 break points cannot be 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 subroutines are enabled when executing NEXT.
9.10 Executing a step

[Procedure]
1) Press the \[F 11\] (STEP) key in “AUTO” mode.

2) Each time this key is pressed, the command statement of the highlighted line number is executed.
   After execution, the pointer moves to the next line.
   If the command statement is a sub-routine or sub-procedure, its top line is executed.

![Fig. 4-9-31 STEP execution](image)

9.11 Skipping a step

[Procedure]
1) Press the \[F 12\] (SKIP) key in “AUTO” mode.

2) The program moves (skips) to the next line each time this key is pressed without executing the command statement of the line number where the pointer is displayed.

9.12 Executing the next step

[Procedure]
1) Press the \[F 13\] (NEXT) key in “AUTO” mode.

2) Each time this key is pressed, the command statement of the highlighted line number is executed. After execution, the pointer moves to the next line.
   If the command statement is a sub-routine or sub-procedure, it is executed at once.
10. “PROGRAM” mode

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

The initial “PROGRAM” mode screen is shown in Fig. 4-10-1. On entering “PROGRAM” mode, the currently selected program appears on the screen.

**Fig. 4-10-1 “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.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑ / ↓)</td>
<td></td>
<td>Selects the program and scrolls the screen.</td>
</tr>
<tr>
<td>Page key (← / →)</td>
<td></td>
<td>Switches the page display.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the program.</td>
</tr>
<tr>
<td>F3</td>
<td>DIR</td>
<td>Displays the program data.</td>
</tr>
<tr>
<td>F5</td>
<td>COMPILE</td>
<td>Compiles the program.</td>
</tr>
<tr>
<td>F6</td>
<td>JUMP</td>
<td>Displays the program listing from a specified line.</td>
</tr>
<tr>
<td>F7</td>
<td>FIND</td>
<td>Specifies the character string to be found.</td>
</tr>
<tr>
<td>F8</td>
<td>FIND+</td>
<td>Finds the specified character string searching backwards from the cursor position.</td>
</tr>
<tr>
<td>F9</td>
<td>FIND-</td>
<td>Finds the specified character string searching forwards from the cursor position.</td>
</tr>
<tr>
<td>F13</td>
<td>ERR.RST</td>
<td>Allows editing if the selected program is destroyed.</td>
</tr>
</tbody>
</table>

**NOTE**
Refer to the separate “Programming Manual” for details on the programming language.

### 10.1 Scrolling a program listing

**[Procedure]**
1) 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.

2) Pressing the page (<<, >>, , , ) key scrolls one page screen at a time.
10. “PROGRAM” mode

10.2 Program editing

[Procedure]

1) Press the F 1 (EDIT) key in “PROGRAM” mode.
   A cursor appears on the top line of a program listing as shown in Fig. 4-10-2, allowing program editing.

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

3) When program editing is complete, press the ESC key.

NOTE
Program editing is finished when any of the key, up/down cursor (↑↓) keys, page up/down (↑↓) keys, or ESC key 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.

Pressing the key finishes the program input for one line and moves the cursor to the beginning of the next line.
Valid keys and submenu descriptions in “PROGRAM > EDIT” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td></td>
<td>Moves the cursor and scrolls the screen.</td>
</tr>
<tr>
<td>Page key (←/→)</td>
<td></td>
<td>Switches the page display.</td>
</tr>
<tr>
<td>INS</td>
<td></td>
<td>Switches between Insert and Overtype modes.</td>
</tr>
<tr>
<td>L.INS</td>
<td></td>
<td>Inserts one blank line.</td>
</tr>
<tr>
<td>DEL</td>
<td></td>
<td>Deletes one character.</td>
</tr>
<tr>
<td>L.DEL</td>
<td></td>
<td>Deletes one line.</td>
</tr>
<tr>
<td>USER</td>
<td></td>
<td>Displays the user function key.</td>
</tr>
<tr>
<td>ESC</td>
<td></td>
<td>Ends program editing.</td>
</tr>
<tr>
<td>key</td>
<td></td>
<td>Finishes the program input for one line and moves the cursor to the beginning of the next line.</td>
</tr>
<tr>
<td>F1</td>
<td>SELECT</td>
<td>Selects the starting line for copy or cut.</td>
</tr>
<tr>
<td>F2</td>
<td>COPY</td>
<td>Copies the selected line and temporarily stores it in a buffer.</td>
</tr>
<tr>
<td>F3</td>
<td>CUT</td>
<td>Cuts the selected lines and temporarily stores it in a buffer.</td>
</tr>
<tr>
<td>F4</td>
<td>PASTE</td>
<td>Inserts the buffer data directly prior to the cursor line.</td>
</tr>
<tr>
<td>F5</td>
<td>BS</td>
<td>Backs the cursor and deletes the preceding character.</td>
</tr>
<tr>
<td>F6</td>
<td>JUMP</td>
<td>Displays the program listing from the specified line.</td>
</tr>
<tr>
<td>F7</td>
<td>FIND</td>
<td>Specifies the character string to be found.</td>
</tr>
<tr>
<td>F8</td>
<td>FIND+</td>
<td>Finds the specified character string searching backwards from the cursor position.</td>
</tr>
<tr>
<td>F9</td>
<td>FIND-</td>
<td>Finds the specified character string searching forwards from the cursor position.</td>
</tr>
</tbody>
</table>
10. “PROGRAM” mode

10.2.1 Cursor movement

[Procedure]
1) 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.

2) Pressing the page (<<, >>, <<, >>) key moves the cursor one page screen at a time.

Fig. 4-10-3 Cursor movement

10.2.2 Insert/Overwrite mode switching

[Procedure]
1) Press the INS key in “PROGRAM > EDIT” mode.

The cursor changes to underline ( _ ) form, and the screen switches to Insert mode. In Insert mode, the input character is inserted just previous to the cursor position.

Fig. 4-10-4 Insert mode
2) Press the [INS] key again.
The cursor changes back to a thick line (■), and the screen returns to Overwrite mode. In Overtype mode, the input character replaces the character at the cursor position.

Fig. 4-10-5 Overtype mode

10.2.3 Inserting a line

[Procedure]
Pressing the [LINS] (= [LOWER] + [INS]) key in “PROGRAM > EDIT” mode inserts a blank line at the line previous to the cursor position.

Fig. 4-10-6 Inserting a line

10.2.4 Deleting a character

[Procedure]
Pressing the [DEL] key in “PROGRAM > EDIT” mode deletes one character at the cursor position.
10.2.5 Deleting a line

[Procedure]
Pressing the \( L.DEL \) key in the “PROGRAM > EDIT” mode deletes one line at the cursor position.
The program lines after the cursor position then move upward. For example, deleting one line on the screen in Fig. 4-10-3 changes to the following screen.

![Fig. 4-10-7 Deleting a line](image)

10.2.6 User function key display

User function keys make it easier to enter programs.

[Procedure]
1) Press the \( \text{USER} \) key in “PROGRAM > EDIT” mode to display the character strings on the guideline, which are preassigned to function keys \( \text{F 1} \) to \( \text{F 15} \).
Each character string is displayed in up to 7 characters from the beginning.
2) Press the function key matching the character string you want to enter.

For example, when the \( \text{F 2} \) (GOTO *) key is pressed in Fig. 4-10-8, the character string for “GOTO *” is entered at the cursor position.

![Fig. 4-10-8 User function keys](image)

**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.
10.2.7 Quitting program editing

Press the [ESC] key to quit program editing in “PROGRAM>EDIT” mode.

10.2.8 Specifying the copy/cut lines

[Procedure]
1) In “PROGRAM>EDIT” mode, move the cursor to the line you want to copy or cut.

2) Press the [F 1] (SELECT) key to select the line.

3) Use the cursor (↓) keys to specify the copy/cut range.
   A “[C]” mark appears on each line which was specified.

Press the [ESC] key if you want to cancel this operation.

Fig. 4-10-9 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.

10.2.9 Copying the selected lines

[Procedure]
After selecting the lines in “10.2.8”, press the [F 2] (COPY) key.
The data on the selected lines are copied into the buffer. The “[C]” marks then disappear.

Fig. 4-10-10 Copying the selected lines
10. “PROGRAM” mode

10.2.10 Cutting the selected lines

[Procedure]
After selecting the lines in “10.2.8”, press the [F 3] (CUT) key.
The data on the selected lines are cut and stored into the buffer. The “□” marks then disappear.

Fig. 4-10-11 Cutting the selected lines

10.2.11 Pasting the data

[Procedure]
When the [F 4] (PASTE) key is pressed in “PROGRAM>EDIT” mode, the data stored into the buffer by copy/cut operation is inserted just before the cursor line.

Fig. 4-10-12 Pasting the data

10.2.12 Backspace

[Procedure]
Pressing the [F 5] (BS) key 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.
10.2.13 Line jump

[Procedure]

1) In “PROGRAM>EDIT” mode, press the \[F6\] (JUMP) key to enter “PROGRAM>EDIT>JUMP” mode.
   The message “Enter line no. >” appears on the guideline.

![Fig. 4-10-13 Line jump](image)

2) Enter the line number to jump to and press the \[Enter\] key.
   The program is then displayed from the specified line.

![Fig. 4-10-14 Performing line jump](image)
10. “PROGRAM” mode

10.2.14 Searching a character string

[Procedure]

1) In “PROGRAM>EDIT” mode, press the $F_7$ (FIND) key to enter “PROGRAM>EDIT>FIND” mode. The message “Character string >” appears on the guideline.

2) Enter the character string you want to search for and press the $\text{+}$ key. A maximum of 20 characters can be used.

![Fig. 4-10-15 Character string search](image1)

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

![Fig. 4-10-16 Character string search](image2)

3) To continuously search for another character string, press the $F_8$ (FIND+) or $F_9$ (FIND-) key. Pressing the $F_8$ (FIND+) key restarts the search from the current cursor position towards the end of the program. Pressing the $F_9$ (FIND-) key 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 the F 3 (DIR) key is pressed in “PROGRAM” mode, information on each program appears as shown below.

Fig. 4-10-17 Program information (1)

![Program information](image)

Pressing the → key on the above screen displays the “DATE” and “TIME” data.

(Press the ← key to return to the previous display.)

Fig. 4-10-18 Program data (2)

![Program data](image)

Contents of each item are shown below.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Indicates the serial number of the program. The number of the program which is currently selected is highlighted (reversed background).</td>
</tr>
<tr>
<td>Name</td>
<td>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.</td>
</tr>
<tr>
<td>Line</td>
<td>Shows the number of lines in the program.</td>
</tr>
<tr>
<td>Byte</td>
<td>Shows how many bytes of memory the program uses.</td>
</tr>
<tr>
<td>RW/RO</td>
<td>Indicates the program attribute. RW: Reading or writing enabled. RO: Reading only enabled; writing inhibited.</td>
</tr>
<tr>
<td>Date</td>
<td>Shows the date when the program was made or edited.</td>
</tr>
<tr>
<td>Time</td>
<td>Shows the time when the program was made or edited.</td>
</tr>
</tbody>
</table>

**NOTE**

A maximum of 100 programs can be stored.

**NOTE**

The date and time are updated when the program is created or edited.
10. “PROGRAM” mode

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td></td>
<td>Selects the program or scrolls the screen vertically.</td>
</tr>
<tr>
<td>Cursor key (←/→)</td>
<td></td>
<td>Switches between the program information display and the date/time display.</td>
</tr>
<tr>
<td>Page key (∆/▽)</td>
<td></td>
<td>Switches to other screens.</td>
</tr>
<tr>
<td>F1</td>
<td></td>
<td>Registers a new program name.</td>
</tr>
<tr>
<td>F5</td>
<td></td>
<td>Shows the number of bytes used for the entire program.</td>
</tr>
<tr>
<td>F6</td>
<td></td>
<td>Copies the program.</td>
</tr>
<tr>
<td>F7</td>
<td></td>
<td>Erases the program.</td>
</tr>
<tr>
<td>F8</td>
<td></td>
<td>Renames the program.</td>
</tr>
<tr>
<td>F10</td>
<td></td>
<td>Changes the program attribute.</td>
</tr>
<tr>
<td>F11</td>
<td></td>
<td>Shows the object program information.</td>
</tr>
<tr>
<td>F15</td>
<td></td>
<td>Automatically creates the program name “FUNCTION”.</td>
</tr>
</tbody>
</table>

10.3.1 Cursor movement

[Procedure]
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.

[Procedure]
1) In “PROGRAM>DIR” mode, press the F 1 (NEW) key to enter “PROGRAM>DIR>NEW” mode.
The message “Enter program name > ” appears on the guideline.

2) Use the 0 to 9, A to Z or _ keys to enter a program name.
   A maximum of 8 characters can be used. (Press the ESC key if you want to cancel the data input.)
10. “PROGRAM” mode

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

3) Press the key to register the program name.

10.3.3 Directory information display

[Procedure]
In “PROGRAM>DIR” mode, press the (INFO) key to enter “PROGRAM>DIR>INFO” mode. The following information on the selected program appears.

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

---

Fig. 4-10-19 Registering a new program

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Line</th>
<th>Byte</th>
<th>RW/RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TEST1</td>
<td>55</td>
<td>952</td>
<td>RW</td>
</tr>
<tr>
<td>2</td>
<td>TEST2</td>
<td>50</td>
<td>907</td>
<td>RW</td>
</tr>
<tr>
<td>3</td>
<td>PARTS100</td>
<td>38</td>
<td>843</td>
<td>RW</td>
</tr>
<tr>
<td>4</td>
<td>TEST100</td>
<td>100</td>
<td>1968</td>
<td>RW</td>
</tr>
</tbody>
</table>

Enter program name >ABC123_

Fig. 4-10-20 Program information

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source (use/sum)</td>
<td>Displays a count of used bytes and bytes available for source program and point data.</td>
</tr>
<tr>
<td>Object (use/sum)</td>
<td>Displays a count of used bytes and bytes available for object program.</td>
</tr>
<tr>
<td>Sequence (use/sum)</td>
<td>Displays a count of used bytes and bytes available for sequence object program. (8 bytes are used for one circuit of sequence program.)</td>
</tr>
<tr>
<td>Number of program</td>
<td>Displays the number of programs.</td>
</tr>
<tr>
<td>Number of points</td>
<td>Displays the number of points that have been set. (28 bytes are used for one point.)</td>
</tr>
</tbody>
</table>
10. “PROGRAM” mode

10.3.4 Copying a program

A program in the directory can be copied under a different name.

**Procedure**

1) In “PROGRAM>DIR” mode, use the cursor (↑/↓) keys to select the program to be copied.

2) Press the F 6 (COPY) key to enter “PROGRAM>DIR>COPY” mode.

   The message "Enter program name >“ appears on the guideline along with an edit cursor.

3) Enter a new program name.

   Press the ESC key if you want to cancel this operation.

   **Fig. 4-10-21 Copying a program**

   ![Program Directory Table]

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Line</th>
<th>Byte</th>
<th>RW/RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TEST1</td>
<td>55</td>
<td>952</td>
<td>RW</td>
</tr>
<tr>
<td>2</td>
<td>*TEST2</td>
<td>50</td>
<td>907</td>
<td>RW</td>
</tr>
<tr>
<td>3</td>
<td>PARTS100</td>
<td>38</td>
<td>843</td>
<td>RW</td>
</tr>
<tr>
<td>4</td>
<td>TEST100</td>
<td>100</td>
<td>1968</td>
<td>RW</td>
</tr>
</tbody>
</table>

   Enter program name >TEST3

4) Press the key to make a copy.

**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 (_).
10. “PROGRAM” mode

10.3.5 Erasing a program

Unnecessary programs in the directory can be erased.

[Procedure]

1) In “PROGRAM>DIR” mode, use the cursor (↑/↓) keys to select the program to be erased.

2) Press the [F 7] (ERASE) key to enter “PROGRAM>DIR>ERASE” mode. A confirmation message appears on the guideline.

Fig. 4-10-22 Erasing a program

![Program listing before erasing](image)

3) Press the [F 4] (YES) key to erase the selected program. Press the [F 5] (NO) key if you want to cancel erasure. After the program is erased, the lower program names move upward.

Fig. 4-10-23 After erasing a program

![Program listing after erasing](image)

⚠️ 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”.

NEW INFO
10. “PROGRAM” mode

10.3.6 Renaming a program

To change the names of programs in the directory, proceed as follows.

[Procedure]

1) In “PROGRAM>DIR” mode, use the cursor (↑/↓) keys to select the program to be renamed.

2) Press the \texttt{F 8} (RENAME) key to enter “PROGRAM>DIR>RENAME” mode. The message “Enter program name” appears on the guideline along with the original program name.

Fig. 4-10-24 Renaming a program

\begin{tabular}{|c|c|c|c|c|}
\hline
No. & Name & Line & Byte & RW/RO \\
\hline
1 & TEST1 & 55 & 952 & RW \\
2 & *TEST2 & 50 & 907 & RW \\
3 & PARTS100 & 38 & 843 & RW \\
4 & TEST100 & 100 & 31968 & RW \\
\hline
\end{tabular}

Enter program name >TEST_

3) Enter a new program name.

Press the \texttt{ESC} key if you want to cancel this operation.

4) Press the \texttt{ Rename } key to rename the program.

\textbf{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 (_).
10.3.7 Changing the program attribute

Editing and erasing the programs can be prohibited by specifying the program attribute. There are two program attributes: RW and RO. Each time a change is made a program attribute is alternately switched.

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.

[Procedure]
1) In “PROGRAM>DIR” mode, use the cursor (↑/↓) keys to select the program with the attribute to be changed.

2) Press the F 10 (ATTRBT) key to enter “PROGRAM>DIR>ATTRBT” mode. A confirmation message appears on the guideline.

Fig. 4-10-25 Changing a program attribute

3) Press the F 4 (YES) key to change the program attribute. Press the F 5 (NO) key if you want to cancel the change.

10.3.8 Displaying object program information

To display information on an executable object program, proceed as follows.

[Procedure]
1) Press the F 11 (OBJECT) key to enter “PROGRAM>DIR>OBJECT” mode.

2) Object information appears as shown below.

Fig. 4-10-26 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.

[Procedure]

1) In “PROGRAM>DIR” mode, press the \texttt{F 15} (EXAMPLE) key to enter “PROGRAM>DIR>EXAMPLE” mode.

A confirmation message appears on the guideline.

\begin{figure}[h]
\centering
\includegraphics[width=0.8\textwidth]{fig4-10-27.png}
\caption{Loading a sample program}
\end{figure}

2) Press the \texttt{F 4} (YES) key to perform this operation.

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

Press the \texttt{F 5} (NO) key if you want to cancel this operation.

3) Rewrite the contents of this program as needed.

User function keys can be customized with this program.

\textbf{NOTE}
Use caution when creating a sample program automatically, since previously defined user function data will be rewritten.

\textbf{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. “PROGRAM” mode
10. “PROGRAM” mode

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.

[Procedure]

1) In “PROGRAM>DIR” mode, select the program to compile with cursor (↑/↓) keys and press the \texttt{ESC} key.

2) Press the \texttt{F 5} (COMPILE) key to enter “PROGRAM>COMPILE” mode. A confirmation message appears on the guideline.

3) Press the \texttt{F 4} (YES) key to compile the program. The message “Compiling” is displayed during compiling. Press the \texttt{F 5} (NO) key if you want to cancel the 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.

\textbf{NOTE}
Even if the specified program is yet not compiled, it is compiled automatically when you move to “AUTO” mode.
10. “PROGRAM” mode

10.5 Line jump and character string search

The \[ F 6 \] (JUMP), \[ F 7 \] (FIND), \[ F 8 \] (FIND+) and \[ F 9 \] (FIND-) keys can be used in the same way as in “PROGRAM>EDIT” mode. Refer to “10.2.13 Line jump” and “10.2.14 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.

[Procedure]

1) In “PROGRAM” mode, press the \[ F 3 \] (DIR) key to enter “PROGRAM>DIR” mode.

2) Press the \[ F 1 \] (NEW) key.

3) When the message “Enter program name >” appears on the guideline, enter “FUNCTION” following this message and press the \[ \] key.

Fig. 4-10-30 Registering “FUNCTION” program (1)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Line</th>
<th>Byte</th>
<th>RW/RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TEST1</td>
<td>55</td>
<td>952</td>
<td>RW</td>
</tr>
<tr>
<td>2</td>
<td>*TEST2</td>
<td>50</td>
<td>907</td>
<td>RW</td>
</tr>
<tr>
<td>3</td>
<td>PARTS100</td>
<td>38</td>
<td>843</td>
<td>RW</td>
</tr>
</tbody>
</table>

Enter program name >FUNCTION

4) Press the \[ ESC \] key to return to “PROGRAM” mode. At the same time, the program name “FUNCTION” appears on the system line as the current program.
10. “PROGRAM” mode

Fig. 4-10-31 Registering “FUNCTION” program (2)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Line</th>
<th>Byte</th>
<th>RW/RO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TEST1</td>
<td>55</td>
<td>952</td>
<td>RW</td>
</tr>
<tr>
<td>2</td>
<td>*TEST2</td>
<td>50</td>
<td>907</td>
<td>RW</td>
</tr>
<tr>
<td>3</td>
<td>PARTS100</td>
<td>38</td>
<td>843</td>
<td>RW</td>
</tr>
<tr>
<td>4</td>
<td>FUNCTION</td>
<td>1</td>
<td>1</td>
<td>RW</td>
</tr>
</tbody>
</table>

5) Press the [F 1] (EDIT) key to enter “PROGRAM>EDIT” mode. A cursor appears on the first line.

6) Enter a command statement for registering function keys in the following format. The command statement format differs between the “PROGRAM” mode and “MANUAL” mode.

When registering function keys for editing in “PROGRAM” mode

*P_F<n>:<character string>

<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).

Example)

*P_F2:’MOVE, P .......... Character string “MOVE, P” is assigned to the [F 2] key.

*P_F8:’DELAY ............. Character string “DELAY” is assigned to the [F 8] key.
When registering function keys for I/O commands in “MANUAL” mode

*<function key number>:<character string>*

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

Example)

*M_F2:'MOMENT ...... Character string “MOMENT” is assigned to the F 2 key.
DO (20) =1 ................... DO (20) is turned ON when the F 2 key is pressed.
DO (20) =0 ................... DO (20) is turned OFF when the F 2 key is released.

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.

Fig. 4-10-32 Registering user functions

7) When the registration is complete, press the ESC key.

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.
10. “PROGRAM” mode

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.

[Procedure]

1) Press the \[F 13\] (ERR. RST) key in “PROGRAM” mode.
   A confirmation message appears on the guideline.

   Fig. 4-10-33

   ![Program Listing]

   1 '***** TEST2 PROGRAM *****
   2 GOSUB *SUBPROG
   3 DO2(0)=-^23-OFW
   4 WAIT DI3(4,3,2)=3
   5 MOVE P,P0 'ORIGIN

   Error reset OK?

   YES NO

2) Press the \[F 4\] (YES) key to reset the error.
   The program can be edited after resetting the error.
   Press the \[F 5\] (NO) key if you want to cancel the error reset.

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.

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 screens are shown in Fig. 4-11-1, Fig. 4-11-2 and Fig. 4-11-3.

**Fig. 4-11-1 “MANUAL” mode (one-robot setting)**

**Fig. 4-11-2 “MANUAL” mode (two-robot setting)**

**Fig. 4-11-3 “MANUAL” mode (with auxiliary axis)**
11. “MANUAL” mode

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 / sub group”, 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) key.

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) key.

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.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jog key</td>
<td></td>
<td>Moves the robot manually.</td>
</tr>
<tr>
<td>F1</td>
<td>POINT</td>
<td>Switches to the point data processing screen.</td>
</tr>
<tr>
<td>F2</td>
<td>PALLET</td>
<td>Switches to the pallet data processing screen.</td>
</tr>
<tr>
<td>F3</td>
<td>ORIGIN</td>
<td>Performs return-to-origin.</td>
</tr>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases automatic movement speed for the selected robot group in steps. (100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F6</td>
<td>SHIFT</td>
<td>Switches to the shift data processing screen.</td>
</tr>
<tr>
<td>F7</td>
<td>HAND</td>
<td>Switches to the hand data processing screen.</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Changes the current position display units to “mm” or “pulse”.</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1% increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1% decrements.</td>
</tr>
<tr>
<td>F15</td>
<td>COORDI</td>
<td>Sets the standard coordinates.</td>
</tr>
<tr>
<td>ROBOT</td>
<td>(LOWER + MODE)</td>
<td>Switches the robot group.</td>
</tr>
</tbody>
</table>
11. “MANUAL” mode

11.1 Manual movement

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

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 MPB screen.

Fig. 4-11-4 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 MPB screen. If “Tool coordinate” mode is selected, a letter “T” is displayed.

Fig. 4-11-5 Display shown in “mm” units (X)

Fig. 4-11-6 Display shown in “mm” units (Tool coordinate mode: T)
11. “MANUAL” mode

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+ or #1- key moves the hand forwards or backwards.
Pressing the #2+ or #2- key moves the hand to the left or right.
Pressing the #4+ or #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.

Fig. 4-11-7 Robot movement in “Tool coordinate” mode (example)

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

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
11. “MANUAL” mode

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

(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. Performs return-to-origin.
11.2 Displaying and editing point data

Press the \( F_1 \) (POINT) key 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.

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.

![Scroll keys](image)

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.

**Fig. 4-11-8 Point data**

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>50% [MG][SOH0J]</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x ) 100.00</td>
<td>( y ) 250.00</td>
</tr>
<tr>
<td>( x ) 122.62</td>
<td>( y ) -24.54</td>
</tr>
<tr>
<td>COMNT: [ ]</td>
<td>[POS] 0 0 0 0 0</td>
</tr>
<tr>
<td>EDIT</td>
<td>TEACH</td>
</tr>
</tbody>
</table>

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

**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).
11. “MANUAL” mode

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

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

11.2.1 Point data input and editing

[Procedure]
1) In “MANUAL>POINT” mode, use the cursor (↑/↓) keys to select the point to edit.

2) Press the [F 1] (EDIT) key to enter “MANUAL>POINT>EDIT” mode.
   An edit cursor appears at the left end of the point line data that was selected.

**Fig. 4-11-9 Editing point data**

```plaintext
MANUAL>POINT>EDIT  50% [MG][SOHOJ]

P7 = 100.00  250.00  15.00  30.00
P8 =
P9 = 122562  -24654  2535  -13711
COMNT: [ ]
[POS] 0 0 0 0 0

UNDO  ■■■ JUMP  ■■■■■
```
3) Use the 0 to 9, +, –, and SPACE keys to enter the point data.
Enter a space to separate between the data for x, y, z, r, a, b. 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.)

±####

• 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).

4) Press the key, cursor up/down (↑/↓) keys or page up/down (↑/, ↓/) keys to finish the point data input.
Press the ESC key if you want to cancel the point data input.

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td></td>
<td>Moves the cursor and scrolls the screen.</td>
</tr>
<tr>
<td>Page key (↑/, ↓/)</td>
<td></td>
<td>Switches to other screen.</td>
</tr>
<tr>
<td>INS</td>
<td></td>
<td>Toggles between Insert mode and Overwrite mode.</td>
</tr>
<tr>
<td>DEL</td>
<td></td>
<td>Deletes one character on the cursor position.</td>
</tr>
<tr>
<td>F1</td>
<td>UNDO</td>
<td>Restores the point data.</td>
</tr>
<tr>
<td>F3</td>
<td>JUMP</td>
<td>Jumps to the specified point number.</td>
</tr>
</tbody>
</table>

### 11.2.1.1 Restoring point data

**[Procedure]**

During point data editing, pressing the F 1 (UNDO) key reverses the last data input and restores the preceding data.
This function is enabled only on lines that are not yet complete.
11. **“MANUAL” mode**

11.2.2 **Point data input by teaching**

The current position of the robot can be obtained as point data by teaching.

**When no auxiliary axis is used:**

**[Procedure]**

1) In “MANUAL> POINT” mode, use the cursor (↑/↓) keys to select the point number to obtain point data.

![Fig. 4-11-10 Point data teaching (with no auxiliary axis [1])](image)

2) 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.

3) When the arm arrives at the target point, press the **(TEACH)** key. 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.

![Fig. 4-11-11 Point data teaching (with no auxiliary axis [2])](image)
11. “MANUAL” mode

4) When point data is already allotted to the currently selected point number, a confirmation message appears on the guideline when the \( F_2 \) (TEACH) key is pressed.

**Fig. 4-11-12 Point data teaching (with no auxiliary axis [3])**

<table>
<thead>
<tr>
<th>MANUAL &gt; POINT &gt; TEACH</th>
<th>50% [MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x )</td>
<td>( y )</td>
</tr>
<tr>
<td>P7 = 100.00 250.00 15.00 30.00</td>
<td></td>
</tr>
<tr>
<td>P8 = 50.00 100.00 5.00 10.00</td>
<td></td>
</tr>
<tr>
<td>P9 = 122.62 -24.54 12.35 -23.11</td>
<td></td>
</tr>
<tr>
<td>COMNT:</td>
<td>[ ]</td>
</tr>
<tr>
<td>[POS] 50.00 100.00 5.00 10.00</td>
<td></td>
</tr>
<tr>
<td>Overwrite point OK? YES NO</td>
<td></td>
</tr>
</tbody>
</table>

Press the \( F_4 \) (YES) key to perform the teaching. The specified point number data is rewritten.

Press the \( F_5 \) (NO) key if you want to cancel the teaching input.

**When an auxiliary axis is used:**

**[Procedure]**

1) In “MANUAL > POINT” mode, use the cursor keys to select the point number to obtain point data.

**Fig. 4-11-13 Point data teaching (with auxiliary axis [1])**

**When teaching at P8**

<table>
<thead>
<tr>
<th>MANUAL &gt; POINT</th>
<th>100% [MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>( x )</td>
<td>( y )</td>
</tr>
<tr>
<td>P7 = 100.00 250.00 15.00 30.00</td>
<td></td>
</tr>
<tr>
<td>P8 = 220.00 150.00 115.00 90.00</td>
<td></td>
</tr>
<tr>
<td>P9 = 400.00 200.00 15.00 -30.00</td>
<td></td>
</tr>
<tr>
<td>COMNT:</td>
<td>[ ]</td>
</tr>
<tr>
<td>[POS] -100.00 400.00 50.15 111.23</td>
<td></td>
</tr>
<tr>
<td>EDIT TEACH JUMP VEL+ VEL-</td>
<td></td>
</tr>
</tbody>
</table>
2) Use the cursor (↑/↓) keys, \[ F\, 14\] (AXIS ←) or \[ F\, 15\] (AXIS →) key 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.

Fig. 4-11-14 Point data teaching (with auxiliary axis [2])

<table>
<thead>
<tr>
<th>MANUAL &gt; POINT</th>
<th>100%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>y</td>
</tr>
<tr>
<td></td>
<td>z</td>
</tr>
<tr>
<td></td>
<td>r</td>
</tr>
<tr>
<td>P7</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td>250.00</td>
</tr>
<tr>
<td></td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>30.00</td>
</tr>
<tr>
<td>P8</td>
<td>220.00</td>
</tr>
<tr>
<td></td>
<td>150.00</td>
</tr>
<tr>
<td></td>
<td>115.00</td>
</tr>
<tr>
<td></td>
<td>90.00</td>
</tr>
<tr>
<td>P9</td>
<td>400.00</td>
</tr>
<tr>
<td></td>
<td>200.00</td>
</tr>
<tr>
<td></td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>-30.00</td>
</tr>
<tr>
<td>COMNT:</td>
<td>[ ]</td>
</tr>
<tr>
<td>[POS]</td>
<td>-100.00</td>
</tr>
<tr>
<td></td>
<td>400.00</td>
</tr>
<tr>
<td></td>
<td>50.15</td>
</tr>
<tr>
<td></td>
<td>111.23</td>
</tr>
<tr>
<td>EDIT</td>
<td>TEACH</td>
</tr>
<tr>
<td>JUMP</td>
<td>VEL+</td>
</tr>
<tr>
<td>VEL-</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4-11-15 Point data teaching (with auxiliary axis [3])

<table>
<thead>
<tr>
<th>MANUAL &gt; POINT</th>
<th>100%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>y</td>
</tr>
<tr>
<td></td>
<td>z</td>
</tr>
<tr>
<td></td>
<td>r</td>
</tr>
<tr>
<td>P7</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td>250.00</td>
</tr>
<tr>
<td></td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>30.00</td>
</tr>
<tr>
<td>P8</td>
<td>220.00</td>
</tr>
<tr>
<td></td>
<td>150.00</td>
</tr>
<tr>
<td></td>
<td>115.00</td>
</tr>
<tr>
<td></td>
<td>90.00</td>
</tr>
<tr>
<td>P9</td>
<td>400.00</td>
</tr>
<tr>
<td></td>
<td>200.00</td>
</tr>
<tr>
<td></td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>-30.00</td>
</tr>
<tr>
<td>COMNT:</td>
<td>[ ]</td>
</tr>
<tr>
<td>[POS]</td>
<td>-100.00</td>
</tr>
<tr>
<td></td>
<td>400.00</td>
</tr>
<tr>
<td></td>
<td>50.15</td>
</tr>
<tr>
<td></td>
<td>111.23</td>
</tr>
<tr>
<td>EDIT</td>
<td>TEACH</td>
</tr>
<tr>
<td>JUMP</td>
<td>VEL+</td>
</tr>
<tr>
<td>VEL-</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 4-11-16 Point data teaching (with auxiliary axis [4])

<table>
<thead>
<tr>
<th>MANUAL &gt; POINT</th>
<th>100%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>y</td>
</tr>
<tr>
<td></td>
<td>z</td>
</tr>
<tr>
<td></td>
<td>r</td>
</tr>
<tr>
<td>P7</td>
<td>100.00</td>
</tr>
<tr>
<td></td>
<td>250.00</td>
</tr>
<tr>
<td></td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>30.00</td>
</tr>
<tr>
<td>P8</td>
<td>220.00</td>
</tr>
<tr>
<td></td>
<td>150.00</td>
</tr>
<tr>
<td></td>
<td>115.00</td>
</tr>
<tr>
<td></td>
<td>90.00</td>
</tr>
<tr>
<td>P9</td>
<td>400.00</td>
</tr>
<tr>
<td></td>
<td>200.00</td>
</tr>
<tr>
<td></td>
<td>15.00</td>
</tr>
<tr>
<td></td>
<td>-30.00</td>
</tr>
<tr>
<td>COMNT:</td>
<td>[ ]</td>
</tr>
<tr>
<td>[POS]</td>
<td>-100.00</td>
</tr>
<tr>
<td></td>
<td>400.00</td>
</tr>
<tr>
<td></td>
<td>50.15</td>
</tr>
<tr>
<td></td>
<td>111.23</td>
</tr>
<tr>
<td>EDIT</td>
<td>TEACH</td>
</tr>
<tr>
<td>JUMP</td>
<td>VEL+</td>
</tr>
<tr>
<td>VEL-</td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**
The robot starts to move when a Jog key is pressed. To avoid danger, do not enter the robot movement range.

3) 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.
4) When the axis arrives at the target point, press the \[ F_2 \] (TEACH) key.

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 the \[ F_2 \] (TEACH) key is pressed.

Press the \[ F_4 \] (YES) key to perform the teaching.

Press the \[ F_5 \] (NO) key if you want to cancel the teaching.

**Fig. 4-11-17 Point data teaching (with auxiliary axis [5])**

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT&gt;TEACH</th>
<th>100%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P7 = 100.00 250.00 15.00 30.00</td>
<td></td>
</tr>
<tr>
<td>P8 = 220.00 150.00 115.00 90.00</td>
<td></td>
</tr>
<tr>
<td>P9 = 400.00 200.00 15.00 -30.00</td>
<td></td>
</tr>
<tr>
<td>[POS] 212.43 152.31 100.26 86.86</td>
<td></td>
</tr>
<tr>
<td>Overwrite point OK? YES NO</td>
<td></td>
</tr>
</tbody>
</table>

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

**Fig. 4-11-18 Point data teaching (with auxiliary axis [6])**

When teaching on all axes

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>100%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P7 = 100.00 250.00 15.00 30.00</td>
<td></td>
</tr>
<tr>
<td>P8 = 212.43 152.31 100.26 86.86</td>
<td></td>
</tr>
<tr>
<td>P9 = 400.00 200.00 15.00 -30.00</td>
<td></td>
</tr>
<tr>
<td>[POS] 212.43 152.31 100.26 86.86</td>
<td></td>
</tr>
<tr>
<td>EDIT TEACH JUMP VEL+ VEL-</td>
<td></td>
</tr>
</tbody>
</table>

**Fig. 4-11-19 Point data teaching (with auxiliary axis [7])**

When teaching on standard axes

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>100%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>P7 = 100.00 250.00 15.00 30.00</td>
<td></td>
</tr>
<tr>
<td>P8 = 212.43 152.31 100.26 90.00</td>
<td></td>
</tr>
<tr>
<td>P9 = 400.00 200.00 15.00 -30.00</td>
<td></td>
</tr>
<tr>
<td>[POS] 212.43 152.31 100.26 86.86</td>
<td></td>
</tr>
<tr>
<td>EDIT TEACH JUMP VEL+ VEL-</td>
<td></td>
</tr>
</tbody>
</table>

---

**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.
11. “MANUAL” mode

Fig. 4-11-20 Point data teaching (with auxiliary axis [8])

When teaching on auxiliary axis

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>100%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td>P7</td>
<td>100.00</td>
</tr>
<tr>
<td>P8</td>
<td>220.00</td>
</tr>
<tr>
<td>P9</td>
<td>400.00</td>
</tr>
<tr>
<td>[POS]</td>
<td>212.43</td>
</tr>
</tbody>
</table>

EDIT TEACH JUMP VEL+ VEL-

COMNT:                   

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).

[Procedure]
1) Press the emergency stop button on the MPB.

2) Move the robot by hand to the target point and perform point teaching in “MANUAL>POINT” mode.

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.)

11.2.4 Point jump display

[Procedure]
1) Press the \[F3\] (JUMP) key in “MANUAL>POINT” mode.

The message “Enter point no.” appears on the guideline.

Fig. 4-11-21 Point jump (1)

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>50%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td>P7</td>
<td>100.00</td>
</tr>
<tr>
<td>P8</td>
<td>50.00</td>
</tr>
<tr>
<td>P9</td>
<td>122.62</td>
</tr>
<tr>
<td>[POS]</td>
<td>50.00</td>
</tr>
</tbody>
</table>

Enter point no.>100_
2) Enter the point number to jump to, and press the key. A jump is made so that the point data is displayed from the designated point number.

**Fig. 4-11-22 Point jump (2)**

![Manual POINT mode with point data](image)

### 11.2.5 Copying point data

Point data can be copied under another point number.

**[Procedure]**

1) Press the key in “MANUAL>POINT” mode. The message “Copy(####-####,####)▶” appears on the guideline.

**Fig. 4-11-23 Copying point data (1)**

![Manual POINT mode with point data](image)
2) Use the 0 to 9, – and , keys to enter the point number range for the copy source and the point number for the copy destination in the following format and press the $key.

“(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” and press the $key. A confirmation message appears on the guideline.

Fig. 4-11-24 Copying point data (2)

3) Press the (YES) key 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 the (NO) if you want to cancel the copy.

11.2.6 Erasing point data

[Procedure]

1) Press the (ERASE) key in “MANUAL>POINT” mode. The message “Erase (####-####)>” appears on the guideline.
2) Use the 0 to 9 and – keys to specify the point number range in the following format and press the key.
“(erase start number) - (erase end number)”

For example, to erase the data between P30 and P34, enter “30-34” and press the key.
A confirmation message appears on the guideline.

![Fig. 4-11-26 Erasing point data (2)]

3) Press the F 4 (YES) key to erase the data. The point data in the specified range is erased.
Press the F 5 (NO) key if you want to cancel erasure.

### 11.2.7 Point data trace

Point data positions can be checked by actually moving the robot. Refer to “9.7 Executing the point trace” earlier in this chapter for details.

**[Procedure]**

1) In “MANUAL>POINT” mode, press the F 11 (TRACE) key to switch to “AUTO>POINT” mode.
11. “MANUAL” mode

11.2.8 Point comment input and editing

Press the \[ F \ 12 \] (COMMENT) key 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.

Fig. 4-11-27

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key</td>
<td>EDIT</td>
<td>Specifies point data or scrolls the screen vertically.</td>
</tr>
<tr>
<td>Page key</td>
<td>TEACH</td>
<td>Switches to other screens.</td>
</tr>
<tr>
<td>F1</td>
<td>JUMP</td>
<td>Edits point comments.</td>
</tr>
<tr>
<td>F2</td>
<td>VEL+</td>
<td>Enters point data by teaching.</td>
</tr>
<tr>
<td>F3</td>
<td>VEL-</td>
<td>Displays the specified (jumped) data.</td>
</tr>
<tr>
<td>F4</td>
<td>COPY</td>
<td>Increases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td>F5</td>
<td>ERASE</td>
<td>(1 (\rightarrow) 5 (\rightarrow) 20 (\rightarrow) 50 (\rightarrow) 100 %)</td>
</tr>
<tr>
<td>F6</td>
<td>UNITCHG</td>
<td>Decreases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td>F7</td>
<td>VEL++</td>
<td>(100 (\rightarrow) 50 (\rightarrow) 20 (\rightarrow) 5 (\rightarrow) 1 %)</td>
</tr>
<tr>
<td>F8</td>
<td>VEL--</td>
<td>Copies point comments.</td>
</tr>
<tr>
<td>F9</td>
<td>FIND</td>
<td>Deletes point comments.</td>
</tr>
<tr>
<td>F10</td>
<td>FIND+</td>
<td>Changes the current position display units to “mm” or “pulse”.</td>
</tr>
<tr>
<td>F11</td>
<td>FIND-</td>
<td>Increases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td>F12</td>
<td>ROBOT</td>
<td>increments.</td>
</tr>
<tr>
<td>F13</td>
<td>ROBOT+</td>
<td>Decreases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td>ROBOT</td>
<td>ROBOT-</td>
<td>increments.</td>
</tr>
</tbody>
</table>

NOTE
- Point comments can be entered for point numbers having no data.
- A point comment can be up to 15 characters.
11.2.8.1 Point comment input and editing

[Procedure]

1) In “MANUAL>POINT>COMMENT” mode, use the cursor (↑/↓) keys to select the point to edit or enter a comment.

2) Press the \( \text{F 1} \) (EDIT) key in “MANUAL>POINT>COMMENT” mode. An edit cursor appears on the guideline.

Fig. 4-11-28

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT&gt;COMMENT</th>
<th>50%[MG][SOH0X]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td>z</td>
<td>r</td>
</tr>
<tr>
<td>P7 = 100.00</td>
<td>250.00</td>
</tr>
<tr>
<td>15.00</td>
<td>30.00</td>
</tr>
<tr>
<td>P8 =</td>
<td></td>
</tr>
<tr>
<td>P9 = 122.62</td>
<td>-24.54</td>
</tr>
<tr>
<td>12.35</td>
<td>-23.11</td>
</tr>
<tr>
<td>COMNT:</td>
<td>[ ]</td>
</tr>
<tr>
<td>[POS] 50.00</td>
<td>100.00</td>
</tr>
<tr>
<td>5.00</td>
<td>10.00</td>
</tr>
<tr>
<td>Comment&gt;</td>
<td></td>
</tr>
</tbody>
</table>

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

4) Press the enter key to finish the point comment input and display it.
   Press the \( \text{ESC} \) key 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”.

**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.
11. “MANUAL” mode

11.2.8.3 Jump to a point comment

[Procedure]

1) Press the \[ F 3 \] (JUMP) key in “MANUAL>POINT>COMMENT” mode. The message “Enter point no. >” appears on the guideline.

Fig. 4-11-29

\begin{verbatim}

MANUAL>POINT>COMMENT  50%[MG][SOHOX]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
<th>z</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>P7</td>
<td>100.00</td>
<td>250.00</td>
<td>15.00</td>
</tr>
<tr>
<td>P8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P9</td>
<td>122.62</td>
<td>-24.54</td>
<td>12.35</td>
</tr>
</tbody>
</table>

COMNT: [ ]

[POS] 50.00 100.00 5.00 10.00

Enter point no. >107_

\end{verbatim}

2) Enter the point comment to jump to, and press the \[ \] key.
A jump is made to the designated point and its comment is then displayed.

Fig. 4-11-30

\begin{verbatim}

MANUAL>POINT>COMMENT  50%[MG][SOHOX]

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
<th>z</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>P107</td>
<td>340.05</td>
<td>250.03</td>
<td>115.00</td>
</tr>
<tr>
<td>P108</td>
<td>340.05</td>
<td>200.05</td>
<td>115.00</td>
</tr>
<tr>
<td>P109</td>
<td>122.62</td>
<td>-24.54</td>
<td>12.35</td>
</tr>
</tbody>
</table>

COMNT: WAIT_POS 08 [ ]

[POS] 50.00 100.00 5.00 10.00

EDIT TEACH JUMP VEL+ VEL-

\end{verbatim}

**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.

[Procedure]

1) Press the \[F 6\] (COPY) key in “MANUAL>POINT>COMMENT” mode.

   The message “Copy(####-####,####)▶” appears on the guideline.

2) Use the 0 to 9, – and , keys to enter the point number range for the copy source and the point number for the copy destination in the following format, and press the \[\] key.
   “(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” and press the \[\] key.

   Fig. 4-11-31

3) A confirmation message appears on the guideline.

   Press the \[F 4\] (YES) key to make a copy. The comments in the selected range are copied onto the data lines starting from the specified copy destination number.

   Press the \[F 5\] (NO) if you want to cancel the copy.

   Fig. 4-11-32

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT&gt;COMMENT</th>
<th>50%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x     y     z     r</td>
<td></td>
</tr>
<tr>
<td>P7 = 100.00 250.00 15.00 30.00</td>
<td></td>
</tr>
<tr>
<td>P8 =</td>
<td></td>
</tr>
<tr>
<td>P9 = 122.62 -24.54 12.35 -23.11</td>
<td></td>
</tr>
<tr>
<td>COMNT:</td>
<td>[ ]</td>
</tr>
<tr>
<td>[POS] 50.00 100.00 5.00 10.00</td>
<td></td>
</tr>
<tr>
<td>(7-16,107)Copy OK? YES NO</td>
<td></td>
</tr>
</tbody>
</table>

NOTE

Valid point numbers are from 0 to 9999.
11. “MANUAL” mode

11.2.8.5 Erasing point comments
Point comments already entered can be deleted.

[Procedure]

1) Press the \([ F 7 ]\) (ERASE) key in “MANUAL>POINT>COMMENT” mode.
   The message “Erase(####-####) >” appears on the guideline.

2) Use the \([ 0 ]\) to \([ 9 ]\) and \([-\) keys to specify the point number range in the following format and press the \([\Rightarrow]\) key.
   “(erase start number) - (erase end number)”

   For example, to erase the data between P7 and P16, enter “7-16” and press the \([\Rightarrow]\) key.

   **Fig. 4-11-33**

<table>
<thead>
<tr>
<th>Manual &gt; Point &gt; Comment</th>
<th>50%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td>P7 100.00 250.00 15.00 30.00</td>
<td>P8 =</td>
</tr>
<tr>
<td>P9 122.62 -24.54 12.35 -23.11</td>
<td>Comnt: [ ]</td>
</tr>
<tr>
<td>Pos 50.00 100.00 5.00 10.00</td>
<td>Erase(####-####) &gt;7-16</td>
</tr>
</tbody>
</table>

3) A confirmation message appears on the guideline.
   Press the \([ F 4 ]\) (YES) key to erase the point comments. The point comments in the specified range are erased.
   Press the \([ F 5 ]\) (NO) key if you want to cancel erasure.

   **Fig. 4-11-34**

<table>
<thead>
<tr>
<th>Manual &gt; Point &gt; Comment</th>
<th>50%[MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x</td>
<td>y</td>
</tr>
<tr>
<td>P7 100.00 250.00 15.00 30.00</td>
<td>P8 =</td>
</tr>
<tr>
<td>P9 122.62 -24.54 12.35 -23.11</td>
<td>Comnt: [ ]</td>
</tr>
<tr>
<td>Pos 50.00 100.00 5.00 10.00</td>
<td>(7-16)Erase OK?</td>
</tr>
</tbody>
</table>

**NOTE**
Valid point numbers are from 0 to 9999.
11.2.8.6 Point comment search

Point comments already entered can be located.

[Procedure]

1) Press the $F_{11}$ (FIND) key in “MANUAL>POINT>COMMENT” mode.
   The message “Character string >” appears on the guideline.

2) Enter the character string you want to search for, and press the $F_{12}$ key.
   A maximum of 15 characters can be used.

   Fig. 4-11-35

   | MANUAL>POINT>COMMENT | 50%|[MG][S0H0X] |
   |-----------------------|------------------|
   | 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      |
   | Character string >WAIT|

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

   Fig. 4-11-36

   | MANUAL>POINT>COMMENT | 50%|[MG][S0H0X] |
   |-----------------------|------------------|
   | P334                  | 100.00 250.00 15.00 30.00 |
   | P335                  |                  |
   | P336                  | 122.62 -24.54 12.35 -23.11 |
   | COMNT:WAIT_PICKUP    | [ ]             |
   | [POS] 50.00 100.00    | 5.00 10.00      |
   | EDIT TEACH JUMP VEL+ VEL-|

4) To continuously search for another character string, press the $F_{12}$ (FIND+) or
   $F_{13}$ (FIND-) key.

   Pressing the $F_{12}$ (FIND+) key restarts the search from the current cursor position
   towards the end of the program and stops at the first matching character string.
   Pressing the $F_{13}$ (FIND-) key restarts the search from the current cursor position
   towards the top of the program and stops at the first matching character string.
11. “MANUAL” mode

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.

[Procedure]

1) Press the \( F_{13} \) (ERR. RST) key in “MANUAL>POINT” mode.
   A confirmation message appears on the guideline.

   ![Fig. 4-11-37](image)

<table>
<thead>
<tr>
<th align="center">MANUAL&gt;POINT</th>
<th>50% [MG][SOHOX]</th>
</tr>
</thead>
<tbody>
<tr>
<td align="center">9.2:Point data destroyed</td>
<td></td>
</tr>
<tr>
<td align="center">P30 = 100.00 250.00 15.00 30.00</td>
<td></td>
</tr>
<tr>
<td align="center">P31 = 50.00  100.00 15.00  10.00</td>
<td></td>
</tr>
<tr>
<td align="center">P32 = 122.62 -24.54 12.35 -23.11</td>
<td></td>
</tr>
<tr>
<td align="center">[POS] 50.00 100.00 5.00 10.00</td>
<td></td>
</tr>
<tr>
<td align="center">Error reset OK? YES NO</td>
<td></td>
</tr>
</tbody>
</table>

2) Press the \( F_{4} \) (YES) key to reset the error.
   Point data can be edited after resetting the error.
   Press the \( F_{5} \) (NO) key if you want to cancel the error reset.

⚠️ **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.

💡 **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 the \( \text{F 2} \) (PALLET) key in “MANUAL” mode to enter “MANUAL>PALLET” mode.

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 “11.9 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*NZ*NZ).

![Fig. 4-11-38](image)

<table>
<thead>
<tr>
<th>Pallet number</th>
<th>Point number used</th>
<th>Pallet number</th>
<th>Point number used</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL0</td>
<td>P3996 to P4000</td>
<td>PL10</td>
<td>P3946 to P3950</td>
</tr>
<tr>
<td>PL1</td>
<td>P3991 to P3995</td>
<td>PL11</td>
<td>P3941 to P3945</td>
</tr>
<tr>
<td>PL2</td>
<td>P3986 to P3990</td>
<td>PL12</td>
<td>P3936 to P3940</td>
</tr>
<tr>
<td>PL3</td>
<td>P3981 to P3985</td>
<td>PL13</td>
<td>P3931 to P3935</td>
</tr>
<tr>
<td>PL4</td>
<td>P3976 to P3980</td>
<td>PL14</td>
<td>P3926 to P3930</td>
</tr>
<tr>
<td>PL5</td>
<td>P3971 to P3975</td>
<td>PL15</td>
<td>P3921 to P3925</td>
</tr>
<tr>
<td>PL6</td>
<td>P3966 to P3970</td>
<td>PL16</td>
<td>P3916 to P3920</td>
</tr>
<tr>
<td>PL7</td>
<td>P3961 to P3965</td>
<td>PL17</td>
<td>P3911 to P3915</td>
</tr>
<tr>
<td>PL8</td>
<td>P3956 to P3960</td>
<td>PL18</td>
<td>P3906 to P3910</td>
</tr>
<tr>
<td>PL9</td>
<td>P3951 to P3955</td>
<td>PL19</td>
<td>P3901 to P3905</td>
</tr>
</tbody>
</table>

![Fig. 4-11-39](image)

Pallet definition numbers marked “SET” mean that they have already been defined.

**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.

When two robots (main and sub robots) are specified, pallet definitions can be shared between them.
11. “MANUAL” mode

Valid keys and submenu descriptions in “MANUAL>PALLET” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td></td>
<td>Specifies the pallet definition number.</td>
</tr>
<tr>
<td>Page key (↖/↗)</td>
<td></td>
<td>Switches to other screens.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits pallet definitions.</td>
</tr>
<tr>
<td>F2</td>
<td>METHOD</td>
<td>Sets the pallet definition point by teaching.</td>
</tr>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F6</td>
<td>COPY</td>
<td>Copies pallet definitions.</td>
</tr>
<tr>
<td>F7</td>
<td>ERASE</td>
<td>Deletes pallet definitions.</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decrements.</td>
</tr>
<tr>
<td>F15</td>
<td>PASSWD</td>
<td>Does not function.</td>
</tr>
<tr>
<td>ROBOT (LOWER + MODE)</td>
<td></td>
<td>Switches the robot group.</td>
</tr>
</tbody>
</table>
11.3.1 Editing pallet definitions

[Procedure]
1) In “MANUAL>PALLET” mode, select the pallet number with the cursor (↑/↓) keys.

2) Press the F 1 (EDIT) key to enter “MANUAL>PALLET>EDIT” mode.

3) Use the cursor (↑/↓) keys to move the cursor to the position you want edit.

4) Use the 0 to 9 keys to enter the desired value.

   The maximum number of points per pallet must be within 32767 (=NX*NY*NZ).

5) Press the key to determine the input value.

6) To continue editing, repeat steps 3) to 5).

7) Press the ESC key to quit editing and return to “MANUAL>PALLET” mode.

Valid keys and submenu descriptions in “MANUAL>PALLET>EDIT” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td>POINT</td>
<td>Move cursors.</td>
</tr>
<tr>
<td>F1</td>
<td>POINT</td>
<td>Set point data in the pallet definitions.</td>
</tr>
</tbody>
</table>

NOTE
The maximum number of points per pallet is 32767 (=NX*NY*NZ).
11. “MANUAL” mode

11.3.1.1 Point setting in pallet definition

In “MANUAL>PALLET>EDIT” mode, a screen like that shown below is displayed.

**Fig. 4-11-41**

```
MANUAL>PALLET>EDIT        50%[MG][SOH0X]
POINT=P3996(P[1])-P4000(P[5])
P[1] = 98.87 -24.54  12.35  -23.11
P[3] =  98.62 -94.54  12.35  -23.11
[POS]  0.00    0.00    0.00      0.00
EDIT   TEACH   VEL+   VEL-
```

The 3rd line shows the point numbers and point data in the pallet definition.

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key</td>
<td></td>
<td>Specifies the point data or scrolls the screen.</td>
</tr>
<tr>
<td>(↑/↓)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the point in pallet definition.</td>
</tr>
<tr>
<td>F2</td>
<td>TEACH</td>
<td>Sets the point in pallet definition by teaching.</td>
</tr>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Switches the current position display units.</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decrements.</td>
</tr>
<tr>
<td>ROBOT</td>
<td></td>
<td>Switches the robot group.</td>
</tr>
<tr>
<td>(LOWER +MODE)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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”.

• These 5 points should be defined in order from P[1] to P[5]. See “11.3 Displaying, editing and setting pallet definitions”. 
11. “MANUAL” mode

11.3.1.1.1 Editing the point in pallet definition

[Procedure]
1) Press the F 1 (EDIT) key in “MANUAL>PALLET>EDIT>POINT” mode.

2) Use the cursor (←/→/↑/↓) keys to move the cursor to the position you want edit.

3) Use the 0 to 9, +, –, . and SPACE keys to enter the point data.

4) Press the key or cursor up/down (↑/↓) keys to finish the point data input. Press the ESC key if you want to cancel the point data input.

5) To continue editing, repeat steps 2) to 4).

6) Press the ESC key to quit editing and return to “MANUAL>PALLET >EDIT>POINT” mode.

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td>Moves the cursor.</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>undo</td>
<td>Reverses the last data input and restores the preceding data.</td>
</tr>
</tbody>
</table>

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”.

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”.

Fig. 4-11-42
11. “MANUAL” mode

11.3.2 Pallet definition by teaching

[Procedure]
1) Select the pallet number in “MANUAL>PALLET” mode with the cursor (↑/↓) keys.

2) Press the [F2] (METHOD) key to enter “MANUAL>PALLET>METHOD” mode.

3) Select the dimension of the pallet to be defined from “2-D” (plane) or “3-D” (solid).

Fig. 4-11-43

4) Move the robot work point to P[1] used in the pallet definition, and perform teaching by pressing the [key.

Fig. 4-11-44


6) Enter the number of points NX between P[1] and P[2] on the pallet with a positive integer.

Fig. 4-11-45
7) Enter the number of points NY and NZ (only when “3-D” is selected) as in step 6).

8) A confirmation message then appears after setting the number of points.
   Press the **F 4** (YES) key to determine the setting.
   Press the **F 5** (NO) key if you want to cancel the setting.

![Fig. 4-11-46](image)

**Valid keys and submenu descriptions in “MANUAL>PALLET>METHOD” mode are shown below.**

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Switches between the current display units (mm or pulses).</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decrements.</td>
</tr>
</tbody>
</table>

**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”.

---

4-101 Operation
11. “MANUAL” mode

11.3.3 Copying a pallet definition

[Procedure]
1) Select the pallet number in “MANUAL>PALLET” with the cursor (↑/↓) keys.

2) Press the [F 6] (COPY) key and then enter the pallet number where you want to copy the currently selected pallet definition.

3) A confirmation message then appears in the guideline.
   Press the [F 4] (YES) key to make a copy.
   Press the [F 5] (NO) key if you want to cancel the copy.

NOTE
• Valid pallet numbers are from 0 to 19.
• Pallet definition cannot be copied if the currently selected pallet is undefined.
11.3.4 Deleting a pallet definition

[Procedure]
1) Select the pallet number in “MANUAL>PALLET” mode with the cursor (↑/↓) keys.

2) Press the [F 7] (ERASE) key. A confirmation message then appears asking if the currently selected pallet definition is to be deleted.
   Press the [F 4] (YES) key to delete it.
   Press the [F 5] (NO) key if you want to cancel.

NOTE
Pallet definition cannot be deleted if the currently selected pallet is undefined.

Fig. 4-11-49

<table>
<thead>
<tr>
<th>MANUAL&gt;PALLET</th>
<th>50%[MG][50H0X]</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL0 =SET</td>
<td></td>
</tr>
<tr>
<td>PL1 =SET</td>
<td></td>
</tr>
<tr>
<td>PL2 =SET</td>
<td></td>
</tr>
<tr>
<td>PL3 =SET</td>
<td></td>
</tr>
<tr>
<td>[POS] 0.00 0.00 0.00 0.00</td>
<td></td>
</tr>
<tr>
<td>Erase OK?</td>
<td>YES</td>
</tr>
</tbody>
</table>
11. “MANUAL” mode

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.

**[Procedure]**

1) Press the \[F 4\] (VEL+) or the \[F 5\] (VEL-) key 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%.

2) Press the \[F 9\] (VEL++) or the \[F 10\] (VEL--) key 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 / sub group”, with the currently selected robot group highlighted. To switch the robot group, use the ROBOT key (LOWER + MODE).
11. “MANUAL” mode

11.5 Displaying, editing and setting shift coordinates

Press the \[ F 6 \] (SHIFT) key 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 “11.9 Setting the standard coordinates” for details.

Shift coordinates cannot be used with MULTI type robots.

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.

• Shift coordinate data format

\[ S_n = \pm \#\#.## \pm \#\#.## \pm \#\#.## \pm \#\#.## \]

\[ dX (mm) \quad dY (mm) \quad dZ (mm) \quad dR (degrees) \]

\( (n=0 \text{ to } 9) \)

When the shift amount is \( dX=0.00, dY=0.00, dZ=0.00, dR=0.00 \), the shift coordinates equal the standard coordinates.

Fig. 4-11-50 Standard coordinates and shift coordinates

**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.

**NOTE**

Shift coordinates cannot be used with MULTI type robots since the SHIFT/HAND selection display on the 1st line on the MPB screen appears blank.
Upon entering “MANUAL>SHIFT” mode, a screen like that shown in Fig. 4-11-51, Fig. 4-11-52 or Fig. 4-11-53 appears. The currently selected shift coordinate number is highlighted.

Fig. 4-11-51 “MANUAL>SHIFT” mode (one-robot setting)

```
MANUAL>SHIFT  50% [MG][S1H0X]
  x              y              z              r
S0 = 0.00      0.00          0.00          0.00
S1 = 300.00    0.00          0.00          0.00
S2 = 300.00    -300.00      100.00        0.00
S3 = 0.00      0.00          0.00          180.00
[POS] 600.00   0.00          0.00          0.00
EDIT  RANGE    VEL+         VEL-
```

Fig. 4-11-52 “MANUAL>SHIFT” mode (two-robot setting [1])
Main robot group is selected:

```
MANUAL>SHIFT  50/50% [MG][S1H0X]
  x              y              z              r
S0 = 0.00      0.00          0.00          0.00
S1 = 300.00    0.00          0.00          0.00
S2 = 300.00    -300.00      100.00        0.00
S3 = 0.00      0.00          0.00          180.00
[POS] 600.00   0.00          0.00          0.00
EDIT  RANGE    VEL+         VEL-
```

Fig. 4-11-53 “MANUAL>SHIFT” mode (two-robot setting [2])
Sub robot group is selected:

```
MANUAL>SHIFT  50/50% [SG][S3H4X]
  x              y              z              r
S0 = 0.00      0.00          0.00          0.00
S1 = 300.00    0.00          0.00          0.00
S2 = 300.00    -300.00      100.00        0.00
S3 = 0.00      0.00          0.00          180.00
[POS] 600.00   0.00          0.00          0.00
EDIT  RANGE    VEL+         VEL-
```
Valid keys and submenu descriptions in “MANUAL>SHIFT” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key</td>
<td></td>
<td>Specifies the shift coordinate number.</td>
</tr>
<tr>
<td>Page key</td>
<td></td>
<td>Switches to other screens.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the shift coordinates.</td>
</tr>
<tr>
<td>F2</td>
<td>RANGE</td>
<td>Sets the shift coordinates range.</td>
</tr>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F6</td>
<td>METHOD1</td>
<td>Makes setting 1 for shift coordinates.</td>
</tr>
<tr>
<td>F7</td>
<td>METHOD2</td>
<td>Makes setting 2 for shift coordinates.</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decrements.</td>
</tr>
<tr>
<td>ROBOT</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>{}LOWER</td>
<td>Switches the robot group.</td>
</tr>
</tbody>
</table>
11. “MANUAL” mode

11.5.1 Editing shift coordinates

[Procedure]
1) In the “MANUAL>SHIFT” mode, select a shift coordinate number with the cursor (↑/↓) keys.

2) Press the F 1 (EDIT) key to enter “MANUAL>SHIFT>EDIT” mode.

3) Use the cursor (←/→) key to move the cursor to the position you want to change.

4) Use the 0 to 9, +, - and SPACE keys 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.
     ±###.##, ±####.#, ±#####.

   Fig. 4-11-54 Editing shift coordinate data

5) Press the UNDO key, cursor up/down (↑/↓) keys or page up/down (▲/▼) keys to finish the data input.
   Press the ESC key if you want to cancel the data input.

6) To continue the editing, repeat steps 3) to 5).

7) Press the ESC key to quit editing and return to “MANUAL>SHIFT” mode.

Valid keys and submenu descriptions in “MANUAL>SHIFT>EDIT” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>UNDO</td>
<td>Reverses the last data input and restores the preceding data.</td>
</tr>
</tbody>
</table>
11.5.1.1 Restoring shift coordinates

[Procedure]

During shift coordinate data editing, pressing the F1 (UNDO) key 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)

- Minus side
  SM n= ±###.## ±###.## ±###.## ±###.##
  dMX (mm) dMY (mm) dMZ (mm) dMR (degrees)
  (n=0 to 9)

Fig. 4-11-55 Shift coordinate range

To edit a shift coordinate range, use the procedure below.

[Procedure]

1) In “MANUAL>SHIFT” mode, use the cursor (↑/↓) keys to select the shift coordinate number you want to edit.
11. “MANUAL” mode

2) Press the \( \boxed{F2} \) (RANGE) key to enter the “MANUAL>SHIFT>RANGE” mode.

A cursor for editing the shift coordinate range appears.

Fig. 4-11-56 Editing shift coordinate range (1)

3) Use the cursor (←/→) keys to move the cursor to the position you want to change.

4) Use the \( \boxed{0} \) to \( \boxed{9} \), \( \boxed{-} \), \( \boxed{+} \), \( \boxed{.} \) and \( \boxed{SPACE} \) keys to enter the point 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.
  \[ \pm \boxed{###.##}, \pm \boxed{####.#}, \pm \boxed{#####.} \]

Fig. 4-11-57 Editing shift coordinate range (2)

5) Press the \( \boxed{ESC} \) key, cursor up/down (↑/↓) keys or page up/down (\( \boxed{\uparrow}, \boxed{\downarrow} \)) keys to finish the data input.

Press the \( \boxed{ESC} \) key if you want to cancel the data input.

6) To continue editing the shift coordinate range on the minus side, repeat steps 3) to 5).

7) Press the \( \boxed{ESC} \) key to quit editing and return to “MANUAL>SHIFT” mode.

Valid keys and submenu descriptions for editing shift coordinates range are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>UNDO</td>
<td>Reverses the last data input and restores the preceding data.</td>
</tr>
</tbody>
</table>
11. “MANUAL” mode

11.5.2.1 Restoring a shift coordinate range

[Procedure]
During editing of shift coordinate range data, pressing the F 1 (UNDO) key 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.

Fig. 4-11-58 Shift coordinate setting method 1 (1)

[Procedure]
1) In “MANUAL>SHIFT” mode, select the shift coordinate number with the cursor (↑/↓) key.
2) Press the F 6 (METHOD1) key to enter “MANUAL>SHIFT> METHOD1” mode.

Fig. 4-11-59 Shift coordinate setting method 1 (2)

**NOTE**
When two robots (main and sub robots) are specified, check the currently selected robot group on the MPB screen. “[MG]” indicates the main robot group is selected, and “[SG]” indicates the sub robot group is selected. To change the robot group, use the ROBOT ([LOWER] [MODE]) key.
11. “MANUAL” mode

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.

3) Use the Jog keys to move the robot arm tip to teach point 1. (Position it accurately.)

4) Press the key, and the current position is then obtained as “1st P”. (This value becomes the shift coordinate origin.)

Fig. 4-11-60 Shift coordinate teaching

5) Determine teach point 2 with the same procedure as for teach point 1.

6) Select the plus/minus direction of teach point 1 towards point 2 by using the \(F_1\) (+X), \(F_2\) (-X), \(F_3\) (+Y) or \(F_4\) (-Y) key.

Fig. 4-11-61 Coordinate direction setting

7) When the coordinate direction is selected, the shift coordinate values (dX, dY, dZ, dR) are automatically calculated and stored. The screen then returns to “MANUAL>SHIFT” mode.

Valid keys and submenu descriptions in “MANUAL>SHIFT>METHOD1” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Switches between the current display units (mm or pulses).</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1% increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1% decrements.</td>
</tr>
</tbody>
</table>
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.

PROCEDURE

1) In “MANUAL>SHIFT” mode, select the shift coordinate number with the cursor (↑/↓) key.

2) Press the F 7 (METHOD2) key to enter “MANUAL>SHIFT> METHOD2” mode.

3) Use the Jog keys to move the robot arm tip to teach point 1. (Position it accurately.)

NOTE

When two robots (main and sub robots) are specified, check the currently selected robot group on the MPB screen. “[MG]” indicates the main robot group is selected, and “[SG]” indicates the sub robot group is selected. To change the robot group, use the ROBOT (LOWER+MODE) key.

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.
4) Press the key to obtain the current position as “1st P”. An edit cursor appears at the head of the “1st P” line.

**Fig. 4-11-64 Shift coordinate setting**

```
MANUAL>SHIFT>METHOD2  50% [MG][SGOHX]

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st P=</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>2nd P=</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

Enter the point data [mm]

5) Use the 0 to 9, +, - , and keys to enter the point data (x, y, z) and press the key.

6) Determine teach point 2 with the same procedure as for teach point 1.

7) 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.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Switches between the current display units (mm or pulses).</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1% increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1% decrements.</td>
</tr>
</tbody>
</table>

**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.

**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.

**CAUTION**
If teach points and input points are not accurately determined, calculation results will be inaccurate, so always determine these points correctly.
11. "MANUAL" mode

11.6 Displaying, editing and setting hand definitions

Press the [F 7] (HAND) key 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 “11.9 Setting the standard coordinates” for details.

Hand definitions cannot be used with MULTI type robots.

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

\[ H_n = \pm \text{aaaaaa} \pm \text{bbbbbb} \pm \text{cccccc} \ [R] \]

(main robot : \( n = 0 \) to 3 / sub robot : \( n = 4 \) to 7)

1st parameter .................. \pm \text{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 .. \pm \text{bbbbbb}, \pm \text{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 ............... \text{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.

On entering “MANUAL>HAND” mode, a screen like that shown in Fig. 4-11-65, Fig. 4-11-66 or Fig. 4-11-67 appears.

The currently selected hand definition number is highlighted.

Fig. 4-11-65 Hand definition screen (one-robot setting)
11. “MANUAL” mode

Fig. 4-11-66 Hand definition screen (two-robot setting [1])

Main robot group is selected:

```
MANUAL>HAND  50/50% [MG][S0H1X]
1    2    3    4
H0   =   0.00    0.00    0.00
H1   = 100.00  100.00    100.00  R
H2   =  90.00  100.00  100.00  R
H3   =  8000  100.00  100.00
[POS]  600.00   0.00    0.00    0.00
EDIT  VEL+ VEL-
```

Fig. 4-11-67 Hand definition screen (two-robot setting [2])

Sub robot group is selected:

```
MANUAL>HAND  50/50% [SG][S3H5X]
1    2    3    4
H4   =   0.00    0.00    0.00
H5   = 100.00  100.00    100.00  R
H6   =  90.00  100.00  100.00  R
H7   =  8000  100.00  100.00
[POS]  600.00   0.00    0.00    0.00
EDIT  VEL+ VEL-
```

Valid keys and submenu descriptions in “MANUAL>HAND” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑↓)</td>
<td></td>
<td>Specifies the hand definition number.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the hand definition.</td>
</tr>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps. (1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps. (100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F6</td>
<td>METHOD1</td>
<td>Makes setting 1 for hand coordinates.</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Switches between the current display units (mm or pulses).</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1% increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1% decrements.</td>
</tr>
<tr>
<td>ROBOT (LOWER + MODE)</td>
<td></td>
<td>Switches the robot group.</td>
</tr>
</tbody>
</table>
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
      <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”.

Fig. 4-11-68 Hands attached to 2nd arm (SCARA type)
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”.

Fig. 4-11-70

Fig. 4-11-71 Hands attached to R-axis (SCARA type)
(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”.

Fig. 4-11-72

Fig. 4-11-73 Hands attached to 2nd arm (Cartesian type)
11. “MANUAL” mode

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”.

   **Fig. 4-11-74**

   ![Diagram of hands attached to R-axis (Cartesian type)]

   **Fig. 4-11-75 Hands attached to R-axis (Cartesian type)**

<table>
<thead>
<tr>
<th>MANUAL &gt; HAND</th>
<th>50% [MG][S0H1X]</th>
</tr>
</thead>
<tbody>
<tr>
<td>H0</td>
<td>0.00</td>
</tr>
<tr>
<td>H1</td>
<td>-90.00</td>
</tr>
<tr>
<td>H2</td>
<td>0.00</td>
</tr>
<tr>
<td>H3</td>
<td>0.00</td>
</tr>
<tr>
<td>[POS]</td>
<td>600.00</td>
</tr>
<tr>
<td>EDIT</td>
<td></td>
</tr>
</tbody>
</table>
11. “MANUAL” mode

11.6.1 Editing hand definitions

[Procedure]

1) Press the \[F 1\] (EDIT) key in “MANUAL>HAND” mode.

2) Use the cursor (\[↑/\downarrow\]) keys to select the hand definition you want to edit. An edit cursor appears at the left end of the selected hand definition line.

   Fig. 4-11-76 Hand editing screen (1)

   \[
   \begin{array}{cccc}
   \text{MANUAL>HAND>EDIT} & \text{50% [MG][SOH1X]} \\
   \hline
   \text{H0} = & 0 & 0.00 & 0.00 \\
   \text{H1} = & 0.00 & 100.00 & 0.00 & \text{R} \\
   \text{H2} = & 90.00 & 100.00 & 100.00 & \text{R} \\
   \text{H3} = & 8000 & 100.00 & 100.00 \\
   [\text{POS}] & 600.00 & 0.00 & 0.00 & 0.00 \\
   \end{array}
   \]

   3) Use the cursor (\[←/\rightarrow\]) key to move the cursor to the position you want to edit.

   4) Use the \[0\] to \[9\], \[+\], \[−\], \[.\], \[SPACE\], \[R\] and \[\text{ESC}\] keys to enter the data.

   Fig. 4-11-77 Hand editing screen (2)

   \[
   \begin{array}{cccc}
   \text{MANUAL>HAND>EDIT} & \text{50% [MG][SOH1X]} \\
   \hline
   \text{H0} = & 0 & 0.00 & 0.00 \\
   \text{H1} = & 45.00 & 300 & 100 & \text{R} \\
   \text{H2} = & 90.00 & 100.00 & 100.00 & \text{R} \\
   \text{H3} = & 8000 & 100.00 & 100.00 \\
   [\text{POS}] & 600.00 & 0.00 & 0.00 & 0.00 \\
   \end{array}
   \]

   5) Pressing the \[\text{ESC}\] key or cursor up/down (\[\uparrow/\downarrow\]) keys completes the hand definition settings. Press the \[\text{ESC}\] key if you want to cancel the settings.

   6) To continue editing, repeat steps 2) to 4).

   7) Press the \[\text{ESC}\] key to quit editing and return to “MANUAL>HAND” mode.

Valid keys and submenu descriptions in “MANUAL>HAND>EDIT” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>UNDO</td>
<td>Reverses the last data input and restores the preceding data.</td>
</tr>
</tbody>
</table>

\[\text{NOTE}\]

The hand definition data with which the cursor was positioned when returning to “MANUAL>HAND” mode is used as the current hand definition.
11. “MANUAL” mode

11.6.1 Restoring hand definitions

[Procedure]
1) During hand definition editing, pressing the $F_1$ (UNDO) key 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.

[Procedure]
1) In “MANUAL>HAND” mode, use the cursor ($\uparrow/\downarrow$) key to select the hand definition number.
2) Press the $F_6$ (METHOD1) key to enter “MANUAL>HAND> METHOD1” mode.

![Fig. 4-11-78 Hand setting 1 (1)]

3) Use the Jog keys to move the robot working point to point 1. (Position it accurately.)
4) Press the $\text{key}$ to enter the teaching value.

![Fig. 4-11-79 Hand setting 1 (2)]

**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 MPB screen. “[MG]” indicates the main robot group and “[SG]” the sub robot group. Switch the robot group with the ROBOT key ($\text{LOWER}+\text{MODE}$) as needed.

**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.
5) Use the Jog keys to move the robot working point to point 2. (Position it accurately.)

6) Press the \[ \text{key} \] key 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:

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F4</td>
<td>VEL+</td>
<td>Increases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1→5→20→50→100 %)</td>
</tr>
<tr>
<td>F5</td>
<td>VEL-</td>
<td>Decreases manual movement speed for the selected robot group in steps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(100→50→20→5→1 %)</td>
</tr>
<tr>
<td>F8</td>
<td>UNITCHG</td>
<td>Switches between the current display units (mm or pulses).</td>
</tr>
<tr>
<td>F9</td>
<td>VEL++</td>
<td>Increases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increments.</td>
</tr>
<tr>
<td>F10</td>
<td>VEL--</td>
<td>Decreases manual movement speed for the selected robot group in 1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>decrements.</td>
</tr>
</tbody>
</table>

**NOTE**
- When teach point 1 is obtained, the Z direction shift value is automatically determined.
- If the [ESC] key 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.
11. “MANUAL” mode

11.7 Changing the display units

The units used to indicate the current position on the MPB 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.

[Procedure]

1) Press the \[ F 8 \] (UNITCHG) key in “MANUAL” mode. This switches the units used to indicate the current position in “MANUAL” mode.

2) Each time the key is pressed, the units displayed on the upper right of the MPB 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),

Fig. 4-11-80 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 mode axes. On semi-absolute mode 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.

<table>
<thead>
<tr>
<th>Category</th>
<th>Parameter name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot parameter</td>
<td>Origin sequence</td>
<td>Sets the order in which to perform return-to-origin or absolute search on each axis.</td>
</tr>
<tr>
<td>Axis parameter</td>
<td>Origin speed</td>
<td>Sets the speed at which to perform return-to-origin or absolute search.</td>
</tr>
<tr>
<td></td>
<td>Origin shift</td>
<td>Sets the offset of origin position data.</td>
</tr>
<tr>
<td></td>
<td>Origin method</td>
<td>Sets the method for performing return-to-origin or absolute search.</td>
</tr>
<tr>
<td></td>
<td>Origin direction</td>
<td>Sets the direction for performing return-to-origin or absolute search.</td>
</tr>
</tbody>
</table>

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 return-to-origin.

● Return-to-origin operation using the sensor method

![Fig. 4-11-81](image)

① Before performing return-to-origin, check that all axes are in positions that allow return-to-origin.

<table>
<thead>
<tr>
<th>Return-to-origin direction</th>
<th>Position allowing return-to-origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minus (-) direction</td>
<td>Plus (+) side from origin sensor position</td>
</tr>
<tr>
<td>Plus (+) direction</td>
<td>Minus (-) side from origin sensor position</td>
</tr>
</tbody>
</table>

② Upon 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.

③ After 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.
11. “MANUAL” mode

● Return-to-origin operation using the stroke end detection method

Fig. 4-11-82

1. In the stroke end detection method, return-to-origin can start from any position.
2. Upon starting return-to-origin, the robot starts moving in the return-to-origin direction.
3. When 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.

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

Fig. 4-11-83

1. Upon 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.

2. The robot moves back from position A, determines the current position, and then stops. The stop position does not exceed the absolute search start position.
11. “MANUAL” mode

- Sensor method: When the origin sensor turns on during absolute search
- Stroke end detection method: When the stroke end is detected during absolute search

Fig. 4-11-84

Upon starting return-to-origin, the robot moves in the return-to-origin direction to start an absolute search.

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.

1. 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. (Operation starts from ② shown on the right.)

2. In 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.

3. The 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

This section explains how to perform return-to-origin on all axes specified by the controller.

The robot must be at servo-on to perform return-to-origin on incremental mode 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 mode axes.

[Procedure]

1) In "MANUAL" mode, press the \[F 3\] (ORIGIN) key.  
A confirmation message appears on the guide line in the programming box screen.  
Press the \[F 4\] (YES) key to perform return-to-origin.  
Press the \[F 5\] (NO) key to cancel return-to-origin.

![Fig. 4-11-85](image)

2) After return-to-origin (absolute search on semi-absolute mode axes) is complete, the machine reference on each axis is displayed.

![Fig. 4-11-86](image)

3) 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.

4) To cancel the return-to-origin operation, press the \[STOP\] key.  
In this case, the message "0.14: Stop executed" appears on the message line.
11.9 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).

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.

**NOTE**

On Cartesian type robots, there is no need to set the standard coordinates.
The following parameters are automatically set when the standard coordinates are entered.

1) “Arm length [mm]”
   \[ M1= ###.## \ldots \text{X-axis arm length (distance to rotation center \text{X-axis} and \text{Y-axis})} \]
   \[ M2= ###.## \ldots \text{Y-axis arm length (distance to rotation center of \text{Y-axis} and \text{R-axis}, or distance to rotation center of \text{Y-axis} and working point)} \]

2) “Offset pulse”
   \[ M1= ###### \ldots \text{X-axis of fset pulse (angle formed by the \text{X-axis} when the robot is at the origin (0 pulse) position and the \text{X-axis} on the standard coordinate plane)} \]
   \[ M2= ###### \ldots \text{Y-axis offset pulse (angle formed by the \text{X-axis} and \text{Y-axis} when the robot is at the origin (0 pulse) position)} \]
   \[ M4= ###### \ldots \text{R-axis of fset pulse (angle formed by the \text{R-axis} when the robot is at the origin (0 pulse) position and the \text{X-axis} on the standard coordinate plane)} \]

When two robots (main and sub robots) are specified, the following parameters are also entered automatically for the sub robot.

1) “Arm length [mm]”
   \[ S1= ###.## \ldots \text{X-axis arm length (distance to rotation center \text{X-axis} and \text{Y-axis})} \]
   \[ S2= ###.## \ldots \text{Y-axis arm length (distance to rotation center of \text{Y-axis} and \text{R-axis}, or distance to rotation center of \text{Y-axis} and working point)} \]

2) “Offset pulse”
   \[ S1= ###### \ldots \text{X-axis of fset pulse (angle formed by the \text{X-axis} when the robot is at the origin (0 pulse) position and the \text{X-axis} on the standard coordinate plane)} \]
   \[ S2= ###### \ldots \text{Y-axis offset pulse (angle formed by the \text{X-axis} and \text{Y-axis} when the robot is at the origin (0 pulse) position)} \]
   \[ S4= ###### \ldots \text{R-axis of fset pulse (angle formed by the \text{R-axis} when the robot is at the origin (0 pulse) position and the \text{X-axis} on the standard coordinate plane)} \]

However, the R-axis offset is not entered automatically. Set it in “SYSTEM>PARAM>AXIS” mode.

---

**CAUTION**

When 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.
11. “MANUAL” mode

Press the \[F \ 15\] (COORDI) key in “MANUAL” mode. This mode allows setting the standard coordinates.

**CAUTION**
When two robots (main and sub robots) are specified, check the currently selected robot group on the MPB. To switch the robot group, use the ROBOT key (\(\text{LOWER} + \text{MODE}\)).

**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.

Valid keys and submenu descriptions in “MANUAL” mode are as shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>4POINTS</td>
<td>F1 Sets standard coordinates by 4-point teaching.</td>
</tr>
<tr>
<td>F2</td>
<td>3POINTS</td>
<td>F2 Sets standard coordinates by 3-point teaching.</td>
</tr>
<tr>
<td>F5</td>
<td>SIMPLE</td>
<td>F5 Sets standard coordinates by simple teaching.</td>
</tr>
</tbody>
</table>
11.9.1 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.

**Precondition:** Coordinate values made for P[2], P[3], P[4] must be accurate when P[1] is set as the origin position.

**[Procedure]**
1) In “MANUAL>COORDI” mode, press the \[F 1\] (4POINTS) key to enter the mode for setting standard coordinates by 4-point teaching.

---

**Fig. 4-11-90**

**Fig. 4-11-91**
2) Use the Jog keys to move the robot arm tip to teach point P[1] and press the \(\text{+} \) key.


4) Enter the position of teach point P[2] in millimeters, relative to P[1] set as the origin.

![Fig. 4-11-92](image)

5) Repeat step 3), 4) to set teach points P[3] and P[4].

6) A message for checking the length and offset pulse value appears on the guideline. (If the calculation failed, an error message appears.)
   - Press the \(\text{F 4} \) (YES) key to store the setting.
   - Press the \(\text{F 5} \) (NO) key if you want to cancel the setting.

![Fig. 4-11-93](image)

**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.
11.9.2 Setting the standard coordinate by 3-point teaching

Fig. 4-11-94


[Procedure]
1) In “MANUAL>COORDI” mode, press the F 2 (3POINTS) key to enter the mode for setting standard coordinates with 3-point teaching.

Fig. 4-11-95

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.

2) Use the Jog keys to move the robot arm tip to teach point P[1] and press the key.

Fig. 4-11-96

NOTE Separate the teach points from each other as much as possible.
11. “MANUAL” mode


4) Use the \[F 1\] (+X) to \[F 4\] (-Y) keys to set the direction from P[1] to P[3].

Fig. 4-11-97

5) Use the \[0\] to \[9\], . keys to enter the length between P[1] and P[3], and press the \[\rightarrow\] key.
(The length should be less than 1000.)

Fig. 4-11-98

6) A message for checking the arm length and offset pulse value appears on the guideline. (If the calculation failed, an error message appears.)
Press the \[F 4\] (YES) key to store the setting.
Press the \[F 5\] (NO) key if you want to cancel the setting.

Fig. 4-11-99
11.9.3 Setting the standard coordinates by simple teaching

[Procedure]

1) In “MANUAL>COORDI” mode, press the F 5 (SIMPLE) key to enter the mode for simple standard coordinate setting.

2) 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 the key. At this point, the +X direction is set as shown in Fig. 4-11-95.

3) Enter the X arm length and press the key.
11. “MANUAL” mode

4) Enter the Y arm length and press the key.

Fig. 4-11-103

5) A message for checking the arm length and offset pulse value appears on the guideline.

Press the (YES) key if you want to store the setting.
Press the (NO) key if you want to cancel the setting.
11. “MANUAL” mode

11.10 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.

[Procedure]

1) Press the USER key in “MANUAL” mode and the menus (character strings shown highlighted) from F 1 to F 15 or F 16 to F 30 appear when assigned in advance.

Each character string is displayed in up to 7 characters from the beginning.

2) Press the desired function key and the preassigned task will be executed just as if using online commands.

Fig. 4-11-105

<table>
<thead>
<tr>
<th>MANUAL &gt; POINT 50%[MG][SOH0X]</th>
<th>x</th>
<th>y</th>
<th>z</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>P7 = 100.00 250.00 15.00 30.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P8 = 122.62 -24.54 12.35 -23.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMNT: [ ]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[POS] 0.00 0.00 0.00 0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 DO(20)A DO(21)A DO(22)A DO(23)A DO(24)A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

**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.
- 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.
- 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.
12. “SYSTEM” mode

The “SYSTEM” mode controls all kinds of operating conditions for the overall robot system.

The initial screen in “SYSTEM” mode is shown in Fig. 4-12-1.

**Fig. 4-12-1 “SYSTEM” mode**

<table>
<thead>
<tr>
<th>① Mode hierarchy</th>
<th>② Version display</th>
<th>③ Message line</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
<td>Shows the version number of software currently installed in the robot controller.</td>
<td>If an error occurs, the error message appears here.</td>
</tr>
<tr>
<td>④ Online command execution mark</td>
<td>⑤ Robot model name</td>
<td>⑥ Axis configuration</td>
</tr>
<tr>
<td>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.</td>
<td>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 (/).</td>
<td>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 (+).</td>
</tr>
<tr>
<td>⑦ Standard system configuration</td>
<td>⑧ Other expanded configurations</td>
<td>⑨ Guideline</td>
</tr>
<tr>
<td>Shows the memory type and size and standard DIO type.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td><strong>Meaning</strong></td>
<td></td>
</tr>
<tr>
<td>DIO_N</td>
<td>Standard DIO works on NPN specifications.</td>
<td></td>
</tr>
<tr>
<td>DIO_P</td>
<td>Standard DIO works on PNP specifications.</td>
<td></td>
</tr>
</tbody>
</table>

---

**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.

<table>
<thead>
<tr>
<th>Display</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIO_N(m/n..)</td>
<td>An optional DIO with NPN specifications is installed. The number in parentheses is an ID number.</td>
</tr>
<tr>
<td>DIO_P(i/j..)</td>
<td>An optional DIO with PNP specifications is installed. The number in parentheses is an ID number.</td>
</tr>
<tr>
<td>CCLNK(n/m)</td>
<td>A CC-Link unit is installed. The number in parentheses indicates a station number ‘n’ and a communication speed ‘m’.</td>
</tr>
<tr>
<td>D_Net(n/m)</td>
<td>A DeviceNet unit is installed. The number in parentheses indicates a MAC ID number ‘n’ and a communication speed ‘m’.</td>
</tr>
<tr>
<td>Profi(n/m)</td>
<td>A PROFIBUS unit is installed. Letters in parentheses indicate a Station address ‘n’ and communication speed ‘m’.</td>
</tr>
<tr>
<td>E_Net</td>
<td>An Ethernet unit is installed.</td>
</tr>
<tr>
<td>YCLnk(Mn)</td>
<td>An YC-Link unit is installed. The number in parentheses indicates a station number ‘n’.</td>
</tr>
</tbody>
</table>

When set to SAFE mode, the following display appears.

<table>
<thead>
<tr>
<th>Display</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>safemode</td>
<td>Operation mode is set to SAFE mode that enables service mode.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>PARAM</td>
<td>Sets parameters for the controller and for robot operation.</td>
</tr>
<tr>
<td>F2</td>
<td>CMU</td>
<td>Sets communication parameters.</td>
</tr>
<tr>
<td>F3</td>
<td>OPTION</td>
<td>Sets parameters for expansion function.</td>
</tr>
<tr>
<td>F4</td>
<td>INIT</td>
<td>Initializes data.</td>
</tr>
<tr>
<td>F5</td>
<td>DIAGNOS</td>
<td>Performs diagnostics and calls up error history, etc.</td>
</tr>
<tr>
<td>F9</td>
<td>BACKUP</td>
<td>Saves and restores data on internal flash ROM.</td>
</tr>
</tbody>
</table>
12. “SYSTEM” mode

12.1 Parameters

This section explains various parameters relating to the controller setting and robot operation.
There are 4 types of parameters: robot parameters and axis parameters for robot operation, controller setting parameters and option board parameters.

[Procedure]

1) Press the \( \text{F 1} \) (PARAM) key in “SYSTEM” mode to enter “SYSTEM>PARAM” mode.

2) Press the \( \text{F 1} \) (ROBOT), \( \text{F 2} \) (AXIS), \( \text{F 3} \) (OTHERS) or \( \text{F 5} \) (OP. BRD) key to select the parameter type.
   Items for the selected parameter type are displayed.

3) Select a parameter item with the cursor (↑/↓) keys.
   Or press the \( \text{F 2} \) (JUMP) key and enter a parameter number to jump to that parameter item.

4) Press the \( \text{F 1} \) (EDIT) key.

5) 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 “12.1.1 Robot parameters”, “12.1.2 Axis parameters”, “12.1.3 Other parameters” and “12.1.4 Parameters for option boards”.

6) Press the \( \text{ESC} \) key to quit the parameter editing.
Valid keys and submenu descriptions in “SUSTEM>PARAM” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>ROBOT</td>
<td>Sets robot parameters for robot operation.</td>
</tr>
<tr>
<td>F2</td>
<td>AXIS</td>
<td>Sets axis parameters for robot operation.</td>
</tr>
<tr>
<td>F3</td>
<td>OTHERS</td>
<td>Sets other parameters for setting the controller.</td>
</tr>
<tr>
<td>F5</td>
<td>OP. BRD</td>
<td>Sets parameters for option boards.</td>
</tr>
<tr>
<td>F10</td>
<td>PASSWRD</td>
<td>Allows write-prohibited axis parameters to be changed.</td>
</tr>
</tbody>
</table>
12. “SYSTEM” mode

12.1.1 Robot parameters

On the MPB 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>

Fig. 4-12-4 Robot parameter setting (one-robot setting)

Fig. 4-12-5 Robot parameter setting (two-robot setting)

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td>EDIT</td>
<td>Moves the cursor up and down.</td>
</tr>
<tr>
<td>Page key (←/→)</td>
<td>JUMP</td>
<td>Moves the cursor to the designated parameter.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the parameter.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Moves the cursor to the designated parameter.</td>
</tr>
</tbody>
</table>

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.
12. “SYSTEM” mode

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 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.

[Procedure]

1) Select “1. Tip weight [kg]” in “SYSTEM>PARAM>ROBOT” mode.

2) Press the F 1 (EDIT) key.

3) Select the parameter with the cursor (↑/↓) keys.

4) Enter the value with the 0 to 9 keys and then press the key.

5) Press the ESC key to quit the edit mode.

---

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.

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.
2. Origin sequence /ORIGIN

This parameter sets a sequence for performing return-to-origin or absolute search on each axis of the robot to determine the reference position. The numbers 3 1 2 4 5 6 are set automatically when the parameters are initialized.

Enter axis numbers of the robot in the sequence for performing return-to-origin. For example, when the numbers 1, 2, 3, 4, 5, 6 are entered, return-to-origin is performed in sequence from axis 1 to axis 6.

If an axis number is not set, then return-to-origin for that axis number is performed last in the return-to-origin sequence. This is the same for absolute search.

It is recommended to perform return-to-origin first on those axes that might interfere with surrounding equipment.

[Procedure]
1) Select “2.Origin sequence” in “SYSTEM>PARAM>ROBOT” mode.

2) Press the F 1 (EDIT) key.

3) Select the parameter with the cursor (↑/↓) keys.

4) Enter the value with the 0 to 9 keys and then press the key.

5) Press the ESC key 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.

**[Procedure]**


2. Press the F1 (EDIT) key.

3. Select the parameter with the cursor (↑/↓) keys.

4. Press the F1 (KEEP) key or the F2 (FREE) key.

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

**NOTE**

This parameter is valid only on SCARA robots.

**NOTE**

This function is invalid if there is no R-axis or the R-axis is an auxiliary axis.
4. **Arctype 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.

**[Procedure]**

1) Select “4. Arctype at PGM reset” in “SYSTEM>PARAM>ROBOT” mode.

2) Press the F1 (EDIT) key.

3) Select the parameter with the cursor (↑/↓) keys.

![Fig. 4-12-9 Setting the “Arctype at PGM reset”](image)

4) Press the F1 (RIGHTY) key or the F2 (LEFTY) key to select the hand system.

5) Press the ESC key to quit the edit mode.
12. “SYSTEM” mode

12.1.2 Axis parameters

Each axis parameter is displayed in the following format on the MPB 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>

Fig. 4-12-10 Axis parameter setting (one-robot setting)

Fig. 4-12-11 Axis parameter setting (two-robot setting)

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.

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key</td>
<td></td>
<td>Moves the cursor up and down.</td>
</tr>
<tr>
<td>Page key</td>
<td></td>
<td>Scrolls up and down the screen.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the parameter.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Moves the cursor to the designated parameter.</td>
</tr>
</tbody>
</table>
12. “SYSTEM” mode

1. **Accel coefficient [%] /ACCEL**
   This parameter sets acceleration in “AUTO” mode in a range from 1 to 100% during movement by robot movement command. This is automatically set to 100% when the parameters are initialized. 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.

   **[Procedure]**
   1) Select “1.Accel coefficient [%]” in “SYSTEM>PARAM>AXIS” mode.

   2) Press the F 1 (EDIT) key.

   3) Select the axis with the cursor (↑↓) keys.

   4) Enter the value with the 0 to 9 keys and then press the key.

   5) Repeat the above steps 3) and 4) if necessary.

   6) Press the ESC key to quit the edit mode.

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

   **CAUTION**
   Lowering the acceleration coefficient lengthens the time needed to stop when the STOP key was pressed or an interlock was triggered. Do not use a drastically lowered acceleration coefficient.
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.

[Procedure]
1) Select “2. Decel. rate [%]” in “SYSTEM>PARAM>AXIS” mode.

2) Press the F 1 (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

   ![Fig. 4-12-13 Setting the “Decel. rate [%]”](image)

4) Enter the value with the 0 to 9 keys and then press the key.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the ESC key to quit the edit mode.

**NOTE**
This parameter value is a rate to the acceleration.

**NOTE**
If the robot arm tip shakes or sways when the robot stops, lower this value to suppress the shaking.

**CAUTION**
Lowering the deceleration rate lengthens the time needed to stop, when the STOP key was pressed or an interlock was triggered. Do not use a drastically lowered deceleration rate.
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 MPB screen.

**[Procedure]**


2) Press the **F 1 (EDIT)** key.

3) Select the axis with the cursor (↑↓) keys.

4) Enter the value with **0** to **9**, and **.**, **–** keys and then press the **key. If the value you input was a real number (number containing a decimal point), then the soft limit setting is converted into “pulse” units.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the **ESC** key to quit the edit mode.

---

**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.
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 MPB screen.

![Fig. 4-12-15](image)

**[Procedure]**
1) Select “5. Tolerance [pulse]” in “SYSTEM>PARAM>AXIS” mode.

2) Press the **F 1** (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

![Fig. 4-12-16 Setting the “Tolerance [pulse]”](image)

<table>
<thead>
<tr>
<th>SYSTEM &gt; PARAM &gt; AXIS</th>
<th>8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Tolerance [pulse]</td>
<td>(0.09mm)</td>
</tr>
<tr>
<td>M1=80 M2=80 M3=80 m4=80</td>
<td></td>
</tr>
</tbody>
</table>

4) Enter the value with the **0** to **9** keys and then press the **<** key. If the value you input was a real number (number containing a decimal point), then the tolerance range is converted into “pulse” units.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the **ESC** key to quit the edit mode.

---

**CAUTION**
- This is a critical parameter for determining the robot movement near 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.
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 MPB screen.

![Fig. 4-12-17](image)

[Procedure]

1) Select “6. Out position [pulse]” in “SYSTEM>PARAM>AXIS” mode.

2) Press the F1 (EDIT) key.

3) Select the axis with cursor (↑/↓) keys.

![Fig. 4-12-18 Setting the “Out position [pulse]”](image)

4) Enter the value with the 0 to 9, and . keys and then press the OK key. If the value you input was a real number (number containing a decimal point), then it is converted into pulse units.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the ESC key to quit the edit mode.

⚠️ 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.
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 MPB screen.

![Fig. 4-12-19 Arch motion](image)

**[Procedure]**

1) Select “7. Arch position [pulse]” in “SYSTEM>PARAM>AXIS” mode.

2) Press the F1 (EDIT) key.

3) Select the axis with cursor (↑/↓) keys.

![Fig. 4-12-20 Setting the “Arch position [pulse]”](image)

4) Enter the value with the 0 to 9, and , keys and then press the key. If the value you input was a real number (number containing a decimal point), then it is converted into pulse units.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the ESC key to quit the edit mode.

---

**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.
8. Origin speed [pulse/ms] / ORGSPD

This parameter sets the speed to perform return-to-origin or absolute search in pulses per millisecond.

When initialized, this speed is set to a value unique to each axis for incremental mode axes or set to 20 pulses per millisecond (= 20mm/s) for semi-absolute mode axes.

[Procedure]
1) Select “8. Origin speed [pulse/ms]” in “SYSTEM>PARAM>AXIS” mode.
2) Press the F 1 (EDIT) key.
3) Select the axis with the cursor (↑/↓) keys.
4) Enter the value with the 0 to 9 keys and then press the key.
5) Repeat the above steps 3) and 4) if necessary.
6) Press the key to quit the edit mode.

CAUTION
- The maximum return-to-origin speed on incremental mode axes is determined by the motor. The maximum speed of semi-absolute mode axes is 20 pulses per millisecond (= 20mm/s).
- In the case of semi-absolute mode axes, a value larger than 20 pulses per millisecond (= 20mm/s) can be entered if the controller version is prior to Ver. 8.69, but do not enter a value larger than 20 pulses per millisecond (= 20mm/s). If a larger value is entered, return-to-origin cannot be performed correctly.

Fig. 4-12-21 Setting the “Origin speed [pulse/ms]”

<table>
<thead>
<tr>
<th>SYSTEM&gt;PARAM&gt;AXIS</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Origin speed[pulse/ms]</td>
<td></td>
</tr>
<tr>
<td>M1 = 20  M2 = 20  M3 = 20</td>
<td></td>
</tr>
<tr>
<td>m4 = 20</td>
<td></td>
</tr>
</tbody>
</table>

[1- ] Enter > 20
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%.

**[Procedure]**


2) Press the [F 1] (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

4) Input the value with the 0 to 9 keys and then press the [key].

5) Repeat the above steps 3) and 4) if necessary.

6) Press the [ESC] key to quit the edit mode.

**NOTE**

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

**CAUTION**

Lowering the acceleration coefficient lengthens the time needed to stop when the [STOP] key was pressed or an interlock was triggered. Do not use a drastically lowered acceleration coefficient.

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”,

[Procedure]


2) Press the F1 (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

4) Enter the value with the 0 to 9, +, - keys and then press the key.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the ESC key to quit the edit mode.

**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 performing return-to-origin.
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.

[Procedure]
1) Select “11. Arm length [mm]” in “SYSTEM>PARAM>AXIS” mode.

2) Press the (EDIT) key.

3) Select the axis with the cursor (↑ / ↓) keys.

4) Enter the value with the 0 to 9, , and keys and then press the key.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the key to quit the edit mode.

⚠️ 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.
12. “SYSTEM” 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.

[Procedure]
1) Select “12. Offset pulse” in “SYSTEM>PARAM>AXIS” mode.

2) Press the F1 (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

Fig. 4-12-25 Setting the “Offset pulse”

```
SYSTEM>PARAM>AXIS V8.30
12.Offset pulse
M1= 10000 M2= 20000 M3= 0
m4= 1000
[+/-6144000] Enter >10000
```

4) Enter the value with the 0 to 9 keys and then press the key.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the ESC key to quit the edit mode.

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.
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.

[Procedure]

1) Select “13. Axis tip weight [kg]” in “SYSTEM>PARAM>AXIS” mode.

2) Press the F 1 (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

4) Enter the value with the 0 to 9 keys and then press the key.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the ESC key to quit the edit mode.

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.

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.
12. “SYSTEM” mode

14. Origin method /ORSNS

This parameter selects the method for performing return-to-origin or absolute search 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” .......... : This method cannot be used with the RCX141.

**[Procedure]**


2) Press the **F 1** (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

4) Press one of the **F 1** (SENSOR), **F 2** (TORQUE) or **F 3** (MARK) keys.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the **ESC** key 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 or absolute search. When initialized, this is automatically set according to the current robot model.

“---” ............ : Return-to-origin or absolute search direction is in the manual movement minus (-) direction.
“+++” ............ : Return-to-origin or absolute search direction is in the manual movement plus (+) direction.

[Procedure]

1) Select “15. Origin direction” in “SYSTEM>PARAM>AXIS” mode.

2) Press the \( F \) \( 1 \) (EDIT) key.

3) Select the parameter with the cursor (↑/↓) keys.

4) Press the \( F \) \( 1 \) (---) or \( F \) \( 2 \) (++) key.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the \( ESC \) key 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.

Fig. 4-12-28 Setting the “Origin direction”
12. “SYSTEM” mode

16. Motor direction /MOTDIR

This parameter specifies the robot movement direction. When initialized, this is set automatically according to the current robot model.

X series robots:
“---” .............: Motor minus (-) direction is set as the - direction.
“+++”.............: Motor minus (-) direction is set as the + direction.

PHASER series robots:
“---” .............: Robot L-direction is set as the - direction.
“+++”.............: Robot L-direction is set as the + direction.

(See the robot catalog for the definition of the L-direction.)

This parameter cannot be changed while the servo is on. To change the parameter, make sure the servo is off.

[Procedure]


2) Press the \( F_1 \) (EDIT) key.

3) Select the axis with the cursor (↑/↓) keys.

4) Press the \( F_1 \) (---) or \( F_2 \) (+++) key.

5) Repeat the above steps 3) and 4) if necessary.

6) Press the \( ESC \) key to quit the edit mode.

NOTE
This parameter cannot be changed while servo is on.

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.
12.1.3 Other parameters

When changing other parameters on the MPB, use the descriptions in this section.

Fig. 4-12-30 Editing other parameters

<table>
<thead>
<tr>
<th>SYSTEM &gt; PARAM &gt; OTHERS</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Display language (JPN/ENG)</td>
<td>ENGLISH</td>
</tr>
<tr>
<td>2. Data display length</td>
<td>6char</td>
</tr>
<tr>
<td>3. Parameter display unit</td>
<td>PULSE</td>
</tr>
<tr>
<td>4. DO cond. on EMG</td>
<td>HOLD</td>
</tr>
<tr>
<td>5. Watch on STD.DIO DC24V</td>
<td>VALID</td>
</tr>
<tr>
<td>EDIT</td>
<td>JUMP</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td></td>
<td>Moves the cursor up and down.</td>
</tr>
<tr>
<td>Page key (☞/☞)</td>
<td></td>
<td>Switches to other screens.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the parameter.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Moves the cursor to the designated parameter.</td>
</tr>
</tbody>
</table>

1. Display language/DSPLNG

This parameter sets the language for displaying messages on the MPB.

[Procedure]

1) Select “1. Display language (JPN/ENG)” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the F 1 (EDIT) key.

   The function key menu changes.

Fig. 4-12-31 Setting the display language

<table>
<thead>
<tr>
<th>SYSTEM &gt; PARAM &gt; OTHERS</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Display language (JPN/ENG)</td>
<td>ENGLISH</td>
</tr>
<tr>
<td>2. Data display length</td>
<td>6char</td>
</tr>
<tr>
<td>3. Parameter display unit</td>
<td>PULSE</td>
</tr>
<tr>
<td>4. DO cond. on EMG</td>
<td>HOLD</td>
</tr>
<tr>
<td>5. Watch on STD.DIO DC24V</td>
<td>VALID</td>
</tr>
<tr>
<td>JAPANES</td>
<td>ENGLISH</td>
</tr>
</tbody>
</table>

3) Press the F 1 key (JAPANES) or F 2 key (ENGLISH) to set the language to display.

4) Press the ESC key to quit the edit mode.
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.

[Procedure]
1) Select “2. Data display length” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the [F 1] (EDIT) key.
The function key menu changes.

Fig. 4-12-32 Setting the “Data display length”

3) Press the [F 1] (6char) or [F 2] (8char) key.

4) Press the [ESC] key 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.

[Procedure]
1) Select “3. Parameter display units” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the [F 1] (EDIT) key.
The function key menu changes.

Fig. 4-12-33 Setting the parameter display units

3) Press the [F 1] (PULSE) or [F 2] (MM/DEG) key.

4) Press the [ESC] key to quit the edit mode.
12. “SYSTEM” mode

4. DO cond. on EMG /EMGCDO

This parameter sets whether or not to hold output of the DO/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.

[Procedure]
1) Select “4. DO cond. on EMG ” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the F1 (EDIT) key.
   The function key menu changes.

3) Press the F1 (RESET) or F2 (HOLD) key.

4) Press the ESC key to quit the edit mode.

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.

[Procedure]
1) Select “5. Watch on STD.DIO DC24V” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the F1 (EDIT) key.
   The function key menu changes.

3) Press the F1 (INVALID) or F2 (VALID) key.

4) Press the ESC key to quit the edit mode.

CAUTION
This parameter is invalid if the sequence program starts up.

NOTE
- 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.

NOTE
When DC 24V is supplied, the STD. DIO becomes valid regardless of the setting.
12. “SYSTEM” mode

6. Incremental Mode control /INCMOD
You do not have to set this parameter for the RCX141.

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 input) of the STD.DIO connector. This is automatically set to “INVALID” when the parameters are initialized.

[Procedure]
1) Select “7. IO cmd (DI05) on STD.DIO” in “SYSTEM>PARAM>OTHERS” mode.
2) Press the F 1 (EDIT) key.
The function key menu changes.

3) Press the F 1 (INVALID) or F 2 (VALID) key.

4) Press the ESC key to quit the edit mode.

NOTE
• Command functions using DI05 (I/O command execution trigger input) 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.

Fig. 4-12-36

<table>
<thead>
<tr>
<th>SYSTEM&gt;PARAM&gt;OTHERS</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.Parameter display unit</td>
<td>PULSE</td>
</tr>
<tr>
<td>4.DO cond. on EMG</td>
<td>HOLD</td>
</tr>
<tr>
<td>5.Watch on STD.DIO DC24V</td>
<td>VALID</td>
</tr>
<tr>
<td>6.Incremental Mode control</td>
<td>INVALID</td>
</tr>
<tr>
<td>7.IO cmd (DI05) on STD.DIO</td>
<td>VALID</td>
</tr>
</tbody>
</table>

INVALID VALID
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 25msec since the controller does not respond to any signal input shorter than 25msec. This prevents the controller from responding to noise inputs.

[Procedure]
1) Select “8. DI noise filter” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the F 1 (EDIT) key.
   The function key menu changes.

   Fig. 4-12-37 Setting “DI noise filter”

<table>
<thead>
<tr>
<th>SYSTEM&gt;PARAM&gt;OTHERS</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.DO cond. on EMG</td>
<td>HOLD</td>
</tr>
<tr>
<td>5.Watch on STD.DIO DC24V</td>
<td>VALID</td>
</tr>
<tr>
<td>6.Incremental Mode control</td>
<td>INVALID</td>
</tr>
<tr>
<td>7.IO cmd (DI05) on STD.DIO</td>
<td>INVALID</td>
</tr>
<tr>
<td>8.DI noise filter</td>
<td>VALID</td>
</tr>
</tbody>
</table>

3) Press the F 1 (INVALID) or F 2 (VALID) key.

4) Press the ESC key 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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1 (default setting)</td>
<td>When conditional expression is a numeric expression, the result is &quot;TRUE&quot; if the expression value is -1, and is &quot;FALSE&quot; if 0. If the value is other than -1 and 0, an error &quot;6.35: EXPRESSION ERROR&quot; occurs.</td>
</tr>
<tr>
<td>not 0</td>
<td>When conditional expression is a numeric expression, the result is &quot;TRUE&quot; if the expression value is other than 0, and is &quot;FALSE&quot; if 0.</td>
</tr>
</tbody>
</table>

[Procedure]

1) Select “9. TRUE condition” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the \( F_1 \) (EDIT) key.

   The function key menu changes.

   ![Fig. 4-12-38 Setting “TRUE condition”](image)

3) Press the \( F_1 \) (-1) or \( F_2 \) (not 0) key.

4) Press the \( \text{ESC} \) key 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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (default setting)</td>
<td>Sets the unit system that was last selected.</td>
</tr>
<tr>
<td>J (pls)</td>
<td>Sets to “pulses” unit system.</td>
</tr>
<tr>
<td>X (mm/°)</td>
<td>Sets “mm” unit system in normal setting (other than tool coordinate mode).</td>
</tr>
<tr>
<td>T (mm/°)</td>
<td>Sets “mm” unit system in tool coordinate mode.</td>
</tr>
</tbody>
</table>

**[Procedure]**

1) Select “10. Unit select” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the \[F1\] (EDIT) key.
   The function key menu changes.

3) Press a key from \[F1\] (Normal) to \[F4\] (mm/°) to enter the unit system.

4) Press the \[ESC\] key 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.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF (default setting)</td>
<td>Does not output errors.</td>
</tr>
<tr>
<td>20 to 27</td>
<td>Outputs errors from the specified port (DO and SO).</td>
</tr>
</tbody>
</table>

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

[Procedure]

1) Select “11. Error output (DO & SO)” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the \[F 1\] (EDIT) key. The function key menu changes.

3) Press a key from \[F 1\] (OFF) to \[F 9\] (27) to enter the setting.

4) Press the \[ESC\] key to quit the edit mode.
12. "SYSTEM" mode

12. MOVEI/DRIVEI start position /MOVIMD

This parameter setting is used when a relative motion operation is stopped by an interlock or emergency stop, etc., and specifies whether motion is to occur to the original target position, or to a new target position referenced to the current position, when the motion command is re-executed. When initialized, this parameter setting is "Keep".

<table>
<thead>
<tr>
<th>Setting</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keep (default setting)</td>
<td>Motion to the original specified target position occurs when operation resumes after a relative motion interruption. Target position is unchanged.</td>
</tr>
<tr>
<td>Reset</td>
<td>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)</td>
</tr>
</tbody>
</table>

[Procedure]

1) Select “12. MOVEI/DRIVEI start position” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the \( F_1 \) (EDIT) key.

3) Press the \( F_1 \) (Keep) or \( F_2 \) (Reset) key.

4) Press the \( ESC \) key to quit the edit mode.

---

**NOTE**

- This parameter is supported by controller Ver. 8.66 and later. In earlier versions, relative motion to a new target position referenced to the current position occurs when operation is re-executed after a relative motion interruption.
- This parameter’s factory setting (when shipped) is “Keep”.

---
13. 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.

**[Procedure]**

1) Select “13. Skip undefined parameters” in “SYSTEM>PARAM>OTHERS” mode.

2) Press the F 1 (EDIT) key. The function key menu changes.

Fig. 4-12-42 Setting “Skip undefined parameters”

<table>
<thead>
<tr>
<th>SYSTEM&gt;PARAM&gt;OTHERS</th>
<th>V8.66</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. TRUE condition</td>
<td>-1</td>
</tr>
<tr>
<td>10. Unit select</td>
<td>Normal</td>
</tr>
<tr>
<td>11. Error output(DO &amp; SO)</td>
<td>Off</td>
</tr>
<tr>
<td>12. MOVEI/DRIVEI start pos.</td>
<td>Keep</td>
</tr>
<tr>
<td>13. Skip undefined parameters</td>
<td>INVALID</td>
</tr>
</tbody>
</table>

3) Press the F 1 (INVALID) or F 2 (VALID) key.

4) Press the ESC key to quit the edit mode.
12. “SYSTEM” mode

12.1.4 Parameters for option boards

This section explains how to set parameters for option boards from the MPB. 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.

[Procedure]

1) Press the {F 5} (OP. BRD) key in “SYSTEM>PARAM” mode to enter the option board parameter setting mode.

The option boards installed in the controller are displayed in order on the MPB screen.

![Fig. 4-12-43](image)

Option boards installed into the option slots are displayed on the MPB screen.

<table>
<thead>
<tr>
<th>Type</th>
<th>Display</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option DIO</td>
<td>DIO_N(n)</td>
<td>An option DIO board of NPN specifications is installed. The number in parentheses is an ID number.</td>
</tr>
<tr>
<td></td>
<td>DIO_P(n)</td>
<td>An option DIO board of PNP specifications is installed. The number in parentheses is an ID number.</td>
</tr>
<tr>
<td>Serial I/O</td>
<td>CC_Lnk(n/m)</td>
<td>A CC-Link unit is installed. Letters in parentheses indicate a station number “n” and a communication speed “m”.</td>
</tr>
<tr>
<td></td>
<td>D_Net(n/m)</td>
<td>A DeviceNet unit is installed. Letters in parentheses indicate a MAC ID number “n” and communication speed “m”.</td>
</tr>
<tr>
<td></td>
<td>ProfI(n/m)</td>
<td>A PROFIBUS unit is installed. Letters in parentheses indicate a station address “n” and communication speed “m”.</td>
</tr>
<tr>
<td>Network</td>
<td>E_Net</td>
<td>An Ethernet unit is installed.</td>
</tr>
<tr>
<td>YC-Link</td>
<td>YCLnk(Mn)</td>
<td>A YC-Link is installed. The number in parentheses indicates a station number “n”.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑/↓)</td>
<td>SELECT</td>
<td>Moves the cursor up and down.</td>
</tr>
<tr>
<td>F1</td>
<td>SELECT</td>
<td>Selects the option board for parameter setting.</td>
</tr>
</tbody>
</table>

NOTE

- For detailed information on serial I/O units such as CC-Link, Ethernet, and YC-Link, refer to their respective manuals.
- On controllers with a DeviceNet board installed and from Ver. 8.63 onwards, there are 4 parameters to be set. Earlier version controllers require 3 parameters to be set.
- No parameter setting is required for the YC-Link.

- On controllers with a DeviceNet board installed and from Ver. 8.63 onwards, there are 4 parameters to be set. Earlier version controllers require 3 parameters to be set.
- No parameter setting is required for the YC-Link.
12. “SYSTEM” mode

12.1.4.1 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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Board condition</td>
<td>Enables or disables monitoring of the 24V supply input. When set to &quot;VALID&quot;, 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 &quot;INVALID&quot;, no error message will be issued and recorded in the error history even if the DC 24V supply is shut off.</td>
</tr>
</tbody>
</table>

[Procedure]

Fig. 4-12-44

```plaintext
SYSTEM>PARAM>OP.BRD           V8.30
1.D_Net(M4/500k)               VALID
2.DIO_N(1)                      VALID
3.---
4.---
SELECT [ ] [ ] [ ] [ ] [ ] [ ] [ ]
```

1) In “SYSTEM>PARAM>OP. BRD” mode, select the option DIO board with the cursor keys and press the [F 1] (SELECT) key.

Fig. 4-12-45

```plaintext
SYSTEM>PARAM>OP.BRD>SELECT  V8.30
1.Board condition           VALID
```

2) Press the [F 1] (EDIT) key.

Fig. 4-12-46

```plaintext
SYSTEM>PARAM>OP.BRD>SELECT  V8.30
1.Board condition           VALID
```

3) Press the [F 1] (INVALID) or [F 2] (VALID) key to select whether to monitor the DC 24V supply input.

4) Press the [ESC] key to quit the edit mode.

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.

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.
12. “SYSTEM” mode

12.1.4.2 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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Board condition</td>
<td>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.</td>
</tr>
<tr>
<td>2. Remote cmd / IO cmd (S105)</td>
<td>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.)</td>
</tr>
<tr>
<td>3. Output MSG to SOW(1)</td>
<td>Enables or disables the function that sends a message number, which is displayed on the MPB, to word information SOW(1). When set to “VALID” the message number to be displayed on the MPB will be output. When set to “INVALID” the message number 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”.</td>
</tr>
<tr>
<td>4. IO size (DeviceNet only)</td>
<td>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 “Small”</td>
</tr>
</tbody>
</table>
12. “SYSTEM” mode

2) Select the parameter with the cursor (↑/↓) keys.

![Fig. 4-12-49]

```
SYSTEM>PARAM>OP.BRD>SELECT V8.63

1. board condition
2. remote cmd / IO cmd(SI05)
3. Output MSG to SOW(1)
4. IO size

EDIT  JUMP
```

3) Press the F1 (EDIT) key.

![Fig. 4-12-50]

```
SYSTEM>PARAM>OP.BRD>SELECT V8.63

1. board condition
2. remote cmd / IO cmd(SI05)
3. Output MSG to SOW(1)
4. IO size

INVALID  VALID
```

4) Press the F1 (INVALID) or F2 (VALID) key.

To select “4. IO size”, press the F1 (Large) or F2 (Small) key.

5) Press the ESC key to quit the edit mode.
CAUTION
When making the Ethernet settings to use TELNET, you will need to set any other parameters than those shown on the right. For more details, see the Ethernet manual.

12. "SYSTEM" mode

12.1.4.3 Setting the network parameters
When using Ethernet, you set four parameters including the parameter to enable or disable the Ethernet board.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Board condition</td>
<td>Enables or disables the Ethernet board. When set to &quot;VALID&quot; the Ethernet can be used. When set to &quot;INVALID&quot; Ethernet cannot be used.</td>
</tr>
<tr>
<td>2. IP address</td>
<td>Sets the IP address.</td>
</tr>
<tr>
<td>3. Subnet mask</td>
<td>Sets the subnet mask.</td>
</tr>
<tr>
<td>4. Gateway</td>
<td>Sets the gateway.</td>
</tr>
</tbody>
</table>

**[Procedure]**

1) In “SYSTEM>PARAM>OP. BRD” mode, select "E_Net" with the cursor keys and press the [F 1] (SELECT) key.

2) Select the parameter with the cursor (↑/↓) keys.
12. “SYSTEM” mode

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

3) The currently set parameters are displayed.
   When changing the “Board condition” parameter, press **F 1** (INVALID) to disable the Ethernet unit or press **F 2** (VALID) to enable the Ethernet unit.
   When changing other parameters, use the **0** to **9** and **.** keys to make the setting and press the **key**.

4) Press the **ESC** key 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 7, “RS-232C interface”.

[Procedure]

1) Press the F2 (CMU) key in “SYSTEM” mode.
   The communication parameter screen appears.

   Fig. 4-12-54 Communication parameter screen

<table>
<thead>
<tr>
<th>SYSTEM&gt;CMU</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CMU mode</td>
<td>ONLINE</td>
</tr>
<tr>
<td>2. Data bits</td>
<td>8</td>
</tr>
<tr>
<td>3. Baud rate</td>
<td>9600</td>
</tr>
<tr>
<td>4. Stop bit</td>
<td>1</td>
</tr>
<tr>
<td>5. Parity</td>
<td>ODD</td>
</tr>
<tr>
<td>EDIT</td>
<td>JUMP</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2) Select the parameter with the cursor (↑/↓) keys.
   Or press the F2 (JUMP) key and enter a parameter number to jump to that parameter item. Page keys (▷, ◄) can be also used.

3) Press the F1 (EDIT) key to enter the edit mode.
   The edit mode stays open until the ESC key is pressed, allowing you to set multiple parameters one after the other.

4) Set the parameter with the function keys.
   The selectable values or items appear as function key menus on the guideline.

5) Press the ESC key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.
Valid keys and submenu descriptions in “SYSTEM>CMU” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑↓)</td>
<td></td>
<td>Moves the cursor up and down.</td>
</tr>
<tr>
<td>Page key (✓✓)</td>
<td></td>
<td>Switches to other screens.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the parameter.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Moves the cursor to the designated parameter.</td>
</tr>
</tbody>
</table>

1. **CMU (communication) mode**
   This parameter sets the communication mode on the computer.

   **[Procedure]**

   1) Select “1. CMU mode” in “SYSTEM>CMU” mode.

   2) Press the [F1] (EDIT) key.
      The function key menu changes.

   **Fig. 4-12-55 Setting the “CMU mode”**

<table>
<thead>
<tr>
<th>SYSTEM&gt;CMU</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CMU mode</td>
<td>ONLINE</td>
</tr>
<tr>
<td>2. Data bits</td>
<td>8</td>
</tr>
<tr>
<td>3. Baud rate</td>
<td>9600</td>
</tr>
<tr>
<td>4. Stop bit</td>
<td>1</td>
</tr>
<tr>
<td>5. Parity</td>
<td>ODD</td>
</tr>
<tr>
<td>OFFLINE</td>
<td>ONLINE</td>
</tr>
</tbody>
</table>

   3) Select the communication mode with the [F1] (OFFLINE) or [F2] (ONLINE) key.

   4) Press the [ESC] key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.

   **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.
2. Data bits

This parameter sets the data bit length.

**[Procedure]**

1) Select “2. Data bits” in “SYSTEM>CMU” mode.

2) Press the **F 1** (EDIT) key.

   The function key menu changes.

   ![Fig. 4-12-56 Setting the “Data bits”](#)

3) Select the data bits with the **F 1** (7) or **F 2** (8) key.

4) Press the **ESC** key to quit the setting. To continue selecting other items, use the cursor (**↑**/**↓**) keys.

3. Baud rate

This parameter sets the communication speed.

**[Procedure]**

1) Select “3. Baud rate” in “SYSTEM>CMU” mode.

2) Press the **F 1** (EDIT) key.

   The function key menu changes.

   ![Fig. 4-12-57 Setting the “Baud rate”](#)

3) Select the baud rate with the **F 1** (4800) through **F 5** (57600) keys.

4) Press the **ESC** key to quit the setting. To continue selecting other items, use the cursor (**↑**/**↓**) keys.

**NOTE**

Katakana letters (Japanese phonetic) cannot be sent if data bit length was set to 7 bits.

**NOTE**

Communication errors are more prone to occur at high communication speeds. If communication errors frequently occur, set a lower communication speed.
4. Stop bit
This parameter sets the stop bit length.

**[Procedure]**

1) Select “4. Stop bit” in “SYSTEM>CMU” mode.
2) Press the \[ F 1 \] (EDIT) key.
   The function key menu changes.

Fig. 4-12-58 Setting the “Stop bit”

<table>
<thead>
<tr>
<th>SYSTEM&gt;CMU</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CMU mode</td>
<td>ONLINE</td>
</tr>
<tr>
<td>2. Data bits</td>
<td>8</td>
</tr>
<tr>
<td>3. Baud rate</td>
<td>9600</td>
</tr>
<tr>
<td>4. Stop bit</td>
<td>1</td>
</tr>
<tr>
<td>5. Parity</td>
<td>ODD</td>
</tr>
</tbody>
</table>

3) Select the stop bit length with the \[ F 1 \] (1) or \[ F 2 \] (2) key.
4) Press the \[ ESC \] key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.

5. Parity
This parameter sets the parity check.

**[Procedure]**

1) Select “5. Parity” in “SYSTEM>CMU” mode.
2) Press the \[ F 1 \] (EDIT) key.
   The function key menu changes.

Fig. 4-12-59 Setting the “Parity”

<table>
<thead>
<tr>
<th>SYSTEM&gt;CMU</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CMU mode</td>
<td>ONLINE</td>
</tr>
<tr>
<td>2. Data bits</td>
<td>8</td>
</tr>
<tr>
<td>3. Baud rate</td>
<td>9600</td>
</tr>
<tr>
<td>4. Stop bit</td>
<td>1</td>
</tr>
<tr>
<td>5. Parity</td>
<td>ODD</td>
</tr>
</tbody>
</table>

3) Select the parity check with the \[ F 1 \] (NON), \[ F 2 \] (ODD) or \[ F 3 \] (EVEN) key.
4) Press the \[ ESC \] key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.

**NOTE**
Set to 2 bits if communication errors frequently occur.

**NOTE**
Use the parity check as often as possible.
6. Termination code

This parameter sets the line feed code.

[Procedure]

1) Select “6. Termination code” in “SYSTEM>CMU” mode.

2) Press the $F_1$ (EDIT) key.
   The function key menu changes.

3) Select the line feed with the $F_1$ (CR) or $F_2$ (CRLF) key.

4) Press the $ESC$ key to quit the setting. To continue selecting other items, use the cursor ($↑$/$↓$) keys.

7. XON/XOFF control

This parameter sets whether to control the data flow using XON/XOFF control.

[Procedure]

1) Select “7. XON/XOFF control” in “SYSTEM>CMU” mode.

2) Press the $F_1$ (EDIT) key.
   The function key menu changes.

3) Select XON/XOFF control with the $F_1$ (YES) or $F_2$ (NO) key.

4) Press the $ESC$ key to quit the setting. To continue selecting other items, use the cursor ($↑$/$↓$) keys.
8. RTS/CTS control

This parameter sets whether to control the data flow using RTS/CTS signal.

[Procedure]

1) Select “8. RTS/CTS CONTROL> in “SYSTEM>CMU “ mode.

2) Press the [F 1] (EDIT) key.

The function key menu changes.

Fig. 4-12-62 “RTS/CTS CONTROL” setting

<table>
<thead>
<tr>
<th>Function</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Stop bit</td>
<td>1</td>
</tr>
<tr>
<td>5. Parity</td>
<td>ODD</td>
</tr>
<tr>
<td>6. Termination code</td>
<td>CRLF</td>
</tr>
<tr>
<td>7. XON/XOFF control</td>
<td>YES</td>
</tr>
<tr>
<td>8. RTS/CTS control</td>
<td>YES</td>
</tr>
</tbody>
</table>

3) Select the [F 1] (YES) or [F 2] (NO) key.

4) Press the [ESC] key to quit the edit mode.
12.3 **OPTION parameters**

The OPTION parameters are used to set expanded controller functions. These parameters consist of 4 types: parameters for area check output, parameters relating to SAFE mode, parameters relating to the serial I/O, and parameters relating to double-carrier type robots.

**[Procedure]**

1) In “SYSTEM” mode, press the \( F_3 \) (OPTION) key to enter “SYSTEM>OPTION” mode.

2) In “SYSTEM>OPTION” mode, press a key from \( F_1 \) (POS.OUT) to \( F_4 \) (W.CARRIER) to show the parameter items.

![Fig. 4-12-63 OPTION parameter setting](image)

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.

3) Press the \( \text{ESC} \) key to quit the parameter edit mode.
12. “SYSTEM” mode

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 this function.

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. (Usable port numbers: DO20 to DO27, SO20 to SO27.)

3. Comparison point No. 1

4. Comparison point No. 2
   Sets the points for determining the area. (Usable point No.: P0 to P4000)

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.

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”)

![Diagram](image)

**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, it will be output.
- On controllers of Ver. 8.63 onwards, 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.
- On earlier version controllers, no error will occur even if comparison points do not exist or the units of comparison points are not the same. Note, however, that the area check output does not function correctly in this case.
- 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.
- “5. Condition for area check output” is supported by controllers of Ver. 8.63 onwards. On earlier version controllers, the area check output turns on when the robot is within a specified area, and turns off when outside it.

![Diagram](image)
[Procedure]

1) Press $F1$ (POS.OUT) in “SYSTEM>OPTION” mode to enter the area check output mode.

Fig. 4-12-65 Selecting the area check output number

<table>
<thead>
<tr>
<th>SYSTEM&gt;OPTION&gt;POS.OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Output of area1</td>
</tr>
<tr>
<td>2. Output of area2</td>
</tr>
<tr>
<td>3. Output of area3</td>
</tr>
<tr>
<td>4. Output of area4</td>
</tr>
</tbody>
</table>

SELECT

2) Select an area check output number with the cursor ($\uparrow$/\downarrow) keys and press the $F1$ (SELECT) key.

3) Select the parameter items with the cursor ($\uparrow$/\downarrow) keys.

Fig. 4-12-66 Selecting the area check output parameters

<table>
<thead>
<tr>
<th>SYSTEM&gt;OPTION&gt;POS.OUT&gt;SELECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Output of area1</td>
</tr>
<tr>
<td>2. Output port1(D0 &amp; SO)</td>
</tr>
<tr>
<td>3. Compare Point number1</td>
</tr>
<tr>
<td>4. Compare Point number2</td>
</tr>
<tr>
<td>5. Condition</td>
</tr>
</tbody>
</table>

EDIT JUMP

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key ($\uparrow$/\downarrow)</td>
<td></td>
<td>Selects the area check output parameter.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the area check output parameter.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Moves to the specified area check output parameter.</td>
</tr>
</tbody>
</table>
12. “SYSTEM” mode

1. Area check output on/off

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

[Procedure]

1) Select “1. Output of area n” in “SYSTEM>OPTION>POS.OUT>SELECT” mode.

2) Press the F1 (EDIT) key.

The function key menu changes.

3) Select the robot for the area check with the F1 (NO), F2 (MAIN) or F3 (SUB) key.

<table>
<thead>
<tr>
<th>Robot</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>The area check output is not executed.</td>
</tr>
<tr>
<td>MAIN</td>
<td>The area check output is executed for the main robot.</td>
</tr>
<tr>
<td>SUB</td>
<td>The area check output is executed for the sub robot.</td>
</tr>
</tbody>
</table>

4) Press the ESC key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.

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: DO20 to DO27, SO20 to SO27.

[Procedure]

1) Select “2. Output port1 (DO & SO)” in “SYSTEM>OPTION>POS.OUT>SELECT” mode.

2) Press the F1 (EDIT) key.

The function key menu changes.

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.
3) Select the output port with the \textbf{F 1} (20) through \textbf{F 8} (27) keys.

4) Press the \textbf{ESC} key to quit the setting. To continue selecting other items, use the cursor (\uparrow/\downarrow) keys.

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.

[Procedure]

1) Select “3. Compare point number n” in “SYSTEM>OPTION>POS.OUT>SELECT” mode.

2) Press the \textbf{F 1} (EDIT) key.

The function key menu changes.

\textbf{Fig. 4-12-69 Entering the comparison point numbers for area check output}

<table>
<thead>
<tr>
<th>SYSTEM&gt;OPTION&gt;POS.OUT&gt;SELECT</th>
<th>V8.63</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Output of area 1</td>
<td>MAIN</td>
</tr>
<tr>
<td>2. Output port 1(DO &amp; SO)</td>
<td>20</td>
</tr>
<tr>
<td>3. Compare Point number 1</td>
<td>PO</td>
</tr>
<tr>
<td>4. Compare Point number 2</td>
<td>PO</td>
</tr>
<tr>
<td>5. Condition</td>
<td>IN</td>
</tr>
</tbody>
</table>

[0-4000] Enter point no. >

3) Enter the point number with the 0 to 9 keys and press the \textbf{key}.

4) Select “4. Compare Point number n2” with the cursor (\uparrow/\downarrow) keys and enter point number as in step 3).

5) Press the \textbf{ESC} key to quit the setting. To continue selecting other items, use the cursor (\uparrow/\downarrow) keys.

Example: When the comparison points \( \bullet \) are set as shown below, and the robot axis tip is moved between the \( \circ \) marks, the output is off at \( \leftarrow \) and the output is on at \( \rightarrow \). (when “5. Condition” is set to “IN”)

\textbf{Fig. 4-12-70 When points are designated in Cartesian coordinates (“mm” unit system)}

\textbf{NOTE}

- The units of comparison point numbers 1 and 2 must be the same to perform correct operation.
- On controllers of Ver. 8.63 onwards, the area check cannot be performed 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. On earlier version controllers, no error will occur even if comparison points do not exist or the units of comparison points are not the same.
- Note, however, that the area check output does not function correctly in this case.

\textbf{NOTE}

- 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.

\textbf{NOTE}

On controllers from Ver. 8.63 onwards, 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. On earlier version controllers, the area check output turns on when the robot is within a specified area, and turns off when outside it.
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.

**[Procedure]**

1) Select “5. Condition” in “SYSTEM>OPTION>POS.OUT>SELECT” mode.

2) Press the [(EDIT)] key.

3) Select the criterion for area check output with the [(IN)] or [(OUT)] key.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN</td>
<td>Turns on when the robot enters a specified area.</td>
</tr>
<tr>
<td>OUT</td>
<td>Turns on when the robot goes out of a specified area.</td>
</tr>
</tbody>
</table>

4) Press the [ESC] key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.

---

**NOTE**

- This parameter is supported by controllers of Ver. 8.63 onwards. On earlier version controllers, the area check output turns on when the robot is within a specified area, and turns off when outside it.
- 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).

**Fig. 4-12-71 Criterion selection for area check output**

```plaintext
SYSTEM>OPTION>POS.OUT>SELECT  V8.63

1. Output of area1  MAIN
2. Output port1(DO & SO)  20
3. Compare Point number1  P1
4. Compare Point number2  P2
5. Condition  IN

IN   OUT
```

- 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).
12. “SYSTEM” mode

12.3.2 Setting the “SERVICE” mode

When using “SERVICE” mode to safely perform tasks with the MPB 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.

There are 3 parameters for “SERVICE” mode.

1. “SERVICE” mode level

Select the mode level by referring to the table below.

<table>
<thead>
<tr>
<th>Level 0</th>
<th>Hold to Run function</th>
<th>AUTO mode operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Disabled</td>
<td>Allowed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Hold to Run function</th>
<th>AUTO mode operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Enabled</td>
<td>Allowed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 2</th>
<th>Hold to Run function</th>
<th>AUTO mode operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Disabled</td>
<td>Prohibited</td>
</tr>
</tbody>
</table>

* Level 3

<table>
<thead>
<tr>
<th>Hold to Run function</th>
<th>AUTO mode operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled</td>
<td>Prohibited</td>
</tr>
</tbody>
</table>

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

2. Operating speed limits in “SERVICE” mode

Specify the maximum robot operating speed.

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3%</td>
</tr>
<tr>
<td>&lt;100%</td>
</tr>
</tbody>
</table>

3. Operating device during “SERVICE” mode

Specify the operating device to use.

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPB</td>
</tr>
<tr>
<td>MPB/DI</td>
</tr>
<tr>
<td>MPB/COM</td>
</tr>
<tr>
<td>ALL</td>
</tr>
</tbody>
</table>

* : These are default settings.

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.

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.
12. “SYSTEM” mode

[Procedure]

1) Press (SERVICE) in “SYSTEM>OPTION” mode. The message, “Enter password” appears on the guideline. Enter “SAF” here and press the key.

Fig. 4-12-72 Entering the "SERVICE" mode setting password

2) The following screen appears when the correct password is entered.

Fig. 4-12-73 "SERVICE" mode initial screen

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key ‹/›</td>
<td>Selects the “SERVICE” mode parameters.</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the “SERVICE” mode parameters.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Moves to the designated “SERVICE” mode parameter.</td>
</tr>
<tr>
<td>F4</td>
<td>SAVE</td>
<td>Saves the designated “SERVICE” mode parameter.</td>
</tr>
<tr>
<td>F5</td>
<td>HELP</td>
<td>Displays the help message for each setting.</td>
</tr>
</tbody>
</table>
1. “SERVICE” mode level

Set the service mode level by referring to the table below.

<table>
<thead>
<tr>
<th>Level</th>
<th>Hold to Run function</th>
<th>AUTO mode operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Disabled</td>
<td>Allowed</td>
</tr>
<tr>
<td>1</td>
<td>Enabled</td>
<td>Allowed</td>
</tr>
<tr>
<td>2</td>
<td>Disabled</td>
<td>Prohibited</td>
</tr>
<tr>
<td>3</td>
<td>Enabled</td>
<td>Prohibited</td>
</tr>
</tbody>
</table>

**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.

**[Procedure]**

1) Select “1. Service level” in “SYSTEM>OPTION>SERVICE” mode.

2) Press the **F 1** (EDIT) key.

3) Select the “SERVICE” mode level with the **F 1** (LEVEL 0) to **F 4** (LEVEL 3) keys.

4) Press the **ESC** key to quit the setting. To continue selecting other items, use the cursor (**↑**/**↓**) keys.
12. “SYSTEM” mode

2. Operating speed limits in “SERVICE” mode

Specify the maximum robot operating speed.

<table>
<thead>
<tr>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;3%</td>
</tr>
<tr>
<td>Sets robot operation within 3 % of maximum operating speed.</td>
</tr>
<tr>
<td>&lt;100%</td>
</tr>
<tr>
<td>Sets no limit on robot operating speed.</td>
</tr>
</tbody>
</table>

[Procedure]

1) Select “2. Movement Vel” in “SYSTEM>OPTION>SERVICE” mode.

2) Press the F 1 (EDIT) key.

3) Select the maximum robot operating speed with the F 1 (<100%) or F 2 (<3%) key.

4) Press the ESC key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.

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.

Fig. 4-12-75 Editing the “SERVICE” mode operating speed
3. Operating device in “SERVICE” mode

Specify the operating device to use.

<table>
<thead>
<tr>
<th>Operating Device</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPB</td>
<td>Only MPB operation is allowed.</td>
</tr>
<tr>
<td>MPB/DI</td>
<td>Allows MPB and dedicated input.</td>
</tr>
<tr>
<td>MPB/COM</td>
<td>Allows MPB and online commands.</td>
</tr>
<tr>
<td>ALL</td>
<td>Allows operation by all devices.</td>
</tr>
</tbody>
</table>

**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.

**[Procedure]**

1. Select “3. Operating device” in “SYSTEM>OPTION>SERVICE” mode.

2. Press the **F 1** (EDIT) key.

3. Select the operating device with the **F 1** (MPB) to **F 4** (ALL) keys.

4. Press the **ESC** key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.
12. “SYSTEM” mode

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.

**[Procedure]**

1) Press the **F 4** (SAVE) key 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.

   ![Fig. 4-12-77 Saving the "SERVICE" mode parameters](image)

2) Press the **F 4** (YES) key to save the setting.

   Press the **F 5** (NO) key if you want to cancel the settings.

12.3.2.2 Help display in “SERVICE” mode

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

**[Procedure]**

1) Press the **F 5** (HELP) key in “SYSTEM>OPTION>SERVICE” mode.

   ![Fig. 4-12-78 Help display in “SERVICE” mode](image)

2) Press the **F 1** (NEXT P.) key to display the next message page.

   Press the **F 2** (PREV P.) key to display the previous message page.

3) Press the **ESC** key 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.

![Fig. 4-12-79 SIO overview](image)

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

<table>
<thead>
<tr>
<th>Input devices such as sensors</th>
<th>Output devices such as valves</th>
</tr>
</thead>
<tbody>
<tr>
<td>Di port → So port</td>
<td>Do port ← Si port</td>
</tr>
<tr>
<td>Di2()</td>
<td>So2()</td>
</tr>
<tr>
<td>Di3()</td>
<td>So3()</td>
</tr>
<tr>
<td>Di4()</td>
<td>So4()</td>
</tr>
<tr>
<td>Di5()</td>
<td>So5()</td>
</tr>
</tbody>
</table>

**[Procedure]**

1) Press the F3 (SIO) key in "SYSTEM>OPTION" mode.

![Fig. 4-12-80 SIO setting initial screen](image)

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cursor key (↑↓)</td>
<td>EDIT</td>
<td>Selects the SIO parameter.</td>
</tr>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Changes the SIO parameter.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Moves the cursor to the designated SIO parameter.</td>
</tr>
</tbody>
</table>

**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.
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.

<table>
<thead>
<tr>
<th>Output devices such as valves</th>
<th>DO port ← SI port</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO2()</td>
<td>SI2()</td>
</tr>
<tr>
<td>DO3()</td>
<td>SI3()</td>
</tr>
<tr>
<td>DO4()</td>
<td>SI4()</td>
</tr>
<tr>
<td>DO5()</td>
<td>SI5()</td>
</tr>
</tbody>
</table>

[Procedure]

1) Select from 1 to 4 in "SYSTEM>OPTION>SIO" mode.

2) Press the F 1 (EDIT) key.

3) Press the F 1 (SET) key to set the direct connection or press the F 2 (NO) key not to set it.

4) Press the ESC key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.

**NOTE**
Output results might be incorrect if the SIO specified port is the same as the port used by the program.
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.

<table>
<thead>
<tr>
<th>Input devices such as sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI port → SO port</td>
</tr>
<tr>
<td>DI2()</td>
</tr>
<tr>
<td>DI3()</td>
</tr>
<tr>
<td>DI4()</td>
</tr>
<tr>
<td>DI5()</td>
</tr>
<tr>
<td>SO2()</td>
</tr>
<tr>
<td>SO3()</td>
</tr>
<tr>
<td>SO4()</td>
</tr>
<tr>
<td>SO5()</td>
</tr>
</tbody>
</table>

**Procedure**

1) Select from 5 to 8 in "SYSTEM>OPTION>SIO" mode.

2) Press the **F1** (EDIT) key.

   ![Fig. 4-12-82 Editing the SIO settings (2)]

3) Press the **F1** (SET) key to set the direct connection or press the **F2** (NO) key not to set it.

4) Press the **ESC** key to quit the setting. To continue selecting other items, use the cursor (↑/↓) keys.
12. “SYSTEM” mode

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.

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.

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. “SYSTEM” mode

12.3.4.2 Setting the double-carrier parameters

[Procedure]

1) Press the \([F 4]\) (W.CARRIER) in “SYSTEM>OPTION” mode.

Fig. 4-12-85 Double-carrier parameter setting (1)

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>EDIT</td>
<td>Edits the parameter being selected with the cursor.</td>
</tr>
<tr>
<td>F2</td>
<td>JUMP</td>
<td>Jumps to the specified point number.</td>
</tr>
<tr>
<td>Cursor key (↑/↓)</td>
<td></td>
<td>Moves the cursor up and down.</td>
</tr>
</tbody>
</table>

1. Stroke setting

[Procedure]

1) Select ”1. Stroke [mm]” and press \([F 1]\) (EDIT).

Fig. 4-12-86 Double-carrier parameter setting (2)

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.
2) Enter the stroke in "mm" units and press [ ]. Up to 2 decimal places are allowed. Refer to the drawing below to determine the stroke.

![Diagram showing stroke setting and points of closest approach](image)

**2. Carrier 1 setting**

**3. Carrier 2 setting**

**[Procedure]**

1) Select "2. Carrier 1" or "3. Carrier 2" and press [F1] (EDIT).

![Double-carrier parameter setting](image)

2) Select the double-carrier axis with the function key.
4. Control mode setting  
Select the double-carrier functions.

[Procedure]


![Fig. 4-12-89 Double-carrier parameter setting (4)](SYSTEM>OPTION>W.CARRIER>EDIT V8.58)

| 1. Stroke [mm] | 650.00 |
| 2. Carrier 1 | M1 |
| 3. Carrier 2 | M2 |
| 4. Control mode | OFF |

The robot moves as follows according to the control mode setting.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>OFF</td>
<td>Anti-collision function is disabled.</td>
</tr>
</tbody>
</table>
| 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. |

**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.

*The “manual movement” and “auto operation” conditions indicated in the above table are defined as shown below
During Manual movement:
- Manual movement at MPB
- 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 MPB
12. “SYSTEM” mode

12.4 Initialization

When initializing the parameter data you entered, follow the descriptions in this section.

[Procedure]

1) Press the \( \text{F 4} \) (INIT) key in “SYSTEM” mode.
   The initialization screen appears.

   Fig. 4-12-90 Initialization screen

   

2) Select the item to initialize with the \( \text{F 1} \) (PARAM) to \( \text{F 4} \) (CLOCK) keys.

Valid keys and submenu descriptions in “SYSTEM>INT” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>PARAM</td>
<td>Initializes the parameter settings.</td>
</tr>
<tr>
<td>F2</td>
<td>MEMORY</td>
<td>Deletes the user memory.</td>
</tr>
<tr>
<td>F3</td>
<td>CMU</td>
<td>Sets the communication parameters to the initial values.</td>
</tr>
<tr>
<td>F4</td>
<td>CLOCK</td>
<td>Sets the clock.</td>
</tr>
<tr>
<td>F6</td>
<td>GENERAT</td>
<td>Sets the robot model. (Normally invalid)</td>
</tr>
<tr>
<td>F10</td>
<td>PASSWRD</td>
<td>Enables the ( \text{f4} ) setting.</td>
</tr>
</tbody>
</table>
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.

[Procedure]

1) Press the \textbf{F 1} (PARAM) key in “SYSTEM>INIT” mode.
A message “Enter password” appears on the guideline.
Enter “INI” and press the \textbf{\textgreater} key.

![Fig. 4-12-91 Initializing the parameters (1)](image)

2) When the correct password was entered, a confirmation message appears on the guideline.

![Fig. 4-12-92 Initializing the parameter (2)](image)

3) Press the \textbf{F 4} (YES) key to initialize the parameters.
If not initializing, press the \textbf{F 5} (NO) key.

\textbf{NOTE}
• Entire parameter is initialized.
  (Except for display letters.)
• Return-to-origin will be incomplete if this parameter is changed.
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.

[Procedure]

1) Press the \[ F 2 \] (MEMORY) key in “SYSTEM>INIT” mode.

   ![Fig. 4-12-93 Initializing the memory](image1)

<table>
<thead>
<tr>
<th>SYSTEM&gt;INIT&gt;MEMORY</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source(use/sum)</td>
<td>1316/364580 bytes</td>
</tr>
<tr>
<td>Object(use/sum)</td>
<td>528/98304 bytes</td>
</tr>
<tr>
<td>Sequence(use/sum)</td>
<td>0/4096 bytes</td>
</tr>
<tr>
<td>Number of program</td>
<td>5</td>
</tr>
<tr>
<td>Number of points</td>
<td>124</td>
</tr>
</tbody>
</table>

   2) Select the item to initialize with the \[ F 1 \] (PROGRAM) to \[ F 7 \] (COMMENT) keys.

   A confirmation message appears on the guideline.

   ![Fig. 4-12-94 Initializing the memory (program)](image2)

<table>
<thead>
<tr>
<th>SYSTEM&gt;INIT&gt;MEMORY&gt;PROGRAM</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source(use/sum)</td>
<td>1316/364580 bytes</td>
</tr>
<tr>
<td>Object(use/sum)</td>
<td>528/98304 bytes</td>
</tr>
<tr>
<td>Sequence(use/sum)</td>
<td>0/4096 bytes</td>
</tr>
<tr>
<td>Number of program</td>
<td>5</td>
</tr>
<tr>
<td>Number of points</td>
<td>124</td>
</tr>
<tr>
<td>Initialize OK?</td>
<td>YES</td>
</tr>
</tbody>
</table>

2) Select the item to initialize with the \[ F 1 \] (PROGRAM) to \[ F 7 \] (COMMENT) keys.

   A confirmation message appears on the guideline.

   ![Fig. 4-12-94 Initializing the memory (program)](image2)

<table>
<thead>
<tr>
<th>SYSTEM&gt;INIT&gt;MEMORY&gt;PROGRAM</th>
<th>V8.30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source(use/sum)</td>
<td>1316/364580 bytes</td>
</tr>
<tr>
<td>Object(use/sum)</td>
<td>528/98304 bytes</td>
</tr>
<tr>
<td>Sequence(use/sum)</td>
<td>0/4096 bytes</td>
</tr>
<tr>
<td>Number of program</td>
<td>5</td>
</tr>
<tr>
<td>Number of points</td>
<td>124</td>
</tr>
<tr>
<td>Initialize OK?</td>
<td>YES</td>
</tr>
</tbody>
</table>

3) Press the \[ F 4 \] (YES) key to initialize the memory.

   If not initializing, press the \[ F 5 \] (NO) key.

NOTE

- External data must be input to restore the memory after it has been initialized.
- The memory must be initialized if damaged due to some kind of problem.
Valid keys and submenu descriptions in “SYSTEM>INIT>MEMORY” mode are shown below.

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

12.4.3 Initializing the communication parameters

To initialize the communication parameters, proceed as follows.

**[Procedure]**

1) Press the F3 (CMU) key in “SYSTEM>INIT” mode.
   A confirmation message appears on the guideline

   ![Fig. 4-12-95 Initializing the communication parameters](image)

   **Fig. 4-12-95 Initializing the communication parameters**

   SYSTEM>INIT>CMU                  V8.30
   MODE ,DATA,RATE,STOP,PARI,TERM,XON,RTS,
   ONLINE, 8,9600, 1 ,ODD ,CRLF,YES,NO

   Initialize OK? YES NO

2) Press the F4 (YES) key to initialize the parameter.
   If not initializing, press the F5 (NO) key.

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. “SYSTEM” mode

12.4.4 Clock setting

A clock function is provided in the controller for setting the date and time.

[Procedure]

1) Press the F 4 (CLOCK) key in “SYSTEM>INIT” mode. The present date and time are displayed.

![Fig. 4-12-96 Initializing the clock](image)

2) Select the item with the F 1 (DATE) or F 2 (TIME) key. A confirmation message appears on the guideline.

3) Enter the date or time in the specified format and then press the key. Enter this data using the 0 to 9, / and : keys.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>DATE</td>
<td>Sets the year/month/date.</td>
</tr>
<tr>
<td>F2</td>
<td>TIME</td>
<td>Sets the hours/minutes/seconds.</td>
</tr>
</tbody>
</table>

![Valid keys](image)

**CAUTION**
The clock used in the controller might differ from the correct time. If this happens, set the correct time.
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 the \[ F 6 \] (GENERAT) key 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.
12. “SYSTEM” mode

12.5 Self diagnosis

This function makes a check of the controller and displays the error history and battery voltages.

[Procedure]

1) In “SYSTEM” mode, press the **F 5** (DIAGNOS) key to enter “SYSTEM>DIAGNOS” mode

Fig. 4-12-97 Self diagnosis

![Fig. 4-12-97 Self diagnosis](image)

Valid keys and submenu descriptions in “SYSTEM>DIAGNOS” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>CHECK</td>
<td>Makes a check of the controller.</td>
</tr>
<tr>
<td>F2</td>
<td>HISTORY</td>
<td>Displays the past error history.</td>
</tr>
<tr>
<td>F5</td>
<td>TOTAL</td>
<td>Allows checking the controller operation time.</td>
</tr>
<tr>
<td>F15</td>
<td>SYS.CHK</td>
<td>Displays details of major software errors that occurred in the past.</td>
</tr>
</tbody>
</table>

12.5.1 Controller check

This makes a self-diagnosis check of the controller.

[Procedure]

1) Press the **F 1** (CHECK) key to enter “SYSTEM>DIAGNOS>CHECK” mode.

Fig. 4-12-98 System check

![Fig. 4-12-98 System check](image)

An error message appears if an error is detected.

2) Check the error message if displayed.
   Pressing the cursor (**↑**/**↓**) keys changes the display one line at a time.
   Pressing the **F 1** (NEXT P.) or **F 2** (PREV. P.) key changes the display one screen at a time.

3) Press the **ESC** key 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.

[Procedure]

1) Press the \( \text{F2} \) (HISTORY) key to enter “SYSTEM>DIAGNOS>HISTORY” mode.

![Fig. 4-12-99 Error history](image)

- One screen displays the past 5 errors in order from the most recent error.
- Error information is displayed in the following format.
  - \(<\text{Date}>, <\text{Time}> <\text{Error No.}>: <\text{Error message}>\)
  - The hour, minute and second are displayed for the time.

2) Check the error history.
   - Pressing the cursor (↑/↓) keys changes the display one line at a time.
   - Pressing the \( \text{F1} \) (NEXT P.) or \( \text{F2} \) (PREV. P.) key changes the display one screen at a time.

3) Press the \( \text{F5} \) key if you want to clear the error history.

4) Press the \( \text{ESC} \) key to return to “SYSTEM>DIAGNOS” mode.

⚠️ 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 the \( \text{F5} \) (CLEAR) key is used. Do not initialize if you want to retain the error history.
12. "SYSTEM" mode

12.5.3 Displaying the total operation time

Use the following procedure to check the total controller operation time.

[Procedure]
1) Press the \textbf{F 5} (TOTAL) key.

![Fig. 4-12-100 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.

Pressing the \textbf{F 5} (CLEAR) key resets the total operation time. The display shows the new total operation time starting from the date and time after reset.

2) Press the \textbf{ESC} key to return to "SYSTEM>DIAGNOS" mode.

12.5.4 System error details display

Details of important software errors that have occurred in the past can be displayed.

[Procedure]
1) Press the \textbf{F 15} (SYS. CHK) key.

![Fig. 4-12-101 Error details]

"No system error code" will appear if no error has occurred.

2) Press the \textbf{ESC} key to return to the "SYSTEM>DIAGNOS" mode.

\textbf{NOTE} All error information will be initialized when the error history is initialized.
12.6 Backup processes

The various data in the controller’s internal memory can be backed up in the internal flash ROM.

[Procedure]

1) Press the F 9 (BACKUP) key in the "SYSTEM" mode.

![Fig. 4-12-102 Backup](image)

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

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F4</td>
<td>RAM CARD</td>
<td>Does not function.</td>
</tr>
<tr>
<td>F5</td>
<td>FROM</td>
<td>Saves and recovers data with the internal flash ROM.</td>
</tr>
</tbody>
</table>

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.

[Procedure]

1) Press the F 5 (FROM) key in the "SYSTEM" mode.

![Fig. 4-12-103 Backing up FROM](image)

Valid keys and submenu descriptions in "SYSTEM>BACKUP>FROM" mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>LOAD</td>
<td>Loads the data backed up in the internal flash ROM into the controller's internal memory.</td>
</tr>
<tr>
<td>F2</td>
<td>SAVE</td>
<td>Saves the controller's internal memory data into the internal flash ROM as backup data.</td>
</tr>
<tr>
<td>F4</td>
<td>INIT</td>
<td>Initializes the internal flash ROM data. All data in the flash ROM is erased.</td>
</tr>
</tbody>
</table>

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.

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.
12. “SYSTEM” mode

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.

[Procedure]

1) Press the [F 1] (LOAD) key in the "SYSTEM>BACKUP>FROM" mode. The types of files will appear in the guideline.

2) Select the type of file to be loaded with the [F 1] (.ALL) to [F 9] (.PCM) keys.

Fig. 4-12-104 Loading FROM

Valid keys and submenu descriptions in "SYSTEM>BACKUP>FROM>LOAD" mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>.ALL</td>
<td>Files are loaded as ALL files.</td>
</tr>
<tr>
<td>F2</td>
<td>.PGM</td>
<td>Only program files are loaded.</td>
</tr>
<tr>
<td>F3</td>
<td>.PNT</td>
<td>Only point files are loaded.</td>
</tr>
<tr>
<td>F4</td>
<td>.SFT</td>
<td>Only shift files are loaded.</td>
</tr>
<tr>
<td>F5</td>
<td>.HND</td>
<td>Only hand files are loaded.</td>
</tr>
<tr>
<td>F6</td>
<td>.PRM</td>
<td>Only parameter files are loaded.</td>
</tr>
<tr>
<td>F8</td>
<td>.PLT</td>
<td>Only pallet files are loaded.</td>
</tr>
<tr>
<td>F9</td>
<td>.PCM</td>
<td>Only point comment files are loaded.</td>
</tr>
</tbody>
</table>

3) A confirmation message appears on the guidelines. Press the [F 4] (YES) key to load the data. Press the [F 5] (NO) key to cancel the procedure.

Fig. 4-12-105 Check of FROM loading

4) The message "0.5: Accessing" will appear during the procedure.
12. “SYSTEM” mode

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.

[Procedure]

1) Press the F2 (SAVE) key in the “SYSTEM>BACKUP>FROM” mode.

2) A confirmation message appears on the guidelines.

Press F4 (YES) to save the data.

Press F5 (NO) to cancel the procedure.

3) The message “0.5: Accessing” will appear during the procedure.

12.6.1.3 Initializing the files

The data saved on the controller’s flash ROM is initialized.

[Procedure]

1) Press the F4 (INIT) key in the “SYSTEM>BACKUP>FROM” mode.

2) A confirmation message appears on the guidelines.

Press F4 (YES) to initialize the data.

Press F5 (NO) to cancel the procedure.

3) The message “0.5: Accessing” will appear during the procedure.
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.

**[Procedure]**

1) Press the [DISPLAY] key.

Input status is displayed in the data area (3rd to 7th lines) as shown below.

**Fig. 4-13-1 Input status display (1)**

```
MANUAL>POINT 50% [MG][S0H0J]
------------------ x ------ y ------ z ------ r ------
DI monitor
DI0(0)=&B000000101 DI4(4)=&B00000000 DI0=7
DI1(1)=&B00000010 DI5(5)=&B00000000 DI1=6
DI2(2)=&B00000000 DI6(6)=&B00000000 DI2=5
DI3(3)=&B00000000 DI7(7)=&B00000000 DI3=4
EDIT TEACH JUMP VEL+ VEL-
```

Display format:

```
<Port No.> = &B<bit 7><bit 6> to <bit 0>
```

2) Press the [DISPLAY] key again.

Input status is displayed in the data area (3rd to 7th lines) as shown below.

**Fig. 4-13-2 Input status display (2)**

```
MANUAL>POINT 50% [MG][S0H0J]
------------------ x ------ y ------ z ------ r ------
DI monitor
DI10(10)=&B000000101 DI14(14)=&B00000000 DI10=9
DI11(11)=&B00000010 DI15(15)=&B00000000 DI11=8
DI12(12)=&B00000000 DI16(16)=&B00000000 DI12=7
DI13(13)=&B00000000 DI17(17)=&B00000000 DI13=6
EDIT TEACH JUMP VEL+ VEL-
```

**NOTE**

I/O ports that do not actually exist are also displayed.
3) Press the [DISPLAY] key again to display other monitor screens.

Pressing the [DISPLAY] key 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

4) To view the previous screen, press the [LOWER+DISPLAY] key.

Pressing the [LOWER+DISPLAY] key changes the screen in the reverse of the sequence
shown in 3).

5) Press the [ESC] key to return to the normal screen display.

**Fig. 4-13-3 Example of bit information display**

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>50% [MG][SOH0J]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x y z r</td>
<td></td>
</tr>
<tr>
<td>DI monitor</td>
<td></td>
</tr>
<tr>
<td>DI0()= &amp;B00000101</td>
<td>DI4()= &amp;B00000000</td>
</tr>
<tr>
<td>DI1()= &amp;B00000001</td>
<td>DI5()= &amp;B00000000</td>
</tr>
<tr>
<td>DI2()= &amp;B00000000</td>
<td>DI6()= &amp;B00000000</td>
</tr>
<tr>
<td>DI3()= &amp;B00000000</td>
<td>DI7()= &amp;B00000000</td>
</tr>
<tr>
<td>EDIT TEACH JUMP VEL+ VEL-</td>
<td></td>
</tr>
</tbody>
</table>

The information is displayed with the following format:
<Port No.> = &B <7th bit> <6th bit> to <0th bit>

**Fig. 4-13-4 Example of word information display**

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>50% [MG][SOH0J]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x y z r</td>
<td></td>
</tr>
<tr>
<td>SIW monitor</td>
<td></td>
</tr>
<tr>
<td>SIW(0)= &amp;H0000</td>
<td>SIW(4)= &amp;H0000</td>
</tr>
<tr>
<td>SIW(1)= &amp;H0000</td>
<td>SIW(5)= &amp;H0000</td>
</tr>
<tr>
<td>SIW(2)= &amp;H0000</td>
<td>SIW(6)= &amp;H0000</td>
</tr>
<tr>
<td>SIW(3)= &amp;H0000</td>
<td>SIW(7)= &amp;H0000</td>
</tr>
<tr>
<td>EDIT TEACH JUMP VEL+ VEL-</td>
<td></td>
</tr>
</tbody>
</table>

The information is displayed with the following format:
<Register No.> = &H<hexadecimal>

**Fig. 4-13-5 Example of task information display**

<table>
<thead>
<tr>
<th>MANUAL&gt;POINT</th>
<th>50% [MG][SOH0J]</th>
</tr>
</thead>
<tbody>
<tr>
<td>x y z r</td>
<td></td>
</tr>
<tr>
<td>Task monitor:Line(Status),Pri</td>
<td></td>
</tr>
<tr>
<td>T1 = 6(RUN),32 T5 =</td>
<td></td>
</tr>
<tr>
<td>T2 = 10(SUS),32 T6 =</td>
<td></td>
</tr>
<tr>
<td>T3 = T7 =</td>
<td></td>
</tr>
<tr>
<td>T4 = T8 = 12(RUN),35</td>
<td></td>
</tr>
<tr>
<td>EDIT TEACH JUMP VEL+ VEL-</td>
<td></td>
</tr>
</tbody>
</table>

The information is displayed with the following format:
<Task No.> = <Execution line> (<Execution state>), <Task priority>
<Execution state> : RUN (execute)/SUS (forced standby)/STP (stop)
13. “MONITOR” mode

Fig. 4-13-6 Current command monitor display

```
Fig. 4-13-6 Current command monitor display

<table>
<thead>
<tr>
<th>Manual &gt; Point</th>
<th>50% [MG][SOHOJ]</th>
<th>x</th>
<th>y</th>
<th>z</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current monitor (100% = Max torque)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1 = 20</td>
<td>D5 = 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2 = -5</td>
<td>D6 = 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D3 = 3</td>
<td>D7 = 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D4 = 0</td>
<td>D8 = 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Display format is as follows:

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.

[Procedure]

1) Press the [UTILITY] ([LOWER]+[ESC]) key.
   
   The “UTILITY” mode screen is displayed.

   ![Fig. 4-14-1 “UTILITY” mode]

   Date, Time: 04/05, 20, 18:59:37    (36°C)
   Motor power: On
   Sequence: DISABLE
   Armtype: RIGHTY

   MOTOR SEQUENC ARMTYPE RST.DO

2) Press the [UTILITY] ([LOWER]+[ESC]) key again.

   The following screen appears.

   ![Fig. 4-14-2 “UTILITY” mode]

   Date, Time: 04/05, 20, 18:59:40    (36°C)
   Execute level: LEVEL0
   Access level: LEVEL0

   EXECUTE ACCESS RST.DO

Valid keys and submenu descriptions in “UTILITY” mode are shown below.

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>MOTOR</td>
<td>Turns the motor power and servo on and off.</td>
</tr>
<tr>
<td>F2</td>
<td>SEQUENC</td>
<td>Prohibit or permits executing the sequence program.</td>
</tr>
<tr>
<td>F3</td>
<td>ARMTYPE</td>
<td>Sets the arm hand type. (Valid only on SCARA robots)</td>
</tr>
<tr>
<td>F5</td>
<td>RST.DO</td>
<td>Clears the output port.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Valid keys</th>
<th>Menu</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>EXECUTE</td>
<td>Sets the execution level.</td>
</tr>
<tr>
<td>F2</td>
<td>ACCESS</td>
<td>Sets the access level.</td>
</tr>
<tr>
<td>F5</td>
<td>RST.DO</td>
<td>Clears the output port.</td>
</tr>
</tbody>
</table>
14. "UTILITY" mode

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.

**[Procedure]**

1) Press the [UTILITY](LOWER + ESC) key to enter "UTILITY" mode.
   (You can switch to "UTILITY" mode from any other mode.)
   The "UTILITY" mode screen appears with a confirmation message shown on the guideline.

Fig. 4-14-3 Canceling emergency stop

```
UTILITY
Date,Time : 04/05/20,18:59:37   (36°C)
motor power: Off
Sequence   : DISABLE
Armtype    : RIGHTY

Cancel emergency flag?  YES  NO
```

2) Press the [F 4] (YES) key 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 the [F 5] (NO) key.
14. “UTILITY” mode

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.

[Procedure]

1) Press the F 1 (MOTOR) key in “UTILITY” mode.

2) Press the F 1 (On) key to turn on the motor power supply and servo. Press the F 2 (Off) key to turn off the motor power supply and servo. Press the F 6 (Power) key to turn on the motor power supply only.

3) Press the ESC key to return to the mode selected just previous to “UTILITY” mode.

4) To set the servo of each axis to “On”, “Off” or “Free”, select the axis with the cursor (↑/↓) keys. When setting the servo to “On”, the servo power for the axis must be turned on beforehand by the operation in step 2.

5) Set the servo status with the F 1 (Servo), F 2 (Brake) or F 8 (Free) key.

**NOTE**

When using a PHASER series robot, noise is emitted for 0.5 to 2 seconds during the first servo-on after turning the power on. This is just the routine pre-action for obtaining information needed to control the robot and is not a problem.

**CAUTION**

At axes with brakes, the brake can be released by pressing the F 8 (Free) key (F 3 key in controller versions prior to Ver. 8.66). Use particular care with regard to heavy up/down vertical axes, as they may drop when the brake is released.

**NOTE**

In controller versions prior to Ver. 8.66, the F 3 (Free) key is used to free an axis (release brake).
14. “UTILITY” mode

14.2 Enabling/disabling the sequence execution flag

To enable or disable execution of sequence programs, proceed as follows.

[Procedure]

1) Press the $\text{F 2}$ (SEQUENC) key in “UTILITY” mode.

2) To enable execution of sequence programs, press the $\text{F 1}$ (ENABLE) key. To disable execution of sequence programs, press the $\text{F 2}$ (DISABLE) key. To enable DO reset during sequence program execution, press the $\text{F 6}$ (RST.DO) key.

**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.
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.)

[Procedure]

1) Press the [F 3] (ARMTYPE) key in “UTILITY” mode.

   Fig. 4-14-7 Main/sub robot specifications

<table>
<thead>
<tr>
<th>UTILITY&gt;ARMTYPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armtype</td>
</tr>
<tr>
<td>Present :Main robot : RIGHTY</td>
</tr>
<tr>
<td>Sub robot : LEFTY</td>
</tr>
<tr>
<td>RIGHTY LEFTY</td>
</tr>
</tbody>
</table>

2) Select the parameter item with the cursor (↑/↓) keys.

3) Press the [F 1] (RIGHTY) or [F 2] (LEFTY) key to set the right-handed or left-handed system.

4) Press the [ESC] key to exit “UTILITY” mode.
14. “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).

[Procedure]

1) Press the \[ F \ 5 \] (RST.DO) key in “UTILITY” mode.
   A confirmation message appears on the guideline.

   **Fig. 4-14-8 Resetting the output ports**

   ![Fig. 4-14-8 Resetting the output ports](image)

   **UTILITY>RST.DO**

   Date,Time : 04/05/20,18:59:37 (36°C)
   Execut level: LEVEL0
   Access level: LEVEL0

   Reset OUTPUT port OK? YES NO

2) Press the \[ F \ 4 \] (YES) key to reset.
   Press the \[ F \ 5 \] (NO) key if not resetting.
14. "UTILITY" mode

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Program execution at origin incomplete</th>
<th>When power is turned on mode</th>
<th>Program reset at program start</th>
<th>Return-to-origin signal in AUTO mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL0</td>
<td>Disabled</td>
<td>MANUAL mode</td>
<td>NO</td>
<td>NO</td>
<td>Invalid</td>
</tr>
<tr>
<td>LEVEL1</td>
<td>Enabled</td>
<td>MANUAL mode</td>
<td>NO</td>
<td>NO</td>
<td>Invalid</td>
</tr>
<tr>
<td>LEVEL2</td>
<td>Enabled</td>
<td>MANUAL mode</td>
<td>YES</td>
<td>NO</td>
<td>Invalid</td>
</tr>
<tr>
<td>LEVEL3</td>
<td>Enabled</td>
<td>AUTO mode</td>
<td>NO</td>
<td>NO</td>
<td>Invalid</td>
</tr>
<tr>
<td>LEVEL4</td>
<td>Enabled</td>
<td>AUTO mode</td>
<td>YES</td>
<td>NO</td>
<td>Invalid</td>
</tr>
<tr>
<td>LEVEL5</td>
<td>Enabled</td>
<td>MANUAL mode</td>
<td>YES</td>
<td>YES</td>
<td>Invalid</td>
</tr>
<tr>
<td>LEVEL6</td>
<td>Enabled</td>
<td>AUTO mode</td>
<td>YES</td>
<td>YES</td>
<td>Invalid</td>
</tr>
<tr>
<td>LEVEL7</td>
<td>Enabled</td>
<td>AUTO mode</td>
<td>NO</td>
<td>NO</td>
<td>Valid (Note 1)</td>
</tr>
<tr>
<td>LEVEL8</td>
<td>Enabled</td>
<td>AUTO mode</td>
<td>YES</td>
<td>YES</td>
<td>Valid (Note 1)</td>
</tr>
</tbody>
</table>

Note 1: When the return-to-origin signal input (DI17) is valid in "AUTO" mode, the robot program-in-progress signal (DO13) turns on during processing by the return-to-origin signal input (DI17) in "AUTO" mode.

**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.
14. “UTILITY” mode

14.5.1 Changing the execution level

To change the execution level, proceed as follows.

[Procedure]

1) Press the [UTILITY] (LOWER + ESC) key twice to enter “UTILITY” mode, then press the [F 1] (EXECUTE) key.

![Fig.4-14-9]

2) Select the execution level with the [F 1] (LEVEL0) to [F 9] (LEVEL8) keys.

![Fig.4-14-10]

3) Press the [ESC] key to exit ”UTILITY” mode.
14. "UTILITY" mode

14.5.2 Displaying the Help message

See the help message as needed.

[Procedure]

1) Press the \text{F 15} (HELP) key. 
The first page of the Help screen appears.
  Press the \text{F 1} (NEXT P.) key or cursor (\text{↓}) key to refer to the next page or press 
  the \text{F 2} (PREV. P.) or cursor (\text{↑}) key to refer to the previous page.

Fig.4-14-11

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{fig4-14-11.png}
\caption{UTILITY>EXECUTE>HELP}
\end{figure}

LEVEL0: Program cannot execute if arm 
  has not returned to ORIGIN. 
  : PowerOn mode is MANUAL. 
  : PowerOn without program reset.

Fig.4-14-12

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{fig4-14-12.png}
\caption{UTILITY>EXECUTE>HELP}
\end{figure}

LEVEL1: Program can execute if arm has 
  not returned to ORIGIN. 
  : PowerOn mode is MANUAL. 
  : PowerOn without program reset.

2) Press the \text{ESC} key to return to the setup screen.
14. “UTILITY” mode

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.

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEVEL0</td>
<td>All operations are allowed.</td>
</tr>
<tr>
<td>LEVEL1</td>
<td>All data changes are prohibited. (Program changes, teaching, data deletion, data initializing, etc are prohibited.)</td>
</tr>
<tr>
<td>LEVEL2</td>
<td>In addition to level 1, mode selection is restricted to MANUAL and AUTO modes.</td>
</tr>
<tr>
<td>LEVEL3</td>
<td>In addition to level 2, mode speed changes and display of program list in AUTO mode are prohibited.</td>
</tr>
</tbody>
</table>

14.6.1 Entering the password

The password must be entered in order to change the access level.

[Procedure]

1) Press the \( F_2 \) (ACCESS) key in “UTILITY” mode. A message “Enter password” appears on the guideline. Enter with “LVL” here and press the \( \downarrow \) key.

Fig. 4-14-13 Setting the access level (1)

2) If the correct password was entered, the following screen appears.

Fig. 4-14-14 Setting the access level (2)

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)

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)
14.6.2 Changing the access level

Change the access level as needed.

[Procedure]

1) Set the access level with the $F\ 1$ (LEVEL0) to $F\ 4$ (LEVEL3) keys.

Fig. 4-14-15 Setting the access level (3)

```
UTILITY>ACCESS
Access level: LEVEL2
LEVEL0 LEVEL1 LEVEL2 LEVEL3 HELP
```

14.6.3 Displaying the Help message

See the help message as needed.

[Procedure]

1) Press the $F\ 5$ (HELP) key.
   The first page of the Help screen appears.

Press the $F\ 1$ (NEXT P.) key or cursor (↓) key to refer to the next page or press
the $F\ 2$ (PREV. P.) or cursor (↑) key to refer to the previous page.

Fig. 4-14-16 Access level Help screen (first page)

```
UTILITY>ACCESS>HELP
LEVEL0: All data access available
LEVEL1: Data change invalid
NEXT P. PREV. P.
```

Fig. 4-14-17 Access level Help screen (second page)

```
UTILITY>ACCESS>HELP
LEVEL2: LEVEL1 + SYSTEM & PROGRAM mode
       change invalid
LEVEL3: LEVEL2 + Program list display &
       speed change invalid
NEXT P. PREV. P.
```
Chapter 5
Parallel I/O interface

Contents

1. Standard I/O interface overview ...................................................... 5-1
   1.1 Power supply .............................................................................. 5-1
   1.2 Connector I/O signals ................................................................. 5-2
   1.3 Connector pin numbers ............................................................... 5-3
   1.4 Typical input signal connection .................................................... 5-4
   1.5 Typical output signal connection .................................................. 5-5
       1.5.1 Dedicated outputs ............................................................... 5-5
       1.5.2 General-purpose outputs ..................................................... 5-6
   1.6 Dedicated input signal description ................................................. 5-7
   1.7 Dedicated output signal description .............................................. 5-9
   1.8 Dedicated I/O signal timing chart ................................................ 5-11
       1.8.1 Controller power ON, servo ON and emergency stop .......... 5-11
       1.8.2 Return-to-origin ................................................................. 5-12
       1.8.3 Switching to AUTO mode, program reset and execution ........ 5-13
       1.8.4 Stopping due to program interlocks ..................................... 5-14
   1.9 General-purpose I/O signals ....................................................... 5-15
       1.9.1 General-purpose input signals .............................................. 5-15
       1.9.2 General-purpose output signals .......................................... 5-15
       1.9.3 General-purpose output signal reset (off) ............................ 5-15

2. Option I/O interface overview ....................................................... 5-16
   2.1 ID settings .................................................................................. 5-17
   2.2 Power supply .............................................................................. 5-17
   2.3 Connector I/O signals ................................................................. 5-18
   2.4 Connector pin numbers ............................................................... 5-19
   2.5 Typical input signal connection .................................................... 5-20
   2.6 Typical output signal connection .................................................. 5-20
   2.7 General-purpose I/O signals ....................................................... 5-20
       2.7.1 General-purpose input signals .............................................. 5-20
       2.7.2 General-purpose output signals .......................................... 5-20
       2.7.3 General-purpose output signal reset (off) ............................ 5-21

3. Ratings ......................................................................................... 5-22

4. Caution items ............................................................................... 5-23
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 9 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 DI (11) (Interlock signal) will all be invalid.

**Specifications**

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Connector name</th>
<th>Connector type No.</th>
<th>Conductor wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Dedicated : 9</td>
<td>STD. DIO</td>
<td>MR-50LM (Honda Tsushin Kogyo)</td>
</tr>
<tr>
<td></td>
<td>General-purpose : 16</td>
<td></td>
<td>0.3mm² or more</td>
</tr>
<tr>
<td>Output</td>
<td>Dedicated : 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>General-purpose : 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**

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.

**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 DI (11) (interlock signal).
### 1.2 Connector I/O signals

<table>
<thead>
<tr>
<th>PIN</th>
<th>I/O No.</th>
<th>Signal name</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Di05</td>
<td>I/O command execution trigger input</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Di01</td>
<td>Servo ON</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Di10</td>
<td>Sequence control</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Di11</td>
<td>Interlock</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Di12</td>
<td>Program start</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Di13</td>
<td>AUTO mode</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Di14</td>
<td>Spare (Do not use.)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Di15</td>
<td>Program reset</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Di16</td>
<td>MANUAL mode</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Di17</td>
<td>Return-to-origin</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Di20</td>
<td>General-purpose input 20</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Di21</td>
<td>General-purpose input 21</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Di22</td>
<td>General-purpose input 22</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Di23</td>
<td>General-purpose input 23</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Di24</td>
<td>General-purpose input 24</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Di25</td>
<td>General-purpose input 25</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Di26</td>
<td>General-purpose input 26</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Di27</td>
<td>General-purpose input 27</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Di30</td>
<td>General-purpose input 30</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Di31</td>
<td>General-purpose input 31</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Di32</td>
<td>General-purpose input 32</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Di33</td>
<td>General-purpose input 33</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Di34</td>
<td>General-purpose input 34</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Di35</td>
<td>General-purpose input 35</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Di36</td>
<td>General-purpose input 36</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Di37</td>
<td>General-purpose input 37</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>COMMON</td>
<td>Relay common</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>DO01b</td>
<td>CPU_OK : contact B (normally closed)</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>DO01a</td>
<td>CPU_OK : contact A (normally open)</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>DO02a</td>
<td>Servo ON : contact B (normally closed)</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>DO02b</td>
<td>Servo ON : contact A (normally open)</td>
<td></td>
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<tr>
<td>32</td>
<td>DO03b</td>
<td>Alarm : contact B (normally closed)</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>DO03a</td>
<td>Alarm : contact A (normally open)</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>DO10</td>
<td>AUTO mode</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>DO11</td>
<td>Return-to-origin complete</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>DO12</td>
<td>Sequence program-in-progress</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>DO13</td>
<td>Robot program-in-progress</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>DO14</td>
<td>Program reset status</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>DO20</td>
<td>General-purpose output 20</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>DO21</td>
<td>General-purpose output 21</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>DO22</td>
<td>General-purpose output 22</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>DO23</td>
<td>General-purpose output 23</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>DO24</td>
<td>General-purpose output 24</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>DO25</td>
<td>General-purpose output 25</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>DO26</td>
<td>General-purpose output 26</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>DO27</td>
<td>General-purpose output 27</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>DC24V</td>
<td>DC+24V (P.COMDI)</td>
<td>External power supply input</td>
</tr>
<tr>
<td>48</td>
<td>GND</td>
<td>GND (N.COMDI)</td>
<td></td>
</tr>
</tbody>
</table>

**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.

Common terminals
- P. COM DI
- N. COM DI

Photocoupler input
- NPN specifications: source type
- PNP specifications: sink type

Relay output
- Maximum capacity of each terminal (resistance load): DC 24V, 0.5A
- Common terminal: COMMON

Transistor output
- NPN or PNP specifications
- Maximum capacity of each terminal (resistance load): 0.1A
- + common terminal: DC +24V
- - common terminal: GND
1. Standard I/O interface overview

1.3 Connector pin numbers

STD. DIO

Connection side

Solder side

Connector type: MR-50LM

An STD. DIO connector is supplied with the controller.
1. Standard I/O interface overview

1.4 Typical input signal connection

CAUTION
See "7. I/O connections" in Chapter 3 for a definition of NPN and 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. Standard I/O interface overview

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.
1. Standard I/O interface overview

1.6 Dedicated input signal description

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

2. DI05 I/O command execution trigger input

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

3. DI10 Sequence control input

DI10 is used to execute a sequence program.

When the DI10 contact is closed (ON), a sequence program is executed.

When the sequence program is executed, DO12 (sequence program-in-progress) is output.

4. DI11 Interlock input

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.

5. DI12 Program start input

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 issued when the robot program is executed.

- Input signal pulse width: 100ms minimum
1. Standard I/O interface overview

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

CAUTION
Signal input to DI14 is prohibited. Do not connect any signal to DI14.

7. 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 cleared. However, the general-purpose outputs are not cleared when a sequence program is being executed without enabling the DO to reset in the sequence execution flag setting.
DO14 (program reset status) is output when the program is correctly reset.
• Input signal pulse width: 100ms minimum

8. DI16 MANUAL mode input
DI16 is used to switch to “MANUAL” mode.
• Input signal pulse width: 100ms minimum

NOTE
This command cannot be executed if the return-to-origin method of an incremental mode axis or semi-absolute mode axis is set to “Mark”.

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.

9. DI17 Return-to-origin input
DI17 is used to perform return-to-origin.
When the DI17 contact is closed (ON) in “MANUAL” mode, return-to-origin or absolute search starts at the rising edge of the signal pulse.
• Input signal pulse width: 100ms minimum
1.7 Dedicated output signal description

1. **DO01a CPU_OK output: 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 output: 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 close, when the servo turns on in “UTILITY” mode or when the servo ON input (DI01) of the I/O interface are turned on, then DO02a turns on at the same time.
   The servo will not turn on if a serious malfunction occurs or the emergency stop input contacts are open.

4. **DO02b Servo ON output: contact B (normally closed)**
   This is a complementary (inverted) logic output of the servo ON (A contact) signal.

5. **DO03a Alarm output: 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 ALARM LED on the controller monitor 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 switch contacts have been closed, alarm turns off when the emergency stop flag is canceled in “UTILITY” mode or the servo ON input (DI01) of the I/O interface is turned on.
   (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.

**NOTE**
When using a PHASER series robot, noise is emitted for 0.5 to 2 seconds during the first servo-on after turning the power on. This is just the routine pre-action for obtaining information needed to control the robot and is not a problem.
1. Standard I/O interface overview

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

9. DO12 Sequence program-in-progress output
DO12 is always on when the sequence program is being executed.

10. DO13 Robot program-in-progress output
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

**Initial servo-on processing when power is turned 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.

**Shifting from emergency stop to servo-ON**

e) Emergency stop input turns on.

f) Servo-ON input turns on.

g) Alarm output turns off.

h) Servo-ON output turns on.

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

* If the emergency stop input contacts are open or a major error (malfunction) occurs when the controller power is turned on, the servo remains off. Likewise, if 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.
1. Standard I/O interface overview

1.8.2 Return-to-origin

Conditions: MANUAL mode and servo ON

- **CPU_OK output**: DO(01)a
  - on
  - off
  - on

- **Servo-ON output**: DO(02)a
  - off
  - on
  - off
  - on

- **Return-to-origin complete output**: DO(11)
  - off
  - on

- **Interlock input**: DI(11)
  - off
  - on

- **Return-to-origin input (DI17)**
  - off
  - on

- **Robot axis status**
  - Stop

---

**Return-to-origin processing**

a) Return-to-origin input turns on.
b) Robot axis starts moving to origin position.
c) Return-to-origin input turns off.
d) Robot axis reaches origin position and stops moving.
   On semi-absolute axes, the current position is determined and movement stops.
e) Return-to-origin complete output turns on.

**Interlocks during return-to-origin**

f) Return-to-origin input turns on and return-to-origin complete output turns off.
g) Robot axis starts moving to origin position.
h) Return-to-origin input turns off.
i) Interlock input turns off.
j) On-going robot axis movement stops.
k) 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.
1.8.3 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. Standard I/O interface overview

1.8.4 Stopping due to program interlocks

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>on</td>
<td>on</td>
<td>off</td>
<td>off</td>
<td>on</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 input of DI11 signal (Interlock input) or other reasons, the program re-executes the command that has stopped. Keep this point in mind when re-executing the program with DI12 signal (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.

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.

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

1) When the 5 (RST.DO) key was pressed in “UTILITY” mode.

2) When any of the following operations is performed without executing a sequence program or the sequencer execution flag was reset.
   - When compiling was done in “PROGRAM” mode.
   - When a program was compiled in “AUTO” mode.
   - When a program was reset in “AUTO” mode.
   - When the dedicated input signal DI15 (Program reset input) was turned on in “AUTO” mode while the program was stopped. (Refer to “1.6 Dedicated input signal description” earlier in this chapter.)
   - When either of the following was initialized in “SYSTEM>INIT” mode.
     1. Program memory (SYSTEM>INIT>MEMORY>PROGRAM)
     2. Entire memory (SYSTEM>INIT>MEMORY>ALL)
   - When the SWI command was executed in “AUTO” mode.
   - When the online commands @RESET, @INIT PGM, @INIT MEM, @INIT ALL, @SWI were executed.
   - When the SWI statement was executed in the program.
   - When the HALT statement was executed in the program.

---

⚠️ CAUTION

If the “DI noise filter” parameter is set to “VALID” (refer to “12.1.3 Other parameters” in Chapter 4), the on and off periods of input signals must be longer than 25msec.
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.

<table>
<thead>
<tr>
<th>Specifications</th>
<th>Connector name</th>
<th>Connector type No.</th>
<th>Conductor wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>Number of I/O points</td>
<td>OPT. DIO</td>
<td>MR-50LM (Honda Tsushin Kogyo)</td>
</tr>
<tr>
<td>1</td>
<td>General-purpose input : 24 General-purpose output : 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>General-purpose input : 24 General-purpose output : 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>General-purpose input : 24 General-purpose output : 16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>General-purpose input : 24 General-purpose output : 16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The ID in the above table are set by the DIP switch on the option I/O interface unit.
2. Option I/O interface overview

2.1 ID settings

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

![Fig. 5-2-1](image)

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

<table>
<thead>
<tr>
<th>DIP switch</th>
<th>ID</th>
<th>Input port No.</th>
<th>Output port No.</th>
</tr>
</thead>
</table>
| ![DIP switch](image) | 1 | DI40 to DI47  
| |  | DI50 to DI57  
| |  | DI60 to DI67  
| |  | DO30 to DO37  
| |  | DO40 to DO47  |
| ![DIP switch](image) | 2 | DI70 to DI77  
| |  | DI100 to DI107  
| |  | DI110 to DI117  
| |  | DO50 to DO57  
| |  | DO60 to DO67  |
| ![DIP switch](image) | 3 | DI120 to DI127  
| |  | DI130 to DI137  
| |  | DI140 to DI147  
| |  | DO70 to DO77  
| |  | DO100 to DO107  |
| ![DIP switch](image) | 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.

⚠️ 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.

2.2 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.
## 2.3 Connector I/O signals

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

*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.
2.4 Connector pin numbers

Connector type: MR-50LM
An OPT. DIO connector is supplied with the controller.
2. Option I/O interface overview

2.5 Typical input signal connection

⚠️ CAUTION
See “7. I/O connections” in Chapter 3 for a definition of NPN and PNP specifications.

2.6 Typical output signal connection

⚠️ CAUTION
If the “DI noise filter” parameter is set to "VALID" (refer to “12.1.3 Other parameters” in Chapter 4), the on and off periods of input signals must be longer than 25msec.

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.

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.
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 any of the following operations is performed while no sequencer program is executed.

- When compiling in program mode and it was routinely quit.
- When compiling the program in automatic mode, and compiling was routinely quit.
- When \( F1 \) (RESET) is executed in “AUTO” mode.
- When in Auto mode, the dedicated input signal DI15 (program reset input) was set on while the program was being stopped.
- When either of the following was initialized in “SYSTEM” mode initialization.
  1. Program memory (SYSTEM>INIT>MEMORY>PROGRAM).
  2. Entire memory (SYSTEM>INIT>MEMORY>ALL).
- In “AUTO” mode \( F7 \) (DIRECT), when SWI command was executed.
- When online commands @RESET, @INIT PGM, @INIT MEM, @INIT ALL, @SWI were executed.
- When the HALT statement was executed during the program.
## 3. Ratings

### 1. Input

**NPN specifications**

<table>
<thead>
<tr>
<th>Method</th>
<th>DC input (positive common type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocoupler insulation method</td>
<td>Photocoupler insulation method</td>
</tr>
<tr>
<td>Input power</td>
<td>DC 24V ±10%, 10mA/point</td>
</tr>
<tr>
<td>Response time</td>
<td>20ms Min. (during on/off)</td>
</tr>
</tbody>
</table>

**PNP specifications**

<table>
<thead>
<tr>
<th>Method</th>
<th>DC input (negative common type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocoupler insulation method</td>
<td>Photocoupler insulation method</td>
</tr>
<tr>
<td>Input power</td>
<td>DC 24V ±10%, 10mA/point</td>
</tr>
<tr>
<td>Response time</td>
<td>20ms Min. (during on/off)</td>
</tr>
</tbody>
</table>

### 2. Output

#### (1) Transistor output

**NPN specifications**

<table>
<thead>
<tr>
<th>Method</th>
<th>NPN open-collector (negative common type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocoupler insulation method</td>
<td>Photocoupler insulation method</td>
</tr>
<tr>
<td>Load</td>
<td>DC 24V ±10%, 100mA/point (resistance load)</td>
</tr>
<tr>
<td>Response time</td>
<td>10ms Max.</td>
</tr>
</tbody>
</table>

**PNP specifications**

<table>
<thead>
<tr>
<th>Method</th>
<th>PNP open-collector (positive common type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocoupler insulation method</td>
<td>Photocoupler insulation method</td>
</tr>
<tr>
<td>Load</td>
<td>DC 24V ±10%, 100mA/point (resistance load)</td>
</tr>
<tr>
<td>Response time</td>
<td>10ms Max.</td>
</tr>
</tbody>
</table>

#### (2) Relay contact output

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

---

**CAUTION**

See "7. I/O connections" in Chapter 3 for a definition of NPN and PNP specifications.
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.
## Chapter 6 SAFETY I/O interface

### Contents

1. SAFETY I/O interface overview .................................................. 6-1
   1.1 Power ......................................................................................... 6-1
   1.2 Connector I/O signals ................................................................. 6-1
   1.3 Connector terminal numbers ..................................................... 6-2
   1.4 Emergency stop input signal connections ................................. 6-3
   1.5 Dedicated input signal connections ......................................... 6-6
   1.6 Input signal description ............................................................ 6-7
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 SAFETY I/O interface contains an emergency stop input and one dedicated input point.

The input signal is from hereon referred to as DI and the output signal as DO.

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.

1.2 Connector I/O signals

<table>
<thead>
<tr>
<th>PIN</th>
<th>Slot</th>
<th>Name</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DI02</td>
<td>SERVICE mode</td>
<td>NPN/PNP specs conform to STD. DIO settings. Common terminal: P. COM / N. COM</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Reserved</td>
<td>Do not use.</td>
</tr>
<tr>
<td>3</td>
<td>EMG1N1</td>
<td>Emergency stop input 1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>EMG2N2</td>
<td>Emergency stop input 2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>EMG3N3</td>
<td>Emergency stop input 3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>EMG4N4</td>
<td>Emergency stop input 4</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>LCK1N1</td>
<td>Enable switch input 1</td>
<td>Usable only when enable switch compatible programming box is used. (MPB-E2)</td>
</tr>
<tr>
<td>8</td>
<td>LCK2N2</td>
<td>Enable switch input 2</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>LCK3N3</td>
<td>Enable switch input 3</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>LCK4N4</td>
<td>Enable switch input 4</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>P.COM</td>
<td>DC+24V (P.COMDI)</td>
<td>Internally connected with P.COMDI terminal of STD. DIO.</td>
</tr>
<tr>
<td>12</td>
<td>N.COM</td>
<td>GND (N.COMDI)</td>
<td>Internally connected with N.COMDI terminal of STD. DIO.</td>
</tr>
<tr>
<td>13</td>
<td>EMG24V</td>
<td>Emergency stop input power</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>EMG RDY</td>
<td>Emergency stop READY signal</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>Reserved</td>
<td>Do not use.</td>
</tr>
</tbody>
</table>

⚠️ 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 EMG 24.
- 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.

⚠️ 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.

Do not connect an external DC 24V to EMG 24.

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.

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.
1.3 Connector terminal numbers
1.4 Emergency stop input signal connections

**CAUTION**
External emergency stop and the MPB 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.

**Operation description:**
- The MPB emergency stop switch and external emergency stop switch are connected in series.
  a. In normal operation, EMG 24V is connected to EMG RDY via the MPB emergency stop switch and SAFETY connector, and turns on the controller internal motor power relay.
  b. When emergency stop is triggered, power to EMG RDY of the SAFETY connector is cut off and the motor power supply turns off. Emergency stop is triggered if the MPB and SAFETY connector are removed.
- Pins 13 and 14 on the MPB connector are shorted in the MPB 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. SAFETY I/O interface overview

**CAUTION**
External emergency stop and the MPB 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 MPB-E2 (MPB compatible with an enable switch) with external emergency stop circuit (PNP specifications)

![Diagram of connections](image)

Operation description:
- The MPB-E2 emergency stop switch and external emergency stop switch are connected in series. The enable switch is also connected in series to the MPB-E2 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, EMG 24V is connected to EMG RDY via the MPB-E2 emergency stop switch and SAFETY connector, and turns on the controller internal motor power relay.
   b. When emergency stop is triggered, power to EMG RDY of the SAFETY connector is cut off and the motor power supply turns off. Emergency stop is triggered if the MPB-E2 and SAFETY connector are removed.

**CAUTION**
- EMG RDY requires at least 100mA for the relay and photocoupler drive current.
- Do not use EMG 24V 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, EMG 24V is connected to EMG RDY via the MPB-E2 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 EMG RDY of the SAFETY connector is cut off and the motor power supply turns off. Emergency stop is triggered if the MPB-E2 and SAFETY connector are removed.

- Pins 13 and 14, pins 15 and 16, pins 17 and 18, and pins 19 and 20 on the MPB connector are shorted in the MPB 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. SAFETY I/O interface overview

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.

---

**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.
1.6 Input signal description

1. DI02 SERVICE mode input

Service mode input can only be used on robot controllers with SAFE mode enabled. When the DI02 contact is open (OFF), the robot controller service mode is set for exclusive control for operating levels, operating speed limits and operating devices conforming to the service mode parameter settings. Normal mode is enabled when the DI02 contacts are closed (ON). When a serial I/O option board is installed, the service mode is controlled by a logic AND circuit comprised of SI02 and DI02.

If the service mode input is changed, the program being executed will pause or ongoing robot jog movement will pause.

2. DI00 Emergency stop inputs 1, 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 MPB-E2 (MPB compatible with an enable switch) is used.

3. Enable switch inputs 1, 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 MPB-E2 (MPB compatible with an enable switch) is used.
## Contents

1. Communication overview ................................................................. 7-1  
2. Communication function overview ............................................... 7-2  
3. Communication specifications ....................................................... 7-3  
   3.1 Connector .................................................................................. 7-3  
   3.2 Transmission mode and communication parameters .................... 7-4  
   3.3 Communication flow control ....................................................... 7-5  
      3.3.1 Flow control during transmit ............................................... 7-5  
      3.3.2 Flow control during receive ............................................... 7-5  
   3.4 Other caution items ................................................................. 7-6  
   3.5 Character code table ............................................................... 7-8  
   3.6 Connecting to a PC ................................................................. 7-9
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 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.

The flow of communication data is shown below.
3. Communication specifications

3.1 Connector

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

- 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.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Name</th>
<th>Description</th>
<th>Input/output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RXD</td>
<td>Receive data</td>
<td>Input</td>
</tr>
<tr>
<td>3</td>
<td>TXD</td>
<td>Send data</td>
<td>Output</td>
</tr>
<tr>
<td>4</td>
<td>NC</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
<td>Ground</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>NC</td>
<td>Not used</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RTS</td>
<td>Request to send</td>
<td>Output</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>Permission to send</td>
<td>Input</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td>Not used</td>
<td></td>
</tr>
</tbody>
</table>
3. Communication specifications

3. Connection cable examples

**a. Cable capable of hardware busy control**

<table>
<thead>
<tr>
<th>Controller</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>1</td>
<td>RXD</td>
<td>2</td>
<td>TXD</td>
<td>3</td>
<td>NC</td>
<td>4</td>
<td>GND</td>
</tr>
</tbody>
</table>
|            |   |    |    |    |    |    |    |    | NC
|            |   |    |    |    |    |    |    |    | RTS
|            |   |    |    |    |    |    |    |    | CTS
|            |   |    |    |    |    |    |    |    | NC
|            |   |    |    |    |    |    |    |    | DCD
|            |   |    |    |    |    |    |    |    | RXD
|            |   |    |    |    |    |    |    |    | TXD
|            |   |    |    |    |    |    |    |    | DTR
|            |   |    |    |    |    |    |    |    | GND
|            |   |    |    |    |    |    |    |    | DSR
|            |   |    |    |    |    |    |    |    | RTS
|            |   |    |    |    |    |    |    |    | CTS

| External device |  |  |  |  |  |  |  |  |
| NC             | 1 | RXD| 2 | TXD| 3 | NC | 4 | GND| 5 |
|                |   |    |    |    |    |    |    |    | NC
|                |   |    |    |    |    |    |    |    | RTS
|                |   |    |    |    |    |    |    |    | CTS
|                |   |    |    |    |    |    |    |    | NC
|                |   |    |    |    |    |    |    |    | DCD
|                |   |    |    |    |    |    |    |    | RXD
|                |   |    |    |    |    |    |    |    | TXD
|                |   |    |    |    |    |    |    |    | DTR
|                |   |    |    |    |    |    |    |    | GND
|                |   |    |    |    |    |    |    |    | DSR
|                |   |    |    |    |    |    |    |    | RTS
|                |   |    |    |    |    |    |    |    | CTS

**b. Cable not using control wires**

<table>
<thead>
<tr>
<th>Controller</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>1</td>
<td>RXD</td>
<td>2</td>
<td>TXD</td>
<td>3</td>
<td>NC</td>
<td>4</td>
<td>GND</td>
</tr>
</tbody>
</table>
|            |   |    |    |    |    |    |    |    | NC
|            |   |    |    |    |    |    |    |    | RTS
|            |   |    |    |    |    |    |    |    | CTS
|            |   |    |    |    |    |    |    |    | NC
|            |   |    |    |    |    |    |    |    | DCD
|            |   |    |    |    |    |    |    |    | RXD
|            |   |    |    |    |    |    |    |    | TXD
|            |   |    |    |    |    |    |    |    | DTR
|            |   |    |    |    |    |    |    |    | GND
|            |   |    |    |    |    |    |    |    | DSR
|            |   |    |    |    |    |    |    |    | RTS
|            |   |    |    |    |    |    |    |    | CTS

| External device |  |  |  |  |  |  |  |  |
| NC             | 1 | RXD| 2 | TXD| 3 | NC | 4 | GND| 5 |
|                |   |    |    |    |    |    |    |    | NC
|                |   |    |    |    |    |    |    |    | RTS
|                |   |    |    |    |    |    |    |    | CTS
|                |   |    |    |    |    |    |    |    | NC
|                |   |    |    |    |    |    |    |    | DCD
|                |   |    |    |    |    |    |    |    | RXD
|                |   |    |    |    |    |    |    |    | TXD
|                |   |    |    |    |    |    |    |    | DTR
|                |   |    |    |    |    |    |    |    | GND
|                |   |    |    |    |    |    |    |    | DSR
|                |   |    |    |    |    |    |    |    | RTS
|                |   |    |    |    |    |    |    |    | CTS

* For signal wire layout on the external device, refer to the instruction manual for that device.

3.2 Transmission mode and communication parameters

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

**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.

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

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

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.

<table>
<thead>
<tr>
<th>Flow Control</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>XON/XOFF</td>
<td>Transmits XOFF when available space in receive buffer falls below a certain capacity. Transmits XON when receive buffer is empty.</td>
<td>XON and XOFF are not transmitted. XON and XOFF are ignored if received.</td>
</tr>
<tr>
<td>RTS/CTS</td>
<td>Turns RTS off when available space in receive buffer falls below a certain capacity. Turns RTS on when receive buffer is empty.</td>
<td>RTS is always on.</td>
</tr>
</tbody>
</table>
3. Communication specifications

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.
Fig. 7-3-1 Problems caused by poor connections

Improper ground wire connection might cause electrical shock if connector metal parts are touched.

Failure to use ground wire might raise the voltage potential.

Malfunction or breakdown might occur when making connection or after connection.

Ground wire was not at ground potential or not connected.

* External device: Notebook PC using an AC adapter, etc.
### 3. Communication specifications

#### 3.5 Character code table

<table>
<thead>
<tr>
<th>HEX.</th>
<th>0-</th>
<th>1-</th>
<th>2-</th>
<th>3-</th>
<th>4-</th>
<th>5-</th>
<th>6-</th>
<th>7-</th>
<th>8-</th>
<th>9-</th>
<th>A-</th>
<th>B-</th>
<th>C-</th>
<th>D-</th>
<th>E-</th>
<th>F-</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0</td>
<td>SP</td>
<td>0</td>
<td>@</td>
<td>P</td>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-1</td>
<td>XON</td>
<td>!</td>
<td>1</td>
<td>A</td>
<td>Q</td>
<td>a</td>
<td>q</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td>&quot;</td>
<td>2</td>
<td>B</td>
<td>R</td>
<td>b</td>
<td>r</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-3</td>
<td>STOP</td>
<td>XOFF</td>
<td>#</td>
<td>3</td>
<td>C</td>
<td>S</td>
<td>c</td>
<td>s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-4</td>
<td>$</td>
<td>4</td>
<td>D</td>
<td>T</td>
<td>d</td>
<td>t</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-5</td>
<td>%</td>
<td>5</td>
<td>E</td>
<td>U</td>
<td>e</td>
<td>u</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-6</td>
<td>&amp;</td>
<td>6</td>
<td>F</td>
<td>V</td>
<td>f</td>
<td>v</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-7</td>
<td>'</td>
<td>7</td>
<td>G</td>
<td>W</td>
<td>g</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-8</td>
<td>BS</td>
<td>(</td>
<td>8</td>
<td>H</td>
<td>X</td>
<td>h</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-9</td>
<td>TAB</td>
<td>)</td>
<td>9</td>
<td>I</td>
<td>Y</td>
<td>i</td>
<td>y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-A</td>
<td>LF</td>
<td>EOF</td>
<td>:</td>
<td>J</td>
<td>Z</td>
<td>j</td>
<td>z</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-B</td>
<td>+</td>
<td>;</td>
<td>K</td>
<td>[</td>
<td>k</td>
<td>]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-C</td>
<td>,</td>
<td>&lt;</td>
<td>L</td>
<td>\</td>
<td>1</td>
<td>!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-D</td>
<td>CR</td>
<td>-</td>
<td>M</td>
<td>]</td>
<td>m</td>
<td>}</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-E</td>
<td>.</td>
<td>&gt;</td>
<td>N</td>
<td>^</td>
<td>n</td>
<td>~</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-F</td>
<td>/</td>
<td>?</td>
<td>O</td>
<td>o</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 MPB.

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

Note 5: TAB is replaced with one space.
3. Communication specifications

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

![Diagram of PC and RS-232C interface](image)

**CAUTION**
There is no problem with reversing the communication cable connections by attaching the straight serial conversion adapter to the PC.

<table>
<thead>
<tr>
<th>Cable length</th>
<th>Cable part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5m</td>
<td>KR7-M538F-100</td>
</tr>
<tr>
<td>5m</td>
<td>KR7-M538F-300</td>
</tr>
</tbody>
</table>

- Straight serial conversion adapter part No.  KX0-M657E-000

2) Using the PC’s USB port

![Diagram of PC and USB connection](image)

**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.
MEMO
Chapter 8  Specifications

Contents

1. Controller basic specifications ......................................................... 8-1
2. Controller basic functions ............................................................... 8-2
3. Robot controller external view ......................................................... 8-3
   3.1  RCX141 external view ............................................................... 8-3
4. MPB basic specifications and external view ...................................... 8-4
# 1. Controller basic specifications

**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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Applicable robots</td>
<td>YAMAHA Cartesian robots, SCARA robots, single-axis robots, P&amp;P robots, linear single-axis robots</td>
</tr>
<tr>
<td>Maximum power consumption</td>
<td>2500VA</td>
</tr>
<tr>
<td>Dimensions</td>
<td>W180 × H250 × D235 (main unit)</td>
</tr>
<tr>
<td>Weight</td>
<td>6.5kg (main unit)</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>Single phase AC 200 to 230V ±10%, 50/60Hz</td>
</tr>
<tr>
<td>No. of axes</td>
<td>4 axes maximum (simultaneous control: 4 axes)</td>
</tr>
<tr>
<td>Drive method</td>
<td>AC full digital servo</td>
</tr>
<tr>
<td>Position detection method</td>
<td>Resolver, magnetic linear scale</td>
</tr>
<tr>
<td>Control method</td>
<td>PTP motion (point to point), ARCH motion, linear interpolation, circular interpolation</td>
</tr>
<tr>
<td>Coordinate systems</td>
<td>Joint coordinates, Cartesian coordinates</td>
</tr>
<tr>
<td>Position display units</td>
<td>Pulses, mm (millimeters), deg (degrees)</td>
</tr>
<tr>
<td>Speed setting</td>
<td>Automatic acceleration setting by robot model and tip weight parameter</td>
</tr>
<tr>
<td></td>
<td>Setting by accel coefficient and decel. rate parameters (1% steps)</td>
</tr>
<tr>
<td></td>
<td>(Can be changed by programming.)</td>
</tr>
<tr>
<td></td>
<td>Zone control (Optimum speed setting matching SCARA robot arm position)</td>
</tr>
<tr>
<td>Program language</td>
<td>YAMAHA BASIC conforming to JIS B8439 (SLIM language)</td>
</tr>
<tr>
<td>Multitask</td>
<td>8 tasks maximum</td>
</tr>
<tr>
<td>Sequence program</td>
<td>1 program</td>
</tr>
<tr>
<td>Memory size</td>
<td>364KB (Total of program and point data) (Available size for program when maximum number of points is used: 84KB)</td>
</tr>
<tr>
<td>Program</td>
<td>100 programs (maximum number of programs)</td>
</tr>
<tr>
<td></td>
<td>9999 lines (maximum lines per program)</td>
</tr>
<tr>
<td></td>
<td>98KB (maximum capacity per program, maximum capacity per object program)</td>
</tr>
<tr>
<td>Point</td>
<td>10000 points (maximum number of points)</td>
</tr>
<tr>
<td>Teaching</td>
<td>MDI (coordinate data input), direct teaching, teaching playback, offline teaching (data input from external unit)</td>
</tr>
<tr>
<td>Memory backup</td>
<td>Lithium battery (service life about 4 years at 0 to 40°C)</td>
</tr>
<tr>
<td><strong>External I/O</strong></td>
<td></td>
</tr>
<tr>
<td>STD. DIO I/O input</td>
<td>General-purpose 16 points, dedicated 9 points (NPN/PNP specifications selectable)</td>
</tr>
<tr>
<td></td>
<td>I/O output General-purpose 8 points, dedicated 11 points</td>
</tr>
<tr>
<td>Emergency stop input</td>
<td>Relay contact</td>
</tr>
<tr>
<td>Service mode input</td>
<td>1 point (NPN/PNP specifications conform to STD.DIO setting.)</td>
</tr>
<tr>
<td>Break output</td>
<td>Relay contact</td>
</tr>
<tr>
<td>Origin sensor input</td>
<td>Connectable to DC24V B-contact (normally closed) sensor</td>
</tr>
<tr>
<td>External communications</td>
<td>RS-232C : 1 channel (D-SUB 9-pin female connector)</td>
</tr>
<tr>
<td></td>
<td>RS-422 : 1 channel (for MPB only)</td>
</tr>
<tr>
<td><strong>General specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0 to 40°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-10 to 65°C</td>
</tr>
<tr>
<td>Operating humidity</td>
<td>35 to 85% RH (no condensation)</td>
</tr>
<tr>
<td>Noise immunity</td>
<td>Conforms to IEC61000-4-4 Level 3</td>
</tr>
<tr>
<td>Protective structure</td>
<td>IP10</td>
</tr>
<tr>
<td><strong>Options</strong></td>
<td></td>
</tr>
<tr>
<td>Parallel DIO board</td>
<td>General-purpose input 24 points/board, output 16 points/board (4 boards maximum, compatible with NPN/PNP specifications)</td>
</tr>
<tr>
<td>CC-Link board</td>
<td>Dedicated input 11 points, dedicated output 11 points General-purpose input 96 points, general-purpose output 96 points</td>
</tr>
<tr>
<td>DeviceNet board</td>
<td>Dedicated input 11 points, dedicated output 11 points General-purpose input 96 points, general-purpose output 96 points</td>
</tr>
<tr>
<td>Profibus board</td>
<td>Dedicated input 11 points, dedicated output 11 points General-purpose input 96 points, general-purpose output 96 points</td>
</tr>
<tr>
<td>Ethernet board</td>
<td>Conforms to IEEE802.3, 10Mbps (10BASE-T)</td>
</tr>
<tr>
<td>Programming box</td>
<td>MPB, MPB-E2</td>
</tr>
<tr>
<td>PC software</td>
<td>VIP</td>
</tr>
</tbody>
</table>
## 2. Controller basic functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operation modes</strong></td>
<td>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.)</td>
</tr>
<tr>
<td><strong>Commands</strong></td>
<td>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.)</td>
</tr>
<tr>
<td><strong>Functions</strong></td>
<td>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.)</td>
</tr>
<tr>
<td><strong>Variables</strong></td>
<td>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</td>
</tr>
<tr>
<td><strong>Arithmetic operation</strong></td>
<td>Arithmetic operators (+, -, *, /, MOD) Logic operators (AND, OR, XOR) Relational operators (=, &lt;, &gt;, &lt;&gt;, &lt;=, =&gt;)</td>
</tr>
<tr>
<td><strong>Monitor</strong></td>
<td>Input/output status monitor (200ms intervals)</td>
</tr>
<tr>
<td><strong>Online commands</strong></td>
<td>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)</td>
</tr>
<tr>
<td><strong>Data files</strong></td>
<td>Program, point, parameter, shift, hand, all, error history</td>
</tr>
<tr>
<td><strong>Internal timer</strong></td>
<td>10ms intervals</td>
</tr>
<tr>
<td><strong>Program break points</strong></td>
<td>4 points maximum</td>
</tr>
</tbody>
</table>
3. Robot controller external view

3.1 RCX141 external view

Fig. 8-3-1-1 Standard RCX141

Fig. 8-3-1-2 RCX141 with RGU-2 option installed
# 4. MPB basic specifications and external view

## MPB basic specifications and external view

<table>
<thead>
<tr>
<th>Model</th>
<th>MPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display screen</td>
<td>Liquid crystal display (40 characters × 8 lines)</td>
</tr>
<tr>
<td>Power</td>
<td>DC ±12V</td>
</tr>
<tr>
<td>Noise resistance</td>
<td>1500V × 1 microsecond</td>
</tr>
<tr>
<td>Operating environment</td>
<td>Ambient temperature: 0 to 40°C, humidity: 35 to 85% (no condensation), storage temperature: -10 to 65°C</td>
</tr>
<tr>
<td>Dimensions (mm)</td>
<td>W189 × H241 × D28.6</td>
</tr>
<tr>
<td>Cable length</td>
<td>5m</td>
</tr>
<tr>
<td>Weight</td>
<td>700g (excluding cable)</td>
</tr>
</tbody>
</table>

## MPB external view

![MPB external view diagram](image-url)
Chapter 9  Troubleshooting

Contents

1. Error Messages ................................................................................................. 9-1
   1.1 Robot controller error messages ................................................................. 9-1
       [ 0] Warnings and messages ................................................................................ 9-3
       [ 1] Warnings (error history entry) ....................................................................... 9-5
       [ 3] Program file operating errors ................................................................. 9-9
       [ 4] Data entry and edit errors .......................................................................... 9-11
       [10] System setting or hardware errors ......................................................... 9-26
       [12] I/O and option board errors ................................................................. 9-28
       [14] RS-232C communication errors ............................................................. 9-33
       [15] Memory card errors ................................................................................ 9-34
       [21] Major software errors ............................................................................ 9-43
       [22] Major hardware errors ............................................................................ 9-44
   1.2 MPB Error Messages .................................................................................... 9-48

2. Troubleshooting .............................................................................................. 9-50
   2.1 When trouble occurs .................................................................................. 9-50
   2.2 Acquiring error information ....................................................................... 9-51
       2.2.1 Acquiring information from the MPB ..................................................... 9-51
       2.2.2 Acquiring information from the RS-232C ............................................. 9-51
   2.3 Troubleshooting checkpoints ..................................................................... 9-52
## 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 MPB screen.

Error messages comprise the following elements.

**12.1: Emg.stop on**

- **Message**
- **Error classification No.**
- **Error group No.**
- **Error No.**

### (1) Error group number

Error messages are classified by content into groups [0] to [22]. Contents of each error group are shown below.

<table>
<thead>
<tr>
<th>Group No.</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>[0]</td>
<td>Warnings and messages</td>
</tr>
<tr>
<td>[1]</td>
<td>Warnings (error history entry)</td>
</tr>
<tr>
<td>[2]</td>
<td>Robot operating area errors</td>
</tr>
<tr>
<td>[3]</td>
<td>Program file operating errors</td>
</tr>
<tr>
<td>[4]</td>
<td>Data entry and edit errors</td>
</tr>
<tr>
<td>[5]</td>
<td>Robot language syntax (compiling) errors</td>
</tr>
<tr>
<td>[7]</td>
<td>(Not used)</td>
</tr>
<tr>
<td>[8]</td>
<td>(Not used)</td>
</tr>
<tr>
<td>[9]</td>
<td>Memory errors</td>
</tr>
<tr>
<td>[10]</td>
<td>System setting or hardware errors</td>
</tr>
<tr>
<td>[11]</td>
<td>(Not used)</td>
</tr>
<tr>
<td>[12]</td>
<td>I/O and option board errors</td>
</tr>
<tr>
<td>[13]</td>
<td>MPB errors</td>
</tr>
<tr>
<td>[14]</td>
<td>RS-232C communication errors</td>
</tr>
<tr>
<td>[15]</td>
<td>Memory card errors</td>
</tr>
<tr>
<td>[16]</td>
<td>(Not used)</td>
</tr>
<tr>
<td>[17]</td>
<td>Motor control errors</td>
</tr>
<tr>
<td>[18]</td>
<td>(Not used)</td>
</tr>
<tr>
<td>[19]</td>
<td>(Not used)</td>
</tr>
<tr>
<td>[20]</td>
<td>(Not used)</td>
</tr>
<tr>
<td>[21]</td>
<td>Major software errors</td>
</tr>
<tr>
<td>[22]</td>
<td>Major hardware errors</td>
</tr>
</tbody>
</table>

**NOTE**

Messages for group No. 0 are not stored in the error history.
1. Error Messages

[Format]
Error No.: [location where error occurred:] error message
… Displays the error message on screen.
Code: Displays the error code in hexadecimal numbers.
Meaning/Cause: Displays the meaning and cause of the error.
Action: Displays a message explaining action needed to eliminate or avoid error status.
Dedicated output: Refer to “(2) Dedicated output status”.

* The beginning of the error message may sometimes include information on the location (axis, option unit, etc.) where the error occurred. An "M" in this information indicates the main group axis No., an "S" indicates the sub group axis No., a "D" indicates the driver axis No., and an "OP" indicates the option unit slot No.

For example, a message "2.1:M1, Soft limit over" indicates that the preset soft limit values have been exceeded on axis 1 of the main group robot. Likewise, the message, "17.4:D2, Overload" indicates that an overload has occurred in axis 2 of the driver unit. The axes viewed by the robot and the axes viewed by the driver are normally a one-to-one match with each other, but when dual-drive axes are used, one axis viewed by the robot may sometimes be treated as 2 axes by the driver.

(2) Dedicated output status

Dedicated output status items described below in *1 to *4 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

*4 … System backup battery defect
• Replace battery to reset.
  DO 03a (ALARM) = ON

CAUTION
When an error cannot be cancelled, contact your YAMAHA sales dealer.
## 0.0 : Undefined error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Undefined system error.</td>
</tr>
<tr>
<td>Action</td>
<td>Contact our company.</td>
</tr>
</tbody>
</table>

## 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.

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0001</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Return-to-origin is incomplete because return-to-origin has not been performed. So you …
  • cannot execute programs and commands.
  • cannot perform point teaching.
  • cannot perform manual Cartesian movement (mm units).
  b. Robot I/O cable was removed or disconnected.
  c. Return-to-origin or absolute search operation was interrupted.
  d. System generation was changed or parameters initialized. Or parameters for specifying the origin position such as for the return-to-origin direction or axis polarity were changed.
(Equivalent to writing ALL or PRM file on controller.) |
| Action | Perform return-to-origin to completion. |

## 0.2 : Running

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Program or command is running.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

## 0.3 : Program terminated by “HALT”

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Program execution was terminated by a HALT command.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

## 0.4 : Compiling

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0004</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Robot language compiling (making an object program) is in progress.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

## 0.5 : Busy

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Data is being saved on a memory card or internal ROM.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>
1. Error Messages

0.6 : Program suspended by “HOLD”
- Code: &H0006
- Meaning/Cause: Program execution was interrupted by a HOLD command.
- Action: Press the [START] key to cancel hold condition and start running the program from the next command.

0.7 : Turn on power again
- Code: &H0007
- Meaning/Cause: a. System generation was performed due to a robot change, etc.
  b. Parameter was changed by data transfer.
  c. System generation data was destroyed.
  d. Error occurred when servo was turned ON.
- Action: Turn the controller on again.

0.8 : Try again
- Code: &H0008
- Meaning/Cause: Operation failed.
- Action: Try again.

0.9 : Arrived at breakpoint
- Code: &H0009
- Meaning/Cause: Break point was reached during program execution.
- Action: ---

0.10 : INC. motor disconnected
- Code: &H000A
- Meaning/Cause: Return-to-origin command was attempted on an absolute axis or an axis that does not exist.
- Action: 1. Select the correct axis.
  2. Check the system generation data.

0.11 : ABS. motor disconnected
- Code: &H000B
- Meaning/Cause: Absolute reset was attempted on an incremental mode axis or semi-absolute mode axis, or an axis that does not exist.
- Action: 1. Specify the correct axis.
  2. Check the system generation data.

0.14 : Stop executed
- Code: &H000E
- Meaning/Cause: Stop was commanded while executing a direct command so operation was stopped.
- Action: ---

0.15 : Can’t execute while servo on
- Code: &H000F
- Meaning/Cause: Writing in "ALL" or "PRM" files was attempted during servo-on. "ALL" or "PRM" files cannot be written in servo-on.
- Action: Turn off the servo before writing files.
### 1. Error Messages

#### 1.16 : Changed SERVICE mode input

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Status of service mode inputs (DI02, SI02) was changed.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

#### 1.17 : Can't edit while STD.DIO DC24V on

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>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.)</td>
</tr>
<tr>
<td>Action</td>
<td>To disable the monitor function, change the parameter after first stopping the DC 24V supply.</td>
</tr>
</tbody>
</table>

### [ 1 ] Warnings (error history entry)

#### 1.31 CPU Reset start

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H011F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Power was turned on and CPU operation commenced.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

#### 1.32 CPU Normal start

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Start-up checks and initialization ended and controller operation started.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

### [ 2 ] Robot operating area errors

#### 2.1 : Over soft limit

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0201</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Soft limit value preset in the parameter for operation position was exceeded.</td>
</tr>
<tr>
<td>Action</td>
<td>1. Change the operating position to within the soft limits. 2. Change the soft limit value.</td>
</tr>
</tbody>
</table>

#### 2.2 : Std. coord. doesn't exist

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0202</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Setting of standard coordinates is incomplete.</td>
</tr>
<tr>
<td>Action</td>
<td>1. Set the standard coordinates. 2. Set the parameter arm length and offset pulse.</td>
</tr>
</tbody>
</table>
## 1. Error Messages

### 2.3 : Coordinate cal. failed

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0203</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Preset calculation for setting standard coordinates is not functioning.  
               b. Operating position exceeded the operating area range. |
| Action   | 1. Set the standard coordinates correctly.  
           2. Change operating position to within operating area. |

### 2.5 : Shift cal. failed

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0205</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Calculating for setting shift coordinates failed.</td>
</tr>
<tr>
<td>Action</td>
<td>Set shift coordinates correctly.</td>
</tr>
</tbody>
</table>

### 2.6 : Hand cal. failed

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0206</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Calculation for setting hand definition failed.</td>
</tr>
<tr>
<td>Action</td>
<td>Set hand definition correctly.</td>
</tr>
</tbody>
</table>

### 2.7 : Illegal Pallet parameter

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0207</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Calculation for setting pallet definition failed.</td>
</tr>
<tr>
<td>Action</td>
<td>Set pallet definition correctly.</td>
</tr>
</tbody>
</table>

### 2.8 : Movable range cal. failed

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0208</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Calculation of movement path failed.  
               b. Current position is not within movement range. |
| Action   | 1. Change to a correct movement point.  
           2. Change current position to within movement range. |

### 2.9 : Overlap soft limit

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0209</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>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.</td>
</tr>
</tbody>
</table>
| Action   | 1. Set the soft limit values correctly.  
           2. Set the soft limit values so that the movement range of the arm is less than 1 rotation. |

### 2.10 : Exceeded movable range

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H020A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Area is outside the movable range of movement path.</td>
</tr>
</tbody>
</table>
| Action   | 1. Set movement points correctly.  
           2. Specify movement path to be within the movable range. |
<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H020B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Shift coordinate range ? value was exceeded.</td>
</tr>
</tbody>
</table>
| Action | 1. Change the operating position of ? value to within the shift coordinates range.  
2. Change shift coordinates range ? value. |

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0211</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>When target point and arch position data are in mm units, arch motion is not used on X and Y axes.</td>
</tr>
<tr>
<td>Action</td>
<td>Change to correct arch motion command.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0212</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>On SCARA type robots, the arm will now use the right-handed system for starting Cartesian movement.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0213</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>On SCARA type robots, arm will now use the left-handed system for starting Cartesian movement.</td>
</tr>
<tr>
<td>Action</td>
<td>---</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0214</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>An R-axis hand definition was attempted on a robot not having an R-axis.</td>
</tr>
</tbody>
</table>
2. Do not use a hand definition. |

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0216</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>When arm length setting is 0 on SCARA type robots, movement on Cartesian coordinates was attempted.</td>
</tr>
</tbody>
</table>
| Action | 1. Set standard coordinates.  
2. Set the arm length parameter. |

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0217</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Interpolation movement shifting from the right-handed system to the left-handed system was executed with a SCARA robot.</td>
</tr>
<tr>
<td>Action</td>
<td>1. Check the current hand system and point data hand system flag.</td>
</tr>
</tbody>
</table>
1. Error Messages

2.24 : Cannot move (LEFTY to RIGHTY)

Code : &H0218
Meaning/Cause : a. Interpolation movement shifting from the left-handed system to the right-handed system was executed with a SCARA robot.
Action : 1. Check the current hand system and point data hand system flag.

2.25 : Cannot use TOOL coord.

Code : &H0219
Meaning/Cause : Failed to select tool coordinates could because no hand data has been entered.
Action : Set the hand data.
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 : Failed to move the double-carrier axis, because one carrier will interfere with the other carrier.
Action : If this error occurred during MANUAL mode:
1. Move the other carrier to a position where the two carriers will not interfere with each other and then move the robot manually.
If this error occurred during AUTO mode:
1. Change the target position of one carrier so it will not interfere with the first carrier's target position, and then move that first carrier.
2. Move the other carrier to a position where it will not interfere with the first carrier's target position.
3. Set the double-carrier parameter control mode to "Off" or "On".
When set to "Off", this error does not occur, but the anti-collision function for double-carriers will not work so the carriers might collide with each other.
When set to "On", one carrier starts moving after waiting until the other carrier moves to a position where no interference occurs.

2.27 : W. carrier deadlock

Code : &H021B
Meaning/Cause : Failed to move the double-carrier axis and a deadlock occurred, because the target positions of both carriers will interfere with each other.
Action : Check the robot program.
1. Error Messages

[ 3] Program file operating errors

3.1 : Too many programs
Code : &H0301
Meaning/Cause : Making of a new program was attempted after number of programs exceeded 100.
Action : Make a new program after deleting an unnecessary program. (Make a backup if necessary.)

3.2 : Program already exists
Code : &H0302
Meaning/Cause : An attempt to make/copy/transmit (by using SEND command) a new program with a name already registered was attempted.
Action : Making a new program/copy/transmission (by using SEND command) using a new (unregistered) program name.

3.3 : Program doesn’t exist
Code : &H0303
Meaning/Cause : A registered program of the specified name does not exist.
Action : Correctly enter a registered program name.

3.4 : Writing prohibited
Code : &H0304
Meaning/Cause : The specified program is write protected.
Action : Use a program that is not write protected.

3.5 : File type error
Code : &H0305
Meaning/Cause : Software error occurred.
Action : Contact our company with relevant information.

3.6 : Too many breakpoints
Code : &H0306
Meaning/Cause : Setting of break point exceeding 4 points was attempted.
Action : After deleting unnecessary break points, set the new break point. (Up to 4 break points can be set in one program.)

3.7 : Breakpoint doesn’t exist
Code : &H0307
Meaning/Cause : Break point was not found during search.
Action : Set a break point if needed.

3.9 : Cannot find strings
Code : &H0309
Meaning/Cause : Could not find specified character string during search.
Action : If needed change the character string and try searching again.
### 1. Error Messages

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.10 :</td>
<td><strong>Object program doesn’t exist</strong></td>
</tr>
<tr>
<td>Code : &amp;H030A</td>
<td>Meaning/Cause : The object program name is not registered.</td>
</tr>
<tr>
<td>Action : Make an object program.</td>
<td></td>
</tr>
<tr>
<td>3.11 :</td>
<td><strong>Cannot use function</strong></td>
</tr>
<tr>
<td>Code : &amp;H030B</td>
<td>Meaning/Cause : Unable to execute or unneeded hierarchy was selected.</td>
</tr>
<tr>
<td>Action : ---</td>
<td></td>
</tr>
<tr>
<td>3.12 :</td>
<td><strong>Cannot overwrite</strong></td>
</tr>
<tr>
<td>Code : &amp;H030C</td>
<td>Meaning/Cause : In AUTO mode or PROGRAM mode, overwrite of a program being selected cannot be made by communication with a program of the same name.</td>
</tr>
</tbody>
</table>
| Action : 1. Change the mode.  
2. Change the program name. |
| 3.13 : | **Changing data prohibited** |
| Code : &H030D | Meaning/Cause : Data cannot be changed because access level is not at 0. |
| Action : Set the access level to 0. |
| 3.14 : | **Cannot use mode** |
| Code : &H030E | Meaning/Cause : Specified mode cannot be changed because access level is set to level 2 or level 3. |
| Action : Change the access level to 0 or 1. |
| 3.15 : | **Illegal password** |
| Code : &H030F | Meaning/Cause : There is a mistake in the password entry. |
| Action : Enter the correct password. |
| 3.16 : | **Cannot reset ABS** |
| Code : &H0310 | Meaning/Cause : Failed to perform absolute reset or return-to-origin correctly. |
| Action : 1. Perform absolute reset or return-to-origin again.  
2. Replace the robot cable.  
3. Replace the controller. |
| 3.17 : | **Cannot erase current program** |
| Code : &H0311 | Meaning/Cause : Currently selected program cannot be deleted. |
| Action : 1. Cancel deletion of program.  
2. Change the specified program. |
3.18 : Duplicated Breakpoint
Code : &H0312
Meaning/Cause : Setting of breakpoint was attempted on line already set with break- points.
Action : To set the breakpoint, specify a line where breakpoints have not yet been set.

[ 4] Data entry and edit errors

4.1 : Point number error
Code : &H0401
Meaning/Cause : A point number was entered exceeding P9999.
Action : Input a correct point number.

4.2 : Input format error
Code : &H0402
Meaning/Cause : Wrong format was used to enter the data.
Action : Use the correct data format.

4.3 : Undefined pallet
Code : &H0403
Meaning/Cause : Specified pallet is undefined.
Action : 1. Change the specified pallet.
          2. Define the pallet.

4.4 : Undefined robot number
Code : &H0404
Meaning/Cause : Specified robot number does not exist.
Action : Enter a correct robot number.

4.5 : Undefined axis number
Code : &H0405
Meaning/Cause : Specified axis number does not exist.
Action : Enter a correct axis number.

[ 5] Robot language syntax (compiling) errors

5.1 : Syntax error
Code : &H0501
Meaning/Cause : Syntax error found in program.
Action : Change to the correct syntax.

5.2 : Data error
Code : &H0502
Meaning/Cause : Data entered in wrong format.
Action : Input the data in the correct format.
## 1. Error Messages

### 5.3 : Number error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0503</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Mistake in the number entry.  
b. Expression value is wrong. |
| Action        | 1. Change to the correct number.  
2. Change to the correct value. |

### 5.4 : Bit number error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0504</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Specified bit number is not within 0 to 7.</td>
</tr>
<tr>
<td>Action</td>
<td>Change to the correct bit number.</td>
</tr>
</tbody>
</table>

### 5.5 : Port number error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0505</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Port number specified for DO, DI, MO, SI, SO ports is outside the range 0 to 7, 10 to 17, or 20 to 27.  
b. Specified port number for LO, TO is not 0.  
c. An output to port 0 or port 1 was set for ports DO, MO, SO. |
| Action        | 1. Change to the correct port number.  
2. Change output for ports DO, MO, SO to a port other than port 0 or port 1. |

### 5.6 : Digit number error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0506</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Binary number has exceeded 8 digits (places).  
b. Octal number has exceeded 6 digits (places).  
c. Decimal number has exceeded the specified range.  
d. Hexadecimal number has exceeded 8 digits (places).  
e. Cartesian coordinate point data has more than 3 decimal places. |
| Action        | 1. Change to the correct number of digits (places).  
2. Specify the Cartesian coordinate point data of up to 2 decimal places. |

### 5.7 : Illegal axis name

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0507</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Robot axis name is wrong.</td>
</tr>
<tr>
<td>Action</td>
<td>Change to the correct axis name.</td>
</tr>
</tbody>
</table>

### 5.8 : Illegal order

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0508</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Wrong bit specified for input/output port.</td>
</tr>
<tr>
<td>Action</td>
<td>Change to ascending order starting from right.</td>
</tr>
</tbody>
</table>
5.10 : Too many characters

Code : &H050A
Meaning/Cause : a. Character string was defined in excess of 75 characters.
b. Addition to the character string total exceeds 75 characters.
Action : 1. Change to character string count of 75 characters or less.
2. Change additions to character string to a total of 75 characters or less.

5.12 : Stack overflow

Code : &H050C
Meaning/Cause : a. Parenthesis was used 6 times or continuously in an expression.
b. Overflow in stack area for compiling/execution.
Action : 1. Reduce parentheses in the expression to 5 times or less.
2. Reduce program size.
3. Reduce nesting of GOSUB statement, CALL statement and FOR to NEXT statement.
4. Reduce argument of CALL statement. (especially character variables)

5.13 : Illegal variable

Code : &H050D
Meaning/Cause : A variable other than a global variable was used in SEND/@READ/@WRITE commands.
Action : Change to a global variable.

5.14 : Type mismatch

Code : &H050E
Meaning/Cause : a. Expression does not match on both sides.
b. Prohibited type constant/variable/expression was used.
Action : 1. Change so that both sides of expression match.
2. Use a correct type of constant/variable/expression.

5.15 : FOR variable error

Code : &H050F
Meaning/Cause : Variable names for NEXT statement and corresponding FOR statement do not match.
Action : Change so that FOR statement variable names match with NEXT statement variable names.

5.16 : WEND without WHILE

Code : &H0510
Meaning/Cause : There is no WHILE statement corresponding to the WEND statement.
Action : 1. Delete the WEND statement.
2. Add a WHILE statement corresponding to the WEND statement.
1. Error Messages

5.17 : WHILE without WEND
Code : &H0511
Meaning/Cause : There is no WEND statement corresponding to WHILE statement.
Action : 1. Delete the WHILE statement.
         2. Add a WEND statement corresponding to the WHILE statement.

5.18 : NEXT without FOR
Code : &H0512
Meaning/Cause : a. There is no FOR statement corresponding to NEXT statement.
                b. NEXT command was executed without executing FOR command.
Action : 1. Delete the NEXT statement.
         2. Add a FOR statement corresponding to the NEXT statement.
         3. Confirm execution of FOR command.

5.19 : FOR without NEXT
Code : &H0513
Meaning/Cause : There is no NEXT statement corresponding to FOR statement.
Action : 1. Delete the FOR statement.
         2. Add a NEXT statement corresponding to the FOR statement.

5.20 : ENDIF without IF
Code : &H0514
Meaning/Cause : There is no IF statement corresponding to ENDIF statement.
Action : 1. Delete the ENDIF statement.
         2. Add an IF statement corresponding to the ENDIF statement.

5.21 : ELSE without IF
Code : &H0515
Meaning/Cause : There is no IF statement corresponding to ELSE statement.
Action : 1. Delete the ELSE statement.
         2. Add an IF statement corresponding to the ELSE statement.

5.22 : IF without ENDIF
Code : &H0516
Meaning/Cause : There is no ENDIF statement corresponding to IF statement.
Action : 1. Delete the IF statement.
         2. Add an ENDIF statement corresponding to the IF statement.

5.23 : ELSE without ENDIF
Code : &H0517
Meaning/Cause : There is no ENDIF statement corresponding to ELSE statement.
Action : 1. Delete the ELSE statement.
         2. Add an ENDIF statement corresponding to the ELSE statement.
1. Error Messages

5.24 : END SUB without SUB

Code : &H0518
Meaning/Cause : a. There is no SUB statement corresponding to END SUB statement.
               b. END SUB command was executed without SUB command.
Action : 1. Delete the END SUB statement.
         2. Add a SUB statement corresponding to the END SUB statement.
         3. Confirm execution of SUB command.

5.25 : SUB without END SUB

Code : &H0519
Meaning/Cause : There is no END SUB statement corresponding to SUB statement.
Action : 1. Delete the SUB statement.
         2. Add an END SUB statement corresponding to the SUB statement.

5.26 : Duplicated variable

Code : &H051A
Meaning/Cause : Two or more array variables were defined for the same name.
Action : Delete a definition statement for the array variables with the same name.

5.27 : Duplicated identifier

Code : &H051B
Meaning/Cause : Two or more identifiers were defined for the same name.
Action : Define another identifier.

5.28 : Duplicated label

Code : &H051C
Meaning/Cause : Two or more of the same labels were defined.
Action : Define another label.

5.29 : Undefined array

Code : &H051D
Meaning/Cause : Assignment/reference was made for undefined array.
Action : Define the undefined array.

5.30 : Undefined identifier

Code : &H051E
Meaning/Cause : An undefined identifier was used.
Action : Define an identifier for undefined identifier.

5.31 : Undefined label

Code : &H051F
Meaning/Cause : Reference made to undefined label.
Action : Set definition for undefined label.
### 1. Error Messages

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| 5.32    | Undefined user function                    | Code: &H0520
Meaning/Cause: Undefined function was called.
Action: Set definition for undefined function. |
| 5.34    | Too many dimensions                        | Code: &H0522
Meaning/Cause: An array exceeding 3 dimensions was defined.
Action: Change array to within 3 dimensions. |
| 5.35    | Dimension mismatch                          | Code: &H0523
Meaning/Cause: The number of array dimensions does not match that defined by the DIM statement.
Action: 1. Make the number of array dimensions match that defined by the DIM statement.
2. Make the number of array dimensions match the DIM statement. |
| 5.36    | Argument mismatch                           | Code: &H0524
Meaning/Cause: The number of SUB statement arguments does not correspond to the CALL statement.
Action: Make the number of SUB statements correspond to the CALL statement. |
| 5.37    | Specification mismatch                      | Code: &H0525
Meaning/Cause: Cannot execute command under present robot specifications.
Action: Change command for execution. |
| 5.38    | Illegal option                              | Code: &H0526
Meaning/Cause: Error is present in command option.
Action: Change to a correct option. |
| 5.39    | Illegal identifier                         | Code: &H0527
Meaning/Cause: Reserved word was used as an identifier.
Action: Change to an identifier not used as a reserved word. Refer to the Reserved Word List. |
| 5.40    | Illegal command in procedure               | Code: &H0528
Meaning/Cause: Cannot execute command within procedure (from SUB to END SUB statements).
Action: Delete command that cannot be executed within procedure. |
1. Error Messages

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.41 :</td>
<td>Illegal command outside procedure.</td>
<td>Command cannot be executed outside of procedure (between SUB to END SUB statements).</td>
<td>Delete command that cannot be executed outside of procedure.</td>
</tr>
<tr>
<td>Code</td>
<td>&amp;H0529</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning/Cause</td>
<td></td>
<td>Command cannot be executed outside of procedure (between SUB to END SUB statements).</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.42 :</td>
<td>Illegal command inside IF</td>
<td>Cannot execute command between IF to ENDIF statements.(Command can be executed for one IF statement line.)</td>
<td>Delete command that cannot be executed between IF to ENDIF statements.</td>
</tr>
<tr>
<td>Code</td>
<td>&amp;H052A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning/Cause</td>
<td></td>
<td>Cannot execute command between IF to ENDIF statements.(Command can be executed for one IF statement line.)</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.43 :</td>
<td>Illegal direct</td>
<td>Independent execution of command is impossible.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>&amp;H052B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning/Cause</td>
<td></td>
<td>Independent execution of command is impossible.</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.44 :</td>
<td>Cannot use external label</td>
<td>Command cannot use an external label.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>&amp;H052C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning/Cause</td>
<td></td>
<td>Command cannot use an external label.</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.45 :</td>
<td>Illegal program name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>&amp;H052D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning/Cause</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.46 :</td>
<td>Too many identifiers</td>
<td>Number of identifiers exceeded 500.</td>
<td>Ensure the number of identifiers is within 500 items.</td>
</tr>
<tr>
<td>Code</td>
<td>&amp;H052E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning/Cause</td>
<td></td>
<td>Number of identifiers exceeded 500.</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 5.47 :  | CASE without SELECT                              | There is no SELECT statement corresponding to CASE statement. | Delete the CASE statement.  
                                                   |                                                    | 2. Add a SELECT statement corresponding to the CASE statement. |
| Code       | &H052F                                           |                                                    |        |
| Meaning/Cause |                                                  | There is no SELECT statement corresponding to CASE statement. |        |
| Action     |                                                    |                                                    |        |
1. Error Messages

5.48 : END SELECT without SELECT
Code : &H0530
Meaning/Cause : There is no SELECT statement corresponding to END SELECT statement.
Action : 1. Delete the END SELECT statement.
2. Add a SELECT statement corresponding to the END SELECT statement.

5.49 : SELECT without END SELECT
Code : &H0531
Meaning/Cause : There is no END SELECT statement corresponding to SELECT statement.
Action : 1. Delete the SELECT statement.
2. Add an END SELECT statement corresponding to the SELECT statement.

5.50 : CASE without END SELECT
Code : &H0532
Meaning/Cause : There is no END SELECT statement corresponding to CASE statement.
Action : 1. Delete the CASE statement.
2. Add an END SELECT statement corresponding to the CASE statement.

5.51 : Illegal command line
Code : &H0533
Meaning/Cause : Cannot execute command statement between SELECT and CASE statements.
Action : Delete the command statement between SELECT and CASE statements.

5.52 : Command doesn’t exist
Code : &H0534
Meaning/Cause : Line does not have a command statement.
Action : 1. Add a command statement.
2. Delete the line that does not have a command statement.

5.53 : Compile failure
Code : &H0535
Meaning/Cause : Error occurred in software
Action : Report details of error to our company.

5.54 : ELSEIF without IF
Code : &H0536
Meaning/Cause : There is no IF statement corresponding to ELSEIF statement.
Action : 1. Delete the ELSEIF statement.
2. Add an IF statement corresponding to the ELSEIF statement.
5.55 : ELSEIF without ENDIF
Code : &H0537
Meaning/Cause : There is no ENDIF statement corresponding to ELSEIF statement.
Action : 1. Delete the ELSEIF statement.
          2. Add an ENDIF statement corresponding to the ELSEIF statement.


6.1 : Illegal command
Code : &H0601
Meaning/Cause : Execution of a non-supported or non-executable command was attempted.
Action : Change to a command that can be executed.

6.2 : Illegal function call
Code : &H0602
Meaning/Cause : The expression “ON <expression> GOTO”/”ON <expression> GOSUB” command was a negative value.
Action : Change <expression> to a positive value.

6.3 : Division by 0
Code : &H0603
Meaning/Cause : A command to divide by 0 (÷ 0) was attempted.
Action : Change from the divide by 0 command.

6.4 : Point doesn’t exist
Code : &H0604
Meaning/Cause : Assignment/movement/reference to an undefined point was attempted.
Action : Define the point.

6.5 : Coordinate type error
Code : &H0605
Meaning/Cause : a. Arithmetic operations of joint coordinate point data and Cartesian coordinate point data were attempted.
b. Joint coordinate system and Cartesian coordinate system were mixed together within the MOVE C, command point data.
c. Point data in PMOVE command was not specified in Cartesian coordinates.
Action : 1. Change to same coordinate system.
          2. Change to Cartesian coordinate system.

6.6 : Subscript out of range
Code : &H0606
Meaning/Cause : A subscript of an array variable has exceeded the range defined in DIM statement.
Action : Change the subscript of array variable to within the defined range.
<table>
<thead>
<tr>
<th>Error Code</th>
<th>Error Message</th>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.7 : RETURN without GOSUB</td>
<td>Code: &amp;H0607</td>
<td>RETURN command was executed without executing the GOSUB command.</td>
<td>Confirm execution of GOSUB command.</td>
<td></td>
</tr>
<tr>
<td>6.8 : END SUB without CALL</td>
<td>Code: &amp;H0608</td>
<td>END SUB command was executed without executing CALL command.</td>
<td>Confirm execution of SUB command.</td>
<td></td>
</tr>
<tr>
<td>6.9 : EXIT SUB without CALL</td>
<td>Code: &amp;H0609</td>
<td>EXIT SUB command was executed without executing CALL command.</td>
<td>Confirm execution of SUB command.</td>
<td></td>
</tr>
<tr>
<td>6.10 : SUSPEND without START</td>
<td>Code: &amp;H060A</td>
<td>SUSPEND command was executed for a task not executed by START command.</td>
<td>Confirm execution of START command.</td>
<td></td>
</tr>
<tr>
<td>6.11 : CUT without START</td>
<td>Code: &amp;H060B</td>
<td>CUT command was executed for a task not executed by START command.</td>
<td>Confirm execution of START command.</td>
<td></td>
</tr>
<tr>
<td>6.12 : RESTART without START</td>
<td>Code: &amp;H060C</td>
<td>RESTART command was executed for a task not executed by START command.</td>
<td>Confirm execution of START command.</td>
<td></td>
</tr>
<tr>
<td>6.13 : RESTART without SUSPEND</td>
<td>Code: &amp;H060D</td>
<td>RESTART command was executed for a task not executed by SUSPEND command.</td>
<td>Confirm execution of SUSPEND command.</td>
<td></td>
</tr>
</tbody>
</table>
### 6.14: Task number error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H060E</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Task number is outside the range 2 to 8.  
b. START, CUT, SUSPEND or RESTART command was executed for task 1 (main task).  
c. START, CUT, SUSPEND or RESTART command was executed for its own task. |
| Action     | 1. Change to a correct task number.  
2. Delete task command for task 1.  
3. Delete command for its own task. |

### 6.15: Task running

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H060F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>START command was executed for a task currently in operation.</td>
</tr>
<tr>
<td>Action</td>
<td>Delete START command.</td>
</tr>
</tbody>
</table>

### 6.16: Task suspending

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0610</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>START or SUSPEND command was executed for a task in pause (suspend) condition.</td>
</tr>
<tr>
<td>Action</td>
<td>Delete START or SUSPEND command.</td>
</tr>
</tbody>
</table>

### 6.17: Illegal command in error routine

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0611</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Command which could not be executed was attempted within an error processing routine.</td>
</tr>
<tr>
<td>Action</td>
<td>Delete the command which could not be executed.</td>
</tr>
</tbody>
</table>

### 6.18: EXIT FOR without FOR

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0612</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>EXIT FOR command was executed without executing FOR command.</td>
</tr>
<tr>
<td>Action</td>
<td>Confirm execution of FOR command.</td>
</tr>
</tbody>
</table>

### 6.19: SUB without CALL

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0613</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>SUB command was executed without executing CALL command.</td>
</tr>
<tr>
<td>Action</td>
<td>Confirm execution of CALL command.</td>
</tr>
</tbody>
</table>

### 6.20: Not execute CALL

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0614</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>CALL command was not executed.</td>
</tr>
<tr>
<td>Action</td>
<td>Confirm execution of CALL command.</td>
</tr>
</tbody>
</table>
### 1. Error Messages

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;H0615</td>
<td>a. Same points exist for 1 of 3 points of an MOVE C command.</td>
<td>1. Change the MOVE C command to 3 different points.</td>
</tr>
<tr>
<td></td>
<td>b. Same points are consecutively on the path of PATH motion.</td>
<td>2. Make changes so that the same points are not consecutively on the path of PATH motion</td>
</tr>
<tr>
<td>&amp;H0616</td>
<td>3 points of an MOVE C command were placed on a straight line.</td>
<td>Change the 3 different points of the MOVE C command so they are not on the same straight line.</td>
</tr>
<tr>
<td>&amp;H0617</td>
<td>MOVE C command radius is less than 1mm.</td>
<td>Change MOVE C command to 1mm or more for circular arc radius.</td>
</tr>
<tr>
<td>&amp;H0618</td>
<td>MOVE C command radius exceeded 5000mm (5 meters).</td>
<td>Change MOVE C command to within 5000mm (5 meters) for circular arc radius.</td>
</tr>
<tr>
<td>&amp;H0619</td>
<td>Specified speed was too low so movement time exceeded 300 seconds.</td>
<td>Increase the specified speed.</td>
</tr>
<tr>
<td>&amp;H061A</td>
<td>Failed to run an OUT command due to insufficient memory caused by multiple OUT commands that were run in succession.</td>
<td>Check the number of OUT commands. The maximum number of OUT commands that can be run in parallel is 16.</td>
</tr>
<tr>
<td>&amp;H061B</td>
<td>Any of PATH L, PATH C and PATH END was executed without executing PATH SET.</td>
<td>First execute PATH SET when setting a path.</td>
</tr>
<tr>
<td>Error Code</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>-------------</td>
<td></td>
</tr>
</tbody>
</table>
| 6.28 : PATH without END | Code: &H061C  
Meaning/Cause: PATH START was executed without executing PATH END.  
Action: Execute PATH END to end the path setting and then execute PATH START. |
| 6.29 : No PATH data | Code: &H061D  
Meaning/Cause: No path is set for PATH motion.  
Action: Set a path with PATH L and PATH C. The previously set path will be lost in the following cases:  
- When PATH SET is executed.  
- When program is changed.  
- When program is reset.  
- When controller power is turned off. |
| 6.30 : Too many PATH data | Code: &H061E  
Meaning/Cause: The number of PATH motion paths has exceeded 300.  
Action: Reduce the number of PATH motion paths to 300 or less in total of straight lines and circular arcs. |
| 6.31 : Not PATH start position | Code: &H061F  
Meaning/Cause: Robot’s current position is not the start position of PATH motion.  
Action: Move the robot to the start position specified with PATH SET and then execute PATH START. |
| 6.32 : PATH execute error | Code: &H0620  
Meaning/Cause: Cannot execute PATH motion.  
Action: 1. Reduce the speed setting.  
2. Lengthen the straight line or circular arc distance containing acceleration/deceleration.  
3. Make setting so that the direction at the connection point of straight lines does not change greatly. |
| 6.34 : MARK method is not allowed | Code: &H0622  
Meaning/Cause: Return-to-origin was attempted with an ORIGIN statement or dedicated input while the return-to-origin method for an incremental mode axis or semi-absolute mode axis is set to "Mark".  
Action: 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. |
1. Error Messages

6.35 : Expression value error

- Code: &H0623
- Meaning/Cause: The expression value is other than -1 and 0 even though conditional expression is a numeric expression.
- Action: 1. Set the expression value correctly.  
2. Change the "TRUE condition" parameter setting.

[ 9] Memory errors

9.1 : Program destroyed

- Code: &H0901
- Meaning/Cause: a. Part or all of the program data has been destroyed
  b. This error message is sometimes issued due to a major error or the power being turned off during rewrite of program data.
- Action: 1. Delete that program during selection.  
2. Initialize the program data.

9.2 : Point data destroyed

- Code: &H0902
- Meaning/Cause: a. Part or all of the point data has been destroyed
  b. This error message is sometimes issued due to a major error or the power being turned off during rewrite of point data.
- Action: Initialize the point data.

9.3 : Memory destroyed

- Code: &H0903
- Meaning/Cause: Error or malfunction occurred in the memory.
- Action: Initialize memory.

9.4 : Parameter destroyed

- Code: &H0904
- Meaning/Cause: Part or all of the parameter data has been destroyed.
- Action: Initialize the parameter data.

9.5 : Illegal object code

- Code: &H0905
- Meaning/Cause: An object program has been destroyed.
- Action: Compile and make an object program.

9.6 : Shift data destroyed

- Code: &H0906
- Meaning/Cause: Part or all of the shift data has been destroyed.
- Action: Initialize the shift data.

9.7 : Hand data destroyed

- Code: &H0907
- Meaning/Cause: Part or all of the hand data has been destroyed.
- Action: Initialize the hand data.
9.8 : POS.OUT data destroyed
   Code       : &H0908
   Meaning/Cause : Part or all of the POS.OUT data was destroyed.
   Action     : Initialize the POS.OUT data.

9.9 : Pallet data destroyed
   Code       : &H0909
   Meaning/Cause : Part or all of the pallet definition data was destroyed.
   Action     : Initialize the pallet definition data.

9.31 : Memory full
   Code       : &H091F
   Meaning/Cause : No available space in the program/point data area.
   Action     : Delete unnecessary programs/points.

9.32 : Object memory full
   Code       : &H0920
   Meaning/Cause : Object program size exceeded the upper limit.
   Action     : Compress the source program size, so that the object program size is smaller.

9.33 : Sys. generation destroyed
   Code       : &H0921
   Meaning/Cause : Part or all of the system generation data has been destroyed.
   Action     : Remake the system generation data correctly.

9.34 : Sys. generation mismatch
   Code       : &H0922
   Meaning/Cause : Mistake made in specifying the robot type/axis number of system generation data.
   Action     : Redo the system generation correctly.

9.35 : Program too big
   Code       : &H0923
   Meaning/Cause : Source program size exceeded the permissible size.
   Action     : Compress the source program size.

9.36 : Task data destroyed
   Code       : &H0924
   Meaning/Cause : Part or all of the data used in a task has been destroyed.
   Action     : Reset the program.

9.37 : Object program destroyed
   Code       : &H0925
   Meaning/Cause : Part or all of an object program has been destroyed.
   Action     : Make the object program again.
### 1. Error Messages

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>9.38</strong> : Sequence object memory full</td>
<td>Code: &amp;H0926&lt;br&gt;Meaning/Cause: Sequence object program exceeded its memory capacity.</td>
<td>Action: Compress the source size of sequence program, so that the object program size is reduced.</td>
</tr>
<tr>
<td><strong>9.39</strong> : Sequence object destroyed</td>
<td>Code: &amp;H0927&lt;br&gt;Meaning/Cause: Part or all of the sequence object program has been destroyed.</td>
<td>Action: Make the sequence object program again.</td>
</tr>
<tr>
<td><strong>9.40</strong> : Cannot found sequence object</td>
<td>Code: &amp;H0928&lt;br&gt;Meaning/Cause: No sequence object program.</td>
<td>Action: Make the sequence object program.</td>
</tr>
<tr>
<td><strong>9.41</strong> : Local variable memory full</td>
<td>Code: &amp;H0929&lt;br&gt;Meaning/Cause: Number of local variables defined within subroutine has exceeded upper limit.</td>
<td>Action: 1. Reduce number of local variables defined in the subroutine. 2. Use the global variable.</td>
</tr>
</tbody>
</table>

### [10] System setting or hardware errors

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10.1</strong> : Robot disconnected</td>
<td>Code: &amp;H0A01&lt;br&gt;Meaning/Cause: Axis control was attempted with &quot;no axis&quot; specified for all axes of system generation.</td>
<td>Action: Re-perform the system generation.</td>
</tr>
<tr>
<td><strong>10.3</strong> : D.unit disconnected</td>
<td>Code: &amp;H0A03&lt;br&gt;Meaning/Cause: Manual movement was attempted on the axis that is not specified.</td>
<td>Action: Do not perform any axis-related operation.</td>
</tr>
<tr>
<td><strong>10.6</strong> : DRIVER.unit version mismatch</td>
<td>Code: &amp;H0A06&lt;br&gt;Meaning/Cause: Driver unit version does not match the CPU unit.</td>
<td>Action: Make sure the CPU unit and driver unit versions match each other.</td>
</tr>
<tr>
<td><strong>10.7</strong> : CPU.unit version mismatch</td>
<td>Code: &amp;H0A07&lt;br&gt;Meaning/Cause: CPU unit version does not match the CPU.</td>
<td>Action: Make sure the CPU unit and driver unit versions match each other.</td>
</tr>
</tbody>
</table>
10.8 : Cannot set auxiliary axis
Code : &H0A08
Meaning/Cause : Setting of axis that cannot be set as an auxiliary axis was attempted.
The following axes cannot be set as an auxiliary axis.
- SCARA type robot axes
- X and Y axes except on MULTI type robots
Action : 1. Do not set an auxiliary axis.
2. Change the axis setting.

10.9 : Cannot set no axis
Code : &H0A09
Meaning/Cause : A no-axis setting was attempted on an axis which cannot accept it.
The following axes cannot be set to no-axis.
- X and Y axes except on MULTI type robots
Action : 1. Do not make a no-axis setting.
2. Change the axis setting.

10.10 : Cannot change axis
Code : &H0A0A
Meaning/Cause : Changing of an axis whose setting cannot be changed was attempted.
The following axes cannot be changed.
- X and Y axes on SCARA type robots
Action : 1. Do not change that axis.
2. Change a different axis.

10.13 : Cannot set Dualdrive
Code : &H0A0D
Meaning/Cause : A dual drive setting was attempted on an axis that cannot be set to dual drive.
Action : 1. Do not set to dual drive.
2. Change the axis setting.

10.14: Undefined parameter found
Code : &H0A0E
Meaning/Cause : a. Undefined, wrong parameter data was written because controller data from different controller version was used.
b. Parameter name is wrong.
Action : 1. Write the correct parameter data.
2. Enter the parameter name correctly.
3. Set the "Skip undefined parameters" parameter to "VALID".
1. Error Messages

10.21 : Sys. backup battery low voltage

Code : &H0A15
Meaning/Cause : a. System backup battery voltage is low.
               b. System backup battery is disconnected from CPU board.
Action : 1. Replace system backup battery.
         2. Connect system backup battery securely to CPU board.
Dedicated output : *4

10.22 : STD.DIO DC24V power low

Code : &H0A16
Meaning/Cause : 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.
Action : 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.DO DC 24V” parameter invalid in SYSTEM>PARAM>OTHER mode.

[12] I/O and option board errors

12.1 : Emg.stop on

Code : &H0C01
Meaning/Cause : a. Emergency stop button was pressed.
                b. Emergency stop terminals on SAFETY connector are open (emergency stop status).
                c. MPB or terminator are not connected to MPB connector.
                d. SAFETY connector is not connected.
Action : 1. Release the MPB emergency stop button.
         2. Close the emergency stop terminals on SAFETY connector.
         3. Connect MPB or terminator to MPB connector.
         4. Attach the SAFETY connector.
Dedicated output : *3

12.2 : Interlock on

Code : &H0C02
Meaning/Cause : a. Program was executed or moving of axis attempted while interlock signal was still input.
                b. Interlock signal turned ON during execution of program or axis movement.
                c. DC 24V not supplied to STD.DIO connector.
                d. STD.DIO connector is not connected.
Action : 1. Cancel the interlock signal, and execute program or move axis.
         2. Supply DC 24V to STD.DIO connector.
         3. Connect the STD.DIO connector.
         4. Disable the "DI (11) control" parameter when not using STD.DIO.
<table>
<thead>
<tr>
<th>12.3</th>
<th>Arm locked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code  :</td>
<td>&amp;H0C03</td>
</tr>
<tr>
<td>Meaning/Cause :</td>
<td>Movement of an arm was attempted while the arm lock variable LO was ON.</td>
</tr>
<tr>
<td>Action :</td>
<td>Clear the arm lock variable LO.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>12.11</th>
<th>CC-Link communication error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code  :</td>
<td>&amp;H0C0B</td>
</tr>
</tbody>
</table>
b. Wrong communication setting for CC-Link system.  
c. Master station sequencer power is turned off, has stopped operating or is damaged.  
d. Breakdown in CC-Link compatible unit. |
| Action : | 1. Check for a break, misconnection or wiring error in CC-Link cable.  
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. |

<table>
<thead>
<tr>
<th>12.12</th>
<th>CC-Link overtime error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code  :</td>
<td>&amp;H0C0C</td>
</tr>
</tbody>
</table>
| Meaning/Cause : | 1. Error in CC-Link system communications due to noise pickup, etc.  
2. Master station sequencer (PLC) power is turned off or has stopped operating. |
| Action : | 1. Implement countermeasures to protect the CC-Link system cable and controller from noise.  
2. Check if the master station sequencer (PLC) is operating correctly. |

<table>
<thead>
<tr>
<th>12.16</th>
<th>DeviceNet link error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code  :</td>
<td>&amp;H0C10</td>
</tr>
</tbody>
</table>
b. The DeviceNet system's MacID or communication speed setting is incorrect.  
c. No power supplied for communication.  
d. The master PLC's power is turned off, has stopped operating, is not operating correctly or is damaged.  
e. Breakdown in DeviceNet compatible unit. |
| Action : | 1. Check for a break, misconnection or wiring error in DeviceNet cable, and check the specifications (cable length, etc.)  
2. Check the MacID and communication speed settings.  
3. Check whether the communication power is supplied.  
4. Check whether the master PLC is operating correctly.  
5. Replace the DeviceNet compatible unit. |
1. Error Messages

12.17 : DeviceNet hardware error
Code : &H0C11
Action : 1. Replace the DeviceNet compatible unit.

12.18 : Incorrect DeviceNet setting
Code : &H0C12
Meaning/Cause : a. The MacID or communication speed setting is incorrect.
Action : 1. Check the MacID and communication speed settings.

12.19 : DeviceNet link error(Explicit)
Code : &H0C13
Meaning/Cause : a. The DeviceNet board was reset by an Explicit message request (Reset request to Identity Obj) from the client (master PLC).
Action : 

12.21 : PROFIBUS link error
Code : &H0C15
Meaning/Cause : a. Error in cable for PROFIBUS system.
b. The PROFIBUS system's station address setting is incorrect.
c. The master station PLC power is turned off, or the PLC has stopped operating or is not operating correctly, or is broken.
d. Breakdown in PROFIBUS compatible unit.
Action : 1. Check for a break, misconnection or wiring error in PROFIBUS cable, and check the specifications (cable length, etc.).
2. Check the station address settings.
3. Check whether the master station PLC is operating correctly.
4. Check the hardware configuration settings.
5. Replace the PROFIBUS compatible unit.

12.22 : PROFIBUS hardware error
Code : &H0C16
Action : 1. Replace the PROFIBUS compatible unit.

12.31 : DI DC24V disconnected
Code : &H0C1F
Meaning/Cause : 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.
Action : 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

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0C20</th>
</tr>
</thead>
</table>
| Meaning/Cause | 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. |
| Action     | 1. Supply DC 24V to DO1 section 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. |

### 12.33 : DO2 DC24V disconnected

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0C21</th>
</tr>
</thead>
</table>
| Meaning/Cause | 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. |
| Action     | 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

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0C22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Comparison point data does not exist.</td>
</tr>
<tr>
<td>Action</td>
<td>Set comparison point data correctly.</td>
</tr>
</tbody>
</table>

### 12.35 : POS.OUT Point unit error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0C23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Comparison points 1 and 2 do not use the same unit system.</td>
</tr>
<tr>
<td>Action</td>
<td>Change them to the same unit system.</td>
</tr>
</tbody>
</table>

### 12.41 : EtherNet link error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H0C29</th>
</tr>
</thead>
</table>
| Meaning/Cause | TELENET is disconnected.  
a. The cable is broken or disconnected.  
b. Communicating with a client was off for more than the time specified by the "7. timeout [min]" parameter for EtherNet.  
c. Logout was attempted while the 11. logout" parameter for EtherNet is set to "STOP".  
d. No response for a keep-alive packet from the client. |
| Action     | 1. Connect the cable or connector securely.  
2. Communicate with a client at least once within the time specified by the "7. timeout [min]" parameter, or set the parameter to "0" to disable the timeout function.  
3. Set the "11. logout" parameter to "CONT." to avoid errors during logout.  
4. Check whether the client is responding to the keep-alive packet, or set the "12. keep-alive [sec]" parameter to "0" to stop the keep-alive packet from being sent out. |
1. Error Messages

12.42 : EtherNet hardware error
Code : &H0C2A
Action : 1. Replace the EtherNet compatible unit.

12.70 : Incorrect option setting
Code : &H0C46
Meaning/Cause : a. Error in DIP switch setting on option unit.
b. Mismatched option units have been installed.
c. Cannot identify the installed option unit.
Action : 1. Check the DIP switch settings on the option unit.
2. Install the correct unit.
3. Replace the option unit.
4. Replace the controller.

12.75 : Illegal remote command
Code : &H0C4B
Meaning/Cause : a. The remote command or command data is incorrect.
Action : 1. Check the remote command or command data.

[13] MPB errors

13.1 : MPB communication error
Code : &H0D01
Meaning/Cause : Error occurred in communication with MPB.
Action : 1. Install the MPB correctly.
2. Replace the MPB.
3. Replace the controller.

13.2 : MPB parity error
Code : &H0D02
Meaning/Cause : Abnormal data was entered in communication with MPB.
Action : 1. Install the MPB correctly.
2. Install the MPB in a good operating environment.
(Do not install near sources of noise.)

13.11 : MPB version mismatch
Code : &H0D0B
Meaning/Cause : MPB version does not match the controller, and connection refused.
Action : Use an MPB version that matches the controller.

13.12 : MPB system error
Code : &H0D0C
Meaning/Cause : Error occurred in communication with MPB.
Action : 1. Replace the MPB.
2. Replace the controller.
### [14] RS-232C communication errors

#### 14.1 : Communication error

- **Code**: &H0E01
- **Meaning/Cause**
  - a. During external communication via the RS-232C, an error occurred.
  - b. An overrun error or framing error occurred via the RS-232C.
  - c. Power supply for external device turned on or off after connecting communication cable with the external device.
- **Action**
  1. Change to a correct system environment for RS-232C. (Do not install near sources of noise.)
  2. Replace the communications cable.
  3. Check the communication parameter settings.

#### 14.2 : Parity error

- **Code**: &H0E02
- **Meaning/Cause**: During external communication via the RS-232C, an error occurred.
- **Action**: Check the communication parameter settings.

#### 14.11 : Receive buffer overflow

- **Code**: &H0E0B
- **Meaning/Cause**: Communication receive buffer exceeded permissible capacity.
- **Action**
  1. Delay the communication parameter speed (baud rate).
  2. Change communication parameter so that flow control is enabled.

#### 14.12 : CMU is not ready

- **Code**: &H0E0C
- **Meaning/Cause**: Could not sent data from controller because receive prohibit status of other party continued for more than 10 seconds.
- **Action**
  1. Replace the communications cable.
  2. Check that flow control is normal in software processing for other party.

#### 14.20 : Too many Command characters

- **Code**: &H0E14
- **Meaning/Cause**
  1. Off-line command character string in 1 line exceeded 80 letters.
  2. Command statement created with a remote command exceeded 80 letters.
- **Action**
  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**
  1. Character string in 1 line exceeded 75 letters.
  2. CR code (0Dh) was not added at end of line.
- **Action**
  1. Limit number of characters in 1 line to 75 letters.
  2. Add a CR code at the end of a single line.
### 1. Error Messages

#### 14.22 : No start code (@)
- **Code**: &H0E16
- **Meaning/Cause**: Starting code "@" was not added at beginning of single line in an on-line command.
- **Action**: Add starting code "@" at the beginning of on-line command.

#### 14.23 : Illegal command, Operating
- **Code**: &H0E17
- **Meaning/Cause**: During data editing, an on-line command was executed.
- **Action**: After completing data edit, execute an on-line command.

#### 14.24 : Illegal command, Running
- **Code**: &H0E18
- **Meaning/Cause**: During program run, a non-executable on-line command was attempted.
- **Action**: 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**: Cannot execute the specified online command in the current mode.
- **Action**: 1. Stop the online command.
   2. Change the mode.

#### 14.26 : Illegal command, SERVICE mode
- **Code**: &H0E1A
- **Meaning/Cause**: Unable to execute since operation is in SERVICE mode.
- **Action**: 1. Cancel SERVICE mode.
   2. Change the exclusive control setting so it can be used in SERVICE mode.

#### 14.31 : Illegal port type
- **Code**: &H0E1F
- **Meaning/Cause**: Communication port not specified.
- **Action**: Contact our company with details on this problem.

### [15] Memory card errors

#### 15.1 : Invalid file attribute
- **Code**: &H0F01
- **Meaning/Cause**: a. Directory was accessed.
   b. Read/write protected file was accessed.
- **Action**: 1. Change to a file which can be accessed.
   2. Change to a file allowing read/write.
### 15.2 : Read only file
- **Code**: &H0F02
- **Meaning/Cause**: Writing was attempted on a write protected file.
- **Action**:  
  1. Change to another file.
  2. Change to a file not write protected.

### 15.3 : Same file name already exists
- **Code**: &H0F03
- **Meaning/Cause**: File name change was attempted but the same file name already exists.
- **Action**: Change it to an unused file name.

### 15.4 : File doesn’t exist
- **Code**: &H0F04
- **Meaning/Cause**: Loading of file was attempted but file name does not exist.
- **Action**: Change to a file name that currently exists.

### 15.11 : Directory full
- **Code**: &H0F0B
- **Meaning/Cause**: The file storage capacity was exceeded.
- **Action**:  
  1. Use a new memory card.
  2. Change the directory to save.
  3. Delete unnecessary files.

### 15.12 : Disk full
- **Code**: &H0F0C
- **Meaning/Cause**: Write failed. No space is available on memory card. (File contents cannot be guaranteed.)
- **Action**:  
  1. Use a new memory card.
  2. Delete unnecessary files.

### 15.13 : Unformatted media
- **Code**: &H0F0D
- **Meaning/Cause**: a. Memory card was not formatted.
  b. Wrong memory card format.
- **Action**:  
  1. Format correctly.
  2. Replace memory card backup battery.

### 15.14 : Media protected
- **Code**: &H0F0E
- **Meaning/Cause**: Cannot write. Memory card has been set to write protect.
- **Action**:  
  1. Change to allow writing.
  2. Use another memory card.
1. Error Messages

15.15: Media type mismatch
Code: &H0F0F
Meaning/Cause: Memory card is unusable.
Action: Replace the memory card.

15.16: Media data destroyed
Code: &H0F10
Meaning/Cause: All or part of data stored on memory card is damaged.
Action: 1. Format the memory card.
2. Overwrite the damaged portion with new data.
3. Replace the memory card backup battery.
4. Replace the memory card.

15.21: Cannot find media
Code: &H0F15
Meaning/Cause: Memory card not inserted correctly in slot.
Action: Insert the memory card correctly.

15.23: Aborted
Code: &H0F17
Meaning/Cause: STOP key was pressed during reading/writing from or into memory card, and the operation halted.
Action: ---

15.24: Media hardware error
Code: &H0F18
Meaning/Cause: a. Memory card is defective
b. Error occurred in controller.
Action: 1. Replace the memory card.
2. Replace the controller.

15.27: Data read error
Code: &H0F1B
Meaning/Cause: Failed to load file.
Action: 1. Try to reload the file.
2. Replace the memory card.
3. Replace the controller.

15.28: Data write error
Code: &H0F1C
Meaning/Cause: Failed to write file.
Action: 1. Try rewriting the file.
2. Replace the memory card.
3. Replace the controller.
1. Error Messages

15.29: Timeout error

- **Code:** &H0F1D
- **Meaning/Cause:** Failed to load/write file.
- **Action:**
  1. Try to reload/rewrite the file.
  2. Replace the memory card.
  3. Replace the controller.

[17] Motor control errors

17.1: System error (DRIVER)

- **Code:** &H1101
- **Meaning/Cause:** Error occurred in software for driver unit.
- **Action:** Contact our company with details of the problem.
- **Dedicated output:** *2

17.2: Watchdog error (DRIVER)

- **Code:** &H1102
- **Meaning/Cause:**
  a. Malfunction occurred in driver unit due to external noise.
  b. Controller is defective.
- **Action:**
  1. Turn the power on again.
  2. Replace the controller.
- **Dedicated output:** *2

17.3: Over current

- **Code:** &H1103
- **Meaning/Cause:**
  a. Short in motor cable.
  b. Malfunction occurred in motor.
- **Action:**
  1. Replace the motor cable.
  2. Replace the motor.
- **Dedicated output:** *2
1. Error Messages

### 17.4: Over load

**Code**: &H1104  
**Meaning/Cause**:
- a. Robot drive section mechanically locked  
- b. Motor current exceeded its rated value due to a motor overload.  
- c. Motor acceleration is excessive.  
- d. System generation setting is wrong.  
- e. Motor cable wiring is broken or wiring is incorrect.  
- f. Electromagnetic brake for holding vertical axis is defective.  
- g. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis.  
- h. SAFETY connector is not used correctly.  

**Action**:
1. Perform robot service and maintenance.  
2. Decrease load on motor.  
3. Lower the motor acceleration.  
4. Redo the system generation.  
5. Wire the motor cable correctly.  
6. Replace the motor cable.  
7. Replace the magnetic brake for holding the vertical axis.  
8. Replace the robot I/O cable.  
9. Do not use DC 24V from SAFETY connector as power source for external loads.  

**Dedicated output**: *2

### 17.5: Over heat

**Code**: &H1105  
**Meaning/Cause**: Temperature in power module of driver unit exceeded 80°C.  

**Action**:
1. Improve the equipment environment.  
2. Check that cooling fan is working correctly.  
3. Lower the robot duty cycle and decrease the amount of heat generated.  
4. Replace the controller.  

**Dedicated output**: *2
### 17.6 : P.E.counter overflow

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1106</th>
</tr>
</thead>
</table>
| Meaning/Cause | a. Robot drive section mechanically locked.  
b. Motor acceleration is excessive.  
c. System generation setting is wrong.  
d. Motor cable wiring is broken or wiring is incorrect.  
e. Electromagnetic brake for holding vertical axis is defective.  
f. Wiring is incorrect or disconnected on electromagnetic brake for holding the vertical axis.  
g. SAFETY connector is not used correctly. |
| Action | 1. Perform robot service and maintenance.  
2. Lower the motor acceleration.  
3. Redo the system generation.  
4. Wire the motor cable correctly  
5. Replace the motor cable.  
6. Replace the magnetic brake for holding the vertical axis.  
7. Replace the robot I/O cable.  
8. Do not use DC 24V from SAFETY connector as power source for driving external loads. |

| Dedicated output | *2 |

### 17.9 : Command error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1109</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Driver cannot identify commands from CPU.</td>
</tr>
<tr>
<td>Action</td>
<td>Check the versions of the CPU unit and driver unit.</td>
</tr>
</tbody>
</table>

| Dedicated output | *2 |

### 17.10 : Feedback error 1

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H110A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Wiring of motor cable or encoder cable is incorrect.</td>
</tr>
</tbody>
</table>
| Action | 1. Rewire the motor cable or encoder cable correctly.  
2. Replace the motor cable or encoder cable. |

| Dedicated output | *2 |

### 17.11 : Feedback error 2

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H110B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Motor cable or encoder cable is broken.</td>
</tr>
<tr>
<td>Action</td>
<td>Replace the motor cable or encoder cable.</td>
</tr>
</tbody>
</table>

| Dedicated output | *2 |

### 17.16 : Over velocity 1

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Axis movement speed exceeded the limit during linear interpolation, circular interpolation or manual orthogonal movement.</td>
</tr>
</tbody>
</table>
| Action | 1. Reduce the acceleration.  
2. Reduce the speed. |

| Dedicated output | *2 |
1. Error Messages

17.17 : Mode error
Code : &H1111
Meaning/Cause : Driver unit is in abnormal control mode status.
Action : Contact our company with details on the problem.
Dedicated output : *2

17.18 : DPRAM data error
Code : &H1112
Meaning/Cause : 2 tries at loading the dual port RAM failed.
Action : Contact our company with details on the problem.
Dedicated output : *2

17.19 : Coord. value error
Code : &H1113
Meaning/Cause : Error occurred during linear interpolation, circular interpolation or manual orthogonal movement.
Action : Contact our company with details on the problem.
Dedicated output : *2

17.20 : Motor type error
Code : &H1114
Meaning/Cause : A motor type unidentifiable by drive unit was selected.
Action : 1. Redo the system generation.
2. Replace the controller.

17.21 : Bad origin sensor
Code : &H1115
b. Sensor cable is broken.
Action : 1. Replace the origin sensor.
2. Replace the origin sensor cable.

17.22 : Bad PZ
Code : &H1116
b. Resolver signal wire is broken.
Action : 1. Replace the motor.
2. Replace the robot I/O cable.

17.23 : Torque limit
Code : &H1117
Meaning/Cause : Torque exceeded the limit.
Action : Lower the acceleration.
17.24 : Can not reserve parameter
Code : &H1118
Meaning/Cause : Data for driver unit from the CPU unit was not received by driver unit.
Action : 1. Turn the power off and then on again.
          2. Replace the controller.

17.28 : Dual P.E. counter overflow
Code : &H111C
Meaning/Cause : On a dual-axis drive, the position differential between the main axis and sub axis is too large.
1. Friction in the robot drive section is too large.
2. Motor brake wiring is broken.
Action : 1. Check the drive sections for assembled condition and lubrication to ensure smooth movement.
          2. Check that the motor brake works properly.

17.30 : Bad position
Code : &H111E
Meaning/Cause : Cannot perform positioning.
Action : 1. Turn the power off and then on again.
          2. Replace the controller.

17.31 : Servo off
Code : &H111F
Meaning/Cause : Movement command was attempted in servo OFF state.
Action : Change status to servo ON.

17.33 : Busy now
Code : &H1121
Meaning/Cause : a. Servo-Off command was attempted while the driver was stopped.
              b. Return-to-origin command was attempted before manual movement was complete.
Action : 1. Turn off the power to the controller and then turn it back on.
          2. Wait until the command has finished.

17.34 : Servo on failed
Code : &H1122
Meaning/Cause : a. Servo-ON was attempted for each axis while motor power was off.
              b. Servo-ON processing failed because the drive unit had been stopped.
Action : 1. First turn on the motor power if servo-ON for each axis was attempted.
          2. Turn the power off and then on again.
1. Error Messages

17.35 : Axis weight over

- **Code**: &H1123
- **Meaning/Cause**: The weight (sum of work weight + axis weight) on a particular robot axis exceeded the maximum payload of that axis.
- **Action**: 1. Redo the system generation.
  2. Select the axis weight parameter to a correct value.

17.39 : Servo off failed

- **Code**: &H1127
- **Meaning/Cause**: Servo-OFF processing failed because the drive unit had been stopped.
- **Action**: Turn the power off and then on again.
- **Dedicated output**: *2

17.40 : Torque mode now

- **Code**: &H1128
- **Meaning/Cause**: Manual movement attempted while in torque mode.
- **Action**: Cancel the torque mode.

17.73 : Resolver wire breakage

- **Code**: &H1149
- **Meaning/Cause**: a. Resolver signal wire is broken.
  b. Motor malfunction occurred.
  c. Controller malfunction occurred.
- **Action**: 1. Replace the robot I/O cable.
  2. Replace the motor.
  3. Replace the controller.

17.78 : Power module error

- **Code**: &H114E
- **Meaning/Cause**: a. Power module overheated.
  b. Power module/motor drew excessive current.
- **Action**: Lighten the load on the robot.

17.82 : CS read error

- **Code**: &H1152
- **Meaning/Cause**: Readout check of resolver electrical angle information failed twice.
- **Action**: 1. Perform return-to-origin twice.
  2. Replace the motor.
  3. Replace the controller.

17.90 : DRIVE2 module type error

- **Code**: &H115A
- **Meaning/Cause**: Motor specifications do not match current sensor specifications.
- **Action**: 1. Replace the controller.
  2. Redo the system generation.
### 17.99: Pole Search Error

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1163</th>
</tr>
</thead>
</table>
| Meaning/Cause | Failed to detect the motor magnetic pole when the servo was turned on.  
  a. Servo wire is broken or misconnected.  
  b. Position sensor cable is miswired.  
  c. Axis parameter setting related to motor control is wrong. |
| Action | 1. Correct the motor wiring.  
  2. Check the position sensor cable wiring.  
  3. Correct the parameter setting. |

### [21] Major software errors

#### 21.1: System error (JOG)

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1501</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Software error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

#### 21.2: System error (srvmod)

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1502</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Software error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

#### 21.3: System error (TaskID)

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1503</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Software error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

#### 21.4: System error (drcom)

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1504</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Software error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

#### 21.5: System error (drmod)

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1505</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Software error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

#### 21.6: System error (Gen.Data)

<table>
<thead>
<tr>
<th>Code</th>
<th>&amp;H1506</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning/Cause</td>
<td>Software error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>
1. Error Messages

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| &H150A| a. CPU malfunctioned due to external noise.  
b. Controller is defective.                                                                                                                              | 1. Turn the power off and then on again.  
2. Replace the controller.                                                   |

21.10 : Watchdog error (CPU)

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;H150B</td>
<td>Software error occurred.</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

21.11 : System error (EmgHalt)

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;H150C</td>
<td>Software error occurred.</td>
<td>Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

21.12 : System error (RTOS)

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| &H150D| 1. Current position of driver does not match the instructed position.                                                                                                                                       | 1. Replace the driver.  
2. Replace the controller. |

21.13 : System error (CRFPOS)

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
</table>
| &H150E| 1. Failed to write PTP command data into driver.                                                                                                                                                           | 1. Replace the driver.  
2. Replace the controller. |

21.14 : DPRAM error (PTP data)

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>&amp;H1529</td>
<td>a. Software error occurred.</td>
<td>1. Contact our company with details of this problem.</td>
</tr>
</tbody>
</table>

2.41 : System error (EXCEPTION)

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Case</th>
<th>Action</th>
</tr>
</thead>
</table>
| &H1601| 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. |

[22] Major hardware errors

22.1 : AC power low

<table>
<thead>
<tr>
<th>Code</th>
<th>Meaning/Case</th>
<th>Action</th>
</tr>
</thead>
</table>
| &H150E| 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.
## 22.3 : DC24V power low

**Code**: &H1603  
**Meaning/Cause**:  
- a. DC 24V power supply malfunctioned and the voltage dropped.  
- b. Electromagnetic brake for vertical axis is defective.  
- c. Wiring for electromagnetic brake of vertical axis is wrong.  
- d. Short in DC 24V for safety connector.  
**Action**:  
1. Replace the controller.  
2. Replace the vertical axis electromagnetic brake.  
3. Replace the robot I/O cable.  
4. Check the SAFETY connector wiring.  
**Dedicated output**: *1

## 22.9 : Abnormal over voltage

**Code**: &H1609  
**Meaning/Cause**:  
- a. Output voltage for motor power supply exceeded 420 volts.  
- b. Regenerative unit not connected to controller.  
- c. Regenerative unit safety device triggered due to temperature rise (120°C or more) in regeneration damping resistor.  
- d. Cable connecting regenerative unit and controller is defective.  
- e. Regenerative unit is defective.  
- f. Safety connector is used incorrectly.  
**Action**:  
1. Check the power supply voltage.  
2. Connect the regenerative unit.  
3. Lower the robot operating duty.  
4. Replace the connecting cable.  
5. Replace the regenerative unit.  
6. Do not supply DC 24V to SAFETY connector from external source.

## 22.10 : Abnormal drop in voltage

**Code**: &H160A  
**Meaning/Cause**:  
- a. Output voltage for motor power supply dropped below 140V.  
- b. Power supply has insufficient capacity.  
- c. Vertical axis electromagnetic brake is defective.  
- d. SAFETY connector is used incorrectly.  
**Action**:  
1. Check the power supply voltage.  
2. Check if supply voltage drops during robot operation.  
3. Lower the robot duty cycle.  
4. Replace the vertical axis electromagnetic brake.  
5. Do not supply DC 24V to SAFETY connector from external source.  
6. Do not use DC 24V from SAFETY connector as power source for driving external loads.
1. Error Messages

22.12: Abnormal temperature
Code: &H160C
Meaning/Cause: Controller internal temperature rose to 60°C or more.
Action:
1. Improve the operating environment.
2. Check if the cooling fan is operating correctly.
3. Replace the controller.
Dedicated output: *1

22.13: Bus interface overtime
Code: &H160D
Meaning/Cause: Could not acquire access rights to dual port RAM.
Action: Replace the controller.
Dedicated output: *1

22.14: Abnormal DRIVER unit error
Code: &H160E
Meaning/Cause: Error occurred in hardware.
Action: Contact our company with details of the problem.
Dedicated output: *1

22.20: DRIVER unit disconnected
Code: &H1614
Meaning/Cause:
1. CPU unit could not recognize driver unit.
2. Dual port RAM is defective.
Action: Replace the controller.
Dedicated output: *1

22.30: DRIVER unit abnormality
Code: &H161E
Meaning/Cause:
1. Wrong DIP switch setting on drive unit.
2. Drive unit not operating correctly.
3. Dual port RAM is defective.
Action: Replace the controller.
Dedicated output: *1 or *2

22.40: PCMCIA interface overtime
Code: &H1628
Meaning/Cause: 1. Failed to acquire access privilege for PCMCIA interface.
Action:
1. Replace the PCMCIA interface driver.
2. Replace the controller.
Dedicated output: *1

22.41: OPT.1 interface overtime
Code: &H1629
Meaning/Cause: 1. Failed to acquire access privilege for interface with option board connected to option slot 1.
Action:
1. Replace the option board connected to option slot 1.
2. Replace the controller.
Dedicated output: *1
1. Error Messages

22.42 : OPT.2 interface overtime
Code : &H162A
Meaning/Cause : 1. Failed to acquire access privilege for interface with option board connected to option slot 2.
Action : 1. Replace the option board connected to option slot 2.
          : 2. Replace the controller.
Dedicated output : *1

22.43 : OPT.3 interface overtime
Code : &H162B
Meaning/Cause : 1. Failed to acquire access privilege for interface with option board connected to option slot 3.
Action : 1. Replace the option board connected to option slot 3.
          : 2. Replace the controller.
Dedicated output : *1

22.44 : OPT.4 interface overtime
Code : &H162C
Meaning/Cause : 1. Failed to acquire access privilege for interface with option board connected to option slot 4.
Action : 1. Replace the option board connected to option slot 4.
          : 2. Replace the controller.
Dedicated output : *1

22.45 : DRIVER interface overtime
Code : &H162D
Meaning/Cause : 1. Failed to acquire access privilege for interface with driver.
Action : 1. Replace the driver.
          : 2. Replace the controller.
Dedicated output : *1
1. Error Messages

1.2 MPB Error Messages

When a hardware error or a software error occurs in the MPB, the following messages are highlighted (shown with reversed background) on the guideline of the lowest line of the screen.

**MPB TRAP!!**

<table>
<thead>
<tr>
<th>Contents</th>
<th>Undefined operation code was executed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>A hardware error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Replace the MPB.</td>
</tr>
</tbody>
</table>

**MPB Receive Error!! (Data Register Full)**

<table>
<thead>
<tr>
<th>Contents</th>
<th>Data receive register is full.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>A hardware error occurred.</td>
</tr>
<tr>
<td>Action</td>
<td>Replace the MPB.</td>
</tr>
</tbody>
</table>

**MPB Receive Error!! (Over Run Error)**

<table>
<thead>
<tr>
<th>Contents</th>
<th>An overrun occurred while receiving data.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>a. Malfunction occurred due to noise.</td>
</tr>
<tr>
<td></td>
<td>b. The cable is broken or disconnected.</td>
</tr>
<tr>
<td></td>
<td>c. The connector is not making contact.</td>
</tr>
<tr>
<td>Action</td>
<td>1. Separate equipment away from noise source.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the MPB cable.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the MPB.</td>
</tr>
</tbody>
</table>

**MPB Receive Error!! (Parity Error)**

<table>
<thead>
<tr>
<th>Contents</th>
<th>Parity error occurred during communication.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>a. Malfunction occurred due to noise.</td>
</tr>
<tr>
<td></td>
<td>b. The cable is broken or disconnected.</td>
</tr>
<tr>
<td></td>
<td>c. The connector is not making contact.</td>
</tr>
<tr>
<td>Action</td>
<td>1. Separate equipment away from noise source.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the MPB cable.</td>
</tr>
</tbody>
</table>

**MPB Receive Error!! (Framing Error)**

<table>
<thead>
<tr>
<th>Contents</th>
<th>Framing error occurred during communication.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>Malfunction occurred due to noise.</td>
</tr>
<tr>
<td>Action</td>
<td>Separate equipment away from noise source.</td>
</tr>
</tbody>
</table>

**MPB Receive Error!! (Buffer Overflow)**

<table>
<thead>
<tr>
<th>Contents</th>
<th>Remaining area in receive buffer fell below 1% during communications.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause</td>
<td>a. Large amount of data was sent from the controller.</td>
</tr>
<tr>
<td></td>
<td>b. Communication control error.</td>
</tr>
<tr>
<td>Action</td>
<td>1. Replace the MPB.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the controller.</td>
</tr>
</tbody>
</table>
**MPB 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 MPB cable. 
2. Replace the MPB. 
3. Replace the controller.

**MPB 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 MPB cable. 
2. Replace the MPB. 
3. Replace the controller.

**MPB 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 MPB cable. 
2. Replace the controller.

**MPB 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 MPB cable. 
2. Replace the controller.

**MPB Memory Error!! (DATA Write Error)**

**Contents**: Internal memory is defective.

**Cause**: Internal memory circuit is defective.

**Action**: Replace the MPB.

**MPB 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 MPB. 
2. Replace the controller.
## 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.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
</table>
| **What happened**          | • Controller model name and serial No.  
  example: RCX141 + regenerative unit  
  • Robot model name + serial No.  
  example: YK250X  
  • Controller version No.  
  example: V8.30 R1045  |
| **When**                   | • Date of purchase  
  example: May 2004  
  • 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 MPB 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.  
  • MPB 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.  |
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 MPB

[Procedure]
1) Press the $F\ 5$ (DIAGNOS) key in “SYSTEM” mode.

2) To check controller error status, press the $F\ 1$ (DIAGNOS) key. A maximum of 5 error histories are displayed.

3) To check a particular error history, press the $F\ 2$ (HISTORY) key. A maximum of 500 error histories can be checked.

2.2.2 Acquiring information from the RS-232C

[Procedure]
1) Connect the robot controller to the PC with the RS-232C cable.

2) Set the communication conditions.

3) 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. Troubleshooting

### 2.3 Troubleshooting checkpoints

#### 1. Installation and power supply

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible cause</th>
<th>Check items</th>
<th>Corrective action</th>
</tr>
</thead>
</table>
| 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/GND).  
• Check power input terminal voltage (L/N/GND).  
• Check if “PWR” LED on front panel is lit. | • Connect power input terminal correctly.  
• Supply rated power supply voltage. |
| 2       | Controller turns on but no MPB display. | • MPB not connected.  
• Wrong MPB connection.  
• MPB malfunctioning.  
• Problem in controller internal power supply. | • Check MPB connector.  
• Check how MPB connector is inserted.  
• Replace MPB and check operation. | • Plug in MPB connector correctly.  
• Replace the MPB.  
• Replace the controller. |
| 3       | Controller turns on but “ERR” LED on front panel lights up. | • Now in emergency stop.  
• Error of error group No. 17 occurred.  
• Error of error group No. 21, 22 occurred. | • Connect the MPB and check the error history.  
• Check DI00 on MPB screen. | • Release MPB emergency stop switch.  
• Insert MPB connector.  
• Connect the emergency stop terminal of SAFETY connector.  
• Check the axis from the error information.  
• Check the cause from the error information.  
• Eliminate the cause of the error. |
|         | Check items | | |
|         | Check power input terminal connection (L/N/GND).  
• Check power input terminal voltage (L/N/GND).  
• Check if “PWR” LED on front panel is lit. | | |
|         | Plug in MPB connector correctly.  
• Replace the MPB.  
• Replace the controller. | | |
|         | Release MPB emergency stop switch.  
• Insert MPB connector.  
• Connect the emergency stop terminal of SAFETY connector.  
• Check the axis from the error information.  
• Check the cause from the error information.  
• Eliminate the cause of the error. | | |
## 2. Troubleshooting

### 2. Robot operation

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible cause</th>
<th>Check items</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Controller turns on but can't execute program and manual movement.</td>
<td>• Interlock signal.</td>
<td>• Check standard I/O interface connector (for interlock signal) and check if DC 24V is supplied.</td>
<td>• Connect the standard I/O interface connector for interlock signal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check DI11 on MPB screen.</td>
<td>• Connect the DC 24V power supply.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Robot is in emergency stop.</td>
<td>• Disable interlock signal with the parameter.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Connect the MPB and check error information.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check DI00 on MPB screen.</td>
<td>• Release MPB emergency stop switch.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Error occurred.</td>
<td>• Plug in MPB connector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Connect the MPB and check error info</td>
<td>• Connect MPB emergency stop terminal of SAFETY connector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check if “ERR” LED on front panel is lit.</td>
<td></td>
</tr>
<tr>
<td>2. Abnormal sound or vibration.</td>
<td>• Wrong robot or axis type setting.</td>
<td>• Check tip weight parameter setting in SYSTEM mode.</td>
<td>• Change to correct robot or axis type setting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check if robot and controller are compatible.</td>
<td>• Make sure robot and controller are compatible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mechanical problem occurred.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check for resonance in robot frame.</td>
<td>• Reinforce the robot frame.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check for loose screws on robot cover.</td>
<td>• Tighten the robot cover screws.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check for warping or damage on guides or ball screws.</td>
<td>• Remove foreign matter if found.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Controller is defective.</td>
<td>• Replace if warped or damaged guides or ball screws are found.</td>
</tr>
<tr>
<td>3. Position deviation occurred.</td>
<td>• Position sensor device is defective.</td>
<td>• Move axis in emergency stop and check the pulse count.</td>
<td>• If operation is normal use the substitute controller.</td>
</tr>
<tr>
<td></td>
<td>• Cable is defective.</td>
<td>• Replace motor if count is incorrect.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace cable if found to be defective.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Position detection error due to noise.</td>
<td>• Ground the robot and controller.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Isolate from noise sources around robot.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Isolate from noise sources around robot I/O cable.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mechanical error occurred.</td>
<td>• Check the belt tension</td>
<td>• Adjust to correct tension if necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check for warping or damage on guides or ball screws.</td>
<td>• Remove foreign matter if found.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Controller is defective.</td>
<td>• Replace guides or ball screws if warping or damage is found.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Replace with another controller and check operation.</td>
<td>• If operation is normal use the substitute controller.</td>
</tr>
</tbody>
</table>
## 3. I/O operation

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible cause</th>
<th>Check items</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Won’t operate even when dedicated input signal is supplied.</td>
<td>• No DC24V supply.</td>
<td>• Check that DC 24V is supplied from standard I/O interface connector. • Check DI04 on MPB screen.</td>
<td>• Supply DC 24V.</td>
</tr>
<tr>
<td></td>
<td>• Problem in signal connection.</td>
<td>• Check wiring on standard I/O interface connector.</td>
<td>• Make the correct wiring on standard I/O interface connector.</td>
</tr>
<tr>
<td></td>
<td>• Error has occurred.</td>
<td>• Connect MPB and check robot settings in SYSTEM mode. • Check if “ERR” LED is lit on front of controller.</td>
<td>• Check the cause from the error information. • Eliminate the cause of the error.</td>
</tr>
<tr>
<td>2 No output of dedicated output signal.</td>
<td>• No DC24V supply.</td>
<td>• Check that DC 24V is supplied from standard I/O interface connector. • Check DI04 on MPB screen.</td>
<td>• Supply DC 24V.</td>
</tr>
<tr>
<td></td>
<td>• Problem in signal connection.</td>
<td>• Check wiring on standard I/O interface connector.</td>
<td>• Make the correct wiring on standard I/O interface connector.</td>
</tr>
<tr>
<td></td>
<td>• Error has occurred.</td>
<td>• Connect the MPB and check robot settings in SYSTEM mode. • Check if “ERR” LED is lit on front of controller.</td>
<td>• Check the cause from the error information. • Eliminate the cause of the error.</td>
</tr>
<tr>
<td>3 No output of general-purpose I/O signal.</td>
<td>• No DC24V supply.</td>
<td>• Check that DC 24V is supplied from standard I/O interface connector. • Check DI04 on MPB screen. • Check that DC 24V is supplied for option I/O interface.</td>
<td>• Supply DC 24V.</td>
</tr>
<tr>
<td></td>
<td>• Problem in signal connection.</td>
<td>• Check wiring on standard I/O interface connector. • Check wiring on option I/O interface connector.</td>
<td>• Make the correct wiring on standard I/O interface connector. • Make the correct wiring on option I/O interface connector.</td>
</tr>
<tr>
<td></td>
<td>• Error in option I/O interface setting.</td>
<td>• Check the option I/O interface setting on the DIP switch.</td>
<td>• Make the correct option I/O interface setting.</td>
</tr>
<tr>
<td></td>
<td>• Error has occurred.</td>
<td>• Connect the MPB and check the error information. • Check if “ERR” LED is lit on front of controller.</td>
<td>• Check the cause from the error information. • Eliminate the cause of the error.</td>
</tr>
</tbody>
</table>
Revision record

<table>
<thead>
<tr>
<th>Manual version</th>
<th>Issue date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ver. 1.00</td>
<td>Feb. 2005</td>
<td>English manual Ver. 1.00 is based on Japanese manual 3rd edition.</td>
</tr>
<tr>
<td>Ver. 1.01</td>
<td>Jun. 2005</td>
<td>English manual Ver. 1.01 is based on Japanese manual Ver. 4.00.</td>
</tr>
<tr>
<td>Ver. 1.02</td>
<td>Jun. 2005</td>
<td>English manual Ver. 1.02 is based on Japanese manual Ver. 4.01.</td>
</tr>
<tr>
<td>Ver. 1.03</td>
<td>Dec. 2005</td>
<td>English manual Ver. 1.03 is based on Japanese manual Ver. 4.02.</td>
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<tr>
<td>Ver. 1.04</td>
<td>Aug. 2006</td>
<td>English manual Ver. 1.04 is based on Japanese manual Ver. 4.04.</td>
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<tr>
<td>Ver. 1.06</td>
<td>Apr. 2007</td>
<td>English manual Ver. 1.06 is based on Japanese manual Ver. 4.06.</td>
</tr>
<tr>
<td>Ver. 2.00</td>
<td>Jul. 2007</td>
<td>English manual Ver. 2.00 is based on Japanese manual Ver. 5.00.</td>
</tr>
<tr>
<td>Ver. 2.01</td>
<td>Nov. 2007</td>
<td>English manual Ver. 2.01 is based on Japanese manual Ver. 5.01.</td>
</tr>
<tr>
<td>Ver. 2.02</td>
<td>Jan. 2008</td>
<td>English manual Ver. 2.02 is based on Japanese manual Ver. 5.02.</td>
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