

YAMAHA SINGLE-AXIS ROBOT CONTROLLER

SR1 series

HPB Operation Guide

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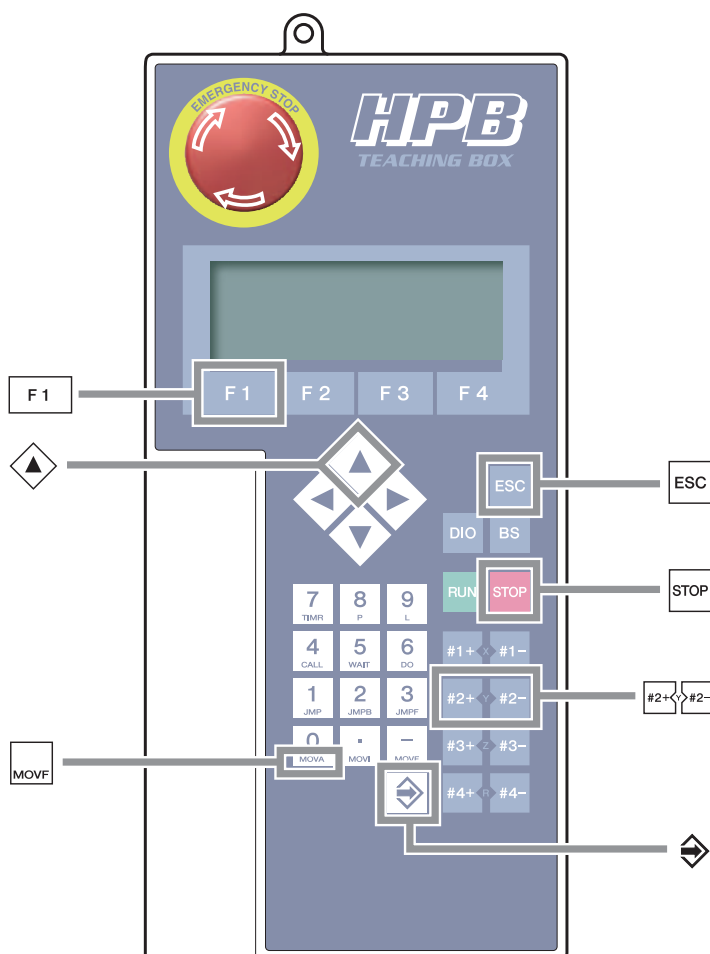
Introduction

This "HPB Operation Guide" explains how to use the HPB (programming box) that comes with the SR1 controller as an option. It includes the procedures for setting parameters, creating programs, editing point data and operating the robot. Before reading this operation guide, read the precautions and description in the "SR1 User's Manual" section to understand the functions and use of the SR1 controller.

Key symbols

This operation guide uses the following symbols to indicate the HPB control keys.

■ Operation key symbols



MEMO

1. An overview of the HPB

The HPB is a handheld, pendant type programming box that connects to the SR1 controller to teach positions, edit various data, and run programs for robot operation.

Featuring an interactive user operation on the LCD display, the HPB operating procedures can be easily mastered even by first-time users. The HPB of Ver. 23.01 or later can be used with the SR1 controller.

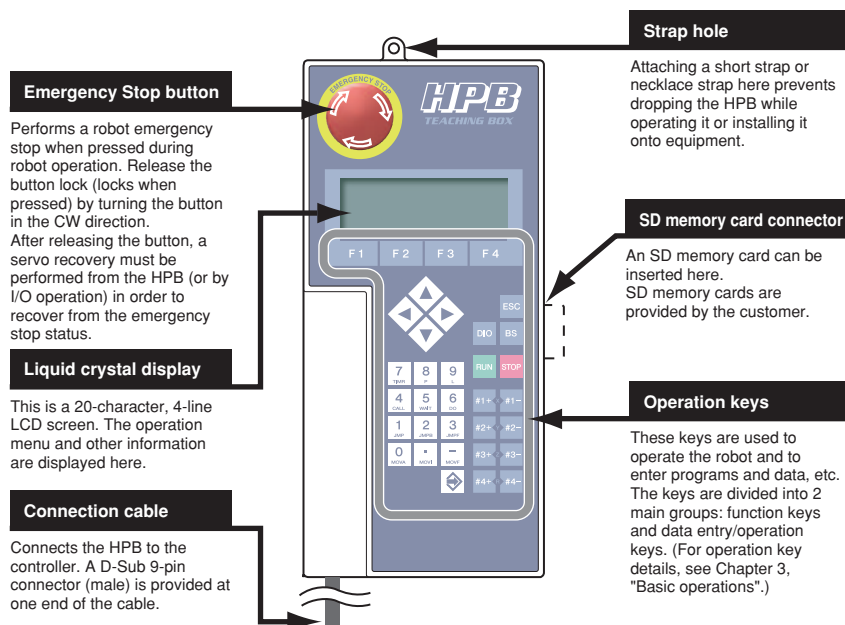
1.1 HPB functions

The HPB connected to the SR1 controller can be used to perform the following operations and checks.

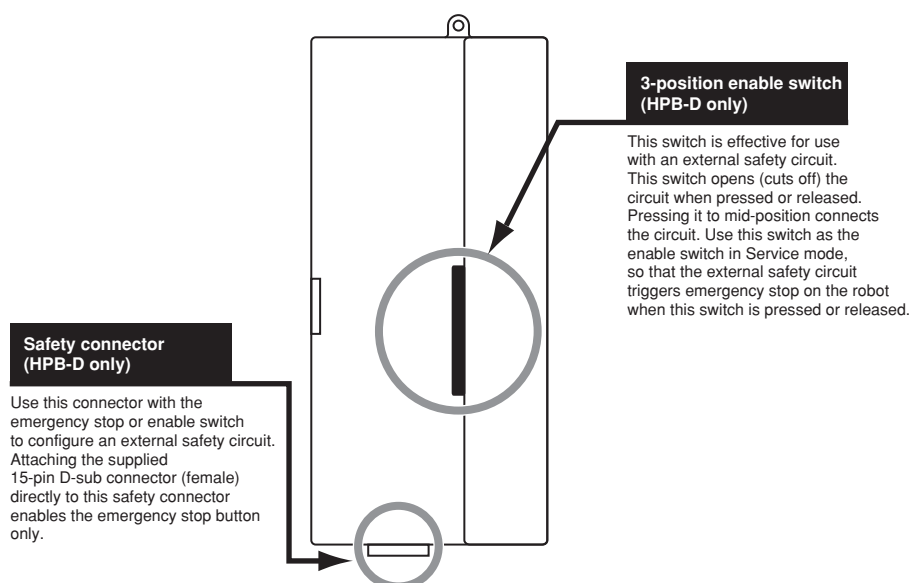
Functions		Description	Refer to:
Programming and data editing	Parameter setting	Sets parameters for robot operation.	Chapter 5
	Programming	Creates and edits programs for robot operation.	Chapter 7
	Point data entry	Enters point data to move the robot to. Either manual key entry or teaching can be used.	Chapter 8
	Teaching	Moves the robot to a position and teach that position to store it as point data.	8.2 in Chapter 8 8.3 in Chapter 8
	Trace	Moves the robot to a point data position that has been registered.	8.7 in Chapter 8
Robot operation	Return-to-origin	Returns the robot to its origin position.	9.1 in Chapter 9
	Step operation	Performs program operation one step at a time.	9.2 in Chapter 9
	Automatic operation	Performs automatic operation according to a program.	9.3 in Chapter 9
Safety functions	Emergency stop	The HPB has an emergency stop button used to trigger robot emergency stop.	10.1 in Chapter 10
	Service mode	Enhances safety when working in the robot movement range.	10.8 in Chapter 10
Data backup	Data backup	Saves the data stored in the SR1 to a memory card.	10.10.2 in Chapter 10
	Data load	Loads the data stored in a memory card to the SR1.	10.10.3 in Chapter 10
Display functions	Error and alarm display	Displays the description of an error or problem if it occurs. Also displays a history of past errors and alarms.	10.11 in Chapter 10
	Others	Duty monitor DIO monitor System information display	10.7 in Chapter 10 10.3 in Chapter 10 10.6 in Chapter 10

1.2 Part names and functions

■ HPB unit



■ Rear view



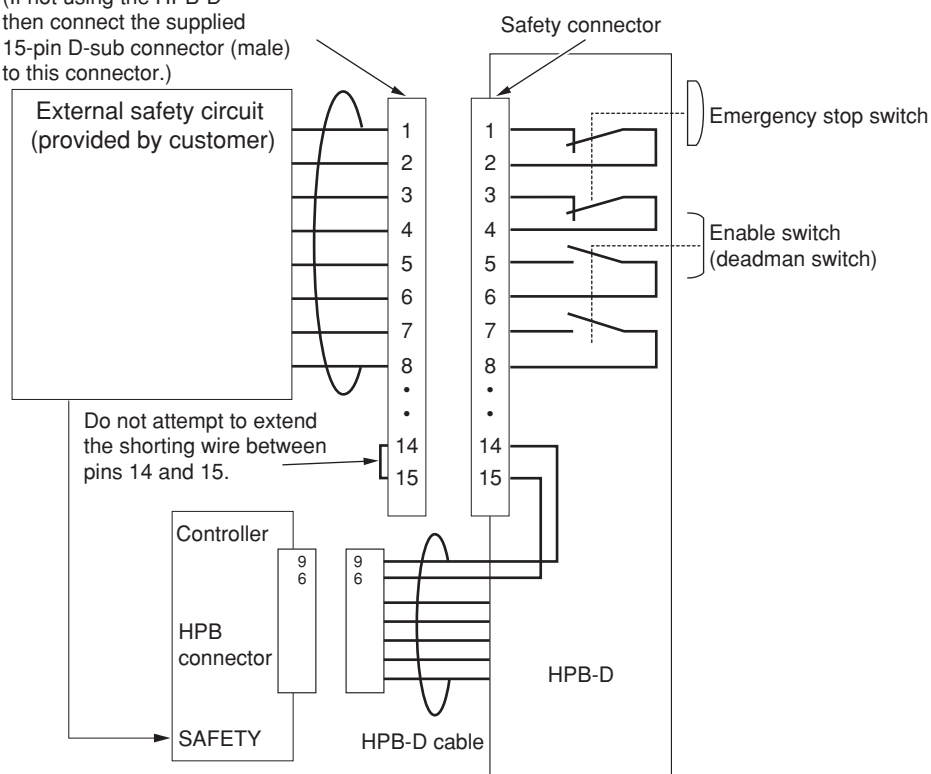
WARNING

- The fluid (liquid crystal) in the LCD display module is a hazardous substance. If this fluid leaks from the display due to damage and adheres to skin or clothes, wash it off with soap and water.
- Do not wind the connection cable around the HPB body when storing or bend it sharply since this might break the wires in the connection cable.
- Do not use an extension cord with the connection cable.

■ HPB-D wiring diagram

15-pin D-sub connector (female)

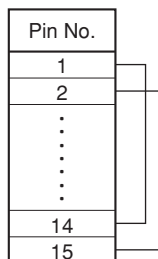
(If not using the HPB-D
then connect the supplied
15-pin D-sub connector (male)
to this connector.)



● 15-pin D-sub connectors (supplied only with HPB-D)

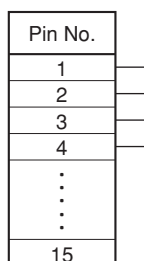
Use these connectors with the emergency stop or enable switch to configure an external safety circuit.

■ 15-pin D-sub connector (female: KS9-M532A-000)



Attaching this connector directly to the safety connector on the HPB-D enables the emergency stop button only.

■ 15-pin D-sub connector (male: KS9-M532E-001)



If not using the HPB-D then attach this connector directly to the 15-pin D-sub connector on the external safety circuit so that the emergency stop circuit is shorted.



CAUTION

Set so the voltage and current ratings on the circuit connected to pins 1 to 8 on the supplied 15-pin D-sub connector are no higher than 30V DC and 1A.

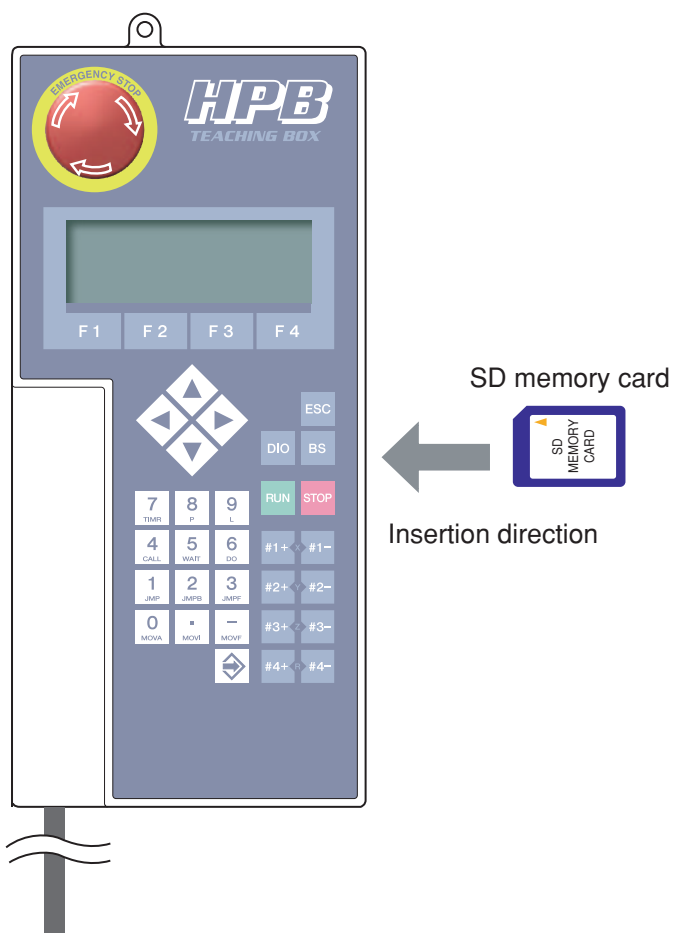
Pins 1 and 14, and pins 2 and 15 on the supplied 15-pin D-sub connector are shorted prior to shipment. When connecting the HPB-D contacts to the external emergency stop circuit, change the wiring as shown in the above diagram to short pins 14 and 15 together.

Never attempt to extend the shorting wire between pins 14 and 15. Doing so might cause noise in the wiring that interferes with HPB-D or controller operation and causes faulty operation. This wiring should be kept short.

● SD memory card

SD memory cards (required format: FAT12/16) are not available as accessory or optional items, and must be provided by the customer.
(For SD memory card handling information, see 10.10, "Using SD memory cards" in Chapter 10.)

■ SD memory card



CAUTION

- The recommended SD memory card size is up to 32MB. Using a memory card size of 64MB or more might cause a message "FAT32" to appear as the preset value during format on Windows. Always select "FAT" at this time because the HPB cannot use FAT32.
- The maximum size of the controller data file backed up on the SD memory card is "328KB". The data file size is generally about "64KB" so up to 512 files can usually be stored on a 32MB memory card.

MEMO

2. Connecting and disconnecting the HPB

The HPB can be connected to, or disconnected from, an SR1 controller regardless of whether the controller power is on or off.

2.1 Connecting to the SR1 controller



CAUTION

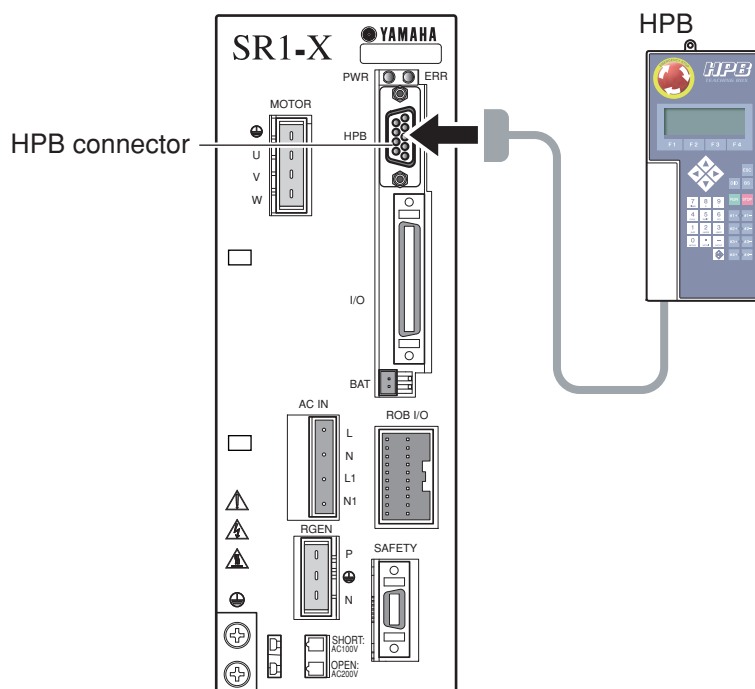
- Do not use a modified HPB connection cable to connect the HPB to an SR1 controller, as this can result in communication errors and equipment failure.
- A poor connection or an incorrect connector insertion can result in equipment failure and malfunctions. Be sure that the cable is securely connected.
- When connecting or disconnecting the HPB from the controller, always grip the connector body itself. When removing the connector from the controller, pull it straight out so as not to bend the connector pins. When attaching the HPB to the controller, make sure that both connectors are aligned with each other.

When SR1 controller power is off

Step 1 Connect the HPB to the SR1 controller.

Plug the HPB connection cable into the HPB connector on the front panel of the SR1 controller and then tighten the screws on both sides of the connector.

■ HPB connection to SR1

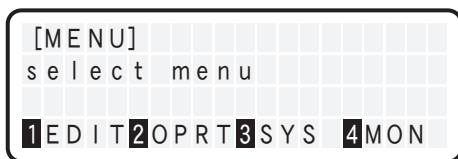


Step 2 Turn on the power to the SR1 controller.

A buzzer sounds for approximately 1 second and the initial menu screen then appears.

Step 3 Check that the initial menu screen is displayed.

■ Initial menu screen



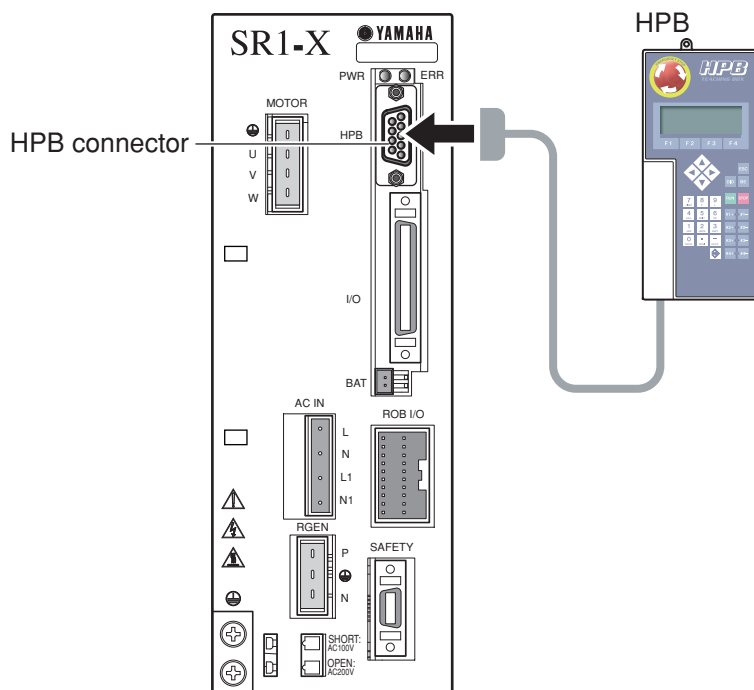
When SR1 controller power is on

The HPB can be connected to the SR1 controller even when the controller power is on.

Step 1 Connect the HPB to the SR1 controller.

Plug the HPB connection cable into the HPB connector on the front panel of the SR1 controller and then tighten the screws on both sides of the connector. A buzzer sounds for approximately 1 second, then the initial menu screen displays.

■ HPB connection to SR1

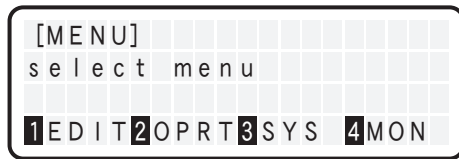


CAUTION

If the HPB is connected to the controller while a program or I/O dedicated command is being executed, the command execution is aborted, and robot operation is stopped.

Step 2 Check that the initial menu screen is displayed

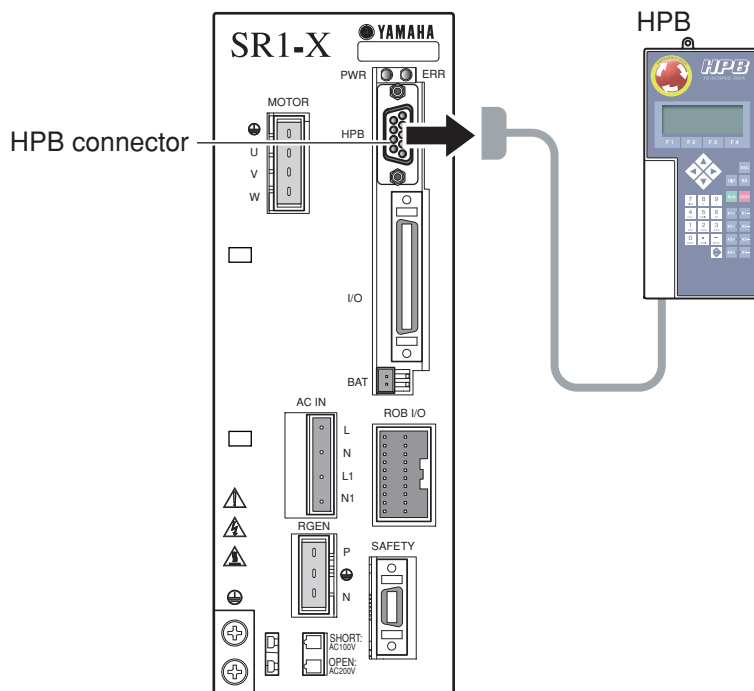
■ Initial menu screen



2.2 Disconnecting from the SR1 controller

The HPB can be disconnected regardless of whether the SR1 controller power is on or off. Simply disconnect the HPB cable from the SR1 controller.

■ HPB disconnection from SR1



CAUTION

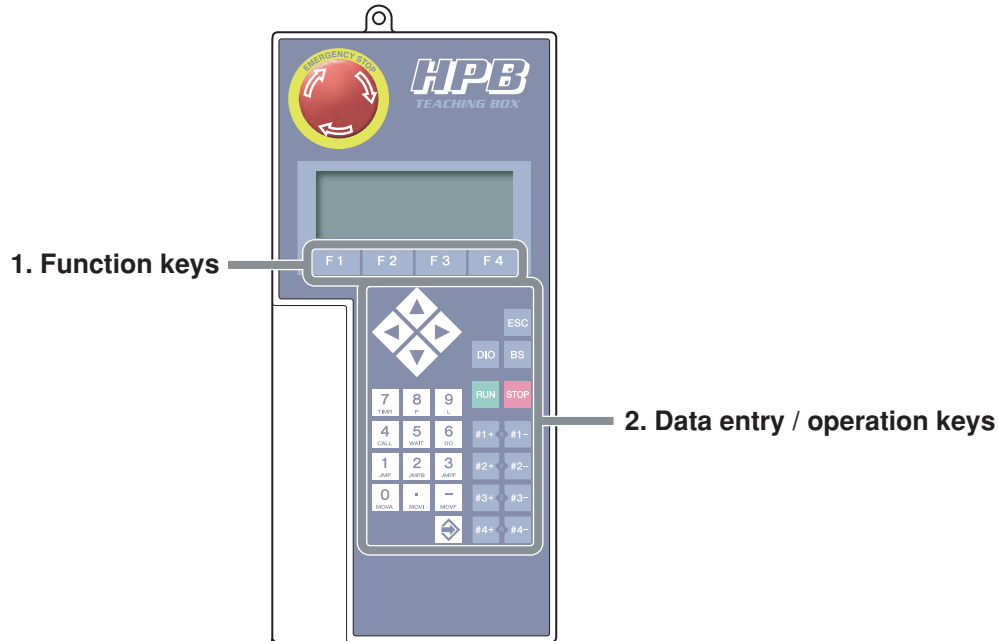
- If the HPB is disconnected from the SR1 controller when the controller power is on, an emergency stop and a robot servo OFF status will occur. If not using the HPB, attach the dummy connector supplied with the SR1. Neglecting to do so will cause an emergency stop.
- If the HPB is disconnected from the controller while a program or I/O dedicated command is being executed, the command execution is aborted, and robot operation is stopped.

3. Basic operations

3.1 HPB operation keys

The HPB operation keys are divided into 2 main groups, as shown below.

■ HPB control key layout



The key functions are described below.

1. Function keys

Keys	Description
F1 to F4	Selects the menus displayed on the bottom line of the HPB screen. The function key numbers correspond to the numbers to the left of each mode or command.

2. Data entry/operation keys

Keys	Description
RUN	Starts robot operation according to the selected program and parameters.
STOP	Stops robot operation. Press RUN to resume operation.
DIO	Displays the DIO monitor.
0 to 9	Enters numbers.
. -	Enters a dot (.) or minus sign (-).
TMR to MOVF	Directly enters a robot language command when creating a program in EDIT-PGM mode.

Keys	Description
	Moves the robot in the + or – direction on the X, Y, Z or R coordinate.
	Scrolls the screen to the left or right or moves the cursor to the left or right.
	Scrolls up or down the screen to display more parameter numbers or point numbers.
	Returns to the previous mode or screen.
	Moves the cursor back one space, erasing the entry in that space when entering numeric values.
	Enables the entered value.

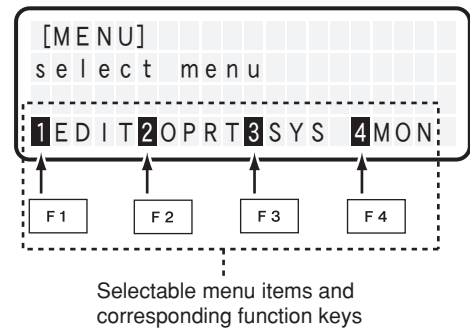
3.2 Basic key operation

You can operate the HPB while selecting the necessary items from the hierarchical menu (see 3.4, "Hierarchical menu structure" in this chapter). To select a menu item, press the corresponding function key. To enter numbers, use the number keys and $\diamond$ key. The following steps explain a basic HPB key operation, showing how to select a program from the initial menu.

Step 1 Check the initial menu screen.

The initial screen shows the title (MENU) on the top line and allows you to select one of the 4 modes displayed on the bottom line.

- 1** EDIT (edit)
- 2** OPRT (operation)
- 3** SYS (system)
- 4** MON (monitor)



NOTE

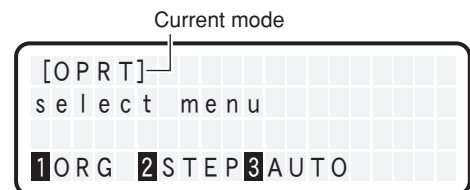
The number to the left of each mode corresponds to the function keys from **F1** to **F4**.

Step 2 Press the function key of the mode you want to select.

The screen changes to the selected mode.

The example on the right is the OPRT (operation) mode screen that appears after pressing the **F2** (OPRT) key on the initial menu screen. You can select the following 3 sub-modes from OPRT mode.

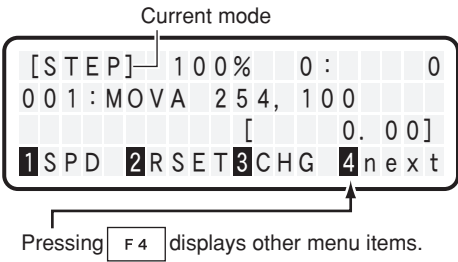
- 1** ORG (return-to-origin)
- 2** STEP (step operation)
- 3** AUTO (automatic operation)



Step 3 Use a function key to select a sub-mode.

Each time you press a function key to select a menu item, the operation proceeds in sequence down the hierarchical menu.

The example on the right is the STEP mode screen that appears after pressing the **F2** (STEP) key on the OPRT mode screen.

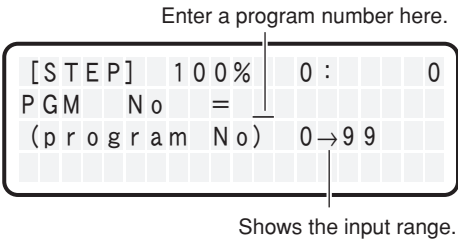


NOTE

The (4 next) item displays at the right end of the bottom line when there are 5 or more selectable menu items. The **F4** key can then be pressed to display the next set of menu items. Press **BS** to return to the previous set of menu items.

Step 4 Use the same procedure to select a next mode.

The example on the right is the STEP-CHG (program switching) mode screen that appears after pressing the **F3** (CHG) key on the STEP mode screen. A blinking cursor (|) appears at a position where you can enter a number with the number keys.



Step 5 Enter the program number you want to select.

Use the number keys to enter the program number and press the **↵** key to select the program.



NOTE

To return to the previous screen or menu level, press the **ESC** key.

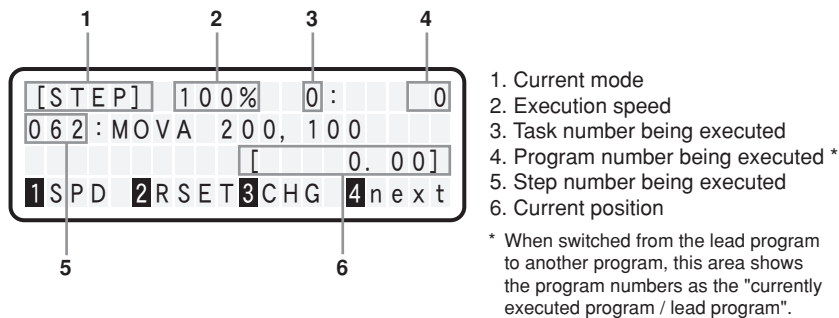
3.3 How to read the screens

The following explains the basic screen displays in each mode and what they mean.

Program execution screen

This is a program execution screen in STEP mode that allows step operation with the selected program. This screen consists of the following elements.

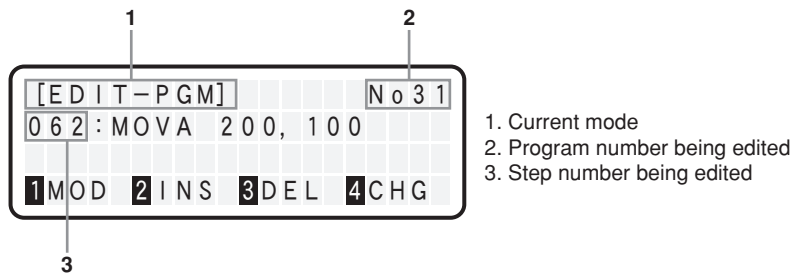
■ Program execution screen example



Program edit screen

This is a program edit screen in EDIT-PGM mode for editing the selected program. This screen consists of the following elements.

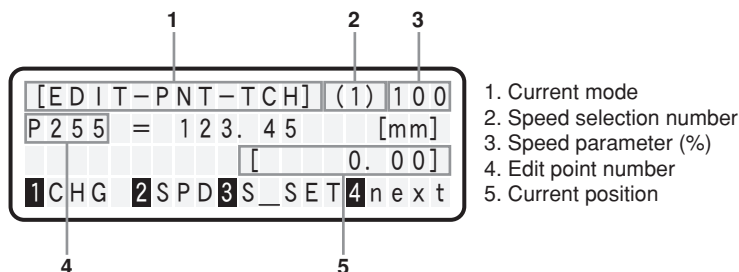
■ Program edit screen



Point edit - teaching playback screen

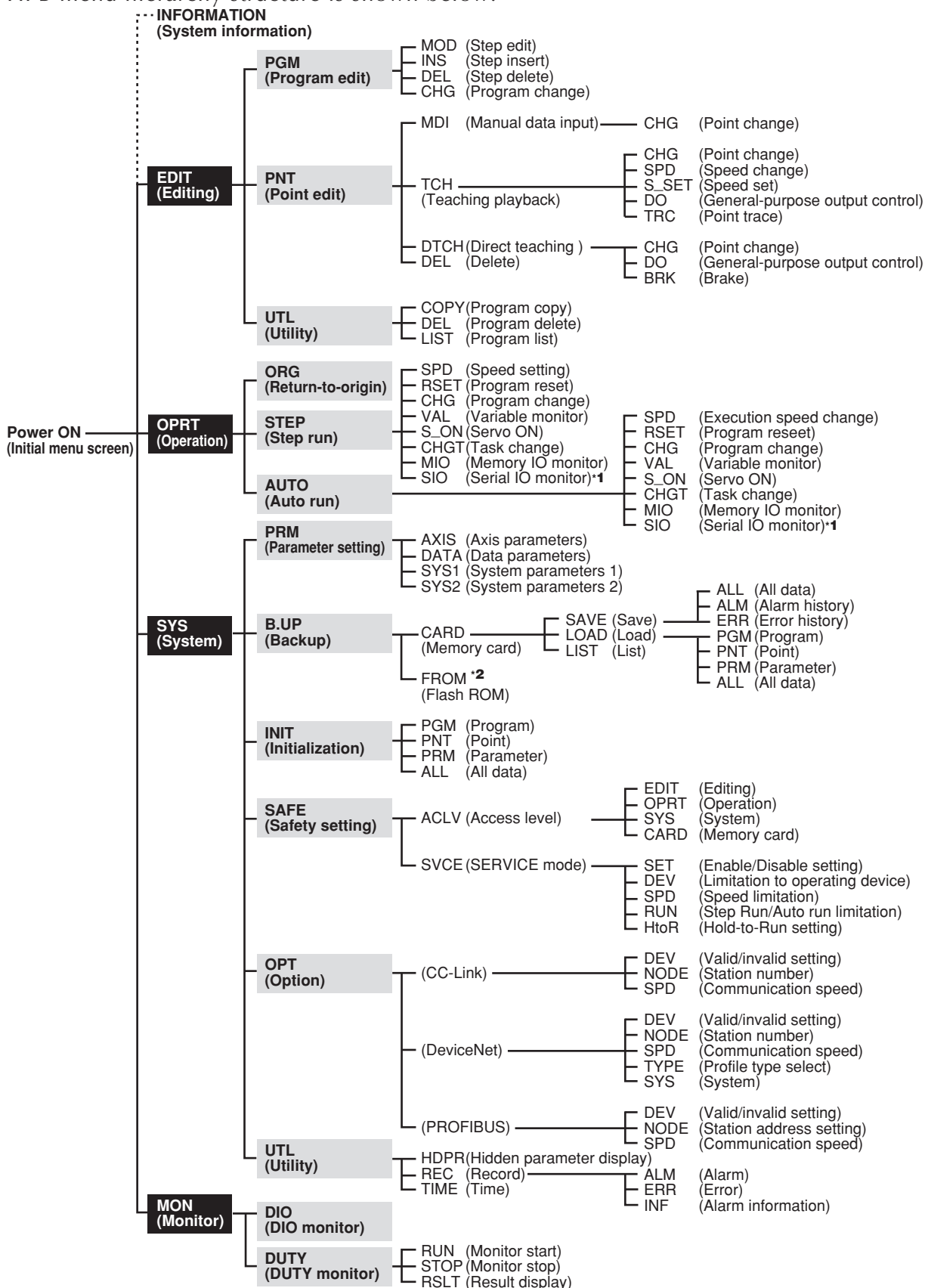
This is a point edit - teaching playback screen in EDIT-PNT-TCH mode for editing or teaching the selected point. This screen consists of the following elements.

■ Point edit - teaching playback screen example



3.4 Hierarchical menu structure

HPB operations are performed by making selections from a hierarchical menu system. The HPB menu hierarchy structure is shown below.



*1: The serial I/O monitor is displayed only when the HPB is connected to the controller with a serial I/O unit installed. The method of operating the serial I/O monitor is the same as that for the memory I/O monitor. Refer to 10.4, "Displaying the memory I/O status" in Chapter 10.

*2: Flash ROM is not available with the SR1 controllers.

4. Restricted key operation by access level

The HPB key operations can be limited by setting the access levels (operation levels). A person not trained in robot operation might accidentally damage the robot system or endanger others by using the HPB incorrectly. Set the access levels to restrict HPB key operations and prevent such accidents.



CAUTION

The access level settings are protected by a password so that changes cannot be instantly made. The user is responsible for controlling who knows the password.

4.1 Access levels

The access levels can be set individually for editing, operation, system-related data and memory card, as explained below.

■ Editing

Level	Description
0	All operations are permitted.
1	Program editing is prohibited. (Program data can be checked.)
2	In addition to Level 1, point data editing, manual release of brake and point trace (movement to registered data point) are prohibited. (The   keys can be used to move the robot and general-purpose outputs can be controlled.)
3	Any operation in EDIT mode is prohibited. (Cannot enter EDIT mode.)

■ Operation

Level	Description
0	All operations are permitted.
1	Changing the execution speed and program is prohibited.
2	In addition to Level 1, automatic operation, step operation and program reset are prohibited. (Return-to-origin can be performed and variables can be monitored.)
3	Any operation in OPRT mode is prohibited. (Cannot enter OPRT mode.)

■ System-related data

Level	Description
0	All operations are permitted.
1	Initialization is prohibited.
2	In addition to Level 1, changing the parameters and setting the option units are prohibited. (Parameter data and option unit settings can be checked.)
3	Parameter editing, initialization and option setting are prohibited. (Cannot enter SYS-PRM, SYS-INIT and SYS-OPT modes.)

■ Memory card

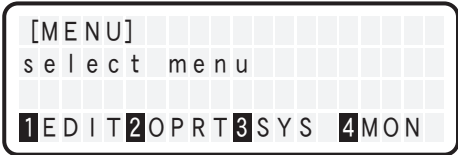
Level	Description
0	All operations are permitted.
1	Batch loading of parameters and all data to the controller is prohibited. (Point data or program data can be loaded.)
2	Loading any data to the controller is prohibited. (Data can be saved and the memory card formatted.)
3	Use of memory card is prohibited. (Cannot enter SYS-B.UP mode.)

4

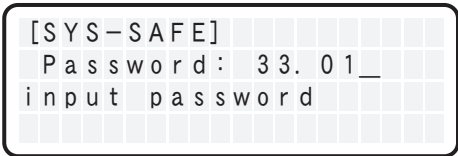
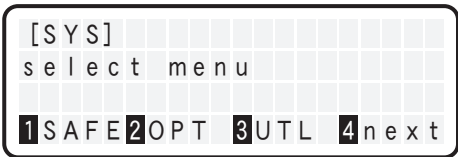
4.2 Changing an access level

To change an access level, follow these steps. (Password is required.)

Step 1 Press **F3** (SYS) on the initial menu screen.
The SYS (system) mode screen appears.



Step 2 Enter the SAFE mode.
1. Press **F4** (next) to switch the menu display and then press **F1** (SAFE).
The password entry screen appears.
2. Enter the password and press **↵**.
The SYS-SAFE mode screen appears if the password is correct.



Step 3 Press **F1** (ACLV).
The access level entry screen appears.



Step 4 Select the item you want to change.

- To change the access level for editing, press **F1** (EDIT).
- To change the access level for operation, press **F2** (OPRT).
- To change the access level for system-related data, press **F3** (SYS).
- To change the access level for memory card, press **F4** (CARD).
- The current access level of the selected item then appears.



Step 5 *Change the access level with the number key and press .**The access level save screen appears.*

[SYS-SAFE-ACLV-EDIT]															
a	c	c	e	s	s	l	e	v	e	l	:	0			
a	l	l	a	c	c	e	s		O	K					

Step 6 *Save the change you made to the access level.*

- To save the change permanently (retain the change even after the controller power is turned off), press  (SAVE).
- To save the change temporarily (retain the change until the controller power is turned off), press  (CHG).
- To cancel saving the change, press  (CANCEL).

When any of the above operation is complete, the screen returns to step 5.

[SYS-SAFE-ACLV-EDIT]																	
a	c	c	e	s	s	l	e	v	e	l	:	1					
c	h	a	n	g	e		P	G	M		i	n	v	a	l	i	d
1	S	A	V	E	2	C	H	G	3	C	A	N	C	E	L		

**NOTE**

The password is identical to the controller version number. For example, if the controller version is 33.01, enter 33.01 as the password. Once the password is accepted, it will not be requested unless the HPB is disconnected from the controller or the controller is turned off.

**NOTE**

To avoid access level conflict between operation and others, the access levels may be automatically adjusted. For example, if the access levels related to editing, system and memory card are "0", they are automatically changed to "1" when the operation-related access level is "1" or "2" or "3". The access levels remain unchanged if they are "1" or "2" or "3".

MEMO

5. Setting the parameters

Parameters needed to operate the robot can be easily set or checked with the HPB. This section explains how to set them with the HPB.

5.1 How to set the parameters

The following steps explain a basic procedure for setting a parameter, using PRM110 (+ soft limit) as an example. Use the same procedure when setting the other parameters.

- Step 1** Press **F3** (**SYS**) on the initial menu screen.
The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

- Step 2** Press **F1** (**PRM**) to enter the parameter setting mode.
The SYS-PRM mode screen appears.

```
[SYS]
select menu
1PRM 2B. UP 3INIT 4next
```

- Step 3** Select the parameter group.
Press **F1** here.
The current setting for PRM100 (Robot type) appears on the screen.

```
[SYS-PRM]
select menu
1AXIS 2DATA 3SYS1 4SYS2
```

- Step 4** Display the PRM110 (+ soft limit) parameter.
Press the **▲** **▼** keys to scroll up or down the parameter list and select the parameter you want to set.

```
[SYS-PRM-AXIS]
PRM100 = 4020
robot type
read only
```

- Step 5** Set the parameter.
Enter the parameter value with the number keys and press **↵**.
The parameter setting range is shown on the bottom line of the screen. (-9999 to 9999 in this case) When setting is complete, the cursor moves back to the beginning of the parameter data.

```
[SYS-PRM-AXIS]
PRM110 = 300_ [mm]
(+) soft limit
range -9999→9999
```

MEMO

6. I/O unit setting

6.1 Setting the CC-Link unit

6.1.1 Validating the CC-Link unit

To use the CC-Link unit, make setting so that the controller can identify the CC-Link unit.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F1** (DEV).

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The screen shows whether the CC-Link unit is currently identified.

To prevent the CC-Link unit from being identified by the controller, enter "0" with the number key and press **↵**. To allow the CC-Link unit to be identified by the controller, enter "1" and press **↵**.

```
[SYS-OPT-DEV]
CC-Link = 0
0:invalid 1:valid
```

Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-DEV]
CC-Link = 1
0:invalid 1:valid
```

6.1.2 Setting the station No.

The CC-Link unit requires 2 stations, so the station displayed on the HPB and another station (the station No. + 1) are required.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F2** (NODE).

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The currently set station No. appears on the screen.

To change the setting, enter the new station No. with the number keys and press .

```
[SYS-OPT-NODE]
node    = 30
range   1→63
```

Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-NODE]
node    = 1
range   1→63
```

6.1.3 Setting the communication speed

Communication speed can be set to 10M, 5M, 2.5M, 625K and 156K in bps. The communication speed must match the master station.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F3** (SPD).

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The currently set communication speed appears on the screen.
To change the speed, press the function key matching the desired communication speed you want to set. If the desired communication speed is not displayed, press **F4** (next) and the remaining available communication speeds will appear.

```
[SYS-OPT-SPD]
speed = 5M [bps]
110M 25M 32.5M 4next
```

Step 5 When setting is complete, the screen returns to step 4.

```
[SYS-OPT-SPD]
speed = 10M [bps]
110M 25M 32.5M 4next
```

6.2 Setting the DeviceNet unit

6.2.1 Validating the DeviceNet unit

To use the DeviceNet unit, make setting so that the controller can identify the DeviceNet unit.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F1** (DEV).

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The screen shows whether the DeviceNet unit is currently identified. To prevent the DeviceNet unit from being identified by the controller, enter "0" with the number key and press **↵**. To allow the DeviceNet unit to be identified by the controller, enter "1" and press **↵**.

```
[SYS-OPT-DEV]
DeviceNet = 0
0:invalid 1:valid
```

Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-DEV]
DeviceNet = 1
0:invalid 1:valid
```

6.2.2 System setting

When setting the MAC ID and communication speed for the DeviceNet unit, there are two methods that can be selected. One is H/W setting with a DIP switch and the other is S/W setting with the HPB.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F4** (next) to switch the menu display and then press **F2** (SYS).

```
[SYS-OPT]
select menu
1TYPE 2SYS 3      4next
```

Step 4 The screen shows whether the DeviceNet unit is currently identified. To make setting with the DIP switch, enter "0" (H/W) with the number key and press **↵**. To make setting with the HPB, enter "1" (S/W) and press **↵**.

```
[SYS-OPT-SYS]
system = 0
0:H/W 1:S/W
```

Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-SYS]
system = 1
0:H/W 1:S/W
```

6.2.3 Selecting the profile type

Profile 1 (normal type) or profile 2 (expanded type) can be selected to match the particular application.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT2OPRT3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE2OPT 3UTL 4next
```

Step 3 Press **F4** (next) to switch the menu display and then press **F1** (TYPE).

```
[SYS-OPT]
select menu
1TYPE2SYS 3 4next
```

Step 4 The currently selected profile type appears on the screen.
To select profile 1 (normal type), enter "1" with the number key and press **↵**. To select profile 2 (expanded type), enter "2" and press **↵**.

```
[SYS-OPT-TYPE]
type = 1
1:normal 2:expand
```

Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-TYPE]
type = 2
1:normal 2:expand
```

6.2.4 How to check MAC ID and communication speed (hardware setting)

MAC ID and communication speed settings made with the DIP switch on the board can be checked on the HPB. After changing the DIP switch settings, always check that the new settings are correct.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F2** (NODE) to display the MAC ID.

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The currently set MAC ID appears on the screen.

```
[SYS-OPT-NODE]
MAC ID = 30
```

Step 5 Press **ESC** to return to the screen of step 3.

Next, press **F3** (SPD) to display the communication speed.

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 6 The currently set communication speed appears on the screen.

Press **ESC** to return to the previous screen.

```
[SYS-OPT-SPD]
speed = 500K [bps]
```

6.2.5 Setting the MAC ID

The MAC ID for DeviceNet unit can be selected from 0 to 63. The following steps explain the procedure when "1" (S/W) is selected by system setting.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F2** (NODE).

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The currently set station No. appears on the screen.
To change the setting, enter the new station No. with the number keys and press .

```
[SYS-OPT-NODE]
node    = 30
range   1→63
```

Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-NODE]
node    = 1
range   1→63
```

6.2.6 Setting the communication speed

Communication speed can be set to 125K, 250K and 500K in bps. The communication speed must match the master station.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT2OPRT3SYS 4MON
```

Step 2 Press **F4** (next) to switch the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE2OPT 3UTL 4next
```

Step 3 Press **F3** (SPD).

```
[SYS-OPT]
select menu
1DEV 2NODE3SPD 4next
```

Step 4 The currently set communication speed appears on the screen.
To change the speed, press the function key matching the desired communication speed you want to set. If the desired communication speed is not displayed, press **F4** (next) and the remaining available communication speeds will appear.

```
[SYS-OPT-SPD]
speed = 500K [bps]
1125K2250K3500K
```

Step 5 When setting is complete, the screen returns to step 4.

```
[SYS-OPT-SPD]
speed = 125K [bps]
1125K2250K3500K
```

6.3 Setting the PROFIBUS unit

6.3.1 Validating the PROFIBUS unit

To use the PROFIBUS unit, make setting so that the controller can identify the PROFIBUS unit.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch to the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F1** (DEV).

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The screen shows whether the PROFIBUS unit is currently identified. To prevent the PROFIBUS unit from being identified by the controller, enter "0" with the number key and press **↵**. To allow the PROFIBUS unit to be identified by the controller, enter "1" and press **↵**.

```
[SYS-OPT-DEV]
PROFIBUS = 0
0:invalid 1:valid
```

Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-DEV]
PROFIBUS = 1
0:invalid 1:valid
```

6.3.2 Setting the station address

The station address can be set from 0 to 126.

Step 1 Press **F3** (SYS) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F4** (next) to switch to the menu display and then press **F2** (OPT).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F2** (NODE).

```
[SYS-OPT]
select menu
1DEV 2NODE 3SPD 4next
```

Step 4 The currently set station address appears on the screen.
To change this setting, enter the new station address with the number keys, and press the **↵** key.

```
[SYS-OPT-NODE]
address = 30
range 0→126
```

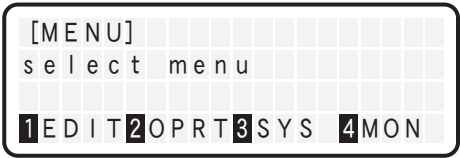
Step 5 When writing is complete, the screen returns to step 4.

```
[SYS-OPT-NODE]
address = 1
range 0→126
```

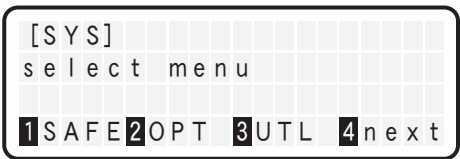
6.3.3 Checking the communication speed

Communication speed is automatically recognized as any of 9.6K, 19.2K, 93.75K, 187.5K, 500K, 1.5M, 3M, 6M and 12M in units of bps.

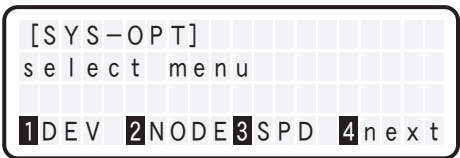
Step 1 Press F3 (SYS) on the initial menu screen.



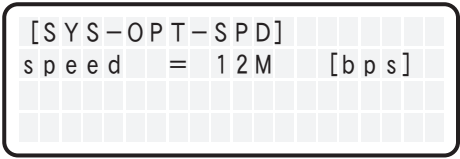
Step 2 Press F4 (next) to switch to the menu display and then press F2 (OPT).



Step 3 Press F3 (SPD).



Step 4 The currently set communication speed appears on the screen.
To return to the previous screen, press the ESC key.



7. Programming

Programs for operating the robot can be easily created and edited with the YAMAHA robot language similar to BASIC. This chapter explains how to make or edit programs using the HPB.

7.1 Robot language list

The following table shows a quick-reference list for YAMAHA robot language. For detailed information on the robot language, see the "Programming Guide" section.

Command	Meaning	Format Command
MOVA	Moves to a point data position.	MOVA <point number>,<maximum speed>
MOVI	Moves from current position by amount of point data.	MOVI <point number>,< maximum speed>
MOVF	Moves until a specified DI input is received.	MOVF <point number>,<DI number>,<DI status>
JMP	Jumps to a specified label in the specified program.	JMP <label number>,<program number>
JMPF	Jumps to a specified label in a specified program according to the input condition.	JMPF <label number>,<program number>,<input condition>
JMPB	Jumps to a specified label in a specified program when general-purpose input or memory input is in the specified state.	JMPB <label number>,<DI or MI number>,<input status>
L	Defines the jump destination for a JMP or JMPF statement.	L <label number>
CALL	Runs another program.	CALL <program number>,<number of times>
DO	Turns general-purpose output or memory output on or off.	DO <DO or MO number>,<output status>
WAIT	Waits until general-purpose input or memory input is in the specified state.	WAIT <DI or MI number>,<input status>
TIMR	Waits the specified amount of time before advancing to the next step.	TIMR <time>
P	Defines point variable.	P <point number>
P+	Adds 1 to point variable.	P+
P-	Subtracts 1 from point variable.	P-
SRVO	Turns servo on or off.	SRVO <servo status>
STOP	Temporarily stops program execution.	STOP
ORGN	Performs return-to-origin.	ORGN
TON	Runs a specified task.	TON <task number>,<program number>,<start type>
TOFF	Stops a specified task.	TOFF <task number>
JMPP	Jumps to a specified label when the axis position condition meets the specified conditions.	JMPP <label number>,<axis position condition>
MAT	Defines a matrix.	MAT <number of rows>,<number of columns>,<pallet number>
MSEL	Specifies a matrix to move.	MSEL <pallet number>
MOVm	Moves to a specified pallet work position on matrix.	MOVm <pallet work position>,<maximum speed>
JMPC	Jumps to a specified label when the counter array variable C equals the specified value.	JMPC <label number>,<counter value>
JMPD	Jumps to a specified label when the counter variable D equals the specified value.	JMPD <label number>,<counter value>
CSEL	Specifies an array element for counter array variable C.	CSEL <array element number>
C	Defines counter array variable C.	C <counter value>
C+	Adds a specified value to counter array variable C.	C+ [<addition value>]
C-	Subtracts a specified value from counter array variable C.	C- [<subtraction value>]
D	Defines counter variable D.	D <counter value>
D+	Adds a specified value to counter variable D.	D+ [<addition value>]
D-	Subtracts a specified value from counter variable D.	D- [<subtraction value>]
SHFT	Shifts the coordinate position by amount of specified point data.	SHFT <point number>
IN	Stores bit information on specified general-purpose input or memory input into counter variable D.	IN <DI or MI number>,<number of bits>
OUT	Outputs the value of counter variable D to specified general-purpose output or memory output.	OUT <DO or MO number>,<number of bits>
LET	Assigns the value of a specified variable to another variable.	LET <variable 1>,<variable 2>

Items in brackets [] can be omitted.

7.2 Relation between robot language and point data

In programs created using the robot language, the robot position information (absolute position, amount of movement) is not expressed in terms of direct numeric values but expressed as point numbers. Point numbers and their corresponding positions are stored as point data separately from the program. Therefore, a position in a program can be changed simply by editing the point data, without rewriting the program.

Example: Program	Point data
005:MOVA 0,100	P0=50.00
006:MOVI 1,50	P1=100.00

Maximum speed

Point number

Robot language

Step number

In this example, the robot moves as follows:

- 005: Moves to a point 50mm from the origin position.
- 006: Then moves to another point 100mm away from the above point.

To change this movement so that the robot first moves to a point 55.5 mm from the origin position and then moves to another point 100mm away from that point, just change the P0 point data as follows:

P0=50.00 → P0=55.50

7

Programming

7.3 Entering a robot language command

Robot language commands frequently used to create programs are printed on the lower part of each number key on the HPB. When creating or editing a program in EDIT-PGM mode, you can enter the robot language commands simply by pressing these keys. To select other robot language commands not printed on these keys, use the function key that corresponds to that command.



NOTE

In EDIT-PGM mode, when the edit cursor (blinking underscore) appears just to the right of a step number, this indicates that you can enter a robot language command by pressing the number key. In the other cases, you can enter numbers with the number keys.

■ Entering a robot language command

Edit cursor

[EDIT] - PGM No 0
001:

1MOVA 2MOVI 3MOVF 4next

F1 F2 F3 F4

7 TIMR 8 P 9 L
4 CALL 5 WAIT 6 DO
1 JMP 2 JMPB 3 JMFF
0 MOVA . MOVI - MOVF

Use these keys to directly enter robot language commands.

7.4 Program specifications

The SR1 has the following memory capacity.

■ SR1 memory capacity

Total number of programs	100 (NO0 to NO99)
Maximum number of steps per program	255
Maximum number of steps in all programs together	3000
Total number of points	1000 (P0 to P999)

7.5 Creating or editing a program

The following jobs can be performed with the HPB in EDIT-PGM mode.

■ EDIT-PGM mode jobs

Job	Refer to:
Creating a new program (after initialization)	7.5.1
Creating a new program	7.5.2
Editing a program	
Adding a step	7.5.3
Changing a step	7.5.4
Inserting a step	7.5.5
Deleting a step	7.5.6
Copying a program	7.6.1
Deleting a program	7.6.2
Viewing the program information	7.6.3

7.5.1 Creating a new program (after initialization)

The following steps explain how to create a new program for the first time after installing the SR1 controller or after initializing all programs (see 10.2, "Initializing the program and data" in Chapter 10) so no programs are stored.

Step 1 Press **F1** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

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

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Check the displayed message.

An error message "43: cannot find PGM" appears since no programs are stored after initialization.

```
[EDIT]
select menu
43: cannot find PGM
1PGM 2PNT 3UTL
```

Step 4 Press **ESC** to reset the error.

A message "New entry OK?" appears asking whether to create a new program as program No. 0.

Step 5 Press **F1** (yes).

Pressing **F1** (yes) selects program No.0 and proceeds to step 7 (edit screen for program No.0).

If you want to select a program other than No.0, press **F2** (no) and proceed to step 6.

```
[EDIT-PGM]
PGM No = 0
New entry OK ?
1yes 2no
```

Step 6 Enter the program number with the number keys.

The screen at the right appears when you selected **F2** (no) in step 5. Enter the program number and press **↵**. The screen returns to step 4, so press **F1** (yes) to continue.

```
[EDIT-PGM]
PGM No = _
(Program No) 0→99
```

Step 7 *Select the robot language.*

Press the number key on which the robot language is printed or press the function key to select the robot language. Press **F4** (next) as needed to switch the robot language menu display. Press **BS** to redisplay the previous robot language menu.

[EDIT-PGM]										No		0
001: _												
1	MAT	2	MSEL	3	MOVM	4	next					

Step 8 *Enter the operand data.*

When you have selected the robot language, press **▶** to move the cursor to the operand 1 position and enter the data with the number keys. (Do not press **↵** at this point.) Enter all necessary operand data while pressing **◀** or **▶** to move the cursor. For the robot language syntax rules, refer to the "Programming Guide" section.

[EDIT-PGM]										No		0
001: MOVA 0 , 100												
(point No) 0→999												
1	P											

Step 9 *Press **↵** after you have entered the operand data.*

The cursor moves to the beginning of the opcode.

[EDIT-PGM]										No		0
001: MOVA 1 , 80_												
(speed) 1→100												

[EDIT-PGM]										No		0
001: MOVA 1 , 80												
1	MAT	2	MSEL	3	MOVM	4	next					

Step 10 *Edit the next step.*

To edit the next step, press **▼** to scroll to the next step number and repeat the procedure from step 7 to 9.

7.5.2 Creating a new program

The following steps explain how to create a new program when one or more programs are already registered.

Step 1 Press **F1** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

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

The EDIT-PGM mode screen appears showing the program number and step number currently selected.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

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

The program number entry screen appears.

```
[EDIT-PGM] No 10
017:MOVA 254, 100
1MOD 2INS 3DEL 4CHG
```

Step 4 Enter the program number to create a new program and press **↵**.

```
[EDIT-PGM]
PGM No = _
(Program No) 0→99
```

Step 5 Check the displayed message and press **F1** (yes).

If you want to change the program number you have just entered, then press **F2** (no) to move back to step 4 and enter the correct program number.

```
[EDIT-PGM]
PGM No = 14
New entry OK ?
1yes 2no
```

Step 6 Edit the program data.

Follow the procedure from step 7 onward in the previous section 7.5.1, "Creating a new program (after initialization)".

```
[EDIT-PGM] No 14
001: _
1MAT 2MSEL 3MOV 4next
```

7.5.3 Adding a step

Step 1 Press **[F1]** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **[F1]** (**PGM**).

The EDIT-PGM mode screen appears showing the program number and step number currently selected.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Press **[F4]** (**CHG**).

The program number entry screen appears.

```
[EDIT-PGM] No 10
017:MOVA 254, 100
1MOD 2INS 3DEL 4CHG
```

Step 4 Enter the program number to add a step and press **↵**.

```
[EDIT-PGM]
PGM No = _
(Program No) 0→99
```

Step 5 Enter the last step number and press **↵**.

The total number of steps in the selected program is displayed on the bottom line of the screen. Enter 50 in this example.

```
[EDIT-PGM]
PGM No = 10
STEP No = _
(REG. steps) 50
```

Step 6 Press **↵** when the last step is displayed.

The next step number (51 in this example) then appears. This is the edit screen for the added step.

```
[EDIT-PGM] No 10
050:WAIT 3, 1
1MOD 2INS 3DEL 4CHG
```

Step 7 Select the robot language.

Press the number key on which the robot language is printed or press the function key to select the robot language. Press **[F4]** (next) as needed to switch the robot language menu display. Press **[BS]** to redisplay the previous robot language menu.

```
[EDIT-PGM] No 10
051:_
1MAT 2MSEL 3MOV 4next
```

Step 8 Enter the operand data.

When you have selected the robot language, press  to move the cursor to the operand 1 position and enter the data with the number keys. (Do not press  at this point.) Enter all necessary operand data while pressing  or  to move the cursor.

[EDIT-PGM]										No 10									
051: JMPF										0, 10, 1									
(label No)										0→255									

Step 9 Press after you have entered the operand data.

The screen returns to step 6.

[EDIT-PGM]										No 10									
051: JMPF										10, 31, 5									
(DI condition)										0→255									

Step 10 Edit the next step.

If adding the next step, press  to scroll to the next step number and repeat the procedure from step 7.

[EDIT-PGM]										No 10									
051: JMPF										10, 31, 5									
1MOD										2INS									
3DEL										4CHG									

7.5.4 Changing a step

Step 1 Select the program.

Follow the procedure from steps 1 to 4 in the previous section 7.5.3, "Adding a step".

Step 2 Enter the step number.

Enter the step number you want to change and press .

[EDIT-PGM]																			
PGM										No = 10									
STEP										No =									
(REG. steps)										50									

Step 3 Press (MOD).

The EDIT-PGM mode screen appears for changing the data of the selected step number.

[EDIT-PGM]										No 10									
010: MOVA										999, 100									
1MOD										2INS									
3DEL										4CHG									

7.5.5 Inserting a step

Step 1 *Select the program.*

Follow the procedure from steps 1 to 4 in the previous section 7.5.3, "Adding a step".

Step 2 *Enter the step number.*

Enter the step number where you want to insert a step and press .

```
[EDIT-PGM]
PGM No = 10
STEP No = _
(REG steps) 50
```

Step 3 *Press (INS).*

The EDIT-PGM mode screen appears for inserting data for the selected step number.

```
[EDIT-PGM] No 10
010:MOVA 999, 100
1MOD 2INS 3DEL 4CHG
```

Step 4 *Select the robot language.*

Press the number key on which the robot language is printed or press the function key to select the robot language. Press  (next) as needed to switch the robot language menu display. Press  to redisplay the previous robot language menu.

```
[EDIT-PGM] No 10
010:_
1MAT 2MSEL 3MOV 4next
```

Step 5 *Edit the operand data.*

When you have selected the robot language, press  to move the cursor to the operand 1 position and enter the data with the number keys. (Do not press  at this point.)

Edit all necessary operand data while pressing  or  to move the cursor.

```
[EDIT-PGM] No 10
010:MOVA 10_, 100
(point No) 0→999
1P
```

Step 6 *Press after you have edited the operand data.*

The screen returns to step 3.

```
[EDIT-PGM] No 10
010:MOVA 10, 100
(speed) 1→100
```

Step 7 *Insert the other steps as needed.*

If inserting the other steps, press  or  to scroll up or down the step number and repeat the procedure from steps 3 to 6.

```
[EDIT-PGM] No 10
010:MOVA 10, 100
1MOD 2INS 3DEL 4CHG
```

7.5.6 Deleting a step

- Step 1** *Select the program.*
 Follow the procedure from steps 1 to 4 in the previous section 7.5.3, "Adding a step".
- Step 2** *Enter the step number.*
 Enter the step number you want to delete and press .
- Step 3** *Press  (DEL).*
 The EDIT-PGM mode screen appears for deleting the selected step.
- Step 4** *Check the displayed message and press  (yes).*
 Pressing  (yes) deletes the selected step and then returns to the previous step.
 If you do not want to delete the step, then press  (no). The screen moves back to the previous step without deleting the selected step.

```
[EDIT-PGM]
PGM No = 10
STEP No =
(REG steps) 50
```

```
[EDIT-PGM] No 10
010: MOVA 999, 100
1MOD 2INS 3DEL 4CHG
```

```
[EDIT-PGM] No 10
010: MOVA 999, 100
delete OK ?
1yes 2no
```

```
[EDIT-PGM] No 10
010: WAIT 3, 1
1MOD 2INS 3DEL 4CHG
```

7.6 Program utility

The EDIT-UTL (utility) mode allows you to copy or delete a program, or to display program information.

7.6.1 Copying a program

Step 1 Press **F1** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F3** (**UTL**).

The EDIT-UTL mode screen appears.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Press **F1** (**COPY**).

The copy source program entry screen appears.

```
[EDIT-UTL]
select menu
1COPY 2DEL 3LIST
```

Step 4 Enter the program number you want to copy from and press **↵**.

```
[EDIT-UTL-COPY]
Copy from No = _
(Program No) 0→99
```

Step 5 Enter the program number you want to copy to and press **↵**.

The screen returns to step 3 after the program has been copied.

If program data is already registered with the selected program number, a confirmation screen appears (step 6).

```
[EDIT-UTL-COPY]
Copy from No = 0
Copy to No = 99_
(Program No) 0→99
```

Step 6 Check the message and press **F1** (yes) or **F2** (no).

To overwrite the program, press **F1** (yes). The screen returns to step 3 after the program has been copied.

If you do not want to copy the program, press **F2** (no).

```
[EDIT-UTL-COPY]
Copy from No = 0
No 99 overwrite OK ?
1yes 2no
```

```
[EDIT-UTL]
select menu
1COPY 2DEL 3LIST
```

7.6.2 Deleting a program

Step 1 Press **F1** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F3** (**UTL**).

The EDIT-UTL (utility) mode screen appears.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Press **F2** (**DEL**).

The screen for deleting the program then appears.

```
[EDIT-UTL]
select menu
1COPY 2DEL 3LIST
```

Step 4 Enter the program number you want to delete and press **↵**.

```
[EDIT-UTL-DEL]
delete PGM No = _
(Program No) 0→99
```

Step 5 Check the message and press **F1** (yes) or **F2** (no).

To delete the selected program, press **F1** (yes). The screen returns to step 3 after the program has been deleted.

If you do not want to delete the program, press **F2** (no).

```
[EDIT-UTL-DEL]
delete PGM No = 22
delete OK ?
1yes 2no
```

```
[EDIT-UTL]
select menu
1COPY 2DEL 3LIST
```

7.6.3 Viewing the program information

Step 1 Press **F1** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F3** (**UTL**).

The EDIT-UTL (utility) mode screen appears.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Press **F3** (**LIST**).

The program information screen then appears.

```
[EDIT-UTL]
select menu
1COPY 2DEL 3LIST
```

Step 4 Check the program information.

The top line "free" shows the number of steps that are not yet registered.

The second and third lines show a program number and the number of steps registered in that program.

To view other program information, press

▲ and ▼ to scroll the screen.

```
[EDIT-UTL-LIST]
free    678 steps
No 0    57 steps
No 1    255 steps
```

Step 5 Press **ESC** to return to the screen of step 3.

```
[EDIT-UTL]
select menu
1COPY 2DEL 3LIST
```



MEMO

In addition to the number of existing steps, the steps equivalent to the number of programs are used internally as the program control steps. For example, if two programs and their respective 50 and 100 steps are registered, the number of available remaining steps will be as follows:

3000 (maximum number of steps) - 2 (number of program control steps) - 50 - 100 = 2848 steps

8. Editing point data

There are three methods to enter point data: manual data input, teaching playback, and direct teaching.

Manual data input	This method allows you to directly enter point data with the HPB number keys.
Teaching playback	This method moves the robot in manual operation to a desired position and obtains that position as point data.
Direct teaching	This is basically the same as teaching playback, except that you move the robot by hand.

8.1 Manual data input

Follow these steps to directly enter point data with the HPB number keys.

Step 1 Press **F1** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F2** (**PNT**).

The EDIT-PNT (edit – point) mode screen appears.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Press **F1** (**MDI**).

The point data manual input screen appears.

```
[EDIT-PNT]
select menu
1MDI 2TCH 3DTCH 4DEL
```

Step 4 Check the displayed point number.

The point number currently selected in the execution program first appears.

If you want to edit the data for another point number, select it with either of the methods described in the next step.

```
[EDIT-PNT-MDI]
P0 = 0.00 [mm]
input data [ ]
1CHG
```

Step 5 Select the point number for manual data input.

Press **▲** or **▼** to scroll up or down the point number until the desired point number appears.

You may also press **F1** (**CHG**) and directly enter the desired point number with the number keys, then press **↵**.

```
[EDIT-PNT-MDI]
Pn : n = _
(point No) 0→999
```

Step 6 Enter the point data with the number keys.

```
[EDIT-PNT-MDI]
P500 = -19.27 [mm]
input data [21.76_]
1CHG
```

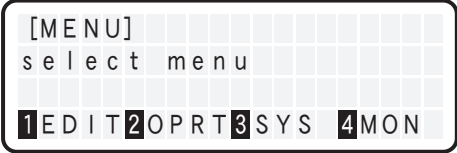
Step 7 Press **↵** to store the point data you entered.

```
[EDIT-PNT-MDI]
P500 = 21.76 [mm]
input data [ ]
1CHG
```

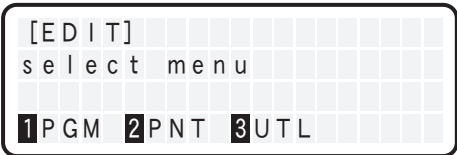
8.2 Teaching playback

In teaching playback, you move the robot in manual operation to a desired position and obtain that position as point data. Follow these steps to perform teaching playback.

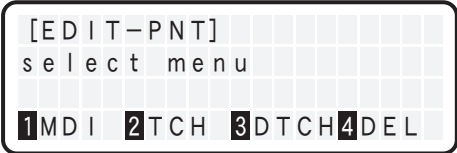
- Step 1** Press **F1** (**EDIT**) on the initial menu screen.
The EDIT mode screen appears.



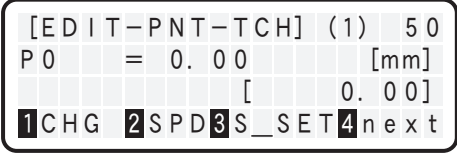
- Step 2** Press **F2** (**PNT**).
The EDIT-PNT (point) mode screen appears.



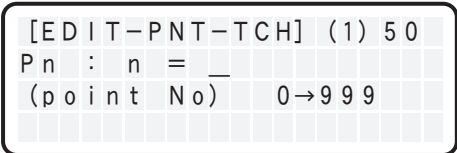
- Step 3** Press **F2** (**TCH**).
The EDIT-PNT-TCH (teaching) screen appears.



- Step 4** Check the displayed point number.
The point number currently selected in the execution program first appears.
If you want to edit the data for another point number, select it with either of the methods described in the next step.



- Step 5** Select the point number.
Press **▲** or **▼** to scroll the point number until the desired point number appears.
You may also press **F1** (**CHG**) and directly enter the desired point number with the number keys, then press **↵**.



Step 6 Move the robot to the teaching position.

● To move the robot:

Use to move the robot. Each time you press , the robot moves a certain amount in the direction indicated by the key and then stops. Holding down moves the robot continuously at a constant speed in the direction indicated by the key until you release the key.

The amount of robot movement and speed are proportional to the number (teaching movement data) displayed on the upper right of the screen.

In the example at the right, the teaching movement data is 50 (%), so the robot moves 0.5mm each time you press , as calculated below:

$$1\text{mm (constant)} \times (50/100) = 0.5\text{mm}$$

If is kept pressed, the robot continuously moves at a speed of 50mm/s, as calculated below:

$$100\text{mm/s (constant)} \times (50/100) = 50\text{mm/s}$$

[EDIT-PNT-TCH] (1) 50									
P500 = 19.27 [mm]									
[0.00]									
1	CHG	2	SPD	3	S_SET	4	next		

● To change the teaching movement data:

Three different speeds, SPEED (1), SPEED (2) and SPEED (3), are selectable as the teaching movement data. Each time you press (SPD), this speed changes in the order of (1) → (2) → (3) → (1).

If you want to change the teaching movement data setting, press (S_SET), enter the desired speed with the number keys, and press . The screen then returns to the previous menu.

[EDIT-PNT-TCH] (1) 50									
SPEED (1) =									
(speed) 1→100									

Step 7 Press  to obtain the teaching position.
The current robot position is stored as point data and displayed on the HPB screen.

[EDIT-PNT-TCH] (1) 100									
P	5	0	0	=	1	6	7	.	2 4 [mm]
								[	1 6 7. 2 4]
1	CHG	2	SPD	3	S_SET	4	next		

Step 8 Obtain other teaching positions.
Use the same procedure to obtain all other necessary point data.



CAUTION When the SERVICE mode function is enabled and "SERVICE mode state" is detected, the following safety control will function. (See 10.8, "SERVICE mode function" in Chapter 10.)

- Robot movement speed is set to 10mm/s or less when the robot movement speed limit is enabled.

8.3 Direct teaching

In direct teaching, you move the robot by hand to a desired position under emergency stop conditions and obtain that position as point data. Follow these steps to perform direct teaching.

Step 1 Press **[F1]** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **[F2]** (**PNT**).

The EDIT-PNT (point) mode screen appears.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Press **[F3]** (**DTCH**).

The EDIT-PNT-DTCH (direct teaching) mode screen appears.

```
[EDIT-PNT]
select menu
1MDI 2TCH 3DTCH 4DEL
```

Step 4 Press the emergency stop button on the HPB.

```
[EDIT-PNT-DTCH]
press EMG. button
```

Step 5 Check the displayed point number.

The point number currently selected in the execution program first appears.

If you want to edit the data for another point number, select it with either of the methods described in the next step.

```
[EDIT-PNT-DTCH]
P0 = 0.00 [mm]
[ 0.00]
1CHG 2DO 3BRK
```

Step 6 Select the point number.

Press **▲** or **▼** to scroll the point number until the desired point number appears.

You may also press **[F1]** (**CHG**) and directly enter the desired point number with the number keys, then press **◆**.

```
[EDIT-PNT-DTCH]
Pn : n = _
(point No) 0→999
```

Step 7 Move the robot by hand to the teaching position.

```
[EDIT-PNT-DTCH]
P500 = 0.00 [mm]
[ 19.27]
1CHG 2DO 3BRK
```

Step 8 Press to obtain the teaching position.

The current robot position is stored as point data and displayed on the HPB screen.

[EDIT-PNT-DTCH]															
P 5 0 0		=	1 6 7 . 2 4		[mm]										
					[		1 6 7 . 2 4		]						
1	CHG	2	DO	3	BRK										

Step 9 Obtain other teaching positions.

Use the same procedure to obtain and store all other necessary point data.

Step 10 Press after you have entered all point data.**Step 11** Release the emergency stop button on the HPB.

A message appears asking if you want to turn the servo on.

[EDIT-PNT-DTCH]															
release EMG. button															

Step 12 Select the servo on or off.

Press  (yes) to turn the servo on, or press  (no) to leave the servo off. The screen returns to step 3.

[EDIT-PNT-DTCH]															
servo on ready ?															
1	yes	2	no												

[EDIT-PNT]															
select menu															
1	MDI	2	TCH	3	DTCH	4	DEL								

8.4 Manual control of general-purpose output

When performing teaching playback or direct teaching with systems that use a general-purpose output through the I/O interface to operate a gripper or other tools, you may want to check the position of workpiece by actually moving it. For this reason, the SR1 controller is designed to allow manual control of general-purpose output from the HPB.

Step 1 *Move the robot to the position at which you want to operate general-purpose output.*

To move the robot, use the same procedure in section 8.2, "Teaching playback", or section 8.3, "Direct teaching".

Step 2 *Stop the robot at the position where you want to operate general-purpose output.*

Step 3 *Display the general-purpose output status screen.*

After pressing (next) to switch the menu display press (DO) to display the general-purpose output status screen.

[EDIT-PNT-TCH] (1) 50									
P0		=	0.00						[mm]
				[					0.00]
1	DO	2	TRC	3				4	next

Step 4 *Select the DO number to control.*

Press the function key that matches the DO number to switch the output on and off (on=1, off=0). If selecting DO3 onward, press (next) to switch the menu display.

[EDIT-PNT-TCH] (1) 50									
DO	0=0	DO	1=0	DO	2=0				
DO	3=0	DO	4=0	DO	5=0				
1	DO0	2	DO1	3	DO2	4	next		

Step 5 *Press to return to step 2.*

If you want to operate general-purpose output at another position, use the same procedure.

[EDIT-PNT-TCH] (1) 50									
P0		=	0.00						[mm]
				[					0.00]
1	DO	2	TRC	3				4	next

8.5 Manual release of the holding brake

The holding brake on vertical type robots can be released as needed. Since the movable part will slide down when the brake is released, attaching a stopper to protect the tool tip from being damaged is recommended.

Step 1 Enter the direct teaching mode.
Use the same procedure up to step 4 in section 8.3, "Direct teaching".

Step 2 Press **F3** (BRK).
A message appears asking if you want to release the brake.

[EDIT-PNT-DTCH]															
P0	=	0.	00												[mm]
1	CHG	2	DO	3	BRK										

Step 3 Press **F1** (yes) to release the brake.
If you do not want to release the brake, press **F2** (no).
The screen returns to step 2.

[EDIT-PNT-DTCH]															
take off the brake ?															
1	yes	2	no												

Step 4 Apply the brake again.
Press **F3** (BRK) again or turn on the robot servo to apply the brake again.

[EDIT-PNT-DTCH]															
P0	=	0.	00												[mm]
1	CHG	2	DO	3	BRK										

 **CAUTION** _____
Use caution because the brake stays released until you perform step 4.

 **MEMO** _____
Manual release of the holding brake is only possible on those robots equipped with a brake.

8.6 Deleting point data

Follow these steps to delete point data that is already stored.

Step 1 Press **[F1]** (**EDIT**) on the initial menu screen.

The EDIT mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **[F2]** (**PNT**).

The EDIT-PNT (edit – point) mode screen appears.

```
[EDIT]
select menu
1PGM 2PNT 3UTL
```

Step 3 Press **[F4]** (**DEL**).

The screen for deleting point data appears.

```
[EDIT-PNT]
select menu
1MDI 2TCH 3DTCH 4DEL
```

Step 4 Enter the point number at the start to delete point data and press **↵**.

```
[EDIT-PNT-DEL]
DEL range P__ -P__
(point No) 0→999
```

Step 5 Enter the point number at the end to delete point data and press **↵**.

A message appears asking if you want to delete the point data.

```
[EDIT-PNT-DEL]
DEL range P100-P__
(point No) 0→999
```

Step 6 Press **[F1]** (yes) to delete the selected point data.

If you want cancel deleting the point data, press **[F2]** (no).
The screen returns to step 3.

```
[EDIT-PNT-DEL]
DEL range P100-P110
delete OK ?
1yes 2no
```

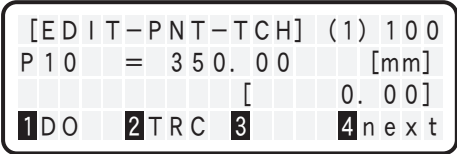
```
[EDIT-PNT]
select menu
1MDI 2TCH 3DTCH 4DEL
```

8.7 Point trace (moving to a registered data point)

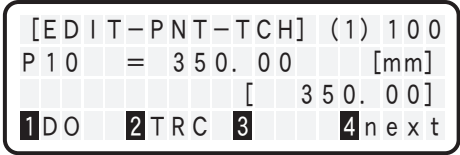
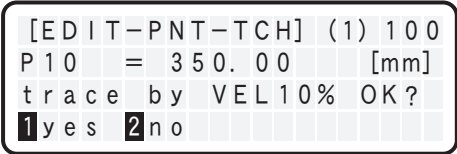
Point trace allows you to move the robot to a position specified by point data. You can check the point data by actually moving the robot.

Step 1 *Select the point number.*
Use the same procedure up to step 5 in section 8.2, "Teaching playback" to select the point number where you want to move the robot.

Step 2 *Press **F4** (next) to switch the menu display and press **F2** (TRC).*
The movement speed during trace appears on the screen. For safety reasons, this speed is 10% of operation speed setting (speed parameter setting displayed on the upper right of the screen).
If you want to change the movement speed during trace, use the same procedure in step 6 in section 8.2, "Teaching playback".



Step 3 *Press **F1** (yes) to move the robot.*
If you do not want to move the robot, press **F2** (no).
The screen returns to step 2.



 **CAUTION** When the SERVICE mode function is enabled and "SERVICE mode state" is detected, the following safety control will function. (See 10.8, "SERVICE mode function" in Chapter 10.)

- Robot movement speed is set to 3% or less of maximum speed when the robot movement speed limit is enabled.
- If the hold-to-run function is enabled, the robot stops moving upon releasing **F1** (yes) and does not reach the target position.

MEMO

9. Operating the robot

This chapter explains how to operate the robot with the HPB. If a program has already been created, you can operate the robot after or while reading this chapter.

There are two methods of robot operation: step operation and automatic operation. Step operation executes the program one step at a time, each time you press the RUN key on the HPB. This is mainly used to check each step of the program. Automatic operation executes the entire program continuously from the first step to the last step.

This chapter describes the procedures for step operation and automatic operation using the HPB as well as return-to-origin operation.

■ Operations in OPT (operation) mode

Operation	Refer to:
Performing return-to-origin	9.1
Using step operation	9.2
Using automatic operation	9.3
Changing the execution program	9.4

9.1 Performing return-to-origin

There are two methods for detecting the origin position (reference point): search method and mark method. The search method is further divided into the origin sensor method and stroke-end detection method. In the mark method, move the robot to a desired position (mark position) and set it as the particular coordinate position to determine a reference point.

The following sections explain how to perform return-to-origin by using the search method and mark method.

9.1.1 Return-to-origin by the search method

When the search method is selected as the origin detection method (PRM123=0 or 1), use the following procedure to perform return-to-origin.

Step 1 Press (OPRT) on the initial menu screen.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press (ORG).

```
[OPRT]
select menu
1ORG 2STEP 3AUTO
```

Step 3 Press (yes) to perform return-to-origin.

To cancel the operation, press (no).

```
[OPRT-ORG-SEARCH]
ORG search OK ?
1yes 2no
```

Step 4 This screen appears during return-to-origin.

Pressing during operation stops the robot and displays a message. Then pressing returns to the screen of step 2.

```
[OPRT-ORG-SEARCH]
searching ...
```

Step 5 When return-to-origin ends normally, the machine reference value appears on the bottom right of the screen.

Pressing returns to step 2.

```
[OPRT-ORG-SEARCH]
origin complete
machine ref. 50%
```



CAUTION

When the SERVICE mode function is enabled, the following safety control will function. (See 10.8, "SERVICE mode function".)

- With the robot movement speed limit enabled, return-to-origin movement speed is limited to less than 10mm/s (10deg/s for rotary robots) when in "SERVICE mode state".
- With the hold-to-run function enabled, the robot stops moving and does not complete return-to-origin unless **F1** (yes) is held down in step 3 when in "SERVICE mode state".



CAUTION

When performing return-to-origin by the stroke-end detection method, do not interrupt the return-to-origin operation while detecting the origin (while contacting the mechanical limit). Otherwise, the operation will stop due to a controller overload alarm and the power will have to be turned on again.



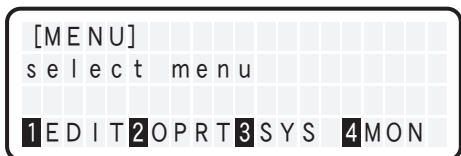
CAUTION

If return-to-origin operation using the stroke-end detection method must be repeated, wait at least 5 seconds before repeating it.

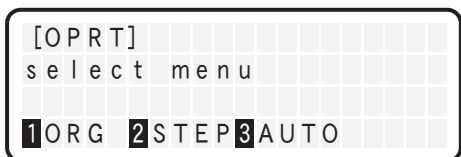
9.1.2 Return-to-origin by the mark method

When the mark method is selected as the origin detection method (PRM123=2), use the following procedure to perform return-to-origin.

Step 1 Press **F2** (**OPRT**) on the initial menu screen.



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



Step 3 Press **F1** (**TCH**) to set the mark position by using the teaching playback method.

If using the direct teaching method, press **F2** (**DTCH**) and advance to step 5.



Step 4 When the teaching playback method was selected, use to move the robot to the mark position.

The method of moving the robot is just the same as the teaching playback method for point data. (See 8.2, "Teaching playback".)

When the robot reaches the mark position, press . (At this point, check that the machine reference value is in a range from 25 to 75%. Otherwise, the origin position cannot be set correctly.)

[ORG-MARK-TCH]										(1)	50
move at mark point											
ref. 50% [0.00]											
1	DO	2	SPD	3	S_SET						

Step 5 When the direct teaching method was selected, press the emergency stop button.

Press the emergency stop button on the HPB when the message on the right appears.

[ORG-MARK-DTCH]											
press EMG. button											

Step 6 Move the robot by hand to the mark position.

After moving the robot to the mark position, press . (At this point, check that the machine reference value is in a range from 25 to 75%. Otherwise, the origin position cannot be set correctly.)

[ORG-MARK-DTCH]											
move at mark point											
ref. 50% [0.00]											
1	DO	2	BRK								

Step 7 Check the message on the screen. When was pressed after moving the robot to the mark position by the teaching playback method or direct teaching method, the screen changes to the coordinate input screen for the mark position.

While making sure that the robot stays at the mark position, use the number keys to enter the coordinate values that the controller should recognize as the current position, and then press .

[ORG-MARK-TCH]											
input mark position											
[] [mm]											

Step 8 Press **F1** (yes) to set the origin position.

To cancel the setting, press **F2** (no).

```
[ORG-MARK-TCH]
ORG mark OK?
1 yes 2 no
```

Step 9 Press **ESC** if the message on the right appears.

If the machine reference value is not in a range from 25 to 75%, the message on the right appears indicating that the origin position cannot be set. In this case, press **ESC** and retry the above procedure.

```
[ORG-MARK-TCH]
cannot set origin
as bad machine ref.
```

Step 10 When the origin position has been set correctly, the message on the right appears.

Pressing **ESC** returns to step 4 when the teaching playback method was used or to step 6 when the direct teaching method was used.

```
[ORG-MARK-TCH]
origin complete
```



MEMO

When you check the robot position after setting the mark position coordinates, the robot position is not always at the coordinates specified as the mark position. This is because the mark position is synchronized to prevent positional shift and make an exact match when the motor's electrical angle is "0".

When the motor's electrical angle is "0", the machine reference value is just 0%. This means that as the machine reference value deviates from 0%, the robot position moves away from the coordinates specified as the mark position.



CAUTION

When the SERVICE mode function is enabled, the following safety control will function. (See 10.8, "SERVICE mode function".)

- With the robot movement speed limit enabled, robot movement speed is limited to less than 10mm/s (10deg/s for rotary robots) when in "SERVICE mode state".

9.2 Using step operation

Step 1 Press **F2** (**OPRT**) on the initial menu screen.

The **OPRT** (operation) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F2** (**STEP**).

The **STEP** mode screen appears showing the currently selected program number and step number.

```
[OPRT]
select menu
1ORG 2STEP 3AUTO
```

Step 3 Press **F3** (**CHG**) if changing the program.

The program number entry screen appears.

```
[STEP] 100% 0: 0
001:MOVA 254, 100
[ 0.00]
1SPD 2RSET 3CHG 4next
```

Step 4 Enter the program number you want to execute and press **↩**.

The first step of the selected program is displayed.

```
[STEP] 100% 0: 0
PGM No = _
(program No) 0→99
```

Step 5 Check the program execution speed.

If changing the program execution speed, press **F1** (**SPD**), enter the desired speed with the number keys, and press **↩**. The screen then returns to step 3.

```
[STEP] 100% 0: 10
001:MOVA 999, 50
[ 0.00]
1SPD 2RSET 3CHG 4next
```

```
[STEP] 100% 0: 10
SPEED = _
(speed) 1→100
```

Step 6 Press **[RUN]** to start step operation.

A message "running..." appears and the first step is executed.

```
[STEP] 50% 0: 10
001: MOVA 999, 50
[ 0. 00]
1SPD 2RSET 3CHG 4next
```

```
[STEP]
running ...
```

If you want to interrupt the step operation, press **[STOP]**. Another message appears indicating the operation has been interrupted. To resume the step operation, press **[ESC]** and then press **[RUN]**.

```
[STEP] 50% 0: 10
001: MOVA 999, 50
[ 201. 11]
1SPD 2RSET 3CHG 4next
```

Step 7 Press **[RUN]** to execute the next step.

The second step is displayed after the first step has been executed, so pressing **[RUN]** executes the second step.

The subsequent steps will be executed one step at a time, each time you press **[RUN]**. To return to the first step, press **[F2]** (RSET).

```
[STEP] 50% 0: 10
035: TIMR 100
[ 250. 00]
1SPD 2RSET 3CHG 4next
```

When the last step has been executed, a message "program end" appears. Pressing **[ESC]** here returns to the first step screen.

If you want to switch the task of a multi-task program, use the procedure of steps 8 and 9.

```
[STEP]
60: program end
```

Step 8 Switch the task number.

Pressing **[F4]** (next) to switch the menu display and then press **[F3]** (CHGT) to switch the task.

The task is switched each time you press **[F3]** (CHGT).

```
[STEP] 50% 1: 11
001: WAIT 0, 1
[ 250. 00]
1VAL 2S_ON 3CHGT 4next
```

Step 9 Press  to execute each step in the selected task.

[STEP]	50%	2:	12
001:DO	1	,	1
		[	250.00]
1 VAL	2 S_ON	3 CHGT	4 next



CAUTION

When the SERVICE mode function is enabled and "SERVICE mode state" is detected, the following safety control will function. (See 10.8, "SERVICE mode function" in Chapter 10.)

- Step operation cannot be performed if the SERVICE mode setting is made so that automatic and step operations are prohibited.
- Robot movement speed is set to 3% or less of maximum speed when the robot movement speed limit is enabled.
- If the hold-to-run function is enabled, step operation stops upon releasing .
When one step has been executed, you must release  and then press  again to execute the next step.

9.3 Using automatic operation

The following procedure explains how to perform automatic operation. In the case of a multi-task program, all tasks which have started are executed in automatic operation.

Step 1 Press **F2** (**OPRT**) on the initial menu screen.

The OPRT (operation) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F3** (**AUTO**).

The AUTO mode screen appears showing the currently selected program number and step number.

```
[OPRT]
select menu
1ORG 2STEP 3AUTO
```

Step 3 Press **F3** (**CHG**) if changing the program.

The program number entry screen appears.

```
[AUTO] 100% 0: 0
001: MOVA 254, 100
[ 0.00]
1SPD 2RSET 3CHG 4next
```

Step 4 Enter the program number you want to execute and press **↵**.

The first step of the selected program is displayed.

```
[AUTO] 100% 0: 0
PGM No = 
(program No) 0→99
```

```
[AUTO] 100% 0: 10
001: MOVA 999, 50
[ 0.00]
1SPD 2RSET 3CHG 4next
```

Step 5 Check the program execution speed.

If changing the program execution speed, press **F1** (**SPD**), enter the desired speed with the number keys, and press **↵**. The screen then returns to step 4.

```
[AUTO] 100% 0: 10
SPEED = 
(speed) 1→100
```

```
[AUTO] 50% 0: 10
001: MOVA 999, 50
[ 0.00]
1SPD 2RSET 3CHG 4next
```

Step 6 Press RUN to start automatic operation.

A message "running..." appears and the program is executed.

If you want to interrupt the automatic operation, press STOP. Another message appears indicating the operation has been interrupted. To resume automatic operation, press ESC and then press RUN. To return to the first step, press F2 (RSET).

```
[AUTO]
  running ...
```

```
[AUTO]  50%    0:    10
035:TIMR 100
          [ 250.00]
1SPD  2RSET 3CHG 4next
```

When the last step has been executed, a message "program end" appears. Pressing ESC here returns to the first step screen. If you want to switch the task of a multi-task program, use the procedure of step 7.

```
[AUTO]
60:program end
```

Step 7 Switch the task number (when a multi-task program is used).

Pressing F4 (next) to switch the menu display and then press F3 (CHGT) to switch the task.

The task is switched each time you press F3 (CHGT).

Then, pressing RUN executes the selected task.

```
[AUTO]  50%    1:    11
010:WAIT 0    , 1
          [ 250.00]
1VAL  2S_ON 3CHGT 4next
```

```
[AUTO]  50%    2:    12
015:DO    1    , 1
          [ 250.00]
1VAL  2S_ON 3CHGT 4next
```

**CAUTION**

When the SERVICE mode function is enabled and "SERVICE mode state" is detected, the following safety control will function. (See 10.8, "SERVICE mode function" in Chapter 10.)

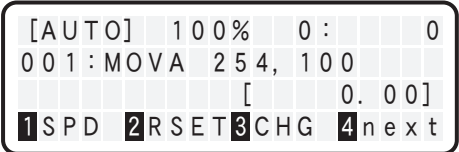
- Automatic operation cannot be performed if the SERVICE mode setting is made so that automatic and step operations are prohibited.
- Robot movement speed is set to 3% or less of maximum speed when the robot movement speed limit is enabled.
- If the hold-to-run function is enabled, automatic operation stops upon releasing RUN.

9.4 Changing the execution program

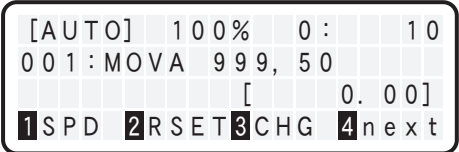
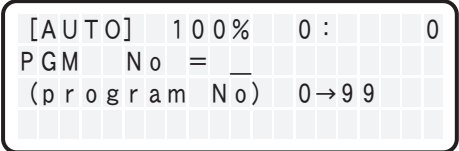
The following procedure explains how to change the program in automatic operation. Use the same procedure in step operation. The program selected by this procedure will be the lead program where operation resumes after program reset.

 **MEMO** _____
Switching the program automatically performs program reset.

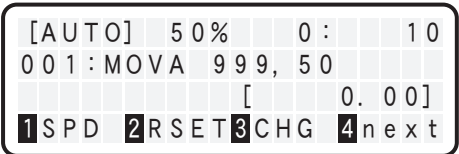
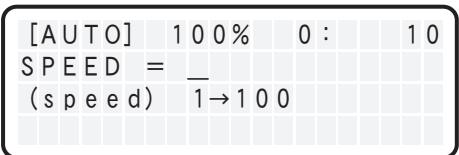
Step 1 *On the OPRT (operation) mode screen, press **F3** (CHG). The program number entry screen appears.*



Step 2 *Enter the program number you want to execute and press . The first step of the selected program is displayed.*



Step 3 *Check the program execution speed. If changing the program execution speed, press **F1** (SPD), enter the desired speed with the number keys, and press . The screen then returns to step 2.*



MEMO

10. Other operations

The HPB has convenient functions in addition to those already described earlier. These include, for example, data initialization, SERVICE mode setting, loading of data from an SD memory card, and saving of data on an SD memory card.

This chapter describes the following operations.

Operation	Refer to:
Emergency stop function	10.1
Initializing the program and data	10.2
Displaying the DIO monitor	10.3
Displaying the memory I/O status	10.4
Displaying the variables	10.5
Displaying the system information	10.6
Using the duty (load factor) monitor	10.7
SERVICE mode function	10.8
Displaying the hidden parameters	10.9
Using SD memory cards	10.10
Displaying the error and alarm histories	10.11

10.1 Emergency stop function

The HPB has an emergency stop button. Pressing this button turns off the robot servo to immediately stop robot movement. Use the emergency stop function when you want to:

- Immediately stop the robot movement for safety or other reasons.
- Inspect the robot under emergency stop conditions.
- Perform direct teaching.

10.1.1 Initiating an emergency stop

To initiate an emergency stop during robot operation, press the emergency stop button on the HPB. The emergency stop button locks in the depressed position, and can be released by turning it to the right.

In emergency stop, the robot is in a "free" state so that commands initiating robot movement (for example, return-to-origin command) cannot be executed.

10.1.2 Resuming operation after emergency stop

When you attempt to resume operation after an emergency stop during HPB operation, the required procedure automatically appears on the HPB screen. Follow those instructions to resume operation after emergency stop for example when:

- Performing return-to-origin.
- Running step operation.
- Running automatic operation.
- Editing point data using teaching playback.
- Exiting the direct teaching mode.

The following steps describe the procedure for running step operation after emergency stop.

Step 1 Press **RUN** to start step operation.
A message appears requesting you to release the emergency stop button.

[STEP]	100%	0:		7
001:MOVA	254,	100		
		[	0.00]	
1 SPD	2 RSET	3 CHG	4 next	

Step 2 Release the emergency stop button by turning it to the right.
Another message appears asking if you want to turn the servo on.

[STEP]	100%	0:		7
release	EMG.	button		

Step 3 Press **F1** (yes) to turn the servo on.
A message appears asking if you want to start operation.
If you want to leave the servo off, press **F2** (no).

[STEP]	100%	0:		7
servo	on	ready	?	
1 yes	2 no			

Step 4 Press (yes) to start operation.

If you do not want to start operation,

press (no).

The screen returns to step 1.

[STEP]	100%	0:		7
continue	OK	?		
1 yes	2 no			

[STEP]	100%	0:		7
001: MOVA	254,	100		
		[	0.00]	
1 SPD	2 RSET	3 CHG	4 next	



CAUTION

When the SERVICE mode function is enabled and "SERVICE mode state" is detected, the following safety control will function. (See 10.8, "SERVICE mode function" in Chapter 10.)

- If the hold-to-run function is enabled, robot movement stops upon releasing

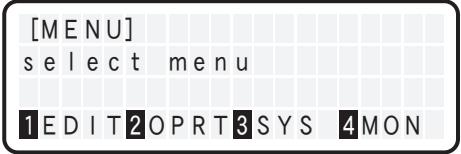
(yes) in step 4.

10.2 Initializing the program and data

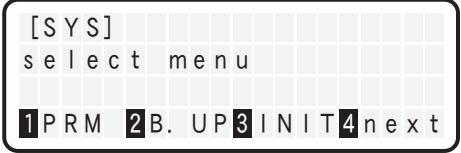
You can initialize the programs, point data and parameter data if needed, by separately specifying each of them. You can also initialize all of them at once.

Initialization	Description
Program	Erases the data in the program currently loaded on the controller.
Point data	Erases the point data currently loaded on the controller.
Parameter	Resets all parameters to the default values.

Step 1 Press **F3** (**SYS**) on the initial menu screen.
The SYS (system) mode screen appears.

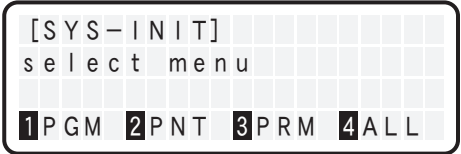


Step 2 Press **F3** (**INIT**).
The SYS-INIT (initialization) mode screen appears.



Step 3 Select the data you want to initialize.

- To initialize the program data, press **F1** (PGM).
- To initialize the point data, press **F2** (PNT).
- To initialize the parameter data, press **F3** (PRM).
- To initialize all of the program data, point data and parameter data, press **F4** (ALL).



NOTE

When **F3** (PRM) or **F4** (ALL) was selected, you must specify the robot type number as described in steps 4 to 7.

Step 4 Specify the robot type number.
When **F3** (PRM) or **F4** (ALL) was selected in step 3, the robot type entry screen appears. Enter the robot type number and press **↵**. (See 5.2.1, "Robot number" in Chapter 5 of the SR1 controller user's manual.



Step 5 Enter the robot stroke length and press .

```
[SYS-INIT-PRM]
robot type : 4020
stroke    : 300_ [mm]
```

Step 6 Enter the robot payload and press .

A message appears asking whether to initialize the data.

```
[SYS-INIT-PRM]
robot type : 4020
stroke    : 300 [mm]
weight    : 3_ [Kg]
```

Step 7 Press  (yes) to initialize the data.
If you do not want to initialize the data, press  (no).
The screen returns to step 3.

```
[SYS-INIT-PRM]
parameter data
initialize OK ?
1yes 2no
```

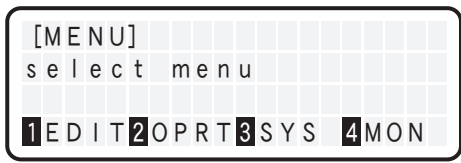
```
[SYS-INIT]
select menu
1PGM 2PNT 3PRM 4ALL
```

10.3 Displaying the DIO monitor

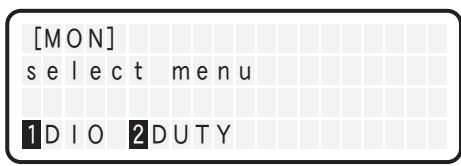
You can check the on/off status of I/O signals by displaying the DIO monitor on the HPB screen.

10.3.1 Displaying from the monitor menu

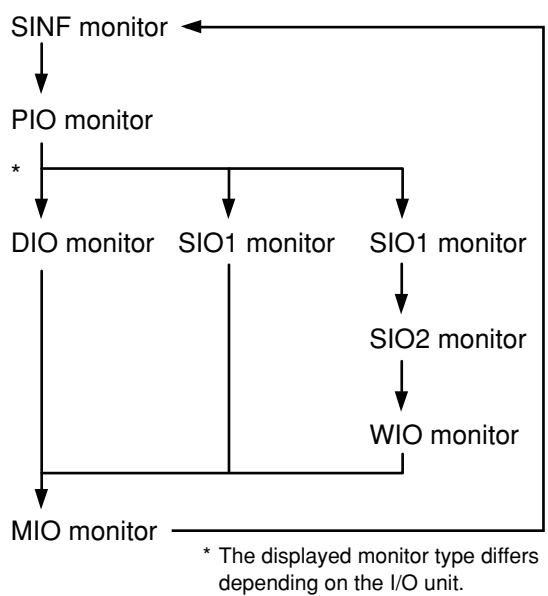
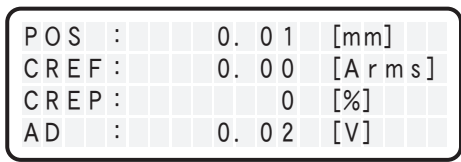
Step 1 Press **F4** (**MON**) on the initial menu screen.
The MON (monitor) mode screen appears.



Step 2 Press **F1** (**DIO**).
The MON-DIO mode screen appears.

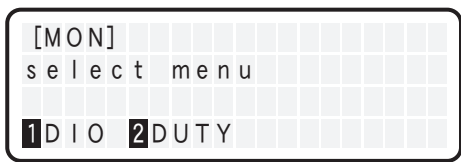


Step 3 Check the on/off status of I/O signals.
Each time the **DIO** key is pressed, the screen display changes as follows:
(The screen on the right shows the SINF monitor.)



For meaning of each display and for information on the displayed monitor type, refer to 6.1.1, "DIO monitor" in Chapter 6 of the "SR1 User's Manual" section.

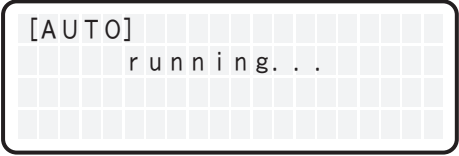
Step 4 Press **ESC** to return to the previous screen.



10.3.2 Displaying from the DIO key

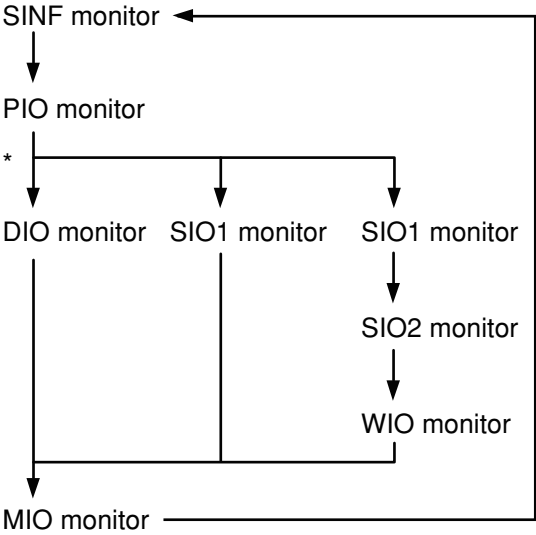
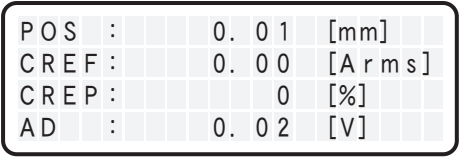
The I/O monitor can also be displayed by pressing the DIO key during robot operation or program editing.

Step 1 Press the DIO key.



Step 2 Check the on/off status of I/O signals.

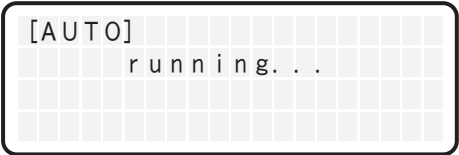
Each time the DIO key is pressed, the screen display changes as follows:
(The screen on the right shows the SIN F monitor.)



* The displayed monitor type differs depending on the I/O unit.

For meaning of each display and for information on the displayed monitor type, refer to 6.1.1, "DIO monitor" in Chapter 6 of the "SR1 User's Manual" section.

Step 3 Press ESC to return to the previous screen.



 **CAUTION** The DIO key is disabled during SYS (system) mode.

10.4 Displaying the memory I/O status

To display and check the memory I/O status, follow these steps.

Step 1 Press **F2** (**OPRT**) on the initial menu screen.

The OPRT (operation) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F2** (**STEP**) or **F3** (**AUTO**).

The STEP or AUTO mode screen appears.
The following steps are explained using the STEP mode screen.

```
[OPRT]
select menu
1ORG 2STEP 3AUTO
```

Step 3 Press **F4** (next) twice and then press **F1** (**MIO**).

The I/O status of each memory is displayed.

```
[STEP] 100% 0: 0
001:MOVA 254, 100
[ 0.00]
1MIO 2 3 4next
```

Step 4 Check the memory I/O status.

For meaning of each display, refer to 6.1.1, "DIO monitor" in Chapter 6 of the "SR1 User's Manual" section.

```
M 00000000 00000000
00000000 00000000
00000000 00000001
```

Step 5 Press **ESC** to return to the previous screen.

```
[STEP] 100% 0: 0
001:MOVA 254, 100
[ 0.00]
1MIO 2 3 4next
```

10.5 Displaying the variables

You can check the values of the point variable P, counter array variable C and counter variable D on the HPB screen.

Step 1 Press **F2** (**OPRT**) on the initial menu screen.

The OPRT (operation) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Press **F2** (**STEP**) or **F3** (**AUTO**).

The STEP or AUTO mode screen appears.
The following steps are explained using the STEP mode screen.

```
[OPRT]
select menu
1ORG 2STEP 3AUTO
```

Step 3 Press **F4** (next) and then press **F1** (VAL).

The value of each variable is displayed.
To view the variables for other tasks if a multi-task program is used, press **F3** (CHGT) and switch the task before pressing **F1** (VAL).

[STEP]	100%	0:		0
001:	MOVA	254,	100	
		[	0.00]	
1 VAL	2 S_ON	3 CHGT	4 next	

Step 4 Check the value of each variable.

From the left, each line shows the following memory I/O numbers.

P : Point variable

C : Counter array variable (Number in brackets () is the array element number selected with CSEL statement.)

D : Counter variable

[STEP]	100%	0:		0
	P =	0		
	C =	1	[0]	
	D =	2		

Step 5 Press **ESC** to return to the previous screen.

[STEP]	100%	0:		0
001:	MOVA	254,	100	
		[	0.00]	
1 VAL	2 S_ON	3 CHGT	4 next	

10.6 Displaying the system information

Step 1 Press **ESC** on the initial menu screen.
The system information is displayed.

[MENU]				
select	menu			
1 EDIT	2 OPRT	3 SYS	4 MON	

Step 2 Check the information.

The controller version number, HPB version number and robot type number are displayed. The screen automatically returns to the initial menu screen after about 2 seconds.

[INFORMATION]				
controller	V53.	01		
HPB	V23.	01		
robot type	4020			

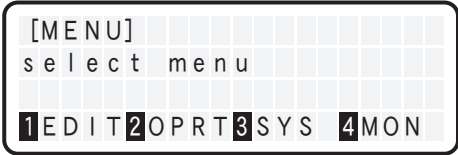
10.7 Using the duty (load factor) monitor

The duty monitor allows you to check the current robot operating status to find out to what degree (how hard) the robot can still work versus overload criteria. By checking the duty monitor, you can change the parameter settings and view the available duty to obtain optimal operating conditions.

To view the duty monitor on the HPB screen, follow these steps.

Step 1 Operate the robot.

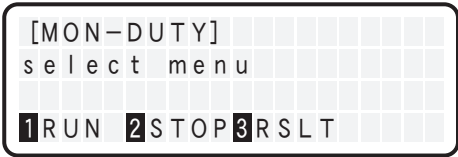
Step 2 Press **F4** (**MON**) on the initial menu screen.
The MON (monitor) mode screen appears.



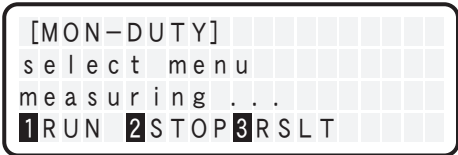
Step 3 Press **F2** (**DUTY**).
The MON-DUTY mode screen appears.



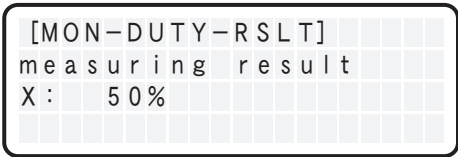
Step 4 Press **F1** (**RUN**) to start measuring the operation duty.



Step 5 Press **F2** (**STOP**) to stop measurement.
Pressing **F2** (**STOP**) retains the measurement data.



Step 6 Press **F3** (**RSLT**) to display the measurement data.
The operation duty value in the period from pressing the **F1** (**RUN**) up to pressing **F2** (**STOP**) is displayed as a percentage.



MEMO The operation duty can also be monitored while the program is being executed with a program command. For more information, see 6.1.2, "Duty (load factor) monitor" in Chapter 6 of the SR1 controller user's manual. The method for displaying the measurement result is the same as described above.

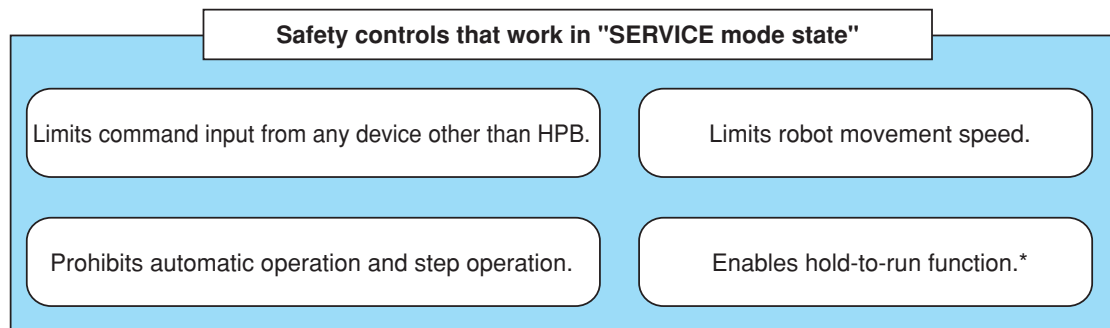
10.8 SERVICE mode function

● Function description

The robot operator or other persons sometimes need to enter the hazardous area in the robot safety enclosure and move the robot to perform robot maintenance or adjustment while using the HPB. This situation is referred to as "SERVICE mode state" and requires extra caution to prevent possible danger.

In "SERVICE mode state", some limits on controller operation are often necessary for operator safety. The SERVICE mode function puts some limits on controller operation when in "SERVICE mode state". When the SERVICE mode function is enabled, the following safety controls will work in "SERVICE mode state".

■ Safety controls that work in "SERVICE mode state"



* Hold-to-run function permits the robot to move only when the HPB key is kept pressed.

● How to use:

To use the SERVICE mode function, it must be enabled on the HPB. See 10.8.2, "Setting the SERVICE mode function on or off" in this chapter for instructions on how to enable or disable the SERVICE mode function.

When the SERVICE mode function is enabled, the controller constantly monitors status to check whether "SERVICE mode state" occurs. The SERVICE mode input (SVCE) is used to notify the controller whether the current state is a "SERVICE mode state".

Turning this input off (contact open) means that the current state is a "SERVICE mode state". For more details, see 3.5.1, "SAFETY connector functions and roles" in Chapter 3 of the "SR1 User's Manual" section.

In addition to enabling or disabling the SERVICE mode function itself, each safety control in "SERVICE mode state" can also be set separately. (See the next subsection, "Safety control description".) However, the SERVICE mode function is protected by a password so that the settings cannot be easily changed.

10.8.1 Safety control description

Safety controls that work in "SERVICE mode state" are explained below. See 10.8.3, "Setting the SERVICE mode safety control" in this chapter for instructions on how to set each safety control.



WARNING

The following safety controls can be cancelled at the user's own discretion. But extra caution must be taken to maintain safety since hazardous situations may occur.

1. Limiting command input from any device other than HPB

When the operator is working within the safety enclosure using the HPB, permitting any command input from devices (such as via I/O) other than the HPB is very hazardous to the operator using the HPB.



DANGER

When the operator is in the safety enclosure, a hazardous situation may occur if someone runs an automatic operation start command (AUTO-R) without letting the operator know about it.

To avoid this kind of hazard, only the HPB can be used to operate the robot in "SERVICE mode state", and all other device command inputs are disabled. However, this limitation can be cancelled even in "SERVICE mode state" to permit command inputs from other devices, provided the user takes responsibility for safety.

Setting	Description
0 (default)	Only command inputs from the HPB are permitted in "SERVICE mode state".
1	Only command inputs from the HPB and parallel I/O are permitted in "SERVICE mode state".
2	Only command inputs from the HPB and optional unit are permitted in "SERVICE mode state".
3	Any command input is permitted even in "SERVICE mode state".

2. Limiting the robot movement speed

Moving the robot at a high speed while the operator is working within the safety enclosure is very dangerous to that operator. Setting the robot movement speed to a safety speed of 250mm/s or less is advisable because most robot operation while the operator is working within the safety enclosure is for maintaining or adjusting the robot. In view of this, the robot movement speed in "SERVICE mode state" is limited to below 3% of maximum speed.

However, this speed limitation can be cancelled even in "SERVICE mode state" to set a speed higher than the safety speed, provided the user takes responsibility for safety.

Setting	Description
0 (default)	Robot movement speed is limited to 3% of maximum speed in "SERVICE mode state".
1	Robot movement speed is not limited even in "SERVICE mode state".

3. Limiting the automatic operation and step operation

Running an automatic operation or step operation while the operator is working within the safety enclosure is very dangerous to that operator.



When the operator is in the safety enclosure, a hazardous situation may occur if someone runs a robot program without letting the operator know about it.

To avoid this kind of hazard, automatic operation and step operation are basically prohibited in "SERVICE mode state". However, this limitation can be cancelled even in "SERVICE mode state" to permit automatic operation and step operation, provided the user takes responsibility for safety.

Setting	Description
0 (default)	Automatic operation and step operation are prohibited in "SERVICE mode state".
1	Automatic operation and step operation are permitted even in "SERVICE mode state".

4. Hold-to-Run function

If the robot continues to move while the operator is working within the safety enclosure without carrying the HPB, the operator may be exposed to a dangerous situation.



A hazardous situation may occur, for example, if the operator working within the safety enclosure should trip or fall by accident and blackout.

To prevent this kind of hazard in "SERVICE mode state", the Hold-to-Run function allows the robot to move only during the time that the HPB key is kept pressed. However, this Hold-to-Run function can be disabled even in a "SERVICE mode state", provided the user takes responsibility for safety.

Setting	Description
0 (default)	Hold-to-Run function is enabled in "SERVICE mode state".
1	Hold-to-Run function is disabled even in "SERVICE mode state".

10.8.2 Setting the SERVICE mode function on or off

To set the SERVICE mode function on or off, follow these steps. (Password is required to change the setting.)

Step 1 Press **F3** (SYS) on the initial menu screen.

The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Enter SYS-SAFE mode.

1. Press **F4** (next) to switch the menu display and then press **F1** (SAFE). The password entry screen appears.
2. Enter the password and press **↵**. The SYS-SAFE mode screen appears if the password is correct.

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

```
[SYS-SAFE]
Password: 33.01_
input password
```

Step 3 Press **F2** (SVCE).

The SYS-SAFE-SVCE (service) mode screen appears.

```
[SYS-SAFE]
select menu
1ACLV 2SVCE
```

Step 4 Press **F1** (SET).

The current SERVICE mode setting is displayed.

```
[SYS-SAFE-SVCE]
select menu
1SET 2DEV 3SPD 4next
```

Step 5 Set the SERVICE mode function.

To disable the SERVICE mode function, enter "0" with the number key and press **↵**.

To enable the SERVICE mode function, enter "1" with the number key and press **↵**.

```
[SYS-SAFE-SVCE-SET]
SERVICE mode = 0
0:Invalid 1:Valid
```



NOTE

The password is identical to the controller version number. For example, if the controller version is 33.01, then enter 33.01 as the password. Once the password is accepted, it will not be requested unless the HPB is disconnected from the controller or the controller is turned off.

10.8.3 Setting the SERVICE mode safety control

The SERVICE mode safety controls can be set separately. (Password is required to change the setting.)

Step 1 Press **F3** (SYS) on the initial menu screen.

The SYS (system) mode screen appears.

[MENU]									
select menu									
1	EDIT	2	OPRT	3	SYS	4	MON		

Step 2 Enter SYS-SAFE mode.

1. Press **F4** (next) to switch the menu display and then press **F1** (SAFE).
The password entry screen appears.
2. Enter the password and press **↵**.
The SYS-SAFE mode screen appears if the password is correct.

[SYS]									
select menu									
1	SAFE	2	OPT	3	UTL	4	next		

[SYS-SAFE]									
Password: 33. 01_									
input password									

Step 3 Press **F2** (SVCE).

The SYS-SAFE-SVCE (service) mode screen appears.

[SYS-SAFE]									
select menu									
1	ACLV	2	SVCE						

Step 4 Select the item whose setting you want to change.

- To change the setting that limits the operation device, press **F2** (DEV).
- To change the setting that limits the speed, press **F3** (SPD).
- To change the setting that limits step operation and automatic operation, press **F4** (next) and then press **F1** (RUN).
- To change the setting for the hold-to-run function, press **F4** (next) and then press **F2** (HtoR).
The current setting for the selected item will appear.

[SYS-SAFE-SVCE]									
select menu									
1	SET	2	DEV	3	SPD	4	next		

Step 5 Change the setting.

Enter the new setting with the number key and press **↵**.

The screen changes to the save mode.

[SYS-SAFE-SVCE-DEV]									
data = 0									
PB only									

Step 6 *Save the change.*

- To save the change permanently (retain the change even after controller is turned off), press **F1** (SAVE).
- To save the change temporarily (retain the change until controller is turned off), press **F2** (CHG).
- To cancel saving the change, press **F3** (CANCEL).
When any of the above operations is complete, the screen returns to step 5.

```
[SYS-SAFE-SVCE-DEV]
data = 1
PB/DI valid
1SAVE2CHG 3CANCEL
```

```
[SYS-SAFE-SVCE-DEV]
data = 1
PB/DI valid
```



NOTE

The password is identical to the controller version number. For example, if the controller version is 53.01, then enter 53.01 as the password. Once the password is accepted, it will not be requested unless the HPB is disconnected from the controller or the controller is turned off.

10.9 Displaying the hidden parameters

If you want to view hidden parameters that are usually not displayed on the HPB screen, follow the steps below.

Use extra caution to avoid inadvertently changing the parameters when hidden parameters are displayed.

Step 1 Press **F3** (SYS) on the initial menu screen.

The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 2 Enter UTL (utility) mode.

Press **F4** (next) to switch the menu display and then press **F3** (UTL).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

Step 3 Press **F1** (HDPR).

A message appears asking whether to display the hidden parameters.

```
[SYS-UTL]
select menu
1HDPR 2REC
```

Step 4 Press **F1** (yes) to permit display of hidden parameters.

If you do not want to display the hidden parameters, press **F2** (no). The screen returns to step 3.

```
[SYS-UTL-HDPR]
hidden parameter
displayed ?
1yes 2no
```

Step 5 Display a hidden parameter you want.

When **F1** (yes) was selected in step 4, you can now display the hidden parameters by using the procedure explained in section 5.1, "How to set the parameters" in Chapter 5.

```
[SYS-UTL]
select menu
1HDPR 2REC
```



NOTE

Display of hidden parameters is permitted until you press **F2** (no) in step 4 of the above procedure or the controller is turned off, or until the HPB is disconnected.



MEMO

Hidden parameter display is also permitted by turning on the power to the controller while holding down the **ESC** key on the HPB, or by connecting the HPB to the controller while holding down the **ESC** key.

10.10 Using SD memory cards

SD memory cards can be used with the HPB to back up controller data.

10.10.1 Before using an SD memory card

Supported SD memory card type

Only SD memory cards with a "FAT12/16" format can be used. These cards are provided by the customer.

The HPB does not offer the following functions when using SD memory cards:

- Volume label display and setting function
- Attribute change function
- Format function

Use a PC (personal computer) to format an SD memory card or change file attributes.



CAUTION

- The recommended SD memory card size is up to 32MB. Using a memory card size of 64MB or more might cause a message "FAT32" to appear as the preset value during format on Windows. Always select "FAT" at this time because the HPB cannot use FAT32.
- The maximum size of the controller data file backed up on the SD memory card is "328KB". The data file size is generally about "64KB" so up to 512 files can usually be stored on a 32MB memory card.

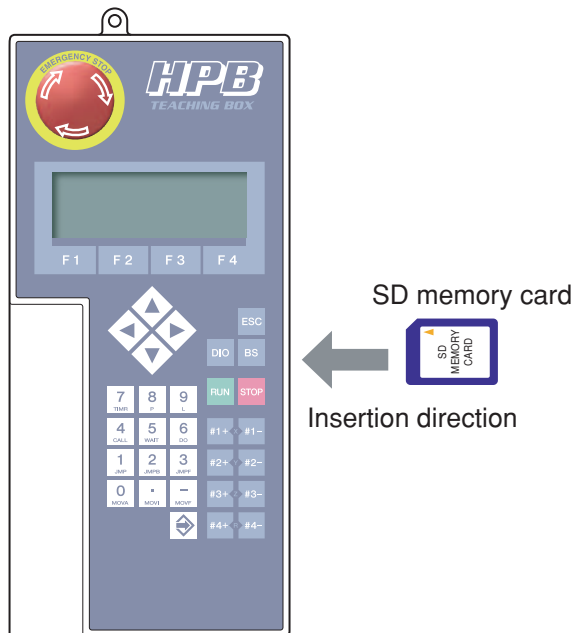
Inserting and ejecting an SD memory card

A push-push type (with breakage prevention mechanism for excessive-force ejection) is used for SD memory card insertion and ejection.

■ Inserting the card

Step 1 Insert the SD memory card into the SD memory card slot (connector).

■ Inserting the SD memory card (1)



Step 2 Push the SD memory card in until a click is heard, then release it.



CAUTION

Use care to avoid inserting the SD memory card in a reversed posture.

■ Ejecting the card

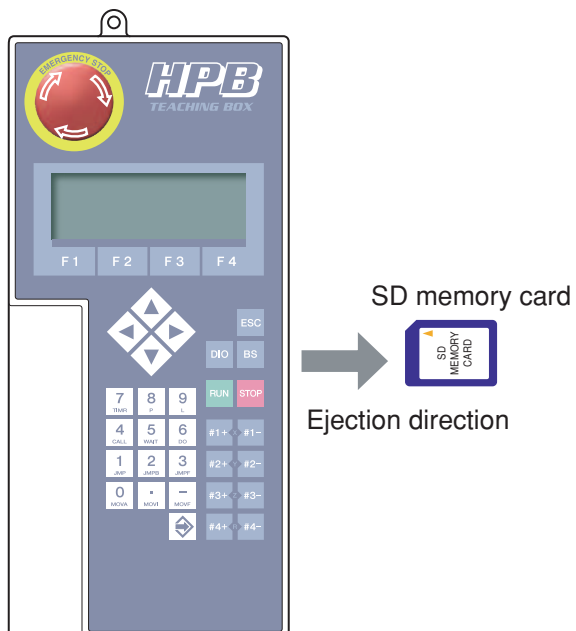
step 1 Push the SD memory card in until a click is heard, then release it.

■ Ejecting the SD memory card (1)



step 2 Remove the SD memory card from the SD memory card slot (connector).

■ Ejecting the SD memory card (2)



Loading backup data

Various data that have been backed up by other controller models can be loaded to the SR1 controller. Data that can be loaded differs according to the controller type and version number indicated on the first line of the data file. Various data that have been backed up by the SR1 controller can also be loaded to other controller models.

For details concerning the controller type and version checking procedure, see 10.10.6, "Displaying SD memory card file content". This controller type and version can also be checked by using the text editor on a PC.

■ **VIEW** screen

```
[VIEW] 0
000: S R C 5 3 0
008: 8 1 * * P R M 0
1 HEX 2 ASCII
```

- Controller type & version
(this example indicates "SRC[53.08]").

■ Data compatibility table (1)

[illegible]

"O" marks indicate that PGM (program data), PNT (point data), PRM (parameter data), ALL (program, point, and parameter data) can all be loaded.

"▲" marks indicate that only PGM (program data) and PNT (point data) can be loaded. PRM (parameter data) and ALL (program, point, and parameter data) cannot be loaded.

[Ex] When "SRC[53.08]" is indicated on the file's 1st line:



PGM (program data), PNT (point data), PRM (parameter data), ALL (program, point, and parameter data) can all be loaded to the SR1-X controller.

Only PGM (program data) and PNT (point data) can be loaded to SRC, SRCH, SRCX, SRCP, SRCD, ERCD, and SR1-P controllers.

[Supplemental Information]

The controller version is not indicated in newly created data (created by using the POPCOM support software) which is loaded to a controller by way of an SD memory card, and the file types are as shown in the table below.

■ Data compatibility table (2)

File's 1st line	Controller type																				
	SRCA	SRC	ERC	SRCH	DRCA	DRC-R	DRC	DRCH	TRCH 3 axes	TRCH 4 axes	SRCX	ERCX	DRCX	TRCX 2 axes	TRCX 3 axes	TRCX 4 axes	SRCP	SRCD	ERCD	SR1-X	SR1-P
SRC		△		△							△						△	△	△	△	△
DRC						△		△					△								
TRC2														△							
TRC3									△						△						
TRC4										△						△					
Other																					

"△" marks indicate that PGM (program data) and PNT (point data) can be loaded. When attempting to load PRM (parameter data) or ALL (program, point and parameter data), a warning message appears asking whether to load the data.

[Ex] When "SRC" is indicated on the file's 1st line:



PGM (program data) and PNT (point data) can be loaded to SRC, SRCH, SRCX, SRCP, SRCD, ERCD, SR1-X, and SR1-P controllers. When attempting to load PRM (parameter data) or ALL (program, point, and parameter data), a warning message appears asking whether to load the data.



CAUTION

If incorrect robot data is loaded to the SR1-X or SR1-P, this may impair robot controller performance and may also cause failures or malfunctions or errors, so use caution. The same holds true for other controller models.

10.10.2 Saving controller data to an SD memory card

Step 1 Insert an SD memory card into the HPB.

Step 2 Press **[F3]** (SYS) on the initial menu screen.

The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 3 Press **[F2]** (B.UP).

The screen changes to the data backup mode.

```
[SYS]
select menu
1PRM 2B. UP 3INIT 4next
```

Step 4 Press **[F1]** (CARD).

The screen changes to the memory card mode.

```
[SYS-B. UP]
select menu
1CARD 2FROM
```

Step 5 Press **[F1]** (SAVE).

```
[SYS-B. UP-CARD]
select menu
1SAVE 2LOAD 3LIST
```

Step 6 Specify the data to be saved.

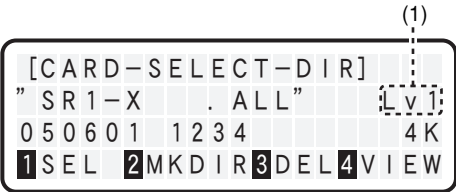
- Press **[F1]** (ALL) to save all data (program, point and parameter data).
- Press **[F2]** (ALM) to save the alarm history.
- Press **[F3]** (ERR) to save the error history.

```
[CARD-SAVE]
select menu
1ALL 2ALM 3ERR
```

Step 7 Specify the save destination.

Display the data save destination and press **F1** (SEL) or **↕**. Data save destinations can be displayed by the following 2 methods.

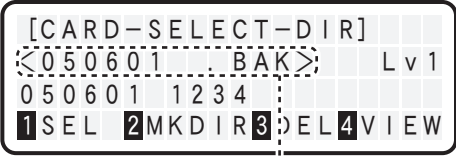
- **Saving in the root directory:**
 - * A "root directory" is the highest level directory in the hierarchy.



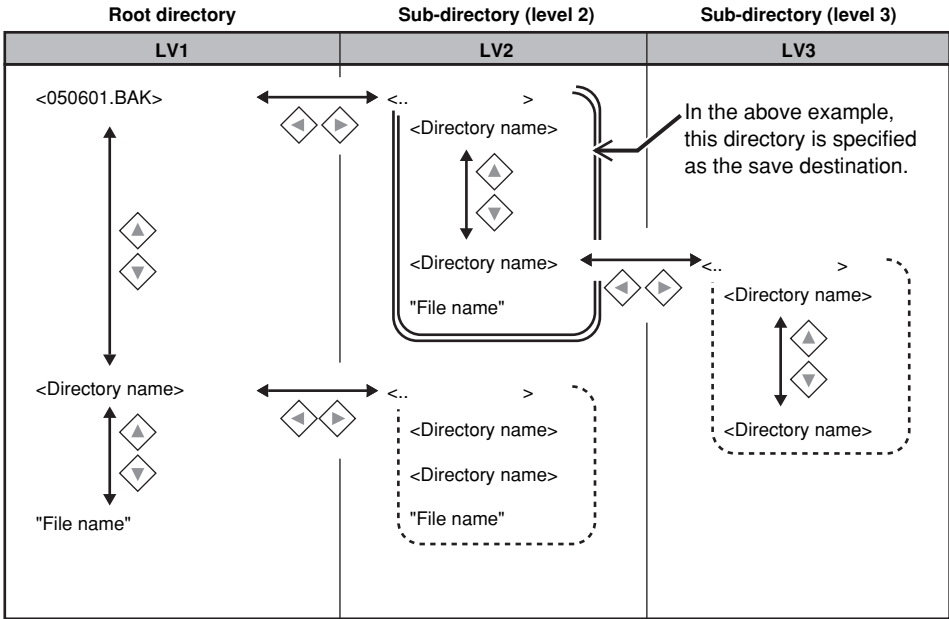
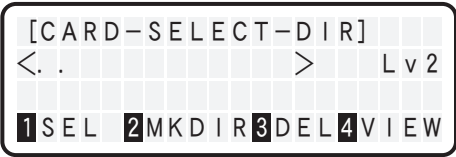
(1) "Lv" indicates the directory level.
("Lv1" denotes the root directory.)

- **Saving in a directory other than the root directory (sub-directory):**

Use the cursor keys (**↶**, **↷**, **↵**, **↴**) to specify the hierarchy level where the data is to be saved.



(1) Directory names are enclosed in angle-brackets (< >).



- Directory names are enclosed in angle-brackets (< >).
- File names are enclosed in quotation marks (" ").

Step 8 Assign a name to the file.

Enter a file name of up to 8 characters (alphanumeric characters, underscores (_), and hyphens (-) are permitted), then press . (File extensions are automatically added, and need not be entered.)

The character input procedure is described below.

(Character input procedure)

Select the desired characters from the character string displayed on the screen's 3rd line. Numerical values and hyphens can be entered directly from the number keys.

To select characters from the screen's 3rd line character string, use the left/right ( ) cursor keys to move the cursor in 1-character units, or use the up/down ( ) cursor keys to move the cursor in 10-character units.

When the cursor is positioned at the desired character, press  (keyIn). After entering the name, press .

Step 9 Press (yes) to save the data.

To cancel saving the data, press  (no). A "saving..." message appears during the save operation, and a "save complete" message then appears when the operation is complete.

```
[CARD-SAVE]
=          . ALL
ABCDEFGHIJKLMNOPQRST
1key in
```

```
[CARD-SAVE]
= SR1-X-1 . ALL
FGHIJKLMNOPQRSTUVWXYZ
1key in
```

```
[CARD-SAVE]
save OK ?
1yes 2no
```

```
[CARD-SAVE]
saving...          0KB
```

```
[CARD-SAVE]
save complete
```

**CAUTION**

- If an alarm occurs during save operation, the file being written is deleted without being destroyed.
- If connection with the controller is severed or the SD memory card is ejected during save operation, the file will be destroyed.
- Since the HPB uses FAT for file management which is usually used on Windows PC, non-contiguous files are created after repeatedly saving and deleting files, possibly reducing the file access speed. If this occurs, back up all files to a Windows PC and then copy only the required files.

**NOTE**

Data is saved in ASCII format and so can be used with the POPCOM support software.

10.10.3 Loading SD memory card data to the controller

Step 1 Insert an SD memory card into the HPB.

Step 2 Press **F3** (SYS) on the initial menu screen.
The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 3 Press **F2** (B.UP).
The screen changes to the data backup mode.

```
[SYS]
select menu
1PRM 2B. UP 3INIT 4next
```

Step 4 Press **F1** (CARD).
The screen changes to the memory card mode.

```
[SYS-B. UP]
select menu
1CARD 2FROM
```

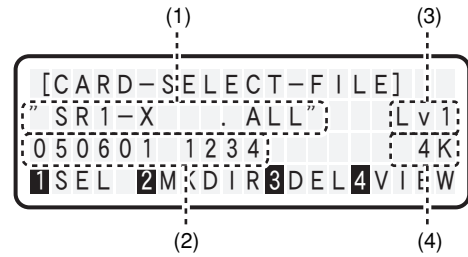
Step 5 Press **F2** (LOAD).

```
[SYS-B. UP-CARD]
select menu
1SAVE 2LOAD 3LIST
```

Step 6 Specify the file to be loaded.

- **Specifying a file in the root directory:**

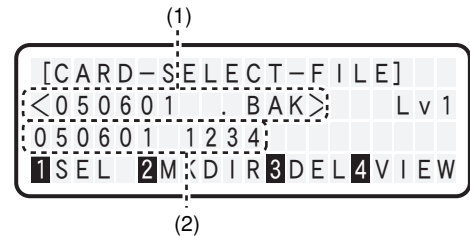
Use the up/down (▲▼) cursor keys to display the file to be loaded, then press **F1** (SEL) or **↵**.



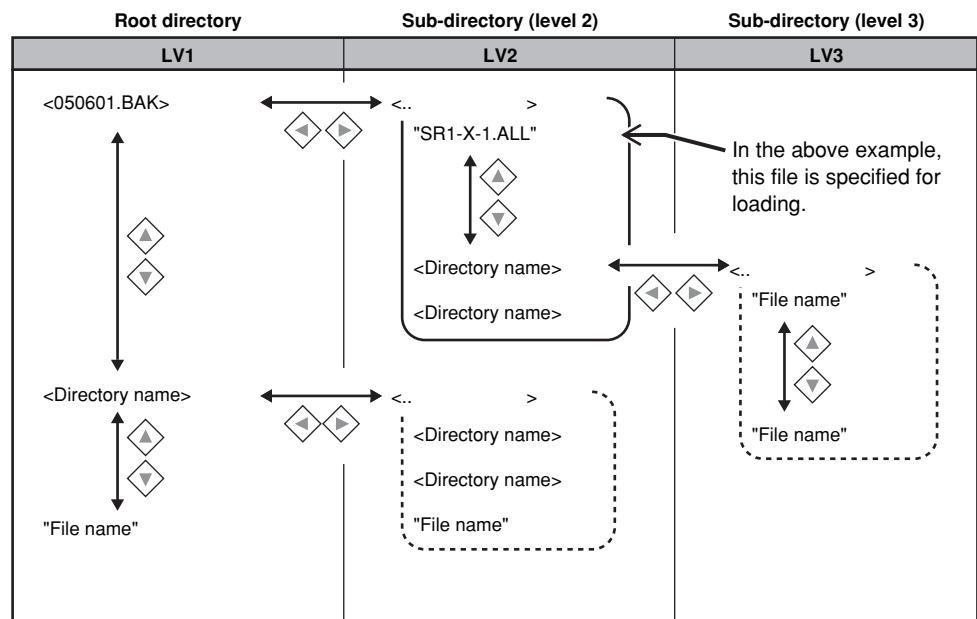
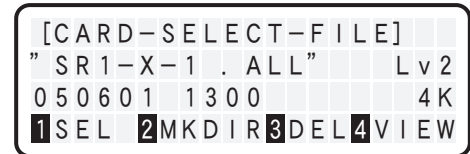
- (1) File names are enclosed in quotation marks (" ").
- (2) Indicates the date and time (no "secs." display).
- (3) "Lv" denotes the directory hierarchy level. ("Lv1" denotes the root directory.)
- (4) Indicates the file size (in Kbyte units).

- **Specifying a file in a directory (sub-directory) other than the root directory:**

Use the cursor keys (▲▼◀▶) to display the file to be loaded, then press **F1** (SEL) or **↵**.



- (1) Directory names are enclosed in angle-brackets (<>).
- (2) Indicates the date and time (no "secs." display).



- Directory names are enclosed in angle-brackets (<>).
- File names are enclosed in quotation marks (" ").

Step 7 Specify the data to be loaded.

- To load program data, press **F1** (PGM).
- To load point data, press **F2** (PNT).
- To load parameter data, press **F3** (PRM).
- To load all data (program, point, parameter data), press **F4** (ALL).

```
[CARD-LOAD]
select menu
1PGM 2PNT 3PRM 4ALL
```

Step 8 Check the message.

- An overwrite confirmation message appears only when **F1** (PGM) or **F2** (PNT) was selected in step 7.
- Press **F1** (yes) to retain program and point data which is not redundant.
- Press **F2** (no) to initialize all controller data and then load the new data.
- If **F4** (ALL) was selected in step 7, the controller's program and point data are initialized, and a load confirmation message then appears.

```
[CARD-LOAD]
program data
over write ?
1yes 2no
```

Step 9 Press **F1** (yes) to load the data.

To cancel loading the data, press **F2** (no).

A "loading..." message appears while the data is being loaded, and a "load complete" message then appears when loading is completed.

```
[CARD-LOAD]
program data
load OK ?
1yes 2no
```

```
[CARD-LOAD]
loading... 78%
```

```
[CARD-LOAD]
load complete
```

**CAUTION**

- Data is not loaded if the initializing processing fails in step 8. If an error occurs during data loading, the data that was loaded up to the point the error occurred remains in the controller because initialization was performed before loading the data.
- Do not eject the SD memory card during data loading.
- Since the HPB uses a FAT for file management which is usually used on Windows PC, non-contiguous files are created after repeatedly saving and deleting files, possibly reducing the file access speed. If this occurs, back up all files to a Windows PC and then copy only the required files.
- If incorrect robot data is loaded to the SR1-X or SR1-P, this may impair robot controller performance and may also cause failures or malfunctions or errors, so use caution.

10.10.4 Creating directories on the SD memory card

Step 1 Insert an SD memory card into the HPB.

Step 2 Press **F3** (SYS) on the initial menu screen.
The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 3 Press **F2** (B.UP).
The screen changes to the data backup mode.

```
[SYS]
select menu
1PRM 2B. UP 3INIT 4next
```

Step 4 Press **F1** (CARD).
The screen changes to the memory card mode.

```
[SYS-B. UP]
select menu
1CARD 2FROM
```

Step 5 Press **F3** (LIST).

```
[SYS-B. UP-CARD]
select menu
1SAVE 2LOAD 3LIST
```

Step 6 Specify the location where the directory is to be created.
Display the hierarchy level where the directory is to be created, then press **F1** (MKDIR). Below is the procedure for displaying the hierarchy level to create the directory.

- **Creating a directory in the root directory:**

- * A "root directory" is the highest level directory in the hierarchy.
- * An "empty" message appears if there are no files in the SD memory card.

```
[CARD-LIST]
"SR1-X . ALL"
050601 1234
1MKDIR 2DEL 3VIEW
```

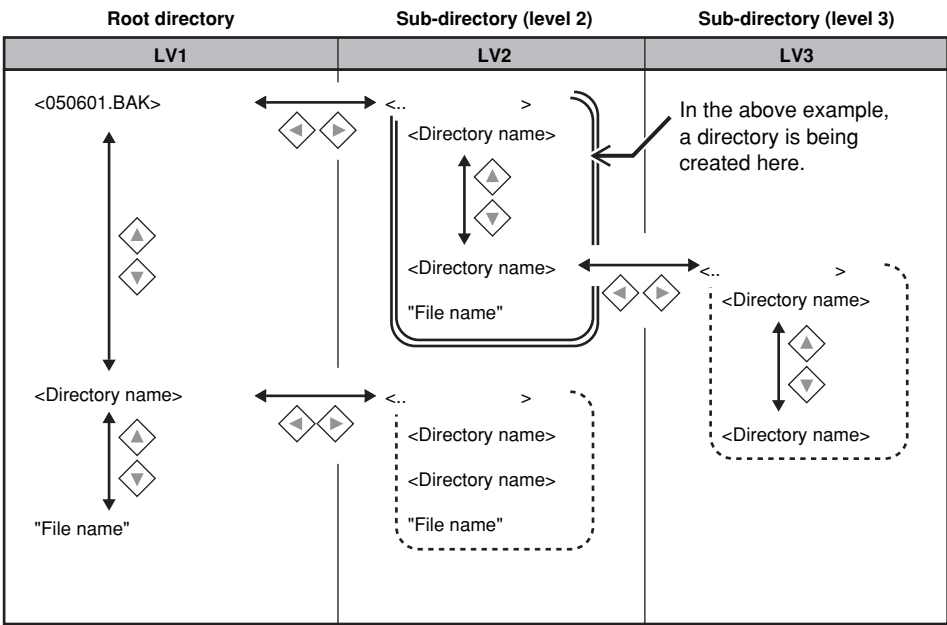
(1) "Lv" denotes the directory hierarchy level.
("Lv1" denotes the root directory.)

- **Creating a directory in a directory (subdirectory) other than the root directory:**

```
[CARD-LIST]
<050601 .BAK>      L v 1
050601 1234
1MKDIR2DEL3VIEW
```

Use the cursor keys (   ) to specify the hierarchy level where the directory is to be created.

```
[CARD-LIST]
<.. >      L v 2
1MKDIR2DEL3VIEW
```



- Directory names are enclosed in angle-brackets (< >).
- File names are enclosed in quotation marks (" ").

Step 7 Assign a name to the directory.

Enter a file name of up to 8 characters (alphanumeric characters, underscores (_), and hyphens (-) are permitted), then press .

A 8.3 file format is used (maximum 8-character string and maximum 3-character string).

The character input procedure is described below.

(Character input procedure)

Select the desired characters from the character string displayed on the screen's 3rd line. Numerical values and hyphens can also be entered directly from the number keys.

[	C	A	R	D	-	L	I	S	T	]										
=																				
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	
1	k	e	y		i	n														

To select characters from the screen's 3rd line character string, use the left/right

() cursor keys to move the cursor in

1-character units, or use the up/down

() cursor keys to move the cursor in

10-character units.

When the cursor is positioned at the

desired character, press  (keyin). After

entering the name, press .

[	C	A	R	D	-	L	I	S	T	]									
=		0	5	0	6	0	1	-	1	.	B	A	K						
A	B	C	D	E	F	G	H	I	J	<u>K</u>	L	M	N	O	P	Q	R	S	T
1	k	e	y		i	n													

Step 8 Press (yes) to create the directory.

To cancel creating the directory, press

 (no).

When the operation is complete, the

screen returns to step 6.

[	C	A	R	D	-	L	I	S	T	]									
c	r	e	a	t	e				?										
1	y	e	s			2	n	o											

**CAUTION**

When naming the directory, names that already exist in the same directory cannot be used.

**NOTE**

A directory hierarchy level down to level 8 (Lv1 to Lv8) can be selected as the directory creation level.

10.10.5 Deleting files and directories from the SD memory card

Step 1 Insert an SD memory card into the HPB.

Step 2 Press **F3** (SYS) on the initial menu screen.
The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 3 Press **F2** (B.UP).
The screen changes to the data backup mode.

```
[SYS]
select menu
1PRM 2B. UP 3INIT 4next
```

Step 4 Press **F1** (CARD).
The screen changes to the memory card mode.

```
[SYS-B. UP]
select menu
1CARD 2FROM
```

Step 5 Press **F3** (LIST).

```
[SYS-B. UP-CARD]
select menu
1SAVE 2LOAD 3LIST
```

Step 6 Select the file or directory to be deleted.

Use the cursor keys (▲▼◀▶) to display the file or directory to be deleted, then press **F2** (DEL).

(A directory cannot be deleted if it contains subdirectories and files. Always first delete the directories and files in the order from the lower hierarchy levels.)

```
[CARD-LIST]
"SR1-X-1 . ALL"      Lv 2
050601 1300          4K
1MKDIR 2DEL 3VIEW
```

Step 7 Press **F1** (yes) to delete the file or directory.

To cancel the deletion, press **F2** (no).
When the deletion is complete, the screen returns to step 6.

```
[CARD-LIST]
delete ?
1yes 2no
```

**CAUTION**

- A directory cannot be deleted if it contains subdirectories and files. Always first delete the directories and files in the order from the lower hierarchy levels.)
- Data is not loaded if the initializing processing fails in step 8. If an error occurs during data loading, the data that was loaded up to the point the error occurred remains in the controller because initialization was performed before loading the data.
- System files and hidden files are displayed, but cannot be deleted. Likewise, read-only files cannot be deleted.
- Since the HPB uses a FAT for file management which is usually used on Windows PC, non-contiguous files are created after repeatedly saving and deleting files, possibly reducing the file access speed. If this occurs, back up all files to a Windows PC and then copy only the required files.

10.10.6 Displaying SD memory card file content

Step 1 Insert an SD memory card into the HPB.

Step 2 Press **F3** (**SYS**) on the initial menu screen.
The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

Step 3 Press **F2** (**B.UP**).
The screen changes to the data backup mode.

```
[SYS]
select menu
1PRM 2B. UP 3INIT 4next
```

Step 4 Press **F1** (**CARD**).
The screen changes to the memory card mode.

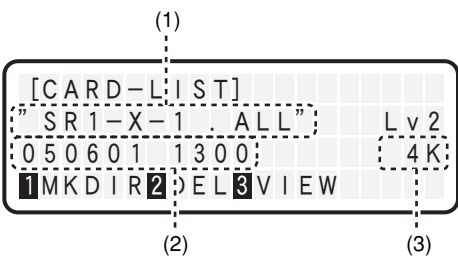
```
[SYS-B. UP]
select menu
1CARD 2FROM
```

Step 5 Press **F3** (**LIST**).

```
[SYS-B. UP-CARD]
select menu
1SAVE 2LOAD 3LIST
```

Step 6 Specify the file with the content to be displayed.

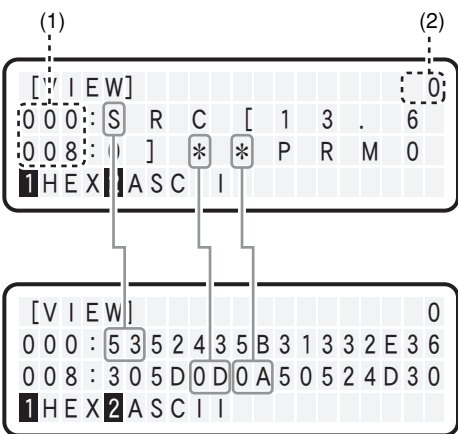
Use the cursor keys (   ) to display the file name, then press  (VIEW) to display its content.



- (1) File names are enclosed in quotation marks (" ").
- (2) Indicates the date and time (no "secs." display).
- (3) Indicates the file size (in Kbyte units).

Step 7 Display the file content.

The file content is displayed in ASCII form. To display it in hexadecimal form, press  (HEX). To switch from a hexadecimal display to an ASCII display, press  (ASCII).



- (1) The first character position of the displayed character string is displayed in hexadecimal form.
- (2) First character position of the displayed character string (in the above example, "S" is the 0 character position.)



NOTE

In ASCII form, 0x20 to 0x7E and 0xA1 to 0xDF are displayed, and all others are expressed by an asterisk (*).

10.11 Displaying the error and alarm histories

Errors and alarms that have occurred in the past can be checked by displaying their histories on the HPB screen.

A maximum of 100 errors and alarms are respectively stored.

Step 1 Press **F3** (SYS) on the initial menu screen.

The SYS (system) mode screen appears.

[MENU]									
select menu									
1	EDIT	2	OPRT	3	SYS	4	MON		

Step 2 Enter UTL (utility) mode.

Press **F4** (next) to switch the menu display and then press **F3** (UTL).

[SYS]									
select menu									
1	SAFE	2	OPT	3	UTL	4	next		

Step 3 Press **F2** (REC).

[SYS-UTL]									
select menu									
1	HDPR	2	REC						

Step 4 Display the error or alarm history.

Press **F1** (ALM) to display the alarm history stored in the SR1 controller.

Press **F2** (ERR) to display the error history stored in the SR1 controller.

[SYS-UTL-REC]									
select menu									
1	ALM	2	ERR	3	INF				

Step 5 Check the error or alarm history.

One screen shows the past 4 errors or alarms in the order from the most recent one.

Pressing ◀ or ▶ scrolls the screen to the right or left to make the hidden items visible.

Pressing ▲ or ▼ scrolls through the error list or alarm list.

The error list shows the following items.
00 : 06/07/31, 10:20:56 CMU, 62:Interlock

↓ ↓ ↓ ↓
① ② ③ ④

- ① Error number
- ② Time the error occurred
- ③ Movement command mode immediately before the error occurred
CMU : HPB or RS-232C control
PIO : Parallel I/O control
SIO : Serial I/O control
WIO : Remote command control
- ④ Error description
See Chapter 7, "Message lists" in the "SR1 User's Manual" section for detailed information.

00	:	06	/	07	/	31	,	10	:	20	:	56
01	:	06	/	07	/	28	,	17	:	54	:	20
02	:	06	/	07	/	25	,	17	:	16	:	47
03	:	06	/	07	/	25	,	09	:	18	:	25

The alarm list shows the following items.
00 : 06/07/30, 11:52:30 X04:POWER DOWN

↓ ↓ ↓
① ② ③

- ① Alarm number
- ② Time the alarm occurred
- ③ Alarm description
See Chapter 8, "Troubleshooting" in the "SR1 User's Manual" section for detailed information.

00	:	06	/	07	/	30	,	11	:	52	:	30
01	:	06	/	07	/	24	,	13	:	33	:	34
02	:	06	/	07	/	24	,	12	:	39	:	58
03	:	06	/	07	/	23	,	15	:	01	:	20

Step 6 Press ESC to return to the previous screen.

10.12 Displaying the alarm information

The position and I/O information when an alarm was issued can be checked.

- Step 1** Press **F3** (**SYS**) on the initial menu screen.
The SYS (system) mode screen appears.

```
[MENU]
select menu
1EDIT 2OPRT 3SYS 4MON
```

- Step 2** Press **F4** (**next**) to switch the menu display and then press **F3** (**UTL**).

```
[SYS]
select menu
1SAFE 2OPT 3UTL 4next
```

- Step 3** Press **F2** (**REC**).

```
[SYS-UTL]
select menu
1HDPR 2REC 3TIME
```

- Step 4** Press **F3** (**INF**).

```
[SYS-UTL-REC]
select menu
1ALM 2ERR 3INF
```

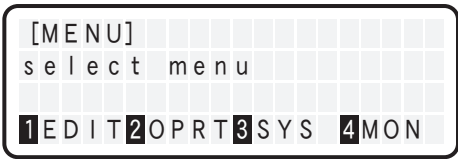
- Step 5** Alarm information appears on the screen.

Pressing  or  scrolls through the alarm screen.

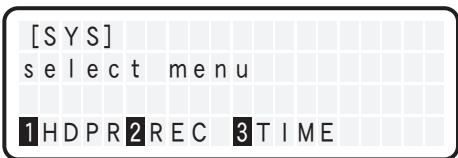
```
3 1 : OVERLOAD
MODE : HOLD
POS : -7.45mm
PNT : 1
```

10.13 Setting the clock

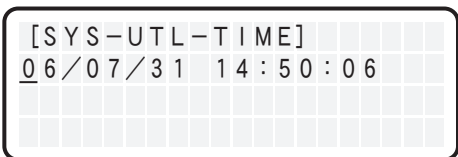
Step 1 Press **F3** (**SYS**) on the initial menu screen.
The SYS (system) mode screen appears.



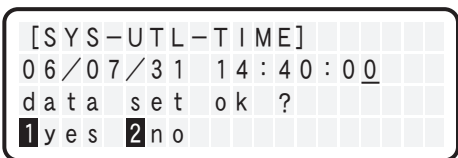
Step 2 Press **F4** (next) to switch the menu display and then press **F3** (UTL).



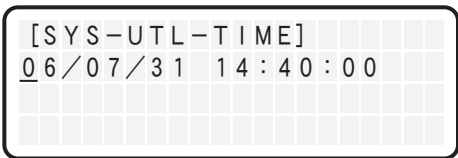
Step 3 Press **F3** (TIME).
The currently set date and time appear.



Step 4 Make the new settings.
Set the date and time with the number keys and press **↵**.



Step 5 Check the new settings and press **F1** (yes).
The newly set date and time are displayed.



11. Error and alarm

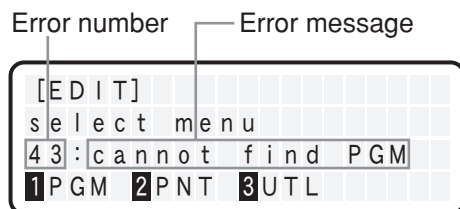
If the wrong operation or an operation error is detected, the error number and message appear on the HPB screen. If a problem occurs, the alarm number and message appear.

For a description of the error message and alarm message, see Chapters 7 and 8 in the "SR1 User's Manual" section.

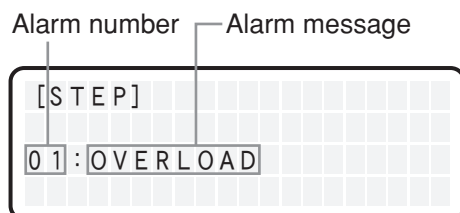
If an error related to the HPB occurs, only the error message is displayed. (See section 11.1, "HPB error message list" in this chapter.)

The followings are typical error and alarm messages that might appear on the HPB screen.

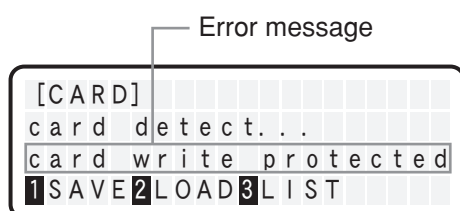
■ Error message example



■ Alarm message example



■ Example of HPB related error message



11.1 HPB error message list

When an HPB-related error occurs, only the error message appears. The table below shows HPB error messages and the action to take.

Message	SIO error
Meaning	(1) HPB was connected while dedicated input was on. (2) No response from controller. (3) Incompatible controller was connected to HPB.
Action	(1) Turn off all dedicated inputs when connecting the HPB. (2) Reconnect the HPB or turn off the controller power and back on. (3) Upgrade the HPB version.
Message	card not exist
Meaning	There is no SD memory card.
Action	Insert an SD memory card into the SD memory card slot.
Message	card failed
Meaning	Failed to detect an SD memory card.
Action	- Remove the SD memory card, and then reinsert it. - Run "chkdsk" at the command prompt on a Windows PC to check the card.
Message	card failed (FAT)
Meaning	SD memory card is not formatted for FAT (12 or 16).
Action	Format the card in FAT (12 or 16) on a Windows PC. Note: Only FAT (12 or 16) format can be used with HPB.
Message	card full
Meaning	There is no area available on the SD memory card for creating a file.
Action	Delete unneeded files or use a new SD memory card and make a subdirectory.
Message	card empty
Meaning	There are no files or subdirectories on the SD memory card.
Action	Using a Windows PC, check for files or subdirectories.
Message	card write-protected
Meaning	The write-protect switch on the SD memory card is set to write-prohibit.
Action	Set the write-protect switch on the SD memory card to write-permit.
Message	card read error
Meaning	Failed to read the SD memory card.
Action	- If the SD memory card was removed during LOAD or VIEW, then try to read it again. - If the SD memory card was removed during SAVE or while making a directory (MKDIR) or deleting a file/subdirectory (DEL), then its file system is damaged, so quickly run "chkdsk/f" at the command prompt on a Windows PC to repair it.

Message	card write error
Meaning	Failed to write on the SD memory card.
Action	• If the memory card became full during SAVE, then the last file being saved was lost so delete it, and try writing again after deleting unneeded files or inserting a new SD memory card. • If the memory card became full while making a directory (MKDIR), then try writing again after deleting unneeded files or inserting a new SD memory card. • If the SD memory card was removed during SAVE or while making a directory (MKDIR) or deleting a file/subdirectory (DEL), then its file system is damaged, so quickly run "chkdsk/f" at the command prompt on a Windows PC to repair it.
Message	access denied
Meaning	The subdirectory itself (<.. >), non-empty subdirectories, and system/hidden/read-only files and directories cannot be deleted.
Action	• To delete (DEL) a subdirectory, first delete the files within the directory. • Check the contents of the directories and files on a Windows PC. If these are system/hidden/read-only files and directories, then change their attributes.
Message	name already exist
Meaning	Name of an already existing file or subdirectory was specified.
Action	Specify a different name.
Message	file empty
Meaning	File is empty.
Action	Use another file.
Message	no data loaded
Meaning	The specified type of data is not contained in the file.
Action	• Specify another file when loading data (LOAD). • Specify another type of data when loading data (LOAD).
Message	cannot access
Meaning	Prohibited operation at that access level was attempted
Action	Change the access level.

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12. Specifications

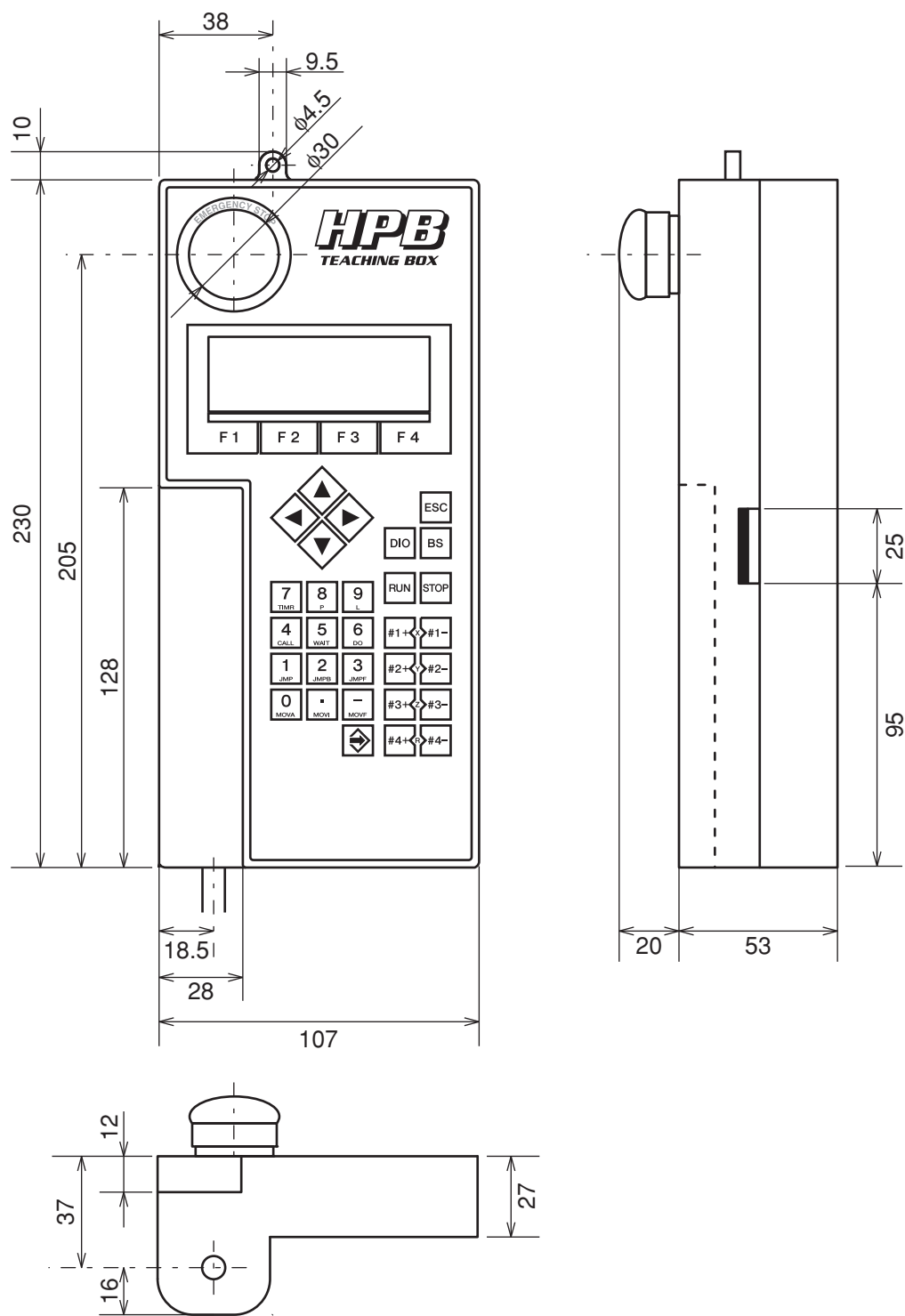
12.1 HPB specifications

Item		Specification
Basic specifications	Outer dimensions	W107 × H230 × D53mm (not including strap holder and emergency stop button)
	Weight	650g
	Power consumption	5V, 200mA or less
	Power supply	DC 12V (supplied from controller)
	Cable length	3.5m
External inputs/outputs	Interface	RS-232C 1CH (dedicated for communication with controller)
	Display	Monochrome LCD, 20 chars. × 4 lines
	Operation keys	Membrane sheet keys
	Emergency Stop button	Normally closed contact (with lock function)
	Auxiliary memory device	SD memory card (FAT 12/16 format)
General specifications	Ambient operating temperature	0 to +40°C
	Ambient storage temperature	-10 to +65°C
	Ambient operating humidity	35 to 85% RH (no condensation)
	Noise immunity	Conforms to IEC61000-4-4 level 2
Others	Compatible controllers	Compatible with all controllers where HPB use is possible.

12.2 Dimensions

■ Dimensional outlines

Units: mm



MEMO

User's Manual

YAMAHA **SR1 series** **Robot Controller**

Dec. 2009

Ver. 3.07

This manual is based on Ver. 3.07 of Japanese manual.

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IM Operations

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