Operation Guide
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1. Teaching Pendant (TP) Outline

1-1 Nomenclature

① Operation keys: The entire area which can be removed is known as the key sheet. One side is in Japanese, and the other side in English.

② Liquid Crystal Display (LCD): Explained later.

③ LED lamp area: Explained later.

④ Safety switch: Explained later.

⑤ Liquid crystal contrast adjustor: Adjusts the liquid crystal’s back-light.

⑥ Emergency stop switch: A hard-wire logic type emergency switch.

⑦ Magnetic rubber sheet: Enables the Teaching Pendant to be attached to the controller, etc.

NOTE
Remove and replace the Teaching Pendant by pressing the INS./EJECT switch on the front panel of the controller. Also, fix the controller to the connector with screws.
1-2 Liquid Crystal Display Meanings

The main liquid crystal display (LCD) screen for each Teaching Pendant is as follows:

EXEC R1* T12 5%STP
0039 INT: 1, J, K
0040 DO VEL(20) P1(START)STEP1LINE >>

- Mode, task name, program type name and other status information.
- Program, data, selection items, etc. These two lines can be scrolled.
- Menu. These items can be selected with the [F1] through [F4] keys on the Teaching Pendant.
1-3 LED Lamp Meanings

ACTIVE TP: Indicates that the Teaching Pendant is able to operate the robot. Set with the Teaching Pendant’s ONLINE key.

SERVO: Will be illuminated if even one of the robot’s servos is enabled.

TASK RUN: Illuminated when even one task is operating.

ROBOT MANUAL: Illuminated when the robot is moved by press the robot operation keys.

1-4 Safety Switch

Any operations which relate to the arm movement, become effective only when this switch is pressed.

- Servo-on
- Arm movement of each axis
- Home return movement
- Point GO movement

NOTE

If you remove your hand from the switch during movement, the arm stops at the position.

Refer to section “Safety Instruction: 3-2 Safety functions”.
(1) Mode selection key

Operations with the Teaching Pendant can be largely divided in the teaching mode and the execution mode. Robot manual operations and point teaching is carried out in the teaching mode. Program debugging and continual operations are carried out in the execution mode.

Enters the teaching mode. All tasks are stopped in general, but it is possible to avoid the deliberate stopping of tasks other than robot tasks by setting flags. Refer to section 5-2 for further details on when the TEACH key is pressed.

Enters the execution mode. It is not possible to enter this mode if there are currently not task programs selected. Refer to section 5-3 for further details on when the PROG. EXEC. key is pressed.

(2) Task selection key

There are four different types of tasks handled by the controller; robot tasks, PLC task, peripheral tasks and system task. The Teaching Pendant can only handle one task at a time, and that task is selected with this key. In other words, monitoring, speed, settings and program type selection operations are all related to the selected task.

Selects the robot task.

Selects the PLC task. Robot operations cannot be performed in the teaching mode when PLC task is being selected.

Selects the peripheral tasks. As multiple peripheral tasks exist, a selection between 1 and 8 is carried out during peripheral selection. Robot operations cannot be performed in the teaching mode when peripheral tasks are being selected.

Selects the system task. Robot operations cannot be performed in the teaching mode when system task is being selected.
(3) Menu selection keys
There are cases where menu F1 - F4 on the 4th line of the LCD screen are selected with the Teaching Pendant’s basic operations. Selection in this situation is carried out with the [F1] - [F4] and [QUIT] keys at the top of the Teaching Pendant.

Ignores the various operations displays on the LCD and moves to the previous menu.

Selects items from the menu displayed on the 4th line of each LCD operation screen.

(4) Cursor keys
Most operations are performed with these cursor keys. These keys are used for scrolling, selection, cursor movement, speed setting and number setting, etc. It is possible to speed up scrolling by pressing the [FAST] key simultaneously. Continual pressure on the keys will also enable continual operations.

Manual robot operations are only possible when the ‘ROBOT MANUAL’ LED is illuminated. Horizontal articulated robots move in the Y coordinate direction, and Cartesian robots move with the Y axis.
Program scroll, selection item scroll, and 1-9 input for numerals and 1-9 and A-F input for hexadecimals is possible when the ‘ROBOT MANUAL’ LED is not illuminated. The symbols ↑ and ↓ represent these keys in this manual.

Manual robot operations are only possible when the ‘ROBOT MANUAL’ LED is illuminated. Horizontal articulated robots move in the X coordinate direction, and Cartesian robots move with the X axis.
The cursor can be moved left or right when the ‘ROBOT MANUAL’ LED is not illuminated. The symbols ← and → represent these keys in this manual.

(5) Robot operation keys
The following keys are for the specific use of manual robot operations in the teaching mode.

Rotates the 1st arm of the horizontal articulated robot.

Rotates the 2nd arm of the horizontal articulated robot.

Raises and lowers the robot’s Z axis.

Rotates the robot’s R axis.
(6) Shift keys
These keys will change the speed of each operation when pressed in combination with the cursor keys or robot operation keys.

The speed of movement will be reduced when pressed together with the robot operation key in the teaching mode.

The speed of movement will be increased when pressed together with the robot operation key in the teaching mode.

Scrolling and cursor movement will also be speeded up when pressed together with the cursor keys displayed on each operation screen.

(7) Numeral keys
Used for the numerical input of point data and variables.

Period point. Also used to separate the n and m values when inputting Pn(m) point data numbers.

Minus mark.

(8) Special teaching mode keys
The following keys are mostly used in the teaching mode.

Enters the menu in which robot point data is handled. It can also be used for point movement in addition to point data display, teaching, modification and copying, etc. Refer to section 5-2-1 (3) for further details on when the POINT key is pressed.

Switches the robot’s servo on and off.

(9) Special execution mode keys
The following keys are mostly used in the execution mode.

Enables variables and other values used in the program to be viewed during the program execution. INT variables, REAL variables and POINT variables, etc., can be monitored and amended for LUNA tasks (robot, peripheral, system).

It is possible to write the values for relay, keep relay, timer and counter, etc., when a PLC task has been selected.

Refer to section 5-3-1 (4) for further details on when the TASK MONIT. key is pressed.
<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL TASK</td>
<td>Enters the menu in which all tasks can be stopped.</td>
</tr>
<tr>
<td>STOP</td>
<td>Sets the override speed for robot operations. The speed becomes the percentage specified with the VEL operation speed in the program. Increase the speed gradually when in the debug mode having performed confirmation with 5% and 10%. Refer to section 5-3-1 for further details on when the SPEED % key is pressed.</td>
</tr>
<tr>
<td>OVERRIDE</td>
<td></td>
</tr>
<tr>
<td>SPEED  %</td>
<td></td>
</tr>
<tr>
<td>I/O</td>
<td>Displays or sets the controller’s user I/O. Refer to section 5-5 for further details on when the I/O key is pressed.</td>
</tr>
<tr>
<td>ROBOT Q STOP</td>
<td>Stops the robot in the shortest possible time. This can be used not only when the robot program is running, but also during home return movement and point GO movement.</td>
</tr>
<tr>
<td>HELP</td>
<td>Displays descriptions of teaching pendant operation methods. Refer to section 5-6-2 for further details on when the HELP key is pressed.</td>
</tr>
<tr>
<td>OPTION</td>
<td>An operation switch for optional functions. Refer to the operation manual for further details on this.</td>
</tr>
<tr>
<td>PROG. TYPE</td>
<td>Enters the menu in which program type selection is performed. The robot tasks and PLC task store multiple programs, and it is possible to switch between them. In this case, an execution program is selected.</td>
</tr>
<tr>
<td>ONLINE TO</td>
<td>Selects the terminal from which to control the robot. Robots can be controlled from not only the Teaching Pendant, but also from personal computers and other external on-line devices, and this key switches between them. The Teaching Pendant has the top priority, so all control signals from personal computers or external devices will be ignored when the Teaching Pendant has selected itself. Refer to section 5-6-1 for further details on when the ONLINE key is pressed.</td>
</tr>
<tr>
<td>ON/OFF</td>
<td></td>
</tr>
<tr>
<td>MANAGE</td>
<td>Handles robot initial settings and home return, and all controller settings and information such as error history and diagnostics. Refer to section 5-4 for further details on when the MANAGE key is pressed.</td>
</tr>
</tbody>
</table>
2. Main Operation System Diagrams

Teaching mode (during robot task selection)
- Servo ON/OFF
- Brake ON/OFF (only when the servo is OFF)
- Manual operations for each robot axis (only when the servo is ON)
- Settings — Manual movement speed setting
- GO position specification

Point
- Teach
  - GO (point raise stand-by movement)
- Display
  - Amendment
  - Copy (copy between points)
- Movement
  - Direct GO (direct point movement)
  - Line GO (point direct linear interpolation movement)
  - Speed (point movement speed)

Teaching mode (during PLC, peripheral and system task selection)
- Settings
  - Stop/continual flag setting when get into the teaching mode.
  - Stop/continual flag setting when the emergency stop occurs.
  - Stop/continual flag setting when error occurs.
Execution mode (during robot, peripheral and system task selection)

- Start
- STEP execution
- Line execution
- toRET (execute up until the RET command)
- Until ▶ (execute up until the cursor position)
- Stop.
- Initialize (preparation for program re-start)
- Break point setting  □ Break 1
  □ Break 2
- Display (line search)  □ Specified line display
  □ Top line display
  □ Bottom line display
- Override speed %
- All task stop

Monitor  □ INT variables
  □ REAL variables
  □ POINT variables
  □ Point data
  □ Common INT variables (DATI)
  □ Common REAL variables (DATR)
  □ STRING variables
  □ Array INT variables
  □ Array REAL variables
Execution mode (during PLC task selection)

- Start
- 1 scan execution
- Line execution
- toEND (execute up until the END command)
- Until ▶ (execute up until the cursor position)
- Stop
- Initialize (preparation for program re-start)
- Scan time (program operation distribution setting for PLC and the robot)
- Break setting
  - Relay selection for relevant break
  - Rising edge/falling edge selection
  - Counter value setting
- Display (line search)
  - Specified line display
  - Top line display
  - Bottom line display
- All task stop
- Monitor
  - Relay
  - Keep relay
  - Timer
  - Counter
  - Input relay
  - Output relay
  - Special relay
  - Label
Management

- Home return
  - Start
  - Axis sequence setting
  - Home return position setting

- Constant setting
  - System limit
  - System offset

- Task list
- Program type list
- PC card

- Diagnostics
  - Hard IN
  - Hard OUT
  - Sensor and position counter

- Error history
- TPWRITE monitor
- Clock setting
- Information
3. Major Operation-Related Terminology

3-1 Task

The term 'task' as it is used here is an independent program unit that is capable of control, and each task executes one user program. The types of available tasks are as follows.

<table>
<thead>
<tr>
<th>Name</th>
<th>Abbreviation</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robot tasks 1～8</td>
<td>R1～8</td>
<td>Executes LUNA programs in which robot operations are mentioned. Communication, I/O and other commands as well as robot commands can also be used. Tasks are stopped when emergency stop occurs and when errors occur within any task. One robot task is run for each robot unit, but a maximum of eight exist in accordance with the robot configuration. Usually only is used.</td>
</tr>
<tr>
<td>PLC task</td>
<td>PLC</td>
<td>Executes PLC programs written with Boolean algebra. Is used for control when the I/O is at high speed. Will not stop when emergency stop occurs or when errors occur within any task, but will continue operations.</td>
</tr>
<tr>
<td>Peripheral tasks 1～8</td>
<td>P1～8</td>
<td>Executes LUNA programs that use commands other than robot operations. Freely uses communication and simple I/O control, and data processing, etc. Depending on settings, it will not stop when emergency stop occurs or when errors occur within any task, but will continue operations.</td>
</tr>
<tr>
<td>System task</td>
<td>SYS</td>
<td>Tasks that automatically start executing the moment mains power is switched on with an external SYSRUN input signal. Executes LUNA programs that use commands other than robot operations. Also uses special system task commands, such as running other tasks and interruption processing during emergency stop, etc. Depending on settings, it will not stop when emergency stop occurs or when errors occur within any task, but will continue operations.</td>
</tr>
</tbody>
</table>

The Teaching Pendant will only allow one of the above tasks to be selected. When multiple tasks are required, task switching can be carried out by selecting the four task selection keys located at the bottom of the Teaching Pendant.
3-2 Program Type

Program types are the area numbers for storing user programs. Although the number allocation does not run sequentially from 0, the allocations are closely related to the tasks.

<table>
<thead>
<tr>
<th>Program type</th>
<th>Task</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>0~15</td>
<td>R1</td>
<td>Program area for robot task 1. Robot task 1 is between 0 and 15, and the program which exists for the selected type is executed.</td>
</tr>
<tr>
<td>20~29</td>
<td>R2</td>
<td>Program area for robot task 2</td>
</tr>
<tr>
<td>30~39</td>
<td>R3</td>
<td>Program area for robot task 3</td>
</tr>
<tr>
<td>40~49</td>
<td>R4</td>
<td>Program area for robot task 4</td>
</tr>
<tr>
<td>50~59</td>
<td>R5</td>
<td>Program area for robot task 5</td>
</tr>
<tr>
<td>60~69</td>
<td>R6</td>
<td>Program area for robot task 6</td>
</tr>
<tr>
<td>70~79</td>
<td>R7</td>
<td>Program area for robot task 7</td>
</tr>
<tr>
<td>80~89</td>
<td>R8</td>
<td>Program area for robot task 8 (Exists in accordance with robot configuration)</td>
</tr>
<tr>
<td>90~93</td>
<td>PLC</td>
<td>Program area for PLC task. PLC task execute the program which exists for the selected type between 90 and 93.</td>
</tr>
<tr>
<td>100</td>
<td>SYS</td>
<td>Program area for system task. Only one program area exists for system task.</td>
</tr>
<tr>
<td>110</td>
<td>P1</td>
<td>Program area for peripheral task 1</td>
</tr>
<tr>
<td>120</td>
<td>P2</td>
<td>Program area for peripheral task 2</td>
</tr>
<tr>
<td>130</td>
<td>P3</td>
<td>Program area for peripheral task 3</td>
</tr>
<tr>
<td>140</td>
<td>P4</td>
<td>Program area for peripheral task 4</td>
</tr>
<tr>
<td>150</td>
<td>P5</td>
<td>Program area for peripheral task 5</td>
</tr>
<tr>
<td>160</td>
<td>P6</td>
<td>Program area for peripheral task 6</td>
</tr>
<tr>
<td>170</td>
<td>P7</td>
<td>Program area for peripheral task 7</td>
</tr>
<tr>
<td>180</td>
<td>P8</td>
<td>Program area for peripheral task 8</td>
</tr>
</tbody>
</table>

Robot tasks and PLC task have multiple program types (program area) and can be used by switching between them.
3-3 Mode

Operations are available in the teaching mode or the execution mode.

(1) Teaching mode

The teaching mode is mainly for performing robot point teaching. Operations can therefore be carried out for most selected robot tasks. Flag setting to determine whether operations will be stopped or continued when emergency stop occurs or when errors occur in any task can only be carried out when other tasks have been selected (PLC task, peripheral tasks, system task). Point operations (movement, teaching, amendment, copy, movement speed setting), servo ON/OFF, brake ON/OFF (only when the servo is OFF) and manual operations for each axis, etc., can be performed when the robot task has been selected.

![NOTE]

Speed of tip of the arm is the safety speed (250 mm/s) or less during teaching mode.

(2) Execution mode

The execution mode performs the execution and debugging of programs created by the user. Powerful functions are available for performing debugging, but user programs are necessary. The program is displayed when the execution mode has been entered, and start, step running, line execution, execution up until the cursor position, etc., and break point settings can be performed. A function to view the user program’s variables during execution is also available, and INT, REAL and POINT variables can be written for LUNA programs, and relay and timer values can be written for PLC programs. In addition to this, an override speed % function is available to control the speed of robot operations when the robot task has been selected, and speeds set with the program can be controlled throughout 100 steps. For example, if a speed of 20 (VEL(20)) has been set with the program and an override of 10% is selected, a 2% speed is used for execution in accordance with the 0.2 × 0.1 = 0.02 equation. The safest settings during debugging is to start execution with an initial 5% override, and then gradually increase the speed.

When the safety cover which is connected to the safety connector of the controller, is opened, speed of tip of the arm is limited to 250 mm/s or less.

Operation at the programmed speed becomes possible when the safety cover is closed.
3-4 On-line/Off-line

The controller is equipped with an on-line status and an off-line status. The selected status is retained even when the mains power has been switched off.

On-line/Off-line selection can be performed by pressing the ONLINE key on the Teaching Pendant, etc., to switch between selection menus.

Off-line

This is the status in which operational control, such as task execution and stopping, is normally carried out with the Teaching Pendant or other man-machine interfaces (personal computers, etc.) by the user. System task cannot be automatically run with external signals (SYSRUN) as long as this status has been selected.

System task can, however, be run from the Teaching Pendant, etc., when in the execution mode.

- Other tasks will be run immediately after system task execution when a command that runs other tasks exists in the system task, so care must be taken when running a system task. Ensure that the emergency stop switch can be immediately operated when performing system task execution.
- Operating speed of tip of the arm is the safety speed (250 mm/s) or less when the safety cover is opened with off-line.

All tasks will continue running when switching from off-line to on-line.

On-line

Operational control, such as task execution and stopping, or writing operations for variables, etc., cannot be performed with the Teaching Pendant when on-line. When control is necessary, switch across to the safety of the off-line setting.

System task can be automatically run when the SYSRUN signal is ON in the on-line mode.

Consequently, system task is automatically run by SYSRUN signal control after the mains power has been switched on when in the on-line mode.

Ensure that system task has been stopped prior to switching from on-line to off-line. This is to prevent new tasks from running, as the system task has the right of executing other tasks. However, other robot tasks, PLC task and peripheral tasks can continue operations.

Note that system task will automatically begin continual operations if the SYSRUN signal is ON when switching across to the on-line mode.

Ensure that the emergency stop switch can be immediately operated when performing system task execution.
## 4. Basic Operations

### 4-1 Operation Categories

Operations with the Teaching Pendant are categorized as follows:

<table>
<thead>
<tr>
<th>Key name</th>
<th>Operation summary</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ROBOT]</td>
<td>Selection of the task to be operated by the Teaching Pendant.</td>
<td>These selection tasks are operable for all teaching mode, execution mode and management constant settings. Initialization is set with the robot task. (Refer to section 5-1 Basic Selections)</td>
</tr>
<tr>
<td>[PLC]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[PERI]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[SYSTEM]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[PROG. TYPE]</td>
<td>Program switching</td>
<td>Selects program type numbers for execution when robot task or PLC task has been selected. (Refer to section 5-1 Basic Selections)</td>
</tr>
<tr>
<td>[TEACH]</td>
<td>Enters the teaching mode.</td>
<td>Enables brake ON/OFF, servo ON/OFF and manual operation for each axis. (When robot task has been selected). Point teaching, point movement and other position data operations are possible when the [POINT] key is pressed and user program exist. (Refer to section 5-2 Teaching Mode)</td>
</tr>
<tr>
<td>[PROG. EXEC.]</td>
<td>Enters the execution mode.</td>
<td>Enables program execution debugging. It is possible to execute a program bit-by-bit for line execution and break point settings, etc. Variables used within a program can also be viewed during program execution by pressing the [TASK MONIT.] key. The operational speed of the robot can be controlled to enable safe debugging by pressing the [SPEED %] key. (Refer to section 5-3 Execution Mode)</td>
</tr>
<tr>
<td>[MANAGE]</td>
<td>Enables operations not available in the modes.</td>
<td>Performs initial home return, constant setting, diagnostics, error history and other operations. (Refer to section 5-4 Management)</td>
</tr>
<tr>
<td>[I/O]</td>
<td>Enables I/O operations.</td>
<td>Performs input I status display, output O status display and enforced setting. I/O can be operated at any time and has no relation with modes or selected tasks. (Refer to section 5-5 I/O)</td>
</tr>
<tr>
<td>[ONLINE]</td>
<td>Sets operational priorities.</td>
<td>Assigns robot operation authority to system task and allows operation commands from personal computers with external commands. (Refer to section 5-6 Others)</td>
</tr>
<tr>
<td>[HELP]</td>
<td>Displays operation descriptions.</td>
<td>Displays descriptions of the Teaching Pendant operations. (Refer to section 5-6 Others)</td>
</tr>
</tbody>
</table>
4-2 Key Input

(1) Beeps
The following beeps for confirmation and warning purposes are sounded when keys are pressed:
Short beep: Indicates that input was carried out normally.
Two successive beeps: A warning to indicate that a key which is currently not acceptable has been pressed.

(2) Repeats
Repeated input is possible by applying pressure to each key for 0.7 seconds or longer. For example, by pressing the [ARM1+] key continually in the teaching mode when a robot task has been selected, the following movement will occur:

<table>
<thead>
<tr>
<th>Time</th>
<th>0</th>
<th>0.5</th>
<th>0.7</th>
<th>1.0</th>
<th>[Seconds]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Movement</td>
<td>Movement equal to pressing the key once.</td>
<td>Continual movement from here.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3) Shift keys
The [SLOW] and [FAST] keys are used as shift keys. In other words, nothing will happen if they are pressed singularly. They are used in combination with other keys (especially cursor keys and robot operation keys).
4-3 Function Keys

Most operations are displayed in a selection menu at the bottom of the LCD. These menu items are selected with the function keys (F1 ~ F4) located at the top of the key sheet.

There is a case when ">>" is displayed on the right-hand edge of the function menu. This indicates that more functions can be displayed by pressing the F4 key. An example of this is shown below.
4-4  **QUIT** Key

The next menu or screen will be displayed when a selection is made from the menu. The display is returned to the original screen when processing is complete on this second screen. The display will return to the original screen without executing any processes when the *QUIT* key is pressed when on the second screen. The display will return to the previous screen whenever the *QUIT* key is pressed until there are no more previous screens. In other words, the *QUIT* key has the following meaning:

- Quit processing and return to the previous menu.
4-5 Scroll Selection

There are cases where selection can be made by scrolling the selection items and aligning the cursor with them when many items are available. In this situation a ‘↑↓’ symbol will flash at the top right-hand corner of the LCD.

The LCD will scroll 2 or 3 lines when the ↑ or ↓ cursor keys are pressed, and selection is made by aligning the required item up with the ▶ symbol. In the following example, Home Return will be selected when the [F4] key is pressed.

```
| MANAGE | ↑↓ |
| HOME RETURN |
| CONSTANT |
| SELECT |
```

F1 F2 F3 F4

The screen will scroll by 5 to 10 lines when the ↑ or ↓ keys are pressed in combination with the [FAST] key.
4-6 Display Scroll

Depending on conditions, it is possible to scroll up, down, left and right. This is available when programs, etc., are displayed.

The LCD will scroll 2 or 3 lines when the $\uparrow$ or $\downarrow$ cursor keys are pressed, and scroll to the left or right when the $\leftarrow$ or $\rightarrow$ cursor keys are pressed.

```
EXEC R1* T1 100%STP
0002 REAL: R, S, T
 0004 DO PASS (PO(0),
START (STEP)_LINE >>
```

The screen will scroll by 5 to 10 lines when the $\uparrow$ or $\downarrow$ keys are pressed in combination with the [FAST] key. In the same way, the screen will scroll by approximately 5 characters when the $\leftarrow$ or $\rightarrow$ keys are pressed in combination with the [FAST] key.
4-7 Direct Writing

It is naturally possible to directly write each parameter and variable with the Teaching Pendant. The operations for this have been unified and are described below.

The following is an example of writing the management system offset. The current value is displayed on the 2nd line, and the numerals (or characters) for input are on the 3rd line. The numerals (or characters) are input on the area of the 3rd line, and they are saved when the WRITE key on the menu is pressed. The process will end without writing if the CANCEL or QUIT keys are pressed without the F1 key.

```
SYSTEM OFFSET R1 ←→ ↑↓
X: 0.000
>
WRITE "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "" "`
5. Operations

5-1 Basic Selections

5-1-1 Task Selection

There is one part over which the user must have full awareness when using the Teaching Pendant. It has already been mentioned that the controller handles multiple tasks, and the Teaching Pendant selects and operates one of these. Consequently, the Teaching Pendant operates all selected task operations (execution, program display, constant setting, variable display, etc.) which rely on that task. It is therefore necessary for the user to maintain a constant aware of the task that is being handled. It does not matter which task is selected with regard to I/O operations, etc., which do not rely on the task and for which only one exists in the controller.

Selections are made with the selection keys to switch between operations when multiple tasks need to be handled. Use the following keys to select the task for which operation is required:

Selects the robot task. It is necessary to select the robot task for performing manual operations for each axis and for point operations.

Selects the PLC task. There is a slight difference between operations for other tasks in the execution mode when PLC task has been selected.

Selects the peripheral tasks. As there are between 1 and 8 peripheral tasks, it is necessary to make a further selection between 1 and 8 with the following menu.

- ↑↓
- P3 TEST
- P4 no program
- SELECT

F1 F2 F3 F4

↑ ↓ Scrolls up and down with the cursor

F4 SELECT Selects the peripheral task on the cursor position

Peripheral task 3 is displayed here, and this is the last peripheral task to have been selected. If the [PERI] key is pressed once more, it has the same effect as making the selection with the [F4] key.

Selects the system task.
5-1-2 Program Type Selection

It is necessary to be aware of what program type has been selected here also. Program type selection becomes necessary when robot task or PLC task has been selected. The Teaching Pendant operates all selected task program type operations (execution, program display, variable display, etc.) which rely on that program. As system task and peripheral tasks have only one program type and switching is subsequently not possible, there is no concept of program type selection here. It is necessary to maintain an awareness of the program type, as point data for the selected program type will be over-written when point teaching is performed.

The following menu will be displayed when the [PROG. TYPE.] key is pressed:

```
R1  T2  ↑↓
| TYPE 1 TEST OBJ, TE |
| TYPE 2 no program |
| SELECT |
```

- Name of the currently selected task
- Program type number selected for the task

- Scrolls up and down with the cursor

- SELECT Selects the program type number on the cursor position
5-2 Teaching Mode

5-2-1 When Selecting Robot Tasks

(1) Basic display (main)

The following screen will be displayed when [TEACH] key has been pressed to enter the teaching mode, [ROBOT] key has been pressed and a robot task selected:

- Teaching mode
- Task name R1 (robot task)
- b: Brake ON, *: Servo ON
- Program type number 1
- The current position is XYZR
- Position of each axis (mm)
- Operation selection menu
  - F1: To the setting menu
  - F4: Brake ON/OFF

### Valid keys

- **F1** SET: Displays the menu for setting manual operation speeds for each axis. Refer to section 5-2-1 (2).

- **F4** BRAKE: Turns the brake ON and OFF. Operation not possible when the servo is on.

- **SERVO**: Enables the servo to be turned on and off. Manual operation for each axis is possible when the servo is on. In this case the 'ROBOT MANUAL' LED on the Teaching Pendant will be illuminated, indicating that robot manual operations are possible.

- **POINT**: Displays the menu from which point data-related operations are performed. Refer to section 5-2-1 (3).

- **F4** PosiGO: Moves to the XYZR position specified with numeric input with raise stand-by movement. Having entered this menu the current position will be displayed, and it is possible to amend the value of each axis and GO. For example, it is possible to GO with X=300 and Y=300. The amended values will become the current position when this menu is exited.
The below keys are only valid when the servo is ON and the 'ROBOT MANUAL' LED is illuminated. The [FAST] and [SLOW] keys may also be pressed simultaneously.

**+X, -X**
Manually moves in the ±X direction. Movement is in the orthogonal ±X direction in the case of horizontal articulation arms.

**+Y, -Y**
Manually moves in the ±Y direction. Movement is in the orthogonal ±Y direction in the case of horizontal articulation arms.

**+Z, -Z**
Manually moves in the ±Z direction. Usually moves either up or down, with the down direction being ‘+’.
Becomes single-pulse movement when pressed in combination with the [SLOW] key.

**+R, -R**
Manually moves in the ±R direction. Usually moves in a rotary direction, with the counter-clockwise direction when seen from above being ‘+’.
Becomes single-pulse movement when pressed in combination with the [SLOW] key.

**ARM1+, ARM1-**
Manually rotates the 1st horizontal articulation arm in a ± direction. The counter-clockwise direction when seen from above is ‘+’. The 1st arm is the upper arm area when compared to a human arm. This has no meaning for cartesian robots.
Becomes single-pulse movement when pressed in combination with the [SLOW] key.

**ARM2+, ARM2-**
Manually rotates the 2nd horizontal articulation arm in a ± direction. The counter-clockwise direction when seen from above is ‘+’. The 2nd arm is the lower arm area when compared to a human arm.
Becomes single-pulse movement when pressed in combination with the [SLOW] key.

---

**Caution**

Take great care when operating robots and ensure that the emergency stop switch is within easy reach.
(2) Settings
The following item is available for setting.

Movement speed
Movement speed is the speed of operation during the manual operation of each axis. In other words, the actual speed of axis movement when the [+Z] or [+X] keys are pressed. Manual operation speeds can be temporarily amended to the initial value or less.
There will be relative changes in speed when these keys are pressed in combination with the [FAST] key.

Press ↓ or ↑ to amend the speed values.
Press [WRITE] to write the speed.
Press 0 ~ 9 to enter the speed values.

Movement speed is temporary. All values will be initialized and reset when the mains power to the controller is switched off and on, and when the Teaching Pendant is returned and re-used.
(3) Point

The menu from which operations relating to point data are performed. The following is displayed when the [POINT] key is pressed:

- Teaching mode
- Task name R1 (robot task)
- b: Brake ON, *: Servo ON
- Program type number 1

### Valid keys

0 ~ 9, .

Direct input of point data. For example, press [0], [1] in order to input P0(1).

↑, ↓

Scrolls point numbers. Scrolling only possible for existing point data numbers.
Scrolling will increase in speed when the [FAST] key is pressed in combination with these keys.

←, →

Used for correcting point numbers. Moves the cursor.

F1 TEACH

Teaches currently displayed point numbers the current robot position. Confirm the values after pressing the [F1] key, and press the [F1] OK key again to set the entry. For example, if P0(1) is to be taught the current position, press [Point], [0], [1], [F1] Teach, [F1] OK.

F2 GO

Moves the robot to the point number position currently displayed. Ensure that the robot has been moved to the top edge with raise → XY movement → lower.
For example, if the robot is to be moved to P0(1), press [Point], [0], [1], [F2] GO.

⚠️ Caution

Take extreme care when moving the robot by pressing GO. Ensure that the emergency stop switch can easily be reached.
The menu from which value amendment and copying is performed for currently displayed point numbers.

- Robot task 1
- Point number

Hand system: Right-hand system, Left-hand system

- Keys which are only valid when this menu is displayed:

  F1 CHG Amends the point data values for each axis. Select X, Y, Z or R in accordance with the axis to be amended, and write the new values.

  F2 COPY Copies point data values across to other point data. In addition to copying current point data values across to other point data, it is also possible to copy other point data values across to the current point data.

These two keys are only valid when this menu is displayed.

  F4 MOVE Moves across to the currently displayed point number position in a variety of ways. The following menu is displayed.

If [F4] is pressed, the circle and speed menu will be displayed.

- These keys are only valid when the movement menu is displayed.

  F1 Drct GO Moves across to the currently displayed point number position. Direct movement is performed without going through raise → XY movement → lower. The route of movement is not limited to a direct line.
F3 LineGO  Moves the robot across to the currently displayed point number position. Direct movement is performed without going through raise → XY movement → lower. The route of movement is direct line interpolation, so movement is in a direct line.

<2nd menu page>

F3 SPEED  Sets the speed of movement for point movement. Amend the value with the ↑ or ↓ cursor keys or by directly inputting the value with the 0~9 keys, and press F1 Write key. The speed will be set at the maximum 100 when setting has been performed with F3 MAX key. For example, if MAX is 50 (mm/s) and a value of 30 is input, the equation is 50 × 30/100 = 15 (mm/s).

However, speed is only reflected accurately during LineGO with constant movement speed, and although changes will be apparent in other situations, movement is not possible with accurate speeds.
The operation speeds can be amended to the initial value or less when the safety cover is opened.
Close the safety cover to set the operation speeds higher than the initial value and operate a robot at the set speeds.

Caution  Take extreme care when moving the robot by pressing GO. Ensure that the emergency stop switch can easily be reached.
5-2-2 When Selecting PLC, Peripheral and System Task

(1) Basic display (main)
The following is displayed when the teaching mode has been entered by pressing the [TEACH] key, the [PLC] or [PERI.] keys have been pressed, and tasks other than robot tasks have been selected.

![Diagram]

Teaching mode
Task name PLC (PLC task)
Program type number

Operation selection menu. [F1] key for the setting menu.

The only operation possible here is the setting of task flags. Task flags determine task execution, and the following three types of flags are available.

Teaching mode flag: The flag to determine whether tasks are to be stopped or not when switching from the execution mode to the teaching mode.

Error occurrence flag: The flag to determine whether tasks are to be stopped or not when errors occur.

Emergency stop flag: The flag to determine whether tasks are to be stopped or not when the emergency stop is triggered.

Choose the flag to be amended and select either RUN or STOP with the [↑] or [↓] cursor keys. The initial default is STOP.
5-3 Execution Mode

5-3-1 When Selecting Robot, Peripheral and System Task

(1) Basic display (main) during termination

The following is displayed when the execution mode has been entered by pressing the [PROG. EXEC.] key, and robot tasks have been selected with the [ROBOT] key.

- Execution mode
- Task name R1 (robot task)
- b: Brake ON, *: Servo ON
- Program type number 1
- Override speed % value
- Execution status STP/RUN
- Line number & program display
  - : Scroll cursor
  - →: Execution stop position
- Operation selection menu

The following menu will be displayed when the program is scrolled with the use of the [↑] or [↓] cursor keys. This menu is entered when [>] scroll cursor and → execution stop position do not match.

If [F4] >> is pressed, to RET, break, initialization and display, etc., will be displayed.

### Valid keys

- **Scrolls the program.**
  - Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

- **Scrolls the program from left to right.**
  - Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

- **Continually executes the program from the current stop position (→ line).** It is necessary to perform initialization once again if initial running is required.
  - START will be displayed after [F1] INIT key is pressed.
**F2 STEP**
Performs step execution for the program from the current stop position (→ line). A step is a separate unit within a single line. For example, a line that includes DO VEL(10),PA,PB means that each of the VEL(10),PA,PB operations are a step, so this line includes three steps.

**F3 1 LINE**
Performs single line execution for the program from the current stop position (→ line).

**F2 to ▶**
Performs execution from the current stop position (→ line) up until the position indicated with the scroll cursor ▶. Execution will stop immediately before the line indicated with the scroll cursor ▶.

**F1 toRET**
Performs execution from the current stop position (→ line) until the RET command has been discovered. This is convenient when it is necessary to leave a sub-routine. However, continual execution will be performed in the same way as START if a RET command is not found.

---

**Caution**
- Take extreme care when executing programs. Ensure that the emergency stop switch can easily be reached.
- To activate any operation regarding robot movement, execute programs while pressing the safety switch in the off-line.

**F3 NOW**
Displays the current stop position (→ line). This is used when the current stop position has been lost during program scrolling. This simply amends the display and is not used for execution purposes.

**F3 BREAK**
Enters the menu from which the break status can be viewed and set. The following two types of break are available:
- Line specification break point
- INT variable unified break
Refer to section 5-3-1 (3) for further details.

**F1 INIT**
Initializes program execution. START, STEP, line execution and toRET will all be performed from the top of the program after initialization has been carried out.
**F3** DISP

Displays the specified program line. Selection is possible for the top of the program, the bottom of the program and specified lines.

**NOTE**

*Comments (marked with ;) and blank lines are not displayed with the Teaching Pendant. If these types of line are selected, the display will be of the next executable line.*

**STOP**

Stops all tasks that are being executed. If no tasks are being executed, a message to this effect is displayed and the process ended. This is consequently only valid when the TASK RUN LED is illuminated.

This enables the variables used by the task program currently selected and common variables, etc., to be read and written regardless of whether the program is running or stopped. Refer to section 5-3-1 (4) for further details.

The following key is only valid when a robot task has been selected.

**SPEED**

Controls the operation execution speed of the robot in percentages with the speed specified by the program (specified with VEL) as 100. For example, if the speed set by the program is 20 (VEL(20)) and an override of 10% is selected, the equation becomes 0.2 × 0.1 = 0.02, or 2%, and execution is performed at this speed.

It is safest to start debugging with an override of 5% and then gradually increase the speed.

The override returns to the initial value (5%) when an error such as emergency stop occurs, or the safety switch is released.

**Caution**

Take extreme care when amending override speeds. Ensure that the emergency stop switch can easily be reached.

**NOTE**

During the off-line mode, the override speed cannot be amended higher than the initial value (5%) when the safety cover is opened. Close the safety cover to operate a robot at the override speed of higher than the initial value.
(2) Basic display (main) during execution

The following is displayed when the execution mode has been entered by pressing the [PROG. EXEC.] key, and selected tasks are being executed.

Execution mode
Task name R1 (robot task)
b: Brake ON, #: Servo ON
Program type number 1
Override speed % value
Execution status: STP/RUN
Line number & program display:
: Scroll cursor
Operation selection menu

If [F4] >> is pressed, the brake and display, etc., will be displayed.

Valid keys

[F1] STOP          Performs step termination for the currently selected task.

Refer to section 5-3-1 (1) basic display (main) during termination as the following keys are the same.

[←][→]          Scrolls the program.

[←][→]          Scrolls the program from left to right.

[F3] BREAK        Enables break status viewing and setting.
Refer to section 5-3-1 (3) for further details.

[F3] DISP          Displays the specified program line.

[STOP]          Stops all tasks that are being executed.

[MONIT.]          Enables variables and common variables, etc., to be read and written.
Refer to section 5-3-1 (4) for further details.
The following key is only valid when a robot task has been selected.

Controls the operation execution speed of the robot.

![Caution]

Take extreme care when amending override speeds. Ensure that the emergency stop switch can easily be reached.

![Note]

During the off-line mode, the override speed cannot be amended higher than the initial value (5%) when the safety cover is opened. Close the safety cover to operate a robot at the override speed of higher than the initial value.

Stops only the robot task.

(3) Break

The following will be displayed for breaks:

- Task name R1 (robot task)
- Break number
- ON/OFF
- Break type and conditions
  - L0001: When a line is specified
  - I=50: When the INT variables match
- Current unified count
- Specified count until the break is applied
- Operation selection menu

Two breaks are available, and it is possible to set both with type, conditions and unified counts, etc. Further details on this are provided below. Use the ↑ or ↓ cursor keys to specify the breaks number only when the breaks is to be switched on or set conditions modified, and press the [F1] CHG key to enter the amendment screen.

The amendment screen is as follows: The break 1 amendment screen will be displayed when break number 1 has been selected.
■ Valid keys

**F1 WRITE**  
Writes break ON/OFF.

**F2 ON/OF**  
Sets the break ON/OFF. Settings will toggle between ON and OFF every time this key is pressed. Settings will not be stored if the **F1 WRITE** key is not pressed after amendment.

**F3 KIND**  
Displays the menu from which break type is selected. The following two types are available:

1. **Line unification break**  
The normal break point. A line number is specified, and when an attempt to execute that line is performed, the process will stop. It is also possible to set the number of arrivals until the specified line number.

2. **INT variable unification break**  
Stops the process when an INT variable changes to a specified value. As only changes are monitored, the number of times are not counted even if a match has already been found when the break is ON. It is also possible to set a unification count.

**F4 SET**  
Sets the break conditions. The menu displayed when this is selected will differ in accordance with the selected type. An explanation of this is as follows:

The setting screen for when the line unification break has been selected is as follows:

```
R1 BREAK1  
10001 0/1
LINE [CNT]
F1 F2 F3 F4
```

**F1 LINE**  
Specifies the break point line number. The program can be scrolled when this key has been pressed. Align the cursor with the line for which a break is to be applied and press WRITE.

**F2 CNT**  
Specifies the arrival count to the specified line number. 1 is set when the break is to be applied to the first count. 0 cannot be substituted. Settings are possible up to a maximum of 999.
The setting screen for when the INT variable unification break has been selected is as follows:

```
R1  BREAK2
  2  OF  I=50  .0/ 1
INT  DATA  CNT  I
```

- **F1 INT**: Selects the INT variable for which the break is to be applied. A list of all INT variables used by the program will be displayed, and selection is made by scrolling with the cursor and aligning the required variable. Switching between decimal and hexadecimal selection is also possible.

- **F2 DATA**: Sets the value for which the INT variable is to match. Normal INT variables can be set within a range of -32767 and 32768. Setting when hexadecimal variables have been selected will be between hexadecimal 0000H and FFFFH.

- **F2 CNT**: Specifies the unification count. As only changes are monitored, the number of times are not counted even if a match has already been found when the break is ON. 1 is set when the break is to be applied to the first count. 0 cannot be substituted. Settings are possible up to a maximum of 999.
(4) Monitor

Monitor is a function to enable the variables and common variables used by a program to be viewed while the program is being executed. Each variable is displayed in the real-time as they change within the program. It is also possible to perform enforced writing.

As Monitor allows the viewing of changes in variables in an executing program, the differing variables for each task are also displayed. In other words, the program variables for currently selected tasks are monitored.

Monitor can be carried out in either of the following two ways in accordance with preference.

List display of variables by type: INT variables, REAL variables, point data and DATI common variables, etc., are available, and it is possible to select one of these for list display. For example, if DATI is selected, it is possible to scroll through the current values between DATI(0) and DATI(255).

Mixed display of selected variables:

The mixed display of selected variables when the by-type selection is not suitable. For example, it is possible to simultaneously display I and J for INT variables, X1 and Y1 for REAL variables, and PO(1) for point data. A maximum of ten variables may be selected.

The following will be displayed when first entering the Monitor mode having pressed the [TASK MONIT.] key. This screen is known as the Monitor Main.

```
MON R1* T1
```

- Indicates that this is the Monitor mode
- Task type R1
- Program type number
- Operation selection menu

Lines 2 and 3 are left blank, but the variables selected from the list will be displayed here. In other words, this is the previously-mentioned 'mixed display of selected variables' screen.
For example, the following will be displayed when the [QUIT] key is pressed several times after registering DATI(5) and returning to the Monitor Main screen.

```
MONI R1* T1
 ▶DATI (5) = -31

CHG  I REMOVED   I LIST
       Operation selection menu
F1   F2   F3   F4
```

- **Valid keys**

  - ![↑ ☐ ↓](image)
    - Scrolls the variables.
    - Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

  - ![F1](image) CHG
    - Enables writing of the variable value over which the cursor is currently located.

  - ![F1](image) REMOVE
    - Removes the specified variable and deletes it from registration.

  - ![F4](image) LIST
    - Moves to the list display of each variable. Selections can be made and registered here when necessary.

The list display of variable types is performed when the menu's LIST is selected.

```
MONI R1* T1  ▶↓
▷INT
       Operation Selection menu
REAL variable
ISELECT
F1    F2    F3    F4
```

The following types of variables are available:

- INT variables
- REAL variables
- POINT variables
- Pn(m) point data
- DATI variables
- DATR variables
- OUTP values
- STRING variables
- Array INT variables
- Array REAL variables
Refer to the Robot Language Guide in the LUNA5.0 Operation Manual for further details on the meanings on these variables.
For example, The following is displayed when DATI variables are selected. This is the previously-mentioned ‘list display of variables by type’ screen.

![Screen Screenshot]

<table>
<thead>
<tr>
<th>MONI</th>
<th>DATI</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATI (0) = 70</td>
<td>DATI (1) = 1</td>
<td></td>
</tr>
<tr>
<td>CHG</td>
<td>16/10</td>
<td>IADD</td>
</tr>
</tbody>
</table>

Operation selection menu

F1  F2  F3  F4

- **Valid keys**
  - ↑, ↓: Scrolls the variables.
    - Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.
  - F1 CHG: Enables writing of the variable value over which the cursor is currently located.
  - F2 16/10: Switches value display between hexadecimal and decimal.
  - F4 ADD: Registers the variable over which the cursor is currently located in Monitor Main. Registration will be performed in decimal when decimal has been selected, and hexadecimal when hexadecimal has been selected.
5-3-2 PLC Task

(1) Basic display (main) during termination

The following is displayed when the execution mode has been entered by pressing the PROG, EXEC, key, and PLC task has been selected with the PLC key.

Execution mode
Task name PLC (PLC task)
Program type number 1
Execution status STP/RUN
Line number & program display
Scroll cursor
Execution stop position
Operation selection menu

The following menu will be displayed when the program is scrolled with the use of the ↑ or ↓ cursor keys. This menu is entered when scroll cursor and execution stop position do not match.

If F4 is pressed, toEND, break, initialization, S time and display, etc., will be displayed.

■ Valid keys

Scrolls the program.
Scrolling will increase in speed when these keys are pressed in combination with the FAST key.

Scrolls the program from left to right.
Scrolling will increase in speed when these keys are pressed in combination with the FAST key.

Continually executes the program from the current stop position (→ line). It is necessary to perform initialization beforehand if initial running is required.
START will be displayed after F1 INIT key is pressed.
F1 1 SCAN
Executes only one scan for the program from the current stop position (→ line). A scan is the execution of the entire program once. Execution will be started from the line at which the process has been stopped, jump to the top of the program and continue execution even when the END command has been passed, and finally stop at the line immediately prior to the starting line.

F3 1 LINE
Performs single line execution for the program from the current stop position (→ line).

F2 to ▶
Performs execution from the current stop position (→ line) up until the position indicated with the scroll cursor ▶. Execution will stop immediately before the line indicated with the scroll cursor ▶.

F1 toEND
Performs execution from the current stop position (→ line) until the END command has been discovered.

⚠️ Caution
Take extreme care when executing programs. Ensure that the emergency stop switch can easily be reached.

F3 NOW
Displays the current stop position (→ line). This is used when the current stop position has been lost during program scrolling. This simply amends the display and is not used for execution purposes.

F3 BREAK
Enters the menu from which the break status can be viewed and set. The break will stop the process at the specified relay rising or falling point. Refer to section 5-3-2 (3) for further details.

F1 INIT
Initializes program execution. START and 1 SCAN execution will all be performed from the top of the program after initialization has been carried out.

NOTE
Everything with the exception of the keep relay will be set at OFF during initialization.

F2 S TIME
Sets PLC task performance. As the scan time measured during execution is displayed (the time required to execute the program once from top to bottom), it is possible to make delicate performance settings.

NOTE
As the performance of other tasks will drop in accordance with raising PLC task performance, consideration must be given to settings.
Displays the specified program line. Selection is possible for the top of the program, the bottom of the program and specified lines.

**NOTE**

Comments (marked with ;) and blank lines are not displayed with the Teaching Pendant. If these types of line are selected, the display will be of the next executable line.

Stops all tasks that are being executed. If no tasks are being executed, a message to this effect is displayed and the process ended. This is consequently only valid when the TASK RUN LED is illuminated.

This enables the variables used by the task program currently selected and common variables, etc., to be read and written regardless of whether the program is running or stopped. Refer to section 5-3-2 (4) for further details.
(2) Basic display (main) during execution

The following is displayed when the execution mode has been entered by pressing the [PROG, EXEC.] key, and the selected task is being executed with PLC. The ◁ symbol indicates that the next relay is ON.

If [F4] ◁ is pressed, the break, S TIME and display, etc., will be displayed.

Valid keys

[F1] STOP Performs step termination for the currently selected task.

Refer to section 5-3-1 (1) basic display (main) during termination as the following keys are the same.

[F3] BREAK Enables break status viewing and setting. Refer to section 5-3-2 (3) for further details.

[F2] S TIME Sets PLC task performance. Refer to section 5-3-2 (1) for further details.

[F3] DISP Displays the specified program line.

[ALL/STOP] Stops all tasks that are being executed.

[MONIT.] Enables variables and common variables, etc., to be read and written. Refer to section 5-3-2 (4) for further details.
(3) Break

The following will be displayed for breaks:

- Task name PLC (PLC task)
- Break number
- OFF/ON
- Break type and conditions
  - L0001: When a line is specified
  - I=50 : When the INT variables match
- Trigger direction Rising / Falling
- Current unified count
- Specified count until the break is applied
- Operation selection menu

Two breaks are available, and it is possible to set both with type, conditions and unified counts, etc. Further details on this are provided below. Use the ↑ or ↓ cursor keys to specify the break number only when the break is to be switched on or set conditions modified, and press the [F1] CHG key to enter the amendment screen.

The amendment screen is as follows: The break 1 amendment screen will be displayed when break number 1 has been selected.

---

**Valid keys**

- **F1 WRITE**  Writes break ON/OFF.
- **F2 ON/OF**  Sets the break ON/OFF. Settings will toggle between ON and OFF every time this key is pressed. Settings will not be stored if the [F1] WRITE key is not pressed after amendment.
- **F4 SET**    Sets the break conditions.
The following menu will be displayed when SET is selected.

<table>
<thead>
<tr>
<th>PLC BREAK1</th>
<th>RO000</th>
<th>0/1</th>
</tr>
</thead>
<tbody>
<tr>
<td>RELAY</td>
<td>TRIG</td>
<td>CNT</td>
</tr>
<tr>
<td>F1</td>
<td>F2</td>
<td>F3</td>
</tr>
</tbody>
</table>

- **F1 RELAY**: Selects the relevant relay. The relay type selection screen will be displayed when this key is pressed, and a type is selected and then one relay is selected.

- **F2 TRIG**: The following two types of break for each relay are as follows:
  - When switching from ON to OFF ↓
  - When switching from OFF to ON ↑
  Select either one of these.

- **F3 CNT**: Specifies the number of triggers until the break is applied. 1 is set when the break is to be applied to the first count. 0 cannot be substituted. Settings are possible up to a maximum of 999.
(4) Monitor

Monitor is a function to enable the relays and channel data used by a program to be viewed while the program is being executed. Each relay and channel data is displayed in the real-time as they change within the program. It is also possible to perform enforced writing.

Monitor can be carried out in either of the following two ways in accordance with preference.

List display of relays by type: Relays, keep relays, timer and counter, etc., are available, and it is possible to select one of these for list display. For example, if the timer is selected, it is possible to scroll through the current values between T000 and T255.

Mixed display of selected relays: The mixed display of selected relays when the by-type selection is not suitable. For example, it is possible to simultaneously display K0001 for the keep relay, T034 and T035 for the timer and C012 for the counter. A maximum of ten relays may be selected.

The following will be displayed when first entering the Monitor mode having pressed the TASK MONIT. key. This screen is known as the Monitor Main.

```
Indicates that this is the Monitor mode
Task name PLC (PLC task)
Program type number 1
```

Operation selection menu

```
LIST
F1 F2 F3 F4
```

Lines 2 and 3 are left blank, but the variables selected from the list will be displayed here. In other words, this is the previously-mentioned 'mixed display of selected relays' screen.
For example, the following will be displayed when the [QUIT] key is pressed several times after registering K0001 and returning to the Monitor Main screen.

```
MONI  PLC  T1
K0001=1
CHG  REMOVE  LIST
```

- **F1** CHG: Enables writing of the variable value over which the cursor is currently located.
- **F2** REMOVE: Removes the specified variable and deletes it from registration.
- **F4** LIST: Moves to the list display of each variable. Selections can be made and registered here when necessary.

The list display of variable types is performed when the menu's LIST is selected.

```
MONI  PLC  T1  ↑↓
↑Relay
Keep relay
```

The following types of relays are available:

- Relay
- Keep relay
- Timer
- Counter
- Input relay
- Output relay
- Special relay
- Label

Refer to the Robot Language Guide in the LUNA5.0 Operation Manual for further details on the meanings on these variables.
For example, the following is displayed when the keep relay is selected.

```
<table>
<thead>
<tr>
<th>MON</th>
<th>Keep relay</th>
<th>↑</th>
<th>↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>◀</td>
<td>K00C=0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>◀</td>
<td>K01C=0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHG</td>
<td>16/10</td>
<td></td>
<td>ADD</td>
</tr>
<tr>
<td>F1</td>
<td>F2</td>
<td>F3</td>
<td>F4</td>
</tr>
</tbody>
</table>
```

*Operation selection menu*

**Valid keys**

- **F1, F2, F3, F4**
  Scrolls the variables.
  Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

- **F1 CHG**
  Enables writing of the variable value over which the cursor is currently located.

- **F2 16/10**
  Switches value display between hexadecimal and decimal.

- **F4 ADD**
  Registers the variable over which the cursor is currently located in Monitor Main. Registration will be performed in decimal when decimal has been selected, and hexadecimal when hexadecimal has been selected.
5-4 Management

A menu which provides operations not normally available in the teaching mode or execution mode will be displayed when the MANAGE key is pressed. The following items are available in the management menu:

- Home Return
- Constant Setting
- Task List
- Type List
- PC Card
- Diagnostics
- Error History
- TPWRITE Monitor
- Clock
- Information

Selection is made by scrolling to the required item with the use of the ↑ or ↓ cursor keys.
5-4-1 Home Return

Home return is the calculation of the relationship between the robot's position and the motor's encoder pulse, and is generally used for position searching. As your newly purchased robot employs a motor equipped with an absolute encoder, normal home return is not necessary. However, there is the necessity of performing home return once when using for the first time after purchase. This section explains the operations involved in home return. Setting modification for home return axis sequences and positions, etc., is also possible.

The following will be displayed when HOME RETURN is selected.

```
HOME RETURN
Start?
OK  I  ISET  ICANCEL
F1  F2  F3  F4
```

F1 OK Starts home return.

⚠️ Caution

*Take extreme care when starting home return and moving the robot. Ensure that the emergency stop switch can easily be reached.*

F3 SET Enables the confirmation and setting modification of home return axis sequences and the position of each axis, etc. This is usually set during initialization, and is not necessary.

F4 CANCEL Ends the procedure without starting home return.

The following menu will be displayed when SET is selected.

```
HOME  R1
ORDER  POSI
```

F1 ORDER Displays the axis sequence of home return.

F2 POSI Displays the home position of each home return axis.
(1) Home return axis sequence

Home return axis sequence if the operational order for each axis when home return is to be performed. Although there are no reasons for amending this, settings can be performed in accordance with preference when tools have to be avoided.

The home return axis sequence is displayed as follows when ORDER is selected.

```
| HOME   | R1 ORDR |
| Z >XY> R |
| CHG 1 |
| F1   | F2  | F3  | F4 |
```

This display indicates that the sequence of execution is to be Z axis, XY axis simultaneously, and then R axis. The amendment screen will be displayed when CHG has been selected.

```
| HOME   | R1 ORDR <-> ↑↓ |
| Z >XY> R |
| >  >  >  > |
| WRITE  | CANCEL |
| F1   | F2  | F3  | F4 |
```

Scrolls X, Y, XY, Z and R for selection.

Moves the cursor to the right and left.
(2) Home return position

The home return position is the final stopping position for each axis for which home return is being performed. Although there are no reasons for amending this, settings can be performed in accordance with preference when tools have to be avoided.

The home return position for each axis is displayed as follows when POSI. is selected.

<table>
<thead>
<tr>
<th>HOME</th>
<th>R1 POSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶️ X -</td>
<td></td>
</tr>
<tr>
<td>⏯ Y +</td>
<td></td>
</tr>
<tr>
<td>CHG I</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>F2</td>
</tr>
</tbody>
</table>

+, – and center are available as positions. In order words, when the X axis home return is completed on +, the X axis will stop at the + edge.

**NOTE**
The X axis display represents the 1st arm (θ1) and the Y axis display represents the 2nd arm (θ2) when a horizontal articulated robots is being used.

**Caution**
Center is only valid for the horizontal articulated robot's 1st arm and 2nd arm. Setting should not be made for cartesian (X-Y) robots or the Z axis and R axis.
The setting cannot be modified in some types of robot. Consult your Sony dealer.

The amendment screen will be displayed when CHG has been selected.

<table>
<thead>
<tr>
<th>HOME</th>
<th>R1 POSI ↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>X -</td>
<td></td>
</tr>
<tr>
<td>⏯ -</td>
<td></td>
</tr>
<tr>
<td>WRITE</td>
<td>CANCEL</td>
</tr>
<tr>
<td>F1</td>
<td>F2</td>
</tr>
</tbody>
</table>

Scrolls +, – and center for selection.
5-4-2 Constant Setting

Constants are individual parameters for each robot and may be amended as required.

The following constants are available:
- System limit
- System offset

(1) System limit

System limit restrict the range of robot movement for the X, Y, Z and R coordinates, and if these limits are exceeded during programed operations, an error is triggered and the robot stopped. In other words, these are known as software limits. + and - settings can be made for each coordinate.

The SYSTEM LIMIT display screen is as follows:

<table>
<thead>
<tr>
<th>SYSTEM LIMIT R1</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>➤➤X</td>
<td>600.000</td>
</tr>
<tr>
<td>➤X</td>
<td>-600.000</td>
</tr>
<tr>
<td>CHG</td>
<td></td>
</tr>
</tbody>
</table>

F1 F2 F3 F4

Amendments can be made by aligning the cursor with the parameter that requires modification and selecting CHG. All units are displayed in [mm].

An immediate stop will be triggered when limits are exceeded during LINE and CIRCLE route for point movement commands within the program, but checks will only be carried out on normal movement commands, such as Do P0(I), when the final position has been attained. No check is implemented for limit excesses mid-route.
(2) System offset

System offset is the parameter that shifts the coordinates (X, Y, Z and R coordinates) held by the robot. In simpler terms, it is a parameter that interpolates the relationship between the positions handled by the robot (robot coordinates) and the spaces excluding the robot (frames and peripheral devices attached to the robot). The following five system offsets are available:

X: Shifts the XY plane home position (X=0, Y=0) handled by the robot towards the X axis for only the amount specified. (Units of mm)

Y: Shifts the XY plane home position (X=0, Y=0) handled by the robot towards the Y axis for only the amount specified. (Units of mm)

Z: Shifts the Z value handled by the robot only for the amount specified. (Units of mm)

For example, if the setting is 20 and movement is performed to Z=30, movement is carried out to the Z=50 position prior to setting.

R: Rotates the R value handled by the robot only for the amount specified. (Units of degrees)

t: Rotates the XY plane value handled by the robot only for the amount specified. (Units of degrees)

The following is indicated when XR and YR are the coordinates prior to offset, and Xs and Ys are the coordinate after offset.

Note that all other teaching point positions may be mis-aligned when only one setting is made.

The most common method of use for robot coordinates is to match the settings to mis-align with the direction of the robot system (eg; the direction of the conveyor belt).
The SYSTEM OFFSET display screen is as follows:

```
SYSTEM OFFSET R1 ↑↓
X 0.000
Y 0.000
CHG I
```

[CHG] Amendments can be made by aligning the cursor with the parameter that requires modification and selecting CHG.
5-4-3 Task List

The execution status of the executable task names and type numbers, and program names when program exist, are displayed when the TASK LIST is selected.

The TASK LIST display screen is as follows:

```
| TASK LIST   | ↑↓ |
| R1 | T1 | TEST | STOP |
| PLC no program |
| SET |
```

F1  F2  F3  F4

The following flags can be set for each task other than robot tasks.

Teaching mode flags: The flag to determine if tasks should be stopped or not when switching between the execution mode and teaching mode.

Error occurrence flags: The flag to determine if tasks should be stopped or not when an error occurs.

Emergency error flags: The flag to determine if tasks should be stopped or not when the emergency error occurs.

The flag for which amendment is to be carried out is selected, and RUN or STOP selected with the ↑ or ↓ cursor keys. The initial default is STOP.
5-4-4 Type List
The program names for each type are displayed when the TYPE LIST is selected.

- Type number
- The task name in which the type number resides
- Program file name

<table>
<thead>
<tr>
<th>TYPE</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>R1</td>
</tr>
<tr>
<td>1</td>
<td>R1</td>
</tr>
<tr>
<td>REMOVE</td>
<td></td>
</tr>
</tbody>
</table>

F1  F2  F3  F4

Scrolls the file names. Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

[FR] REMOVE Displays the menu for deleting the file name over which the cursor is currently located. A menu to select either OBJ or DAT will be displayed for robot tasks.
5-4-5 PC Card

The menu for handling PC cards will be displayed when PC CARD is selected. However, this menu will not be displayed if a PC card has not been inserted in the slot on the front panel of the controller.

<table>
<thead>
<tr>
<th>PC CARD</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>FILE LIST</td>
<td></td>
</tr>
<tr>
<td>SAVE TO PC-CARD</td>
<td></td>
</tr>
<tr>
<td>ISELECT</td>
<td></td>
</tr>
</tbody>
</table>

F1  F2  F3  F4

Selections are available in four separate items. Use the ↑ or ↓ cursor keys to scroll to the selection required, and press the F4 SELECT key to make the selection.

FILE LIST: Displays all files names existing on the PC card. It is also possible to delete specified files. Refer to page 5-40 for further details.

SAVE: User programs, point data and other various data is dropped off into a file and saved onto the PC card. Refer to page 5-41 for further details.

LOAD: Downloads the file containing all user programs, point data and other various data stored on the PC card into the controller. Refer to page 5-43 for further details.

FORMAT: Formats PC card.
The following are simple descriptions of the major file types handled by the PC card.

*****.OBJ  LUNA programs. These files are generated when *****.LUN files are compiled with LUNA compiler.

*****.DAT  Point data files. These files are generated when *****.PON files are compiled with POINT compiler.

*****.COD  PLC programs. These files are generated when *****.PLC files are compiled with the PLC compiler.

*****.CDP  Common point data files. These files are generated when *****.CPN files are compiled with POINT compiler. These files consist of P10(0)-P11(255), DATI(0)-DATI(255) and DATR(0)-DATR(255) values.

*****.KEE  Files which contain the K00C-K255C keep relay channel values.

****.CTR  Controller parameter files. Controller parameters are the setting data used within the controller, and this file need not be opened by users. It is necessary to save this data when replacing CPU boards.

*****.ALL  An information file created when all data (including the above six files) is saved. All data contained in the above six files will be downloaded into the controller when this file is loaded.
**File List**

The file names for all files stored on the PC card are displayed as follows.

<table>
<thead>
<tr>
<th>PC CARD FILE LIST ↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMPLE1. OBJ</td>
</tr>
<tr>
<td>TEST. DAT</td>
</tr>
<tr>
<td>REMOVE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
</tr>
</thead>
</table>

↑ , ↓ Scrolls the file names. Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

F1 REMOVE Displays the menu for deleting the file name over which the cursor is currently located.
Save
Saves the data existing within the controller onto the PC card. The display is as follows:

<table>
<thead>
<tr>
<th>PC CARD SAVE</th>
<th>↑ ↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>LUNA PROGRAM (.OBJ)</td>
<td></td>
</tr>
<tr>
<td>COMMON POINT DATA (.CDP)</td>
<td></td>
</tr>
</tbody>
</table>

F1  F2  F3  F4

The following selections are possible.

LUNA PROGRAM (.OBJ): Saves LUNA programs onto the PC card. The type selection menu is displayed.

POINT DATA (.DAT): Saves point data onto the PC card. The type selection menu is displayed.

PLC PROGRAM (.COD): Saves PLC programs onto the PC card. The type selection menu is displayed.

COMMON POINT DATA (.CDP): Saves common point data onto the PC card. The controller's serial number becomes the file name. Example: C61-0045.CDP

KEEP RELAY DATA (.KEE): Saves keep relay data onto the PC card. The controller's serial number becomes the file name. Example: C61-0045.KEE

CONTROLLER PARAMETERS (.CTR): Saves controller parameters onto the PC card. The controller's serial number becomes the file name. Example: C61-0045.CTR
ALL DATA (.ALL):
Saves all of the above data onto the PC card. The controller's serial number becomes the file name.
Example: C61-0045.ALL

**NOTE**
Files which share the same file name will be over-written.
Load

Saves the data existing within the PC card into the controller. The display is as follows:

```
PC CARD LOAD  ↕
LUNA PROGRAM (.OBJ)
COMMON POINT DATA (.CDP)
SELECT
```

F1 F2 F3 F4

The following selections are possible.

**LUNA PROGRAM (.OBJ):** Loads LUNA programs on the PC card into specified types. The type selection menu is displayed.

**POINT DATA (.DAT):** Loads point data on the PC card into specified types. The type selection menu is displayed.

**PLC PROGRAM (.COD):** Loads PLC programs on the PC card into specified types. The type selection menu is displayed.

**COMMON POINT DATA (.CDP):** Loads common point data from the PC card.

**KEEP RELAY DATA (.KEE):** Loads keep relay data from the PC card.

**CONTROLLER PARAMETERS (.CTR):** Loads controller parameters from the PC card.

**ALL DATA (.ALL):** Loads all data saved with the ALL selection. The type number for each file will return to the values at the time of saving.

**NOTE**

All data existing prior to loading will be erased.
5-4-6 Diagnostics

The main role of diagnostics is to check the controller’s hardware. Functions are separated into three categories as follows:

Hard IN: Displays the ON/OFF status of all types of signal read from the hardware. This enables the status of the PC card and the status of mains power supply, etc., to be monitored.

Hard OUT: Displays the status of the various signals which issue commands to the hardware. ON/OFF is also possible. The status of the LED lamps on the front panel of the controller, etc., can be checked.

SENSOR & CNT: Displays the status of the position counter values calculated with the encoder pulses transmitted from the motor, home position sensors and limit sensors, etc.
(1) Hard IN
Displays the status of control signals read from the hardware. This can be referred to when trouble arises with the controller.

The following is displayed when Hard IN is selected:

```
<table>
<thead>
<tr>
<th>Hard IN</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BATTERY DOWN ERR:0</td>
</tr>
<tr>
<td></td>
<td>CPU WATCHDOG ERR:0</td>
</tr>
</tbody>
</table>
```

The following control signals can be read. 1 represents ON and 0 represents OFF in this display.

- **BATTERY DOWN ERR:** The signal to check the voltage of the battery used for memory back-up. The battery is to be replaced if this signal is ON.

- **CPU WATCHDOG ERR:** The CPU board is not operating correctly when this signal is ON.

- **SVO WATCHDOG ERR:** The servo board is not operating correctly when this signal is ON. Check to ensure that the servo board is correctly located in the slot and firmly connected.

- **SLOT ACCESS ERR:** A hardware error occurred when an attempt was made to access the servo board, the I/O board or any other optional slot. Check to ensure that each board is correctly located in its specified slot and firmly connected.

- **24V POWER ERR:** An error occurred in the 24V system of the power supply. This will arise when the 24V supplied from the controller with the user I/O has been over-used, or when a short circuit has occurred.

- **12V POWER ERR:** An abnormality has occurred with the 12V power supply used within the controller.
<table>
<thead>
<tr>
<th>DC POWER ERR:</th>
<th>An abnormality has occurred in the DC system of the power supply. Both 24V power errors and 12V power errors can occur here.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAFETY BOX LINE:</td>
<td>Not currently in use.</td>
</tr>
<tr>
<td>T.P SAFETY LINE:</td>
<td>Displays the status of the safety switch of the Teaching Pendant or the Safety Box which enables operational control from a personal computer.</td>
</tr>
<tr>
<td>BARRIER LINE:</td>
<td>Displays the input status of the BARSW of the safety connector located on the rear panel.</td>
</tr>
<tr>
<td>SAFETY BOX CONNECTION:</td>
<td>Displays the status of the Safety Box’s connection which enables operational control from a personal computer.</td>
</tr>
<tr>
<td>TP CONNECTION:</td>
<td>Displays the Teaching Pendant’s connection signal.</td>
</tr>
<tr>
<td>CARD Not Connect 1:</td>
<td>Displays whether a PC card has been inserted or not. Will be OFF when a PC card has been inserted. Corresponds with the card’s signal line CD1.</td>
</tr>
<tr>
<td>CARD Not Connect 2:</td>
<td>Displays whether a PC card has been inserted or not. Will be OFF when a PC card has been inserted. Corresponds with the card’s signal line CD2.</td>
</tr>
<tr>
<td>CARD ACCESS OK:</td>
<td>The RDY signal from the PC card. Only meaningful when a card has been inserted.</td>
</tr>
<tr>
<td>CARD BATTERY OK1:</td>
<td>Indicates that the voltage of the PC card’s battery is 2.35 volts or higher. Only meaningful when a card has been inserted.</td>
</tr>
<tr>
<td>CARD BATTERY OK2:</td>
<td>Indicates that the voltage of the PC card’s battery is 2.5 volts or higher. Only meaningful when a card has been inserted.</td>
</tr>
<tr>
<td>CARD WR PROTECT:</td>
<td>Becomes ON when PC card writing is not possible. Only meaningful when a card has been inserted.</td>
</tr>
</tbody>
</table>
EEPROM ACCESS OK: The RDY/BUSY signal for the CPU board's EEPROM memory.

CHILD PCB EXIST: Information on whether the CPU board's optional child PCB has been connected.
(2) Hard OUT
Displays the status of signals which can be controlled by software for the hardware. This can be referred to when trouble arises with the controller.

The following is displayed when Hard OUT is selected:

```
  Hard OUT  ↑↓
  ▲TASK RUN LED :0
  ROBOT RUN LED :0
  CHG 1
```

F1 CHG ON/OFF can be set forcibly.

The following control signals are available. 1 represents ON and 0 represents OFF in this display.

**TASK RUN LED:** The signal to illuminate the TASK RUN LED on the front panel of the controller.

**ROBOT RUN LED:** The signal to illuminate the ROBOT RUN LED on the front panel of the controller.

**ONLINE LED:** The signal to illuminate the ONLINE LED on the front panel of the controller.

**ERROR LED:** The signal to illuminate the ERROR LED on the front panel of the controller.
(3) Sensor & Counter
Displays the status of the position counter values calculated with the encoder pulses transmitted from the motor, home position sensors and limit sensors, etc.

The following is displayed when SENSOR & CNT is selected:

<table>
<thead>
<tr>
<th>Sensor &amp; Counter</th>
<th>R1</th>
<th>✓</th>
<th>34686</th>
<th>2000</th>
<th>h</th>
<th>-</th>
<th>+</th>
</tr>
</thead>
</table>

- **Robot task name**
- **Sensor status (ON when displayed)**
  - h: Home position sensor
  - +: + limit sensor
  - -: - limit sensor
- **Count between index pulses**
- **Count for each motor revolution**
- **Position counter value**
The value which indicates the current position calculated with the encoder pulses transmitted from the motor.
- **Axis name**
5-4-7 Error History

Displays the information related to errors that occurred during controller operation.
The following will be displayed when ERR HISTORY is selected.

Err History | ←→ ↑↓
---|---
E110 R1 L1045 199
E120 R2 L346 199
DELETE

- Date and time of occurrence
- Display is possible in a 1995/10/01 14:43:19 format by scrolling right with the → key.
- Program line number in which the error occurred
- Task name in which the error occurred
- Error number

Date of occurrence is displayed from the latest date.
New occurrences are registered at the top of the list, and the oldest information is deleted.
5-4-8 TPWRITE Monitor

Displays the character strings transmitted by the TPWRITE command available in the LUNA language. Refer to the Robot Language Guide in the LUNA5.0 Operation Manual for further details.

NOTE

- Characters other than those used by the Teaching Pendant will not be displayed correctly. Usable characters are numerals, the alphabet and single-byte katakana. Double-byte katakana or kanji (Chinese characters) will not be displayed correctly.
- This only applies to the TPWRITE commands executed with the currently selected task program.
5-4-9 Clock

Displays the clock built into the controller and performs time settings. Mostly used by the error history.

The following will be displayed when the CLOCK is selected.

<table>
<thead>
<tr>
<th>CLOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955/10/20</td>
</tr>
<tr>
<td>13:43:56</td>
</tr>
</tbody>
</table>

CHG 1

Press F1 CHG key when amendment is necessary, and enter the revised numerals as follows.

<table>
<thead>
<tr>
<th>CLOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955/10/21</td>
</tr>
<tr>
<td>1995/09/</td>
</tr>
<tr>
<td>13:43:56</td>
</tr>
<tr>
<td>WRITE</td>
</tr>
<tr>
<td>CANCEL</td>
</tr>
</tbody>
</table>

F1  F2  F3  F4

NOTE

It is recommended that the clock is checked approximately once per month.
5-4-10 Information
Displays the information related to the controller. The following information is currently available.

① Controller serial number
The number individual to the controller displayed in a C00-0001 format. This character string is used when saving and loading controller parameters onto PC cards, etc.

② Model name
Displays the model name for the product type in a character string starting with SRX-, as in SRX-630.

③ Version
The software version mounted within the controller.
5-5 I/O

A user I/O status screen is displayed when the [I/O] key is pressed. The following four menus are available here. The IN menu will be displayed when the [I/O] key is initially pressed, but OUT can be selected from this menu in order to view OUT data.

IN: Displays the status of user input.

OUT: Displays the status of user output. Output ON/OFF is also possible.

OUT force set: Performs the enforced setting of user output.

IN force set: Performs the enforced setting of user input.
5-5-1 IN
Displays user input in order of number.

The display for IN is as follows:

<table>
<thead>
<tr>
<th>IN (*:ON)</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2*</td>
</tr>
<tr>
<td>3*</td>
<td>4</td>
</tr>
<tr>
<td>5*</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>FORCED</td>
<td>OUT</td>
</tr>
</tbody>
</table>

The numbers on the 2nd and 3rd lines are input numbers. These numbers are ON when an asterisk is displayed beside them, and OFF when no asterisk is displayed. This screen indicates that input 2, 3 and 5 are ON, and 1, 4, 6, 7 and 8 are OFF.

■ Valid keys

1, 4 Scrolling the 2nd and 3rd lines of input display up and down. Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

4 OUT Moves to the OUT (user output) menu.

3 FORCE Moves to the IN enforced setting menu.
5-5-2 OUT
Displays user output in order of number.
The display for OUT is as follows:

```
<table>
<thead>
<tr>
<th>OUT (f:force)</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>14*</td>
</tr>
<tr>
<td>15*</td>
<td>16</td>
</tr>
<tr>
<td>17*</td>
<td>18</td>
</tr>
<tr>
<td>19</td>
<td>f 20</td>
</tr>
<tr>
<td>ON/OFF</td>
<td>FORCE</td>
</tr>
</tbody>
</table>
```

F1  F2  F3  F4

The numbers on the 2nd and 3rd lines are output numbers. These numbers are ON when an asterisk is displayed beside them, and OFF when no asterisk is displayed. Enforced ON/OFF setting is possible for output, and an ‘f’ will be displayed when enforced setting has been performed. The output will not change even if [F1] ON/OFF key is pressed in this situation. Refer to section 5-5-3. OUT Force Set for further details.

- **Valid keys**
  - **↓↓** Scrolls the 2nd and 3rd lines of output display up and down. Scrolling will increase in speed when these keys are pressed in combination with the [F2] key.
  - **←→** Moves the location of the cursor which indicates ON/OFF eligibility by one position for the output display on the 2nd and 3rd lines.
  - **1~9,0** Toggles the output between ON and OFF for output numbers between 1 and 10 (press 0 for 10). If the setting is current ON it will be switched OFF, and if it is OFF it will be switched ON. ON/OFF control for output numbers over 10 cannot be used with this method.
  - **F1 ON/OFF** Toggles the output between ON and OFF for the output number over which the cursor is currently located. If the setting is current ON it will be switched OFF, and if it is OFF it will be switched ON.
  - **F3 FORCE** Moves to the OUT enforced setting menu.
  - **F4 IN** Moves to the IN (user input) menu.

**Caution**

OUT settings (user output) will normally be held as they are during emergency stops. Use system task for controlling each user output during emergency stop.
5-5-3 OUT Force Set

The menu for performing enforced setting for user output. Enforced setting is the
deliberate fixing of user output values at ON or OFF to ensure that ON/OFF
amendments with LUNA programs or PLC programs, or ON/OFF amendment with
the OUT menu are not accepted.

For example, this is particularly convenient during program debugging when a
certain mechanical part of the system must not be moved at all costs.

The following two methods of enforced setting are available:

Enforced ON: Maintains normal output in the ON status, and will
not accept OFF commands from programs, etc.

Enforced OFF: Maintains normal output in the OFF status, and will
not accept ON commands from programs, etc.

The OUT force set display is as follows:

<table>
<thead>
<tr>
<th>OUT force set</th>
<th>↑↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 14* 15* 16</td>
<td></td>
</tr>
<tr>
<td>17* 18 19 f 20</td>
<td></td>
</tr>
<tr>
<td>fON fOFF CLR all CLR</td>
<td></td>
</tr>
<tr>
<td>F1 F2 F3 F4</td>
<td></td>
</tr>
</tbody>
</table>

The display on the 2nd and 3rd lines is the same as the OUT menu. It is from this
screen that enforced setting is performed.

■ Valid keys

<table>
<thead>
<tr>
<th>↑ , ↓</th>
<th>Scrolls the 2nd and 3rd lines of output display up and down. Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.</th>
</tr>
</thead>
<tbody>
<tr>
<td>← , →</td>
<td>Moves the location of the cursor which indicates ON/OFF eligibility by one position for the output display on the 2nd and 3rd lines.</td>
</tr>
</tbody>
</table>

| fON | Forcibly sets the output of the output number over which the cursor is currently located to ON. |
| fOFF | Forcibly sets the output of the output number over which the cursor is currently located to OFF. |
F3 CLR Deletes the enforced setting for the output number over which the cursor is currently located.

F4 all CLR Deletes all enforced settings.

- **OUT force set will normally be held as they are during emergency stop. All settings will be cleared when the mains power for the controller is switched OFF.**
- **Output numbers for which OUT force set has been performed cannot be changed no matter how many times ON/OFF commands are issued by programs.**
5-5-4 IN Force Set

The menu for performing enforced setting for user input. Enforced setting is the deliberate fixing of user input values at ON or OFF, and values will be forcibly set when LUNA programs or PLC programs determine input ON/OFF regardless of the actual ON/OFF input.

The use of this enables program debugging without actual input.

The following two methods of enforced setting are available:

Enforced ON: Under the assumption that the normal status is ON, the input status read by programs, etc., becomes ON regardless of the actual external input status.

Enforced OFF: Under the assumption that the normal status is OFF, the input status read by programs, etc., becomes OFF regardless of the actual external input status.

The IN force set display is as follows:

<table>
<thead>
<tr>
<th>IN force set</th>
<th>↑ ↓</th>
</tr>
</thead>
<tbody>
<tr>
<td>13 14* 15* 16</td>
<td></td>
</tr>
<tr>
<td>17* 18 19 20</td>
<td></td>
</tr>
<tr>
<td>fON fOFF I CLR I a1 I CLR</td>
<td></td>
</tr>
</tbody>
</table>

F1 F2 F3 F4

The display on the 2nd and 3rd lines is the same as the IN menu. It is from this screen that enforced setting is performed.

- **Valid keys**

  - ![↑, ↓](image)
    - Scrolls the 2nd and 3rd lines of input display up and down. Scrolling will increase in speed when these keys are pressed in combination with the [FAST] key.

  - ![←, →](image)
    - Moves the location of the cursor which indicates ON/OFF eligibility by one position for the input display on the 2nd and 3rd lines.

  - ![F1, fON](image)
    - Forcibly sets the input of the input number over which the cursor is currently located to ON.

  - ![F2, fOFF](image)
    - Forcibly sets the input of the input number over which the cursor is currently located to OFF.
F3 CLR  Deletes the enforced setting for the input number over which the cursor is currently located.

F4 all CLR  Deletes all enforced settings.

- *IN force set will normally be held as they are during emergency stop.*
- *All settings will be cleared when the mains power to the controller is switched OFF.*
5-6 Others

5-6-1 On-line

The menu which enables switching between on-line and off-line is displayed when the [ONLINE] key is pressed. It is also possible to switch between operation systems which carry out the control for run and stop operations, etc., when the status is currently off-line.

The following menu is displayed when OFF-LINE.

<table>
<thead>
<tr>
<th>OFFLINE</th>
<th>Current on-line/off-line display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run/Stop/Write ope.</td>
<td></td>
</tr>
<tr>
<td>Only TP can.</td>
<td></td>
</tr>
<tr>
<td>ONLINE</td>
<td>TP</td>
</tr>
<tr>
<td>F1   F2   F3   F4</td>
<td></td>
</tr>
</tbody>
</table>

F1 ONLINE Moves across to the on-line status.

Take note that continual operations for system tasks will automatically be started if the SYSRUN signal is on when moving across to the on-line status. Ensure that the emergency stop switch can easily be reached.

F3 TP When the right of controlling operations is held by a personal computer, this right is removed and passed across to the Teaching Pendant.

F4 PC Passes the right of controlling operations held by the Teaching Pendant across to a personal computer. Control from the personal computer is possible when this operation is performed or when the Teaching Pendant is disconnected from the controller. In other words, the personal computer is not able to remove the right of control from the Teaching Pendant when the Teaching Pendant is being used.

The following menu is displayed when ON-LINE.

<table>
<thead>
<tr>
<th>ONLINE</th>
<th>Current on-line/off-line display</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run/Stop/Write ope.</td>
<td></td>
</tr>
<tr>
<td>is unable in ONLINE.</td>
<td></td>
</tr>
<tr>
<td>OFFLINE</td>
<td></td>
</tr>
<tr>
<td>F1 OFFLINE</td>
<td>Moves across to the off-line status and stops system task.</td>
</tr>
</tbody>
</table>
5-6-2 Help

The help screen displays a list of operation explanations for the Teaching Pendant. All operational items are displayed in alphabetical order, and can be scrolled up or down. This help screen will provide operational explanations when the operating methods of the Teaching Pendant are unknown.

The following will be displayed when entering the HELP screen.

```
HELP  ↑↓
▷LANGUAGE
WHEN ERR.OCCURS
SELECT
```

F1  F2  F3  F4

For example, when details on setting system offset are required, the above screen is scrolled until SYSTEM OFFSET is displayed and selected. In this case, the following screen will be displayed.

```
HELP SYSTEM OFFSET ↑↓
[MANAGE]→CONSTANT
→SYSTEM OFFSET
```

This screen explains the operation as pressing the [MANAGE] key, selecting the constant settings, and then selecting system offset. [ ] in the display represents keys on the Teaching Pendant, and → represents the flow of operations.
Electrical Guide
Electrical Guide

1. Nomenclature .............................................. 1-1
2. Input/Output Specifications ......................... 2-1
3. Maintenance .............................................. 3-1
1. Nomenclature

Front Panel

Rear Panel
2. Input/Output Specifications

2-1 System and User I/O Specifications

Four types of I/O are available as follows:

System input (to control the robot from peripheral devices)
User input (for functions allocated optionally by the user)
System output (for sending robot information to peripheral devices)
User output (actuator drive signals or output signals allocated optionally by the user)

These are contained within the I/O board I/O connector located on the rear panel. Also, special settings have been performed prior to shipping with the system task for user input and user output to enable the device to be used in the same way as the conventional SRX series. Modify the system task program if these settings are not required.

<table>
<thead>
<tr>
<th>Pin name</th>
<th>Signal name</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI 1</td>
<td>SYSRUN</td>
<td>The master signal for when the robot is to be controlled by external signals.</td>
</tr>
<tr>
<td>SI 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI 3</td>
<td></td>
<td>Reserved for future usage</td>
</tr>
<tr>
<td>SI 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI 7</td>
<td>DSS</td>
<td>The Drive safety signal for the SMART system. Refer to section “Safety Instruction: 5. SMART specifications”.</td>
</tr>
<tr>
<td>SI 8</td>
<td></td>
<td>Reserved for future usage</td>
</tr>
</tbody>
</table>

User Input (Set prior to shipping)

<table>
<thead>
<tr>
<th>Pin name</th>
<th>Signal name</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>I 32</td>
<td>ERRRST</td>
<td>Error reset</td>
</tr>
<tr>
<td>I 33</td>
<td>PROG0</td>
<td>Program type selection signal 0</td>
</tr>
<tr>
<td>I 34</td>
<td>PROG1</td>
<td>Program type selection signal 1</td>
</tr>
<tr>
<td>I 35</td>
<td>PROG2</td>
<td>Program type selection signal 2</td>
</tr>
<tr>
<td>I 36</td>
<td>PROG3</td>
<td>Program type selection signal 3</td>
</tr>
<tr>
<td>I 37</td>
<td>PSTEP</td>
<td>Program step termination</td>
</tr>
<tr>
<td>I 38</td>
<td>PSTART</td>
<td>Program automatic operation execution</td>
</tr>
<tr>
<td>I 39</td>
<td>STPSTAT</td>
<td>Program continual execution</td>
</tr>
<tr>
<td>I 40</td>
<td>PRET</td>
<td>Robot home return start</td>
</tr>
</tbody>
</table>

Control is enabled when the SYSRUN signal is ON

Refer to section 8 of the Installation Guide for further details.
## System Output

<table>
<thead>
<tr>
<th>Pin name</th>
<th>Signal name</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO 1</td>
<td>EMC-OUT</td>
<td>Emergency stop switch stop status</td>
</tr>
<tr>
<td>SO 2</td>
<td>ERROR</td>
<td>Error signal</td>
</tr>
<tr>
<td>SO 3</td>
<td>BARRIER</td>
<td>Safety barrier signal</td>
</tr>
<tr>
<td>SO 4</td>
<td>DRIVE</td>
<td>Drive signal</td>
</tr>
<tr>
<td>SO 5</td>
<td></td>
<td>Reserved for conventional usage</td>
</tr>
<tr>
<td>SO 6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO 8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## User Output (Set prior to shipping)

<table>
<thead>
<tr>
<th>Pin name</th>
<th>Signal name</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>L37</td>
<td>STEP</td>
<td>During program step termination</td>
</tr>
<tr>
<td>L38</td>
<td>SAUTO</td>
<td>Automatic mode</td>
</tr>
<tr>
<td>L39</td>
<td>SATDO</td>
<td>During automatic operation execution</td>
</tr>
<tr>
<td>L40</td>
<td>HOMING</td>
<td>During robot home return</td>
</tr>
</tbody>
</table>

Refer to section 8 of the Installation Guide for further details.

---

**NOTE**

- **System and user output specifications:**
  - Ensure that the maximum electrical current for each point is 100mA or less.
  - Ensure that the protective element is used for induced load.

- **Recommended noise protective devices**
  - Noise killer: SR.11201G Okaya Electric Industries Co., Ltd.
2-2 I/O Circuits

2-2-1 I/O Boards and I/O Connectors

(1) Input Circuit, CN_IN

External 24V supply, GND common specification (standard settings)

Slide Switch Settings

- SSW2: Set to the COM. GND side.

Refer to “3-3 I/O Board” on replacing the fuses F1 and F4.
(2) Output Circuit, CN_OUT

External 24V supply (standard settings)

Slide Switch Settings

- SSW3: Set to the COM, 24 V side.
Refer to “3-3 I/O Board” on replacing the fuses F1 and F3.

- Add a diode as indicated above when the output load is to be connected to the relay coil.
- The F3 and F4 fuses will blow is a current of 0.5A or more is used with a 24V output. Ensure that the fuses stipulated are used.
  Fuse: 0.5ADC48V, Model: LM05, Manufacturer: Daito Communication Apparatus Co., Ltd.
- If output current of 100 mA or more flows, the protection device
2-2-2 Safety Connector

External emergency stop and safety barrier switch input circuits

The F1 and F2 fuses will blow if a current of 0.5A or more is used with a 24V output. Ensure that the fuses stipulated are used.

NOTE

Fuse: 0.5ADC48V, Model: LM05, Manufacturer: Daito Communication Apparatus Co., Ltd.
2-3 Connectors and Pin Assignment

(1) Programming unit connector, RS232C port (front panel)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>Transmission data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>Receiving data</td>
</tr>
<tr>
<td>4</td>
<td>DSR</td>
<td>Data set ready</td>
</tr>
<tr>
<td>5</td>
<td>SG</td>
<td>Signal ground</td>
</tr>
<tr>
<td>6</td>
<td>DTR</td>
<td>Data terminal ready</td>
</tr>
<tr>
<td>7</td>
<td>CTS</td>
<td>Clear to send</td>
</tr>
<tr>
<td>8</td>
<td>RTS</td>
<td>Request to send</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td></td>
</tr>
</tbody>
</table>

Model: FCN-674J009-L/F#VA-01 Manufacturer: FUJITSU LIMITED

(2) Safety box connector (front panel)

Do not connect as not normally used.

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EMS 9</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>2</td>
<td>EMS 8</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>3</td>
<td>EMSCN3</td>
<td>Safety Box identifier (2)</td>
</tr>
<tr>
<td>4</td>
<td>EMSCN2</td>
<td>Safety Box identifier (2)</td>
</tr>
<tr>
<td>5</td>
<td>EMSCN1</td>
<td>Safety Box identifier (1)</td>
</tr>
<tr>
<td>6</td>
<td>EMSCN0</td>
<td>Safety Box identifier (1)</td>
</tr>
<tr>
<td>7</td>
<td>EMSSAF1</td>
<td>Safety switch</td>
</tr>
<tr>
<td>8</td>
<td>EMSSAF0</td>
<td>Safety switch</td>
</tr>
<tr>
<td>9</td>
<td>EMSSAF3</td>
<td>Safety switch</td>
</tr>
<tr>
<td>10</td>
<td>EMSSAF2</td>
<td>Safety switch</td>
</tr>
<tr>
<td>11</td>
<td>FG</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>FG</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>FG</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>EMS 11</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>15</td>
<td>EMS 10</td>
<td>Emergency stop</td>
</tr>
</tbody>
</table>

Model: FCN-674J015-L/F#VA-01 Manufacturer: FUJITSU LIMITED
### (3) Teaching pendant connector (front panel)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FG</td>
<td>Frame ground</td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>Transmission data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>Receiving data</td>
</tr>
<tr>
<td>4</td>
<td>RTS</td>
<td>Request to send</td>
</tr>
<tr>
<td>5</td>
<td>CTS</td>
<td>Clear to send</td>
</tr>
<tr>
<td>6</td>
<td>DSR</td>
<td>Data set ready</td>
</tr>
<tr>
<td>7</td>
<td>SG</td>
<td>Signal ground</td>
</tr>
<tr>
<td>8</td>
<td>EMS 7</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>9</td>
<td>EMS 6</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>10</td>
<td>SG</td>
<td>Signal ground</td>
</tr>
<tr>
<td>11</td>
<td>TPSAF1</td>
<td>Safety switch</td>
</tr>
<tr>
<td>12</td>
<td>SG</td>
<td>Signal ground</td>
</tr>
<tr>
<td>13</td>
<td>TPSAF2</td>
<td>Safety switch</td>
</tr>
<tr>
<td>14</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>EXS5</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>17</td>
<td>EXS4</td>
<td>Emergency stop</td>
</tr>
<tr>
<td>18</td>
<td>TPCN1</td>
<td>Teaching pendant identifier</td>
</tr>
<tr>
<td>19</td>
<td>SG</td>
<td>Signal ground</td>
</tr>
<tr>
<td>20</td>
<td>DTR</td>
<td>Data terminal ready</td>
</tr>
<tr>
<td>21</td>
<td>TPCN2</td>
<td>Teaching pendant identifier</td>
</tr>
<tr>
<td>22</td>
<td>P5V</td>
<td>+5V</td>
</tr>
<tr>
<td>23</td>
<td>TPSAF0</td>
<td>Safety switch</td>
</tr>
<tr>
<td>24</td>
<td>SG</td>
<td>Signal ground</td>
</tr>
<tr>
<td>25</td>
<td>P5V</td>
<td>+5V</td>
</tr>
</tbody>
</table>

Model: FCN-674J025-L/F#VA-01  Manufacturer: FUJITSU LIMITED
(4) AC mains power connector (rear panel)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ACP1</td>
<td>AC mains power</td>
</tr>
<tr>
<td>B</td>
<td>ACP2</td>
<td>AC mains power</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td>(Not connected)</td>
</tr>
<tr>
<td>D</td>
<td>FG</td>
<td>Frame ground</td>
</tr>
</tbody>
</table>

Model: CS05-2A18-10PD-B    Manufacturer: DPK Ltd.
(5) Safety Connector (rear panel)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Name</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
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Model: FCN-675J025-L/C#PD  Manufacturer: FUJITSU LIMITED

- Use the pins from number 16 to number 25 without making any connection.
- Refer to section “Safety Instruction: 2. How to connect a safety circuit”.
(6) Motor Power Connector (rear panel)

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Model: Housing: 0930 006 0301  
Frame for housing: 0914 006 0311  
Modules for female contacts: 0914 006 3101  
Female contacts: 0933 000 6205 (1 mm²)  
Manufacturer: Harting
### (7) Feed-back connector (rear panel)

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Model: 10268-52A2JL  Manufacturer: 3M
### (8) I/O board, I/O connector, Input connector CN_IN (rear panel)

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Model: 10250-52A2JL Manufacturer: 3M
Applicable plug: Model:10150-3000VE Manufacturer: 3M
Applicable shell: Model:10350-52F0-008 Manufacturer: 3M
(9) I/O board, I/O connector, Output connector CN_OUT (rear panel)

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Model: 10250-52A2JL Manufacturer: 3M
Applicable plug: Model:10150-3000VE Manufacturer: 3M
Applicable shell: Model:10350-52F0-008S Manufacturer: 3M
(Sony specifications)
(10) Communication connector, RS232C port (rear panel)

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Code</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>TXD</td>
<td>Transmission data</td>
</tr>
<tr>
<td>3</td>
<td>RXD</td>
<td>Receiving data</td>
</tr>
<tr>
<td>4</td>
<td>DSR</td>
<td>Data set ready</td>
</tr>
<tr>
<td>5</td>
<td>SG</td>
<td>Signal ground</td>
</tr>
<tr>
<td>6</td>
<td>DTR</td>
<td>Data terminal ready</td>
</tr>
<tr>
<td>7</td>
<td>CTS</td>
<td>Clear to send</td>
</tr>
<tr>
<td>8</td>
<td>RTS</td>
<td>Request to send</td>
</tr>
<tr>
<td>9</td>
<td>NC</td>
<td></td>
</tr>
</tbody>
</table>

Model: CDS-3109-0122  Manufacturer: SMK
Applicable plug: Model: 17JE-23090-02  Manufacturer: DDK Ltd.
Applicable shell: Model: 17JE-09H-1A  Manufacturer: DDK Ltd.
3. Maintenance

3-1 Accessories

The following accessories are available as consumable products. Additional accessories must be purchased.

<table>
<thead>
<tr>
<th>Name</th>
<th>Model</th>
<th>Manufacturer</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input connector</td>
<td>10150-3000VE (plug complete with solder)</td>
<td>3M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10350-52F0-008 (plastic shell)</td>
<td>3M</td>
<td></td>
</tr>
<tr>
<td>Output connector</td>
<td>10150-3000VE (plug complete with solder)</td>
<td>3M</td>
<td>Sony specifications</td>
</tr>
<tr>
<td></td>
<td>10350-52F0-008S (plastic shell complete with processor)</td>
<td>3M</td>
<td></td>
</tr>
<tr>
<td>Fuses</td>
<td>LM05 (fuse 0.5A)</td>
<td>Daito Communication Apparatus Co., Ltd.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>LM50 (fuse 5A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety connector</td>
<td>DB-25PF-N (with soldering plug)</td>
<td>JAB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DB-C4-J11 (metal case)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I/O board 24V connector</td>
<td>MC1.5/2-ST-3.81</td>
<td>Phoenix Contact</td>
<td></td>
</tr>
<tr>
<td>I/O board 24V Ferrite cores</td>
<td>ZCAT2032-0930</td>
<td>TDK</td>
<td></td>
</tr>
</tbody>
</table>
3-2 Memory Card

A memory card with the following specifications has been prepared:

Standards: PC card standards
Type: Type 1
Capacity: 1 Mbyte SRAM (battery back-up type)

- Memory Card Selection Examples
IC memory card SRAM series 1MB  Model: J41000SRMAD20-A Manufacturer: Mitsubishi Plastic, Inc.
IC memory card CSCJ series 1MB Model:CSCJ-001M-SM-461 Manufacturer: ITT Cannon
* Specifications as of September 1995

- Inserting the memory card
Insert the memory card in accordance with the direction indicated in the following diagram.

![Diagram of memory card insertion]

**NOTE**
Do not remove or replace the memory card during reading or writing processes.
3-3 I/O Board

The I/O board is located on the rear panel. Ensure that the mains power switch has been turned OFF prior to removing the I/O board.

The panel area can be removed by unscrewing the two bolts that hold the I/O board secure. The F1 to F4 fuses, and slide switches SSW1 to SSW3 are located on the I/O board as indicated in the following diagram and will require replacement in accordance with necessity.

SSW1: Set to ENT.24V.
SSW2: Set to COM.GND.
SSW3: Output Common Selection

NOTE: Refer to section "Electrical Guide: 2-2 I/O Circuits".

I/O Board (rear panel)
3-4 Batteries

The following two types of batteries are built into the controller. (Refer to page 3-6).
1. Lithium ion battery Model: CR17335SE Manufacturer: SANYO Electric Co., Ltd. Used for the cpu board’s memory back-up.
2. Lead storage cell battery Model: CYCLON, D cell Manufacturer: Hawker Energy Products INC. Used for backing up the absolute encoder circuit incorporated in the SRX robot’s motor.

3-4-1 Handling Batteries

The mis-handling of lithium ion batteries and lead storage cell batteries is extremely dangerous. Avoid the following at all costs to maintain safety. Sony Corporation refuses all responsibility for trouble ensuing from the following cases.
(1) Short-circuits
Avoid short-circuiting the batteries at all costs.
Failure to observe this may result in damage to equipment or fire caused by generated heat.
(2) Dismantling
Never dismantle the batteries. Failure to observe this may result in respiratory problems caused by escaping gas or the leakage of lithium metal. Deforming the batteries or subjecting them to impact may also result in heat generation, splitting or the outbreak of fire.
(3) Subjecting to flames or water
Applying heat to the batteries may result in leakages or splitting and the outbreak of fire through internal short-circuiting. The batteries may split open when immersed in water, so avoid this at all costs. The function of the batteries will also be lost when immersed in water.
(4) Soldering
Never apply solder directly to the batteries. Applying heat to the batteries may result in leakages or splitting and the outbreak of fire through internal short-circuiting.
(5) Never insert the batteries with the positive and negative poles in the reverse position.
(6) Usage for other purposes
Never use the batteries in other equipment. Differing specifications may result in damage to the battery or equipment.
(7) Recharging
Do not attempt to recharge lithium ion batteries. Failure to observe this may result in internal gas emissions, splitting or the outbreak of fire.
(8) Disposing of lead storage cell batteries
Insulate the terminals of all lead storage cell batteries with insulating tape after use and return to the Sony Service Center or Sony Shop.
3-4-2 Recharging Lead Storage Batteries for Absolute Encoder Back-up Purposes

Recharging is performed by the recharging circuit when the robot controller's power supply is switched on. A current is supplied to the absolute encoder when the mains power has been cut. The absolute encoder can be backed up for approximately one month on a full charge. Recharging will take 24 hours when a battery is completely dead. The life span of lead storage cell batteries is reduced by repeated recharging. This may lead to the loss of position data for the absolute encoder through reduced current within the above-mentioned period. In this event, replace the battery and perform the home return process.

3-4-3 Battery Life and Replacement

The official life span of lithium ion batteries and lead storage cell batteries is six years. Replace these batteries once every six years. Place a new battery in the supplementary connector when replacing batteries and remove the old battery. The use of the supplementary connector will maintain the memory and absolute encoder circuits in a back-up status. Note that all position data for the absolute encoder will be lost if the lead storage battery is completely removed from the connector. There are cases where the official life span will not be reached depended on the environment in which the battery is used.

3-4-4 Protection Circuits

A fuse is connected to the recharging circuit as output short-circuit protection for the absolute encoder’s lead storage cell battery. The circuit will be protected by the fuse blowing when a short-circuit occurs between the controller and the motor encoder. In this event, locate and remedy the cause, and then replace the fuse. Position data for the absolute encoder will be lost when this fuse blows, so home return must be performed once more in order to set the home position. (Refer to page 3-6).

Fuse: 0.5A DC48V  Model: LM05  Manufacturer: Daito Communication Apparatus Co., Ltd.
Controller internal configuration

Memory backup battery

Battery for AC motor absolute encoder

To fan cooler

J7
J8
FAN2
J9
FAN1

To backup battery for user program

J10
BATT.1
BATT.2
J11
BATT.3
3-5 Maintenance Management

The following inspections are recommended on a regular basis of at least once every six months.

a) Operational check of the fan connected to the controller
The operations of the fan connected to the controller must be checked without fail when being used for the first time. If the fan is incapable of ventilating sufficient heat owing to the surrounding environment, heat will build up in the integrated circuits and cause wide-spread damage.

b) Relay cable damage and loose terminal connector checks
Perform visual checks on the relay cable between the controller and the robot for scratches or squashing, and on the cable terminal connectors for loosening.

c) Wiring connection checks for sensors
The limit and home position detectors for each axis use photo-micro sensors and must be checked for socket loosening or scratches on the wiring leading from socket solders.
Mechanical Guide
Mechanical Guide

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3. Maintenance ....................................... 3-1
4. Internal Wiring Diagram ......................... 4-1
1. Nomenclature

- $\theta_2$ Axis Motor
- R Axis Motor
- Z Axis Motor
- R.Z Axis
- 2nd Arm
- 1st Arm
- $\theta_1$ Axis Motor
- Base
- Robot Cable
2. Tooling

2-1 Tool Attachment

The front tip of the RZ axis is shaped as indicated in the following diagram in order to enable tool attachment. The tip is also equipped with a part stopper, and with the exception of special cases, this should never be removed. The ball will disconnect when the ball spline is removed from the top, and replacement becomes impossible. Extreme caution is therefore required. The maximum external shape of tools for the SRX-611 is as indicated in the following diagram. This range prevents the tools from interfering with the robot. When this maximum tool shape is exceeded, it is recommended that safety is maintained by adding software constraints over the range of operations when creating the robot program.

It is possible to attach flanges which incorporate stopper when the stopper proves to be an obstruction for user tooling requirements or for when large flanges, etc., are to be attached, but the diameter of the stopper must be Ø38 or more and must be affixed with stopper rubber.

Consideration must be given to tightening tools during attachment and the firm setting of span rings, etc., in the design stage. Set screws are not recommended for attachment as they have unstable levels of strength.

Never remove the RZ axis from the top. The ball of the ball spline will disconnect and replacement will become impossible. Special tools are required for dismantling.
2-2 User Wiring and Ducting

This device is equipped with user wiring and ducting. As indicated in the diagram below, 15 wires and 3 ø6 air tubes are connected from the connectors located on the rear panel of the base to the upper surface of the 2nd arm. These may be used in accordance with the ranges stipulated in the table below. A pair of D sub-connector for user wiring is provided as a standard accessory and is located in the mechanical accessory box.

![Diagram showing user wiring and ducting](image)

**Connector for User Wirings**
JAE
DA-15PF-N

**Connector for User Wirings**
JAE
DA-15PF-N

---

**NOTE**

- User ducts must be used with 800KPa (8kgf/cm) or less.
- User wiring must be used within the following ranges.

<table>
<thead>
<tr>
<th>Pin number</th>
<th>Maximum current</th>
<th>Maximum voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.5A or less</td>
<td>DC24V or less</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2-3 Hollow of the Axis for Wiring and Ducting

The RZ axis on the SRX-611 is hollow (Ø13) to allow wiring and ducting to pass through. The following points must be taken into consideration during design. The RZ axis moves 150mm up and down. Owing to this, the lowest position of the axis tip is below the cover. Attach a pole to the RZ axis’ leading surface as indicated in the diagram below when using hollow wiring and ducting. Ensure that the diameter of the pole is Ø28mm or less, otherwise it will react with the home position sensor and lead to mis-operations.

Also, the RZ axis rotates within a range of ±290 degrees. In addition to providing sufficient leeway for the upper part, use cables and tubes which can endure twisting.

Pole for hollow axis wiring and ducting
(reference diagram)

Caution

Parts which protrude Ø28mm or more above the top of the RZ axis will lead to mis-operations by the sensor. Ensure that designs include parts of Ø28mm or less.
3. Maintenance

3-1 Lubrication

This device is equipped with three grease lubrication areas: two on the speed reduction gear of θ1 and θ2 axis and one on the spline ball screw area. Ensure that regular maintenance is carried out based upon the following table.

<table>
<thead>
<tr>
<th>Lubrication areas</th>
<th>Replacement yardsticks</th>
<th>Replacement oil (manufacturer names)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>θ1 axis speed reduction gear</td>
<td>8000 hours, or four years at 8 hours</td>
<td>Harmonic grease SK-1A (Harmonic Drive Systems)</td>
<td>15cc</td>
</tr>
<tr>
<td>θ2 axis speed reduction gear</td>
<td>operation per day with 250 days per year.</td>
<td>Maltemp LRL3 (Kyodo Oils)</td>
<td>13cc</td>
</tr>
<tr>
<td>RZ axis spline ball screw</td>
<td>Every six months</td>
<td></td>
<td>Appropriate quantity</td>
</tr>
</tbody>
</table>

- Implement an inspection three months after start of operations.
- It is necessary to apply appropriate quantities of lubrication and avoid dust or foreign objects becoming mixed with the oil in order to ensure high-speed and high levels of accurate operations over the long term.
- Confirm that foreign objects are not mixed in with the grease during lubrication.
- Confirm that the mains power has been switched off and the plug removed from the socket prior to starting lubrication.

![Diagram of lubrication areas]
3-2 Lubricating the Speed Reduction Gear

Harmonic drives are used within the θ1 axis speed reduction gear and θ2 axis speed reduction gear. These are configured to be mechanically maintenance-free, and can be used for long periods of time (approximately 8,000 hours) without being lubricated. Observe the following points during lubrication.

θ1 axis speed reduction gear:
The θ1 axis speed reduction gear is located at the base of the 1st arm’s joint. The M10 hexagonal bolt hole in the center of the upper surface is the lubricant inlet. Remove the bolt and apply 15cc of Harmonic Grease SK-1A.

θ2 axis speed reduction gear:
The θ2 axis speed reduction gear is located at the top of the 1st arm’s tip. The lubricant inlet is located on the lower surface of the tip. Remove the screw with a screwdriver and apply 13cc of Harmonic Grease SK-1A.

<table>
<thead>
<tr>
<th>Lubrication areas</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>θ1 axis speed reduction gear</td>
<td>15 cc</td>
</tr>
<tr>
<td>θ2 axis speed reduction gear</td>
<td>13 cc</td>
</tr>
</tbody>
</table>
3-3 Lubricating the RZ Axis

Carry out inspections and lubricate the RZ axis spline ball screw every six months in accordance with the following instructions.

1. Remove the four hexagonal bolts holding the front cover of the 2nd arm in position, and pull the cover out horizontally to remove it.
2. Confirm that no dust or foreign objects exist in the spline ball screw area.
3. Wipe the area with a cloth that will not generate dust of foreign objects, apply an applicable quantity of grease (Maltemp LRL3) and rub the grease equally over the area by hand.
4. Ensure that the cover is replaced in position after lubrication is complete.

RZ Axis Lubrication Area
3-4 Sensors

Each robot axis is equipped with a home sensor and overrun limit sensor (excluding the R axis). Each of these sensors consists of the following configuration. The positions for attachment are indicated in the diagram below.

The sensors are adjusted in accordance with specifications prior to shipping. The robot’s home position will change if the sensors are moved, so use care in handling. Consult with Sony Corporation when maintenance, such as replacement, etc., for the sensors is required.

**Axis sensor table**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Name</th>
<th>Function</th>
<th>Model number</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>θ1</td>
<td>T1 HOME</td>
<td>Home position confirmation</td>
<td>EE-SX473</td>
<td>OMRON</td>
</tr>
<tr>
<td></td>
<td>T1 + LIMIT</td>
<td>⊕ overrun confirmation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T1 - LIMIT</td>
<td>⊖ overrun confirmation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>θ2</td>
<td>T2 HOME</td>
<td>Home position confirmation</td>
<td>EE-SX427</td>
<td>OMRON</td>
</tr>
<tr>
<td></td>
<td>T2 + LIMIT</td>
<td>⊕ overrun confirmation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2 - LIMIT</td>
<td>⊖ overrun confirmation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>Z HOME</td>
<td>Home position confirmation</td>
<td>GXL-8FIB</td>
<td>SUNX</td>
</tr>
<tr>
<td></td>
<td>Z + LIMIT</td>
<td>⊕ overrun confirmation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z - LIMIT</td>
<td>⊖ overrun confirmation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>R HOME</td>
<td>Home position confirmation</td>
<td>EE-SX427</td>
<td>OMRON</td>
</tr>
</tbody>
</table>
3-5 Motors

This device uses the latest compact AC servo motors. Each motor has been adjusted to support the Sony SRX-C61 controller. These motors are not compatible with similar class AC servo motors available on the open market, so consult with Sony Corporation when maintenance, such as replacement, etc., for the motors is required.

The motor types and attachment positions are as follows.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Name</th>
<th>Output</th>
<th>Sony part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>θ1</td>
<td>AC servo motor</td>
<td>500W</td>
<td>1-698-655-12</td>
</tr>
<tr>
<td>θ2</td>
<td>AC servo motor</td>
<td>300W</td>
<td>1-698-656-12</td>
</tr>
<tr>
<td>Z</td>
<td>AC servo motor (with brakes)</td>
<td>100W</td>
<td>1-698-658-12</td>
</tr>
<tr>
<td>R</td>
<td>AC servo motor</td>
<td>100W</td>
<td>1-698-657-12</td>
</tr>
</tbody>
</table>
### 3-6 Timing Belts

A timing belt is used in this device’s RZ axis drive. The appropriate amount of tension is applied to this timing belt prior to shipping in order to ensure high-speed and high levels of accurate operations for the RZ axis. If this tension is loosened, unsuitable effects will be reflected on accuracy and operations, etc. Ensure that regular inspections and adjustments are carried out in accordance with the following diagram.

Regular inspections should be implemented once every six months, and this should include visual inspections to ensure that soiling, cracking or loosening of the belt does not exists. Adjust belt tension is accordance with the instructions provided in section 3-7 if loosening is apparent. The belt must be replaced if it is cracked or damaged in any other way. Consult with Sony Corporation in this event.

<table>
<thead>
<tr>
<th>Position of usage</th>
<th>Sony part number</th>
<th>Model number</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st stage of the R axis</td>
<td>4-712-886-01</td>
<td>STS 100S3M22B8V</td>
<td>Bando Chemical Industries Ltd.</td>
</tr>
<tr>
<td>2nd stage of the R axis</td>
<td>4-712-884-01</td>
<td>STS 150S3M372V</td>
<td></td>
</tr>
<tr>
<td>Z axis</td>
<td>4-712-885-01</td>
<td>STS 100S3M288V</td>
<td></td>
</tr>
</tbody>
</table>
3-7 Tension Adjustment

Observe the following procedures when adjusting the timing belt:

1. Remove the four M4 hexagonal bolts which hold the 2nd arm's side covers in position, and remove the cover by holding it at the bottom and pulling sideways while pressing upwards.
2. Slightly loosen the screws (M5 hexagonal bolts) of the plate attached to the motor. Loosen just enough to allow the plate to be withdrawn from the gap.
3. Attach a firm length of string around the base of the motor, apply 8kg of tension to a spring balance as indicated in the diagram, and then tighten the bolts while maintaining the tension.
4. Perform the same procedure for each belt.
5. Replace the cover in its original position.

Adjustment sequence

![Diagram showing the sequence of steps for tension adjustment]
4. Internal Wiring Diagram