Work Involved in Installing an SRX Series Robot

The following tasks must be performed without fail when switching on the robot for the first time:

1. Connect the robot specified on the controller's name plate.
   A name plate with 'ASSEMBLY ROBOT' written on it is located at the back of the robot controller.

   For example, a number, such as R.NO.82501 C.NO.C61-0001, will be written on the plate, and this represents the robot's model number (R.NO.) and the controller number (C.NO.).

   In the above case, the controller is connected to the 82501 model robot.

   Ensure that the connection with the robot mentioned on the name plate is definitely secure before switching on the mains power.

2. Home Return

   The absolute decoder used with this robot is equipped with a battery back-up system. As the back-up battery is located within the controller, it is necessary to return to the home position when the feed-back cable between the robot and the controller is disconnected.

   Perform the following procedures for returning to the home position when the electrical power has been switched on for the first time after installation or in the case that the feed-back cable has been disconnected.

   Press the MANAGE key.

   ↓

   Use the ↑, ↓ cursor keys to select home return, and press F4 key.

   ↓

   Press F1 OK key to start home return.

   Settings for the home position and home return operation sequences are also performed in accordance with the robot installation conditions (refer to the operation guide for further details.)
3. Robot Data Back-up

The controller has data stored for each type of usable robot in order to enable other types of robot to be used. This data includes individual robot data, such as servo parameters, etc., and user-amendable data, such as system offset, etc. Take a back-up of this robot data by observing the following procedures when switching on the electrical power for the first time.

Insert the LUNA5.0 system disk in the A drive of a personal computer, a formatted disk in the B drive, and run the following command:
RECALL_D_FB:

A file named after the controller number with .RBT as the extension log will be created on the disk inserted into drive B.
C61_0001.RBT
(When the controller number is C61_0001)

Store this disk in a safe place.
It is also necessary to perform the same procedure when system offset, system limit or tool data has been amended.
This data can be restored to original values by transferring the file with the SEND command.
Refer to the LUNA Programming Unit Guide for further details on commands.

4. Clock

The date and time displayed when confirming error history are set with the internal clock. Ensure that the correct date and time are set when first using the robot.

Press the [MANAGE] key.

Use the [↑], [↓] cursor keys to select clock, and press [F4] key.

Press [F1] CHG key and enter the required numerals.

Press [F1] WRITE key to save the amendments.
About this Operation Manual

Safety Instruction

Installation Guide

Operation Guide

Electrical Guide

Mechanical Guide

Error Code Guide

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Appendix
About this Operation Manual
About this Operation Manual

This Operation Manual is intended as a guide for users of the High-Speed Assembly Robot SRX series.

It contains the information that users are expected to read before operating. Read this manual before starting operation.

- This manual may not be replicated in whole or in part without the prior written authorization of Sony Corporation.

- The information described herein is subject to change without notice.

- The information described herein has been checked for both reliability and accuracy. However, if you have any questions, or notice any errors or omissions in this manual, please contact the following offices of Sony Corporation.

Sony Electronics Inc. Service Department
New York  Telephone : 914-365-6000   Fax : 914-365-6087
San Diego  Telephone : 619-673-2701   Fax : 619-674-1853

Sony Precision Engineering Center Pte Ltd.
Manufacturing Systems Division Service Engineering Dept.
Singapore  Telephone : 02-8691362   Fax : 02-8691322

Sony Wega Produktions GmbH Service Department
Germany   Telephone : 711-5858-446   Fax : 711-574153

Sony Max Corporation   FA Service Shop
Japan   Telephone : 0480-23-1685   Fax : 0480-23-1706
Manual Configuration

The entire layout of this manual has been summarized below for ease of use.

Safety Instruction
Explains the precautions necessary to ensure the correct use of this device.

Installation Guide
1. Outline
   Provides an outline of the device.
2. Features
   Explains the features of the device.
3. Configuration
   Explains the configuration of the device.
4. Specifications
   Explains mechanics, control, language specifications and controller functions.
5. Outline Drawings and Work Envelopes
   Explains the outline drawings of the main unit, the controller and the teaching pendant, and the work envelopes for the robot.
6. Unpacking
   Explains how to unpack the main unit and the controller.
7. Installation
   Explains the methods of transportation, installation and connection.
8. System Task and Signal Control
   Explains emergency stops using the system task and system task I/O sample programs.

Operation Guide
1. Teaching Pendant (TP) Outline
   Explains the name and role of each teaching pendant part.
2. Main Operation System Diagrams
   Operation key flows explained with the use of flow charts.
3. Major Operation-Related Terminology
   Explains the terminology used during operation.
4. Basic Operations
   Explains basic operation methods.
5. Operations
   Explains the teach mode, the execution mode, management and I/O, etc.
Electrical Guide

1. Nomenclature
   Explains the names of each of the controller’s parts.
2. Input/Output Specifications
   Explains the specifications relating to input and output, and circuits and
   connector pin assignment, etc.
3. Maintenance
   Provides details on the batteries and maintenance management, etc.

Mechanical Guide

1. Nomenclature
   Explains the names of each of the robot’s parts.
2. Tooling
   Explains tool attachment, and user wiring and ducting, etc.
3. Maintenance
   Provides details in maintenance and inspections.
4. Internal Wiring Diagram
   Explains the device’s internal wiring system.

Error Code Guide

Explains error displays, meanings and countermeasures.
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Appendix
Safety Instruction
Much care has been paid to machine safety during design and manufacture of this device. However, failure to carry out operations and maintenance in accordance with the safety rules may result in damage to the machine or injury to the operators. It is necessary for operators and maintenance personnel to observe these rules completely to prevent the occurrence of accidents. Ensure that the following precautions have been read thoroughly prior to reading the remainder of this operation manual, and pay attention to the safety rules when operating or maintaining machine.

Observe all precautions to ensure safety.

Read the precautions on pages 2 and 17 thoroughly.

Perform regular inspections.

Ensure that inspections are carried out in accordance with directions outlined in Section 3 of the Electrical Guide, and Section 3 of the Mechanical Guide.

In the event of accidents....... Contact us immediately.
**Definition of warning symbols**

The following symbols are used within this manual and with the product to ensure safe usage. Read and remember the following important safety precautions before using the machine.

**〈Machine Symbols〉**

![Symbol]

Indicates the units and locations which are dangerous to touch when the electrical power is switched on as they contain high-voltages.

![Symbol]

Indicates the grounding terminals connected to protection circuits on the equipment.

**〈Operation Manual Symbols〉**

![Symbol]

Indicates that mis-operations or mis-handling may result in unexpected danger (fire, etc.,) and that the operator is at risk (of major injury).

![Symbol]

Indicates that mis-handling may result in unexpected danger (electric shock, etc.,) and that the operator is at risk of injury or the equipment at risk of damage.
- The drive units are subject to unexpected movement. Avoid coming within the range of movement except when performing maintenance or inspections.
- Switch off the mains power prior to performing maintenance or inspections. Failure to observe this may result in death or severe injury through electric shocks or unexpected movement of the robot.
- Mistakes during maintenance and inspections may result in accidents. Observe the following prior to starting maintenance or inspections:
  1. Read the operation manual thoroughly and following all instructions and warnings closely.
  2. Implement inspections on a daily basis to prevent accidents arising from damaged equipment.
- Ensure that the electrical earth should be connected. Avoid using intense electrical earths for more than one item, and connect to the line (AWG 14) or bigger independently. Electrical potential difference will occur with surrounding equipment if the electrical earth is not connected and may result in electrical leaks or electrical shocks.

- Heavy object. Use special equipment to move and transport and pay attention to safety measures.
- Do not make any conversions to the equipment in order to maintain safety. Contact Sony Corporation before attempting any conversions.
- Note that there may be cases when the equipment will fall over when carrying out work with the arm fully extended.
- Avoid installing in the following locations:
  - In places which receive direct sunlight or which experience temperature ranges exceeding 0 degrees and 40 degrees.
  - In places which experience relative humidity ranges exceeding 35% and 90%, and places in which condensation is generated by rapidly changing humidity.
  - In places where corrosive gas or inflammable gas exists.
  - In places where the unit will be subject to direct vibrations or impact.
  - Close to machinery which emits electrical noise, such as welders, electric dischargers or high-frequency generators.

It is recommended that robot operators attend the robot safety lectures held by Sony Corporation, or receive training from people who have attended the robot safety lectures.
The Sony High Speed Assembly Robot SRX-600 series have the safety functions to comply with the following safety regulations:

- **European safety regulations:** EN292-1, 2, EN60204, EN775, EN60950
- **U. S. A. safety regulations:** RIA, NFPA79

When users develop applications with this robot, setup a safety cover and design a safety circuit according to the instructions described in this manual.

For users in European counties, the safety functions of this robot must be realized in users' application so that the users' application including the robot satisfies safety requirements with "Machinery Directive", and put the "CE mark" on the system by users themselves.
1. Setting up safety cover

A safety cover must be setup around the work envelope of the robot. The open and close status output signals from the safety cover sensor switches must be connected direct to the BARSW connector of the robot controller without passing through software.

The switches SS1 and SS2 sense open and close of the safety cover, and must have a logic which turns ON when the safety door is closed. Use Approval switch of the safety regulation for SS1 and SS2.

The open and close status output signals from the safety cover sensor switches must be connected direct to the “BARSW” connector of the robot controller.

< For users in European countries >
Detailed specifications of the residual openings of the robot system when the safety cover is closed must satisfies the requirements of EN294 and EN349.
Safety when safety cover is installed.
If the safety cover is opened and "BARSW" signal remains OFF, the over speed detector circuit inside the robot controller is activated to monitor the robot if the operating speed of the robot should not exceed the safety speed (speed of robot tip: 250 mm/s). If the robot should exceed this speed, emergency stop is triggered. The over speed detector circuit is made by hardware only.

<table>
<thead>
<tr>
<th>Safety cover opened</th>
<th>BARSW signal</th>
<th>Environment</th>
<th>Over Speed Detector Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OFF</td>
<td>Operator can enter the work envelope of the robot</td>
<td>ON</td>
</tr>
<tr>
<td>Safety cover closed</td>
<td>ON</td>
<td>Operator cannot enter the work envelope of the robot</td>
<td>OFF</td>
</tr>
</tbody>
</table>

⚠️ Caution

This is to secure safety for teaching operator. Be sure to install the safety cover.
2. How to connect a safety circuit

Robot controller

SPD PANEL BOARD

Hardware

Over Speed Detector Circuit

1 2 3 4 EMS0 (I) EMS1 (I) EMS2 (I) EMS3 (I) 5 6 7 8 EGTS0 (O) + EGTS1 (O) EGTS2 (O) EGTS3 (O) 9 10 11 12 13 14 External Emergency status output 15 16 17 18 19 20 21 22 23 24 25 Safety connector

CPU & SERVO

MOTHER BOARD

SERVO AMP

Feedback line

Encoders

(I): Input
(O): Output

NOTE Make short circuit between pins-9, -12 and -13 of the safety connector.
BARSW0, 1 (Input): Safety cover output signal (Do not pass the signal through software.)
The BARSW0 and the BARSW1 must be synchronized.

EMS0-3 (Input): Stop the robot externally by emergency stop
If this emergency stop is triggered, the servo power control lines are shut OFF directly at the same time.
The EMS0-1 and the EMS2-3 must be synchronized.

EGSTS0-3 (Output): This signal is output from hardware when the robot controller is in normal condition. If the emergency stop (inclusive of EMS0 to EMS3) is triggered, OFF signal is output to let the external peripherals know of the emergency status. The EGSTS0-1 and the EGSTS2-3 are synchronized during operation.
In the conventional SRX series robot (models SRX-400 and before), this signal used to be ON when an emergency stop is triggered. Pay attention to this change when using this output signal.
Detection of melting of safety circuit switch contact

This controller has a built-in circuit which detects melting of the switch contact. This melting detection circuit consists of safety relays. Melting of the contacts of the following relays is detected:

- Emergency stop switches of the Teaching Pendant and the Safety Box, the external emergency stop input switch (EMS0-3), the barrier switches (BARS0, 0-3, and 1) and the drive safety switch (DSS0-1 used in SMART only).

**NOTE**

*Be sure to use the double-pole switch when users connect external switches to the above switches.*

If one contact in any of the above switches melts or is short-circuited, SERVO ON will not be possible.

Either one of the two melting indicator LEDs on the SPD PANEL lights and the remaining LED is turned off when melting occurs.

(Both LEDs turn on and off synchronously during normal operation.)

(The "E381 SERVO trap error" is displayed on the Teaching Pendant to indicate that a switch contact has melted.)

---

**SRX-C61 front panel**

- **Caution**: Perform attachment or removal of the Teaching Pendant or the Safety Box while pressing the INS./EJECT switch even during servo OFF.
- **Caution**: The melting detection circuit is effective only when the main power is ON. The melting detection information is cleared when the main power is turned OFF.
3. Operation modes and safety functions

Description of this section follows the system program of the standard installation.

3-1 Operation modes

- **Operation modes**
  - **Off-line**
    - Operation from the Teaching Pendant or PC (SRX platform) and the Safety Box*. If this mode is established, the robot can be operated only when the external system input SYSRUN signal and the ONLINE on the Teaching Pendant are OFF.
  - **Teaching mode**
  - **Execution mode**
    - Low speed continuous operation (Attended Continuous Operation)
    - Programmed speed continuous operation (Attended Program Verification)
  - **On-line**
    - In on-line mode of operation, the robot can be operated only from the external system input.
      - If the master signal SYSRUN and the ONLINE on the Teaching Pendant are set to ON, the respective operating signals become valid. In on-line mode, all the operation switches (excluding emergency stop switch) on the Teaching Pendant and the Safety Box are disabled.

* When you control a robot using a PC which is operating on the SRX platform, be sure to use the Safety Box at the same time.
3-2 Safety functions

3-2-1 Off-line mode

a. Teaching mode

The robot will not move under the conditions below unless the safety switch of the Teaching Pendant or the Safety Box is pressed.

- Servo-on
  Press the SERVO key on the Teaching Pendant while pressing the safety switch, to turn the “Servo-on” of the robot.

- Motion of the arms of respective axes
  If a hand is detached from either the arm operational switch or safety switch, the arm is stopped immediately.

- Home return movement of arms
  If the safety switch is set OFF after arm has started the home return movement, the arm is stopped immediately. To re-start the robot, execute the home return movement again.

- Point GO movement
  This function enables a robot that the arm moves to the specified position automatically if a target point number or coordinate is input.
  If the safety switch is set OFF after arm started the home return movement, the arm is stopped immediately in this movement too.
  To re-start the robot, execute the Point Go movement again.

SAFETY COVER IS OPENED

OVER SPEED DETECTOR CIRCUIT IS TURNED ON

- When operating the SRX-611 robot use either the Safety Box of the SRX platform or the Teaching Pendant.
- If the two devices are connected to the controller both the safety switches will have to be pressed in order to operate the robot.
b. Low speed continuous operation

(Attended Continuous Operation)

This function is prepared to confirm the robot continuous operation (programmed operation) during debugging or other applications with the safety cover opened. This function can be selected from the Teaching Pendant or the SRX platform and cannot be controlled from external system input.

If only a robot is activated from the Teaching Pendant, the robot starts movement at the speed of 5% of the programmed set speed. The safety switch on the Teaching Pendant or the Safety Box must be kept pressed. If the switch is unchanged, the robot stops immediately. To re-start the robot, start the robot while the safety switch is being pressed.

The over-ride function can be used, but can be set in the range of 5% or less.

SAFETY COVER IS OPENED

↓

OVER SPEED DETECTOR CIRCUIT IS TURNED ON

NOTE

During the off-line mode, the SRX-611 cannot enter the servo free state even though the STOP command in the LUNA robot language is executed.
c. Programmed speed continuous operation
(Attended Program Verification)
This function is prepared to confirm the robot at the final stage of debugging if it work correctly at the designated specifications with the program set speed.
This operation is selected from the Teaching Pendant or the SRX platform. Be sure to close the safety cover.

<table>
<thead>
<tr>
<th>SAFETY COVER IS CLOSED</th>
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</thead>
<tbody>
<tr>
<td>↓</td>
</tr>
<tr>
<td>OVER SPEED DETECTOR CIRCUIT IS TURNED OFF.</td>
</tr>
</tbody>
</table>

While pressing the safety switch on the Teaching Pendant or the Safety Box, change the over-ride setting of the Execution mode of robot only operation to 100%.
(Defaut is 5%.) Operation at the programmed speed is now possible. Confirm robot operation in the Execution mode. If the safety switch is unhanded during the operation, the arm stops immediately. To re-start this operation, execute the over-ride setting again. If this operation is once stopped, the over-ride value returns to the default value of 5%.
3-2-2 On-line mode

This function is activated by the external system input. If the external system input SYSRUN and the ONLINE on the Teaching Pendant are set to ON, the other input signals become valid. If the SYSRUN and the ONLINE remains ON, all the operation switches excluding emergency stop switch on the Teaching Pendant and the Safety Box are disabled.

Be sure to close the safety cover to run the robot in on-line operation.

On-line operation (SYSRUN + ONLINE + PSTART) Open the safety cover

- Continuous operation (robot arm is being operating) Emergency stop
  External user output SATD0 ............ ON

- In step stop (robot arm is step-stopped) Normal operation
  External user output SATDO ............ OFF

* While the robot is in step stop state, servo loops are opened to free state. If the safety cover is opened, the over-speed detector circuit starts functioning.

How to use the step stop (servo loops are opened to free state)

If a robot must be stopped during the on-line mode of operation due to operator’s convenience such as out of parts, etc., not due to error of robot itself, the step stop → servo free state of the robot can be established by sending the step signal (PSTEP) to the user input from external source, or by executing the STOP command in the LUNA robot language. The normal on-line operation is executed with the safety cover closed. If the robot is stopped in the step stop, and the safety cover is opened to remove the defective parts, or correct the unwanted parts pickup or placement state manually by operator, then close the safety cover and start again. The effective system operation is available by this function.
Generic Emission Standard EN50081-2/93
Generic Imunity Standard EN50082-2/95

This product is designed and manufactured exclusively for heavy industry. Follow the following items.

a. Never remove the ferrite core attached to the teaching pendant’s cable, and feedback cable.

b. Be sure to use shielded cable for user input and output

<table>
<thead>
<tr>
<th></th>
<th>Work on the shielded wire</th>
<th>Work on the ferrite core</th>
<th>Cable length</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU Board</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS232C</td>
<td>Required</td>
<td>Not required</td>
<td>3 m or less</td>
</tr>
<tr>
<td>I/O Board</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input connector</td>
<td>Required</td>
<td>Not required</td>
<td>–</td>
</tr>
<tr>
<td>Output connector</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC24V connector</td>
<td>Required</td>
<td>Required*</td>
<td>–</td>
</tr>
<tr>
<td>Safety connector</td>
<td>Required</td>
<td>Not required</td>
<td>–</td>
</tr>
</tbody>
</table>

* Use the cores supplied.

Note: The shielded wires of the input and output connectors of the I/O board, and those of the safety connector and RS232C connector must be connected to the inside of the metal housings supplied.

c. Be sure to use the supplied cables for the data transfer cable, feedback cable, motor power cable and AC power cable.
5. SMART specifications

The SMART specifications is the safety function which is applied to the SMART robot only. The Drive Safety Switch (DSS) function is added to the normal functions.

<table>
<thead>
<tr>
<th>DSS function</th>
<th>DSS ON</th>
<th>DSS OFF</th>
<th>DSS ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-line mode</td>
<td>Operation possible with the servo power ON</td>
<td>The servo power is turned OFF once.</td>
<td>The servo power is turned ON and normal operation is possible.</td>
</tr>
<tr>
<td>On-line mode</td>
<td>During start-up</td>
<td>Emergency stop</td>
<td>Starts from the initial state</td>
</tr>
<tr>
<td></td>
<td>During step stop (servo power OFF)</td>
<td>Normal operation (servo power OFF)</td>
<td>Re-start is possible successively.</td>
</tr>
</tbody>
</table>

Points which are different from the normal operation
During the step stop condition (servo free) in the on-line mode:

- Normal function - The safety cover can be opened and closed as it is.
- SMART robot function - After turning OFF the DSS, the safety cover can be opened and closed.

Use the three-pole switch for the Drive Safety Switch. (Refer to the following drawing.)
The DSS0 and DSS1 of the Safety connector shuts the servo down by means of hardware.
The DSS signal of external users input becomes the input signal to software.
Synchronize the switch contact for the DSS signal of external users input with the DSS0 and DSS1 of the Safety connector.
How to connect the SMART safety circuit

Robot controller

SPD PANEL BOARD

Hardware

Over Speed Detector Circuit

CPU & SERVO

MOTHER BOARD

SERVO AMP

Feedback line

Encoders

I/O BOARD

24VIN

0VIN

SI7

DSS (I)

1

2

3

4

5

6

7

8

9

10

11

12

13

25

Safety connector

External Emergency

External Emergency status output

SS1

SS2

Safety Cover

Drive Safety

+24V

External 24V Electrical Supply

COM-24V

(I): Input

(O): Output
Installation Guide
Installation Guide

1. Outline .............................................. 1-1
2. Features ........................................... 2-1
3. Configuration ...................................... 3-1
4. Specifications ..................................... 4-1
5. Outline Drawings and Work Envelopes ... 5-1
6. Unpacking ......................................... 6-1
7. Installation ........................................ 7-1
8. System Tasks and Signal Control ...... 8-1
1. Outline

The Sony SRX-600 High-Speed Assembly Robot Series executes the assembly of small parts, inspections and handling, etc., at high speeds and high rates of efficiency, and also enables easy operation and easy maintenance.

The use of the AC servo motor equipped with an absolute encoder also enables maintenance-free and home-return-less operations. We have also attained high levels of rigidity and precision in a light and compact mechanical package (half the weight of the SRX-510). With a standard payload of 5kg (11 lbs.) and a cycle time of 0.6 seconds (payload: 2kg (4.4 lbs.)), productivity will be increased.

Payload: Maximum 5kg (11 lbs.)
Pose-repeatability: ±0.01mm (XY plan)
(Positioning Accuracy)
Cycle time: In the order of 0.6 seconds (with a payload of 2kg (4.4 lbs.))

The newly developed compact and lightweight controller has only half the weight of the SRX-510, and is a multi-function AC controller with a multi-task function and high performance capability owing to the mounted 32bit CPU.

Controller Dimensions: 430 (w) × 440 (d) × 240.5 (h)
(excluding protruding parts)
Equivalent to 5U of DIN specification
Multi-task: LUNA 16 tasks (robot 8 tasks, peripheral 8 tasks)
System task (1 task)
PLC task (1 task)

Programs, input and output, and variables, etc., can be monitored with the LUNA Ver.5.0 debugging software (Windows edition), and the major improvements to the debugging environment enable the start-up of an efficient robot system. Programs can be made on personal computers available on the open market, and teaching can be carried out simply and speedily with the handy-type teaching pendant.

Full PLC functions have been included as standard in order to enable the control of equipment peripheral to the robot. Programs are run with the scan method with Boolean algebra expressions. I/O is shared with the robot’s I/O, and I/O expansion is possible if necessary.
A single robot can control the entire robot station by using the PLC function.
The features explained below will differ in accordance with variation and payload, etc. Refer to section 4. Specifications and 5. Outline Drawings and Work Envelopes of Operation for further details.

2-1 Robot

■ Mounted with an AC servo motor ⇒ Maintenance-free

The SRX-600 series is mounted with a brushless AC servo motor, so brush maintenance is not necessary.

■ Absolute encoder ⇒ Home return is not necessary under normal working circumstances

The SRX-600 series employs an absolute encoder. This means that there is no necessity to return to the home position when the unit is re-started after electrical power has been switched off.

The absolute encoder retains position data with its battery back-up. Home return is therefore required in the following cases:

1. When the cable connecting the robot controller and the robot has been disconnected.
2. When the mains power has been switched off for one month (a 24-hour recharge is necessary).

■ World’s top-level cycle time

0.6 seconds per unit: SRX-611 (L6015) 2kg (4.4 lbs.) specification

The world’s top-level cycle time, which contributes greatly to increased work efficiency.

Cycle time
The shortest amount of time required to make a single return journey between the two points indicated on the diagram on the left.
■ High pose-repeatability (Positioning accuracy)
The high pose-repeatability levels correspond with high-accuracy applications.
  X-Y plan: ±0.01mm
  Z axis: ±0.02mm
  R axis: ±0.03 degrees

■ Hollow-type Z axis shaft
A hollow-type Z axis shaft has been used. It is therefore possible for user wiring and ducting to be passed through the shaft and exit at the front edge of the Z axis.
2-2 Operability

- Multi-task installation

Multi-tasks have been installed to improve ease of use. A variety of tasks, such as program transferral and the monitoring and amendment of I/O and variables, are possible during automatic operation. A maximum of 18 task which can be run by programs may be used. Each of the tasks are controlled in accordance with time allocations to ensure that operations are carried out under the most suitable conditions.

Robot tasks (8 tasks): Robot operation programs
Tasks which operate robots can be run at a rate of one task for each robot. 16 or 10 types (depending on the tasks) of robot operating programs can be stored for each task. Although it is possible to control a maximum of eight robots (eight tasks) with the software, usually only one robot and only one robot task is used. (The equivalent of conventional LUNA operation programs.)

Peripheral Tasks (8 tasks): Signal control programs for peripheral devices
Control which uses I/O with peripheral devices and serial communication and arithmetic calculation with computers, etc., is performed in parallel with robot operations. Sequential control is performed with peripheral tasks if slow processing is acceptable and if the system has a small number of I/O points for control.

PLC task (1 task): PLC function
A complete sequential control function for the scan method which programs in the Boolean algebra format.

System task (1 task): Total robot control program
A task which programs movements corresponding with the robot's status. This task defines the signal control for peripheral devices between the mains power being switched on and the start of automatic operations, and the special output control following emergency stops.

- PLC functions

A complete sequential control function has been included as one of the multi-tasks. This can be used without adding any hardware by simple programming. The command system uses Boolean algebra, and the same scan method as normal sequential control has been adopted.

The processing speed will be faster than peripheral tasks as a special description format has been adopted. Control is performed for the internal relay and maintenance relay, the timer, counter and I/O relay, and it is possible to program so that complex functions can be processed while linked with peripheral tasks. PLC task make an efficient substitute for individual sequential controllers when the system is too large. I/O is split between the robot's user I/O and used. It is also possible to add an expansion I/O when many more I/Os than standard are necessary.
- **Newly developed compact controller**
  The structure of the controller was completely reviewed, and a compact controller half the size of conventional models developed (compared with other Sony models and excluding protruding parts).
  The controller is equipped with three substrate slots to enable function expansion owing to its small body. The internal structure consists of units, so maintenance has also become easier.

- **Newly design Teaching Pendant**
  The Teaching Pendant’s key layout has been newly designed to enable easy key operations. Improvements have not only been made to the key distribution, but also to operational response.

- **Direct teaching function**
  As direct teaching is possible with the servo switched off, rough teaching can be performed efficiently. (The Z axis brake can be released from the Teaching Pendant.)

- **Vast data storage capacity**
  Robot task and peripheral task programs are stored in a common 128kbyte memory. PLC task and system task programs are stored separately from the above-mentioned memory.
  - Capacity for a single robot task program:
    - Operation program (LUN): Maximum 64 kbytes
    - Point program (PON): Maximum 64 kbytes
    - Point count (for each program): Maximum 3072 points
  - Capacity for a single peripheral task program: Maximum 64 kbytes
  - Capacity for a PLC task program (total): Maximum 32 kbytes
  - Capacity for a system task program: Maximum 16 kbytes

- **Memory card (PC Card) support**
  The standard memory cards (PC card, PCMCIA 2.1 type 1) used by the IBM-PC are supported. As the format registered on the memory card is the same as the personal computer being used, if a program created with the personal computer is copied across to the memory card, the controller can read it as it is.
  Also, if the memory area within the robot is insufficient, the data can be transferred from the memory card during automatic operation.
2-3 LUNA Robot Language

- **LUNA robot language version upgrade**  LUNA5.0
  Commands were added to enable the multi-task environment to be even easier to use. Functions for the commands related to robot operations were also improved.

- **Debugging environment on the Windows platform**
  Specialized software to be run on the Windows platform has been developed in order to improve the efficiency of program debugging.
  Debugging can be carried out while viewing the program for not only the robot tasks, but also for the peripheral tasks, the PLC task and the system task. Operations are performed with simple mouse clicks, which enables the following tasks to be completed easily:
  - Starting or stopping automatic operations with an instruction sent from the personal computer.
  - Program execution by each line or each step.
  - Program partial execution
  - Execution termination with variable values
  - Monitoring of I/O and variables
  - Enforced amendment of output status
  - Amendment of variable numerals
  - Monitoring of the relay status, etc., within the PLC

- **New CP control**  Fixed speed, fixed accuracy
  Two types of essential elements which become fixed are available when performing circular interpolation and direct linear interpolation; the conventional speed fixing specification and the newly prepared accuracy fixing specification. These are selected from the program in accordance with the application.

<table>
<thead>
<tr>
<th>♦ When specifying speed:</th>
<th>There are cases where accuracy will be dispersed depending on the size of the specified speed and the movement location.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE</td>
<td>♦ When specifying accuracy: There are cases where speed will be dispersed depending on the size of the specified accuracy and the movement location.</td>
</tr>
</tbody>
</table>
- **Overwrap Motion** → **Wide reductions of actual work time**

It is possible to reduce actual work time by overwrapping two movements or by overwrapping a movement and any other process. The start of overwrap can be specified in combination with the application between the specification of distance from the destination position and time before arrival, and immediately after movement has been started.

- **Minimal time stop function** → **Work amendments during robot movement**

It is possible to stop the robot during movement in the shortest possible time by entering input signals. For example, this can be used when the work target position has been detected with the sensor, and the robot is to be stopped at this position and work started.

- **Palletizing function**

The position of parts on the palette can be automatically calculated by the simple teaching of three or four points on the palette. The layout of the parts on the palette, including checked patterns, has been prepared in the standard manner.

---

**NOTE**

The absolute accuracy of the robot is not guaranteed. There will consequently be cases when the calculated positions and actual positions on the palette are different depending on the size and location of the palette and the accuracy of the palette. In this situation, improvements can be effected by dismantling the palette and creating a program.

- ** Interruption processing function**

Interruption processing is performed in accordance with signal input from external sources, RS232C communication, the time and other conditions. Interruption processing is functional for both robot tasks and peripheral tasks.
2-4 Extended Functions

■ I/O additions
It is possible to add an I/O board for every 48 I/O points. Increases up to a maximum of 184 points for each I/O is possible by adding three 48 point boards for every 40 I/O points. All of these I/Os can be freely used by robot tasks, peripheral tasks, PLC task and system task.

NOTE
The maximum number of I/O boards that can be added is three boards including additions for other boards.

■ Tracking function ➔ Work without stopping the conveyor belt
Obtains position data in the real time from objects involved in direct line movement, such as conveyor belts, and carries out work while tracking these movements.

NOTE
Work accuracy with tracking will differ to the actual system. A special board (optional) to receive position information when tracking is being carried out is also necessary.
3. Configuration

SRX-611 (L60 15)

<table>
<thead>
<tr>
<th>Series name</th>
<th>Arm length</th>
<th>Z axis stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 : 600 mm</td>
<td>15 : 150 mm</td>
<td></td>
</tr>
<tr>
<td>40 : 400 mm</td>
<td>45 : 450 mm</td>
<td></td>
</tr>
<tr>
<td>80 : 800 mm</td>
<td>*Optional</td>
<td></td>
</tr>
</tbody>
</table>

SRX-611

Controller

Teaching Pendant (optional)

Programing Device (personal computer available on the open market)
4. Specifications

4-1 Unit Specifications

<table>
<thead>
<tr>
<th>SRX-611 (L6015)</th>
<th>Total length</th>
<th>600 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm length</td>
<td>1st arm</td>
<td>350 mm</td>
</tr>
<tr>
<td></td>
<td>2nd arm</td>
<td>250 mm</td>
</tr>
<tr>
<td>Work envelope</td>
<td>1st arm</td>
<td>±150°</td>
</tr>
<tr>
<td></td>
<td>2nd arm</td>
<td>±360°</td>
</tr>
<tr>
<td></td>
<td>Z axis</td>
<td>150 mm</td>
</tr>
<tr>
<td></td>
<td>R axis</td>
<td>±360°</td>
</tr>
<tr>
<td>Payload</td>
<td></td>
<td>2 kg (4.4 lbs.), 3 kg (6.6 lbs.) and 5 kg (11 lbs.)</td>
</tr>
<tr>
<td>Cycle time</td>
<td></td>
<td>0.6 seconds per unit</td>
</tr>
<tr>
<td>(when 2kg (4.4 lbs.))</td>
<td>Combination of 1 and 2 axis</td>
<td>5200 mm/sec</td>
</tr>
<tr>
<td>Maximum speed</td>
<td></td>
<td>770 mm/sec</td>
</tr>
<tr>
<td>(when 2kg (4.4 lbs.))</td>
<td>Z axis</td>
<td>1150°/sec</td>
</tr>
<tr>
<td>Pose-repeatability</td>
<td>XY plan</td>
<td>±0.01 mm</td>
</tr>
<tr>
<td>(Positioning accuracy)</td>
<td>Z axis</td>
<td>±0.02 mm</td>
</tr>
<tr>
<td></td>
<td>R axis</td>
<td>±0.03 mm</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>35 kg (77 lbs.)</td>
</tr>
<tr>
<td>Tool items</td>
<td>Signal wiring</td>
<td>15 pieces</td>
</tr>
<tr>
<td></td>
<td>Air ducts</td>
<td>3 pieces (external form ø6)</td>
</tr>
</tbody>
</table>

**NOTE**  
Use the R axis load imager at $J=GD^2/4=6.0\times10^{-3}kgm^2$ or less.

SRX-611 Variations

<table>
<thead>
<tr>
<th></th>
<th>Total arm length</th>
<th>400 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRX-611 (L4015)</td>
<td>1st arm</td>
<td>200 mm</td>
</tr>
<tr>
<td></td>
<td>2nd arm</td>
<td>200 mm</td>
</tr>
<tr>
<td></td>
<td>1st arm work envelope</td>
<td>180°</td>
</tr>
<tr>
<td></td>
<td>2nd arm work envelope</td>
<td>±130°</td>
</tr>
<tr>
<td>SRX-611 (L8015)</td>
<td>Total arm length</td>
<td>800 mm</td>
</tr>
<tr>
<td></td>
<td>1st arm</td>
<td>450 mm</td>
</tr>
<tr>
<td></td>
<td>2nd arm</td>
<td>350 mm</td>
</tr>
<tr>
<td></td>
<td>1st arm work envelope</td>
<td>220°</td>
</tr>
<tr>
<td></td>
<td>2nd arm work envelope</td>
<td>±150°</td>
</tr>
<tr>
<td>Long Z SRX-611 (L**45)</td>
<td>Z axis work envelope</td>
<td>450 mm</td>
</tr>
</tbody>
</table>
### 4-2 Control Specifications SRX-C61

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive method</td>
<td>AC servo motor drive with an all-axis software servo</td>
</tr>
<tr>
<td>Position detection</td>
<td>Absolute method (battery back-up)</td>
</tr>
<tr>
<td>Movement method</td>
<td>PTP, CP, overlap motion, QM, QT</td>
</tr>
<tr>
<td>Control axis count</td>
<td>Simultaneous and individual control for axis 1 to 4</td>
</tr>
<tr>
<td>Applicable output</td>
<td>Motor power total maximum 1000 W</td>
</tr>
<tr>
<td>Speed control</td>
<td>Speed setting: 1 - 100% in 100 stages</td>
</tr>
<tr>
<td></td>
<td>Override function: 1 - 100%</td>
</tr>
<tr>
<td>Interpolation function</td>
<td>3-dimensional direct linear interpolation, 3-dimensional circular interpolation</td>
</tr>
<tr>
<td>CPU</td>
<td>i486DX2 (50MHz inside)</td>
</tr>
<tr>
<td>Multi-task</td>
<td>LUNA: 16 tasks (robot: 8 tasks, peripheral: 8 tasks)</td>
</tr>
<tr>
<td></td>
<td>System task: 1 task</td>
</tr>
<tr>
<td></td>
<td>PLC task: 1 task</td>
</tr>
<tr>
<td>Data storage capacity</td>
<td>3072 points (for each program) total 176 kbytes for all tasks</td>
</tr>
<tr>
<td>Memory card</td>
<td>PC CARD STANDARD (PCMCIA2.1 type 1) support</td>
</tr>
<tr>
<td>Teaching</td>
<td>Teaching with the Teaching Pendant (optional)</td>
</tr>
<tr>
<td></td>
<td>Direct teaching</td>
</tr>
<tr>
<td></td>
<td>Position program creation when off line</td>
</tr>
<tr>
<td>Peripheral device control</td>
<td>40 points for each I/O, maximum 184 points for each</td>
</tr>
<tr>
<td>Serial I/F</td>
<td>RS232C: 3 systems</td>
</tr>
<tr>
<td></td>
<td>1 special TP, 1 special device for programing, general purpose: 1</td>
</tr>
<tr>
<td>Expansion</td>
<td>Expansion slot device: 3 slots</td>
</tr>
<tr>
<td></td>
<td>Vision board, I/O board, etc.</td>
</tr>
<tr>
<td>Built-in PLC function (optional)</td>
<td>Program format: Boolean algebra</td>
</tr>
<tr>
<td></td>
<td>Operational status: Independent from robot operations</td>
</tr>
<tr>
<td></td>
<td>I/O: Robot user’s I/O used</td>
</tr>
<tr>
<td>Power source</td>
<td>Single phase AC200V - 240V ± 10% 50/60 Hz</td>
</tr>
<tr>
<td>Consumed power</td>
<td>1.5 kVA</td>
</tr>
<tr>
<td>Momentary stop guarantee time</td>
<td>Normal operations for momentary power cuts within 20 ms</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>20MΩ or more between the covering and primary electrical source</td>
</tr>
<tr>
<td>Noise resistance</td>
<td>1000 Vp-p 1μs (With a noise simulator. Between the electrical source and chassis)</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0°C - 40°C</td>
</tr>
<tr>
<td>Ambient conditions</td>
<td>Must not be any corrosive gas. Must be no condensation</td>
</tr>
<tr>
<td>Grounding</td>
<td>Connect to AWG 14 or more</td>
</tr>
<tr>
<td>Humidity</td>
<td>35 - 90%</td>
</tr>
<tr>
<td>External dimensions</td>
<td>430 (w) x 440 (d) x 240.5 (h) ※equivalent to 5U of DIN specification</td>
</tr>
<tr>
<td>Weight</td>
<td>25 kg (55 lbs.)</td>
</tr>
</tbody>
</table>

* Refer to section "7-7 Operations"
### 4-3 Controller Function Table

<table>
<thead>
<tr>
<th>Type</th>
<th>Function name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data transfer</td>
<td>Program transfer</td>
<td>Receipt of robot programs</td>
</tr>
<tr>
<td></td>
<td>Program deletion</td>
<td>Deletion of specified program types</td>
</tr>
<tr>
<td></td>
<td>Program data reverse transfer</td>
<td>Reverse transfer of position data to the programming device</td>
</tr>
<tr>
<td></td>
<td>Stored program display</td>
<td>The name and length, etc., of stored programs</td>
</tr>
<tr>
<td>Manual operations</td>
<td>Home return</td>
<td>Return to the robot's home position</td>
</tr>
<tr>
<td></td>
<td>Axes movement operation</td>
<td>Possible to operate each axis independently (low-speed, fast-forward)</td>
</tr>
<tr>
<td></td>
<td>Cartesian movement operations</td>
<td>Possible to operate with XY coordinates (low-speed, fast-forward)</td>
</tr>
<tr>
<td></td>
<td>Output operations</td>
<td>User output ON and OFF operations possible</td>
</tr>
<tr>
<td></td>
<td>Program type selection</td>
<td>Selection of execution programs</td>
</tr>
<tr>
<td></td>
<td>Current position storage</td>
<td>Current position data registered in the specification point number</td>
</tr>
<tr>
<td></td>
<td>Point data display</td>
<td>Display of the data stored for each point</td>
</tr>
<tr>
<td></td>
<td>Movement to stored points</td>
<td>Movement towards the positions for each point</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Save movement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Direct movement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Linear interpolation</td>
</tr>
<tr>
<td></td>
<td>Coordinate input movement</td>
<td>Movement towards a point for which coordinates have been input</td>
</tr>
<tr>
<td></td>
<td>System offset setting</td>
<td>Input of system offset values</td>
</tr>
<tr>
<td></td>
<td>System limit setting</td>
<td>Input of system limit values</td>
</tr>
<tr>
<td></td>
<td>Movement operation speed settings for each axis</td>
<td>Manual movement operation speed setting for each axis</td>
</tr>
<tr>
<td></td>
<td>Servo ON/OFF</td>
<td>Used for servo OFF teaching, etc.</td>
</tr>
<tr>
<td></td>
<td>Brake ON/OFF</td>
<td>Brake control during servo OFF teaching</td>
</tr>
<tr>
<td></td>
<td>Tool coordinate setting</td>
<td>Parameter setting for tool coordinates</td>
</tr>
<tr>
<td></td>
<td>Q stop</td>
<td>Possible to stop during movement between points</td>
</tr>
<tr>
<td></td>
<td>Point movement speed setting</td>
<td>Speed setting during movement towards stored points</td>
</tr>
<tr>
<td>Auto operations</td>
<td>Automatic operation</td>
<td>Automatic operation with LUNA language programs</td>
</tr>
<tr>
<td></td>
<td>Step termination</td>
<td>Possible to operated by command or by step</td>
</tr>
<tr>
<td></td>
<td>Program display</td>
<td>Display of operational programs during operations</td>
</tr>
<tr>
<td></td>
<td>Storage of latest type numbers</td>
<td>Storage of the latest run type numbers</td>
</tr>
<tr>
<td></td>
<td>Variable reference and data change</td>
<td>Possible to refer to and amend integer variables, real variables and point variables</td>
</tr>
<tr>
<td></td>
<td>Break point</td>
<td>Possible to set line numbers and variables during operational program pauses</td>
</tr>
<tr>
<td></td>
<td>Speed override</td>
<td>Operations can be confirmed with speeds specified in 1/100ths (1 - 100%)</td>
</tr>
<tr>
<td>Type</td>
<td>Function name</td>
<td>Function</td>
</tr>
<tr>
<td>---------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Memory card</td>
<td>Program save</td>
<td>Robots programs stored on the memory card</td>
</tr>
<tr>
<td></td>
<td>Program load</td>
<td>Robot programs re-loaded from the memory card</td>
</tr>
<tr>
<td></td>
<td>Program deletion</td>
<td>Deletion of programs saved on the memory card</td>
</tr>
<tr>
<td></td>
<td>Stored program display</td>
<td>Display of names and length of programs stored on the memory card</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>External I/O signal display</td>
<td>Display of external input status</td>
</tr>
<tr>
<td></td>
<td>Sensor check</td>
<td>Checks for limit and home position sensors</td>
</tr>
<tr>
<td></td>
<td>Position counter check</td>
<td>Check for pulse input from the motor</td>
</tr>
<tr>
<td>Common functions</td>
<td>Error display</td>
<td>Display of the error number on the Teaching Pendant</td>
</tr>
<tr>
<td></td>
<td>Emergency stop</td>
<td>Servo cancellation immediately after emergency stops</td>
</tr>
<tr>
<td></td>
<td>Error history</td>
<td>Display of past error history</td>
</tr>
<tr>
<td></td>
<td>Task list</td>
<td>Display of program names assigned to each task and the operation status</td>
</tr>
<tr>
<td></td>
<td>Help</td>
<td>Display of operation descriptions</td>
</tr>
</tbody>
</table>
### 4-4 Robot Language Specifications

<table>
<thead>
<tr>
<th>LUNA</th>
<th>Version 5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting computer</td>
<td>• IBM-PC : DOS (ver. 5.0 or higher)</td>
</tr>
<tr>
<td>Operational environment</td>
<td>Compilation, etc.: DOS</td>
</tr>
<tr>
<td></td>
<td>Debugging environment: Windows</td>
</tr>
<tr>
<td>Functions</td>
<td>Compilation, transferral, reverse transferral, error history confirmation, etc.</td>
</tr>
<tr>
<td>Debugging environment</td>
<td>On-line robot operations (automatic operation, transferral, etc.)</td>
</tr>
<tr>
<td></td>
<td>Operations by step or by line step when viewing the program</td>
</tr>
<tr>
<td></td>
<td>Partial program operation in accordance with condition setting</td>
</tr>
<tr>
<td></td>
<td>Monitoring of I/O and variables, enforced amendment of settings</td>
</tr>
<tr>
<td>Robot task commands</td>
<td>Robot operational commands, palletize commands</td>
</tr>
<tr>
<td>peripheral task commands</td>
<td>I/O commands, communication commands, functions,</td>
</tr>
<tr>
<td></td>
<td>vision commands, interruption commands</td>
</tr>
<tr>
<td>System task commands</td>
<td>Automatic operation start-up, memory card commands, etc.</td>
</tr>
<tr>
<td>PLC function commands</td>
<td>Relay : internal, keep, I/O, timer, counter,</td>
</tr>
<tr>
<td>(Boolean algebra orthography)</td>
<td>features (clock, errors, robot information)</td>
</tr>
<tr>
<td></td>
<td>Operands, etc : Add-subtract, differentials, data comparisons,</td>
</tr>
<tr>
<td></td>
<td>data transferral, bit extraction,</td>
</tr>
<tr>
<td></td>
<td>(master control) jump</td>
</tr>
</tbody>
</table>

- **NOTE**
  - A personal computer with DOS (ver. 5.0 or higher) should be prepared for LUNA program compilation.
  - To debug in the Windows environment the SRX Platform kit is required.
4-5 Program Device Structural Examples

The program device is to be prepared by the user.

Hardware
Personal computer : IBM-PC

Disk units : 3.5 inch 2HD disk drive,
            100 Mbyte hard disk
Memory capacity : 8 Mbytes or more

Program transferral cables
            : SRX-H005 (D-sub9 pin connector)

Software
• OS : MS-DOS (ver.5.0 or higher) or Windows (ver.3.1 or higher)
• Robot language : LUNA5.0
• Editor : FINAL editor recommended
5. Outline Drawings and Work Envelopes

5-1 Outline Drawing and Work Envelope for the Main Unit

SRX-611 (L6015)
5-2 Outline Drawing for the Controller

NOTE
Dead space will appear on the front and rear panels of the controller when the cable is actually connected, so take care of this during installation.

5-3 Outline Drawing for the Teaching Pendant (Optional)
6. Unpacking

6-1 Transportation

The main unit and the controller for the SRX-611 robot delivered by Sony Corporation are packed separately. Transport both packages to the place of installation without dropping them or allowing them to fall over. Special care must be taken when handling the controller to avoid vibrations and impact as it contains precision electrical components.

NOTE

Always use the packaging specified by Sony Corporation during transportation.

6-2 Unpacking the Robot

- Open the cardboard box as indicated in the diagram below and remove the accessories box.
- Confirm that all standard parts mentioned below and all parts ordered by the user are included.
- Remove the main unit from the box. Ensure that two or more people are involved in removing the main unit from the box.

![Diagram of accessories box and main unit]

Standard accessories
- Feedback cable 1 pc.
- Motor power cable 1 pc.
- Connector 2 pcs.
- Operation manual 1 pc.
Options
- Teaching pendant
6-3 Unpacking the Controller

As the controller weighs approximately 25kg (55 lbs.), ensure that two or more people are involved with the following procedures for safety reasons.

- Open the cardboard box as indicated in the diagram below and remove the accessories.
- Confirm that all standard parts mentioned below are included.
- Remove the top packing and take the main unit out of the box.

Standard accessories

- Mains cable 1 pc.
- Input connector 1 pc.
- Output connector 1 pc.
- 24 V connector 1 pc.
- Safety connector 1 pc.
- Spare fuse 3 pcs.
- Ferrite core 1 pc.
7. Installation

As the robot weighs approximately 35kg (77 lbs.), ensure that two or more people are involved in all lifting procedures. The arms are not fixed in place and will come off if lifted at a certain angle or pressure is applied in certain directions. Take extreme care when lifting. Also, the upper surface of the cover will become deformed if extreme pressure is applied, so support from the bottom surface.

7-1 Transportation Methods

When lifting with a crane, etc., remove the blind cap located in the central part of the 1st arm, screw an eye-bolt into the M10 tap hole and lift with a rope. Ensure that the rope used for lifting is of sufficient strength (ø6 wire rope or greater). Have one person support the unit to maintain balance during lifting. Place the unit gently on the attachment plate to avoid excessive impact.

The controller weighs approximately 25kg (55 lbs.). Avoid impacts during movement. Take special care to place it gently on the platform.
7-2 Installing the Robot

Firmly fix the unit in place with the M12 hexagonal bolt as shown in the diagram below. ( Recommendation: Bolt in a strength class of 12.9T with a tightening torque of 1500kg-cm)

The operational range of the robot is indicated in section 5. Outline Drawings and Work Envelopes, so take care over the directional installation.

Pay attention to the following points during installation:

- Thoroughly review the installation location and provide safety manuals to ensure the safety of operators during use of the robot.
- Ensure that the installation location has sufficient rigidity and strength, and make sure that it is firmly fixed to avoid the effects of vibrations, etc. Example: SS41 thickness of t16mm or more
- Give thorough consideration to the robot's range of operations, and pay special attention to avoid it overlapping peripheral equipment.
- Ensure that user wiring and peripheral equipment, etc., does not obstruct the movement of the robot unit or the robot cable.

The robot is unable to maintain balance on its own during installation and must be supported manually.
7-3 Installing the Controller

The controller contains many electrical parts and connectors, etc., and does not stand up well to vibrations and impact. It also generates heat, so ensure that it is installed in a well-ventilated and vibration-free location. Consult with Sony Corporation if an installation location in which strong electro-magnetic fields or electro-magnetic noise exist is unavoidable.

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
</table>

**Items to beware off for controller installation and storage:**

- **Connect a 3rd class earth or higher to the device's earth line.**
- **Avoid installing in the following locations:**
  - In places which receive direct sunlight or which experience temperature ranges exceeding 0 degrees and 40 degrees.
  - In places which experience relative humidity ranges exceeding 35% and 90%, and places in which condensation is generated by rapidly changing humidity.
  - In places where corrosive gas or inflammable gas exists.
  - In places where the unit will be subject to direct vibrations or impact.
  - Close to machinery which emits electrical noise, such as welders, electric dischargers or high-frequency generators.

- **The controller is equipped with lithium ion batteries for memory back-up purposes, and lead storage batteries for absolute position detector circuits, so avoid storing in locations with high temperatures or high humidity levels.**

- **There is a risk of excessive static electricity building up in extremely dry locations, so care must be taken when handling boards, etc.**

- **There is a risk of thinner, etc., changing the color of the surface panels, so do not use this for cleaning purposes.**

- **Avoid using excessive power when operating or removing switches and connectors.**

- **Ensure that protective circuits, such as noise killers and diodes, etc., are inserted when control is carried out by relays and solenoid valves with external output.**

- **Ensure that the main power is switched OFF when removing plugs, power connectors and sensor connectors.**
Ensure that 100mm or more of space is available around the inlets and outlets of heat dispersal fans.
7-4 Connections

The robot and controller are adjusted in combination during shipping. Confirm that the serial numbers of the robot and the controller are the same when connecting cables. Care must especially be taken when multiple sets have been purchased. Observe the instructions in the following diagram for connections.

---

**NOTE**

Ensure that the serial numbers of the robot and the connector match when connecting together.
7-5 Switching on the Mains Power

Switch on the POWER switch on the front panel of the controller to turn on the mains power.
Wait for at least five seconds before switching on the mains power immediately after switching it off.

**NOTE**
A short break error (all five LEDs on the front panel flashing) may occur if the mains power is switched on within five seconds of turning off.
7-6 Home Return

The absolute decoder used with this robot is equipped with a battery back-up system. As the back-up battery is located within the controller, it is necessary to return to the home position when the feed-back cable between the robot and the controller is disconnected.

Perform the following procedures for returning to the home position when the electrical power has been switched on for the first time after installation or after the feed-back cable has been disconnected.

Press the [MANAGE] key.

↓

Use the [↑], [↓] cursor keys to select home return, and press [F4] key.

↓

Press [F1] OK key to start home return.

Settings for the home position and home return operation sequences are also performed in accordance with the robot installation conditions (refer to the operation guide for further details.)

The battery back-up will last for one month when fully charged.

Note that it is necessary to return to the home position even when the battery voltage drops and position data can no longer be stored (E358-E361 is displayed when the voltage drops. Electricity must be supplied for 24 hours or more to acquire a full recharge.)
7-7 Operations

Grease will become glutinous, especially in cold regions, when the robot is started up cold, and there are cases where a torque limit error (E310-E313) will be triggered when speed operations (acceleration) are performed during normal use, and the robot stopped.

In this situation, set lower speeds and perform warming-up operations. Carry out override at approximately 20%, perform warming-up every 20 minutes and gradually increase the speed.
Emergency stops, system input and other sequences can be controlled by programming the system task with the SRX-600 series. This section provides sample programs for emergency stops and system task input/output with the use of system task.

8-1 Sample Program Outline

1. System programs installed during delivery:
   a. Program contents
   b. Input/Output allocation
   c. Time chart

2. System programs which can be used in the same way as conventional robots:
   a. Program contents
   b. Input/Output allocation
   c. Time chart

3. System programs controlled from PLC:
   a. Program contents
   b. Input/Output allocation
   c. Time chart (same as 2.)
8-2 System Programs Installed During Delivery

8-2-1 Program Contents
This program is a system task sample program that can be used immediately after the SRX-600 series has been installed.

; System program

; Method of usage
; Automatic operation execution
; Set a type number between 133 and 136 (4 bit hexadecimal) and turn 138 on to start program execution and switch on the L38 automatic operation signal and the L39 automatic operation execution signal.

Continual automatic operation
Turn 139 on when in the automatic operation mode to start continual execution and switch on the L39 automatic operation execution.

Step termination
Turn 137 on when in the automatic operation execution mode to terminate the step and switch on the L37 step termination signal and switch off the L39 automatic operation execution signal.

Home return (delete if not necessary)
Turn 140 on to switch L40 on and return to the home position. L40 is switched off when finished.

Error reset
Turn 132 on to reset an error and cancel the error signal.

INIT ; Initialization (the program must have INIT as the header)
INT:1,TYPE
FOR I = 1 TO 5 ; L1-L40 turned off
POUT(I,0)
NEXT
INITEND ; Command to end initialization

EMG ; Processing for emergency stops
DO L37(OFF)
DO L38(OFF)
DO L39(OFF)
DO L40(OFF)
RET ; The module is ended with RET

ERROR ; Processing for errors
DO L37(OFF)
DO L38(OFF)
DO L39(OFF)
DO L40(OFF)
RET
137ON ; Step termination
IF L39(ON) THEN ; Automatic operation being executed
   I = STEP(1) ; Robot 1 step termination
   DO L39(OFF) ; Automatic operation execution termination
DO L37(ON) ; Step termination
ENDIF
RET

138ON ; Automatic operation
IF L39(OFF) AND L40(OFF) THEN ; Not possible during automatic operation
   ; execution or during home return
   PIN(5,TYPE) ; Type number acquisition (type number 133-136)
   TYPE = TYPE&OFH ; 4bit removed
   IF TYPESET(I,TYPE) = 0 THEN ; Program type set in robot 1
      IF START(I) = 0 THEN ; Program started
         DO L38(ON) ; Automatic operation
         DO L39(ON) ; Automatic operation execution
         DO L37(OFF) ; Step termination cancelled
      ENDIF
   ENDIF
ENDIF
RET

138ON ; Continual running
IF L38(ON) AND L39(OFF) AND L40(OFF) THEN ; Not possible during automatic
   ; operation execution or
   ; during home return
   JF CONTINUE(I) = 0 THEN ; Robot 1 continual operation
      DO L38(ON) ; Automatic operation execution
      DO L39(OFF) ; Step termination cancelled
   ENDIF
ENDIF
RET

140ON ; Home return
IF L39(OFF) AND L40(OFF) THEN ; Not possible during automatic operation
   ; execution or during home return
   DO L37(OFF) ; Step termination cancelled
   DO L38(OFF) ; Automatic operation cancelled
   DO L40(ON) ; Home return started
   I = HOMING(I) ; Robot 1 home return
   DO L40(OFF) ; Home return ended
ENDIF
RET

132ON ; Error reset
I = RSTERR
RET
END
### 8-2-2 Input/Output Allocation

#### Input side

| I32 | ERRRST | (Error reset) |
| I33 | PROG0  | (Program type 0) |
| I34 | PROG1  | (Program type 1) |
| I35 | PROG2  | (Program type 2) |
| I36 | PROG3  | (Program type 3) |
| I37 | PSTEP  | (Program step termination) |
| I38 | PSTART | (Program automatic operation execution) |
| I39 | STPSTAT | (Program continual execution) |
| I40 | PRET   | (Robot home return start) |

#### Output side

| L37 | STEP   | (Program step being terminated) |
| L38 | SAUTO  | (Execution mode) |
| L39 | SATDO  | (Automatic operation being executed) |
| L40 | HOMING | (Robot returning to home position) |
### 8-2-3 Time Chart (Example of robot control with peripheral devices)

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS RUN</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td>SI 1</td>
<td>OFF</td>
<td></td>
</tr>
<tr>
<td>PRET</td>
<td>ON</td>
<td>HOMING</td>
</tr>
<tr>
<td></td>
<td>I 40</td>
<td>OFF</td>
</tr>
<tr>
<td>PSTART</td>
<td>ON</td>
<td>HOMING Turned OFF</td>
</tr>
<tr>
<td></td>
<td>I 38</td>
<td>OFF</td>
</tr>
<tr>
<td>PSTEP</td>
<td>ON</td>
<td>SATDO Turned OFF</td>
</tr>
<tr>
<td></td>
<td>I 37</td>
<td>OFF</td>
</tr>
<tr>
<td>PROG 0</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I 33</td>
<td>OFF</td>
</tr>
<tr>
<td>PROG 1</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I 34</td>
<td>OFF</td>
</tr>
<tr>
<td>PROG 2</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I 35</td>
<td>OFF</td>
</tr>
<tr>
<td>PROG 3</td>
<td>ON</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I 36</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Program Type Sampling**

- **PROG 3, 2, 1, 0**
- **(0, 1, 0, 0)**

The robot starts to move by the program type 5.

**Program Type Sampling**

- **PROG 3, 2, 1, 0**
- **(1, 0, 1, 0)**

The robot starts to move by the program type 11. This is an operating sequence to change the program type.

**NOTE:** Output signal from the robot to the user

---

These signals are sent from the user sequence or host computer to the robot.
8-3 System Programs which can be Used in the Same Way as Conventional Robots

8-3-1 Program Contents

This program is a sample program for controlling robots from peripheral devices in the same way as conventional SRX-500 series robots, etc. The sequence for conventional system I/O has been inherited into this system, and as settings have been made related to home return operations, the program can be re-written if necessary.

 System task sample program

 Method of usage

 Automatic operation execution
 Set a type number between 133 and 136 (4 bit hexadecimal) and turn 139 on to start program execution and switch on the L39 execution mode signal and the L40 automatic operation signal.

 Continual automatic operation
 Turn the 139 automatic operation starting signal on when in the step termination mode to execute continual operations and switch on the L40 automatic operation signal.

 Step termination
 Turn L40 step termination signal on when in the automatic operation mode (SATDO ON) to terminate the step and switch off the L40 automatic operation signal.

 Home return (delete if not necessary)
The L37 peripheral device home return signal will be turned on two seconds after the L37 home return start signal has been turned on, home return will be started when the L39 peripheral device home return position signal is turned on, and the L38 home return position signal will be turned on when home return is ended.

```plaintext
INIT: I, TYPE, ERR, TUSK
     ;Initialization (the program must have INIT as the header)
     ;L1-L40 turned off
     FOR l=1 TO 5
     POUT(l,0)
     NEXT
     RET

EMG
     ;Emergency stop process
     FOR l=1 TO 5
     POUT(l,0)
     NEXT
     DO L35(ON)
     ERROR: L35(ON)
     RET

ERROR
     ;Processing for errors
     GETERR(0, ERR, TUSK)
     ;Most recent error information obtained from the error history
```
IF TASK=1 THEN ;Robot task 1 checked for an error
  DO L35(ON) ;ERROR ON
ENDIF
DO L37(OFF) ;PERET OFF
DO L38(OFF) ;SHOME OFF
DO L39(OFF) ;SAUTO OFF
DO L40(OFF) ;SATOO OFF
5 l=RSTERR ;Error checked for cancellation
IF l<>0 GO 5
RET
140ON ;Step termination
IF L40(ON) THEN ;Automatic operation in progress
  IF STEP(1)=0 THEN ;Robot task 1 step termination
    DO L40(OFF) ;SATOO OFF
    DO L39(ON) ;SAUTO ON
  ENDIF
ENDIF
RET
139ON ;Automatic operation
IF L40(OFF) AND L34(OFF) THEN ;Not possible during automatic
  operation execution or during home
  return
  PIN5,TYP=;Type number acquisition (type number 133-136)
  TYPE = TYPE&0FH ;4bit removed
IF TYPESET(1,TYP)=0 THEN ;Program type set in robot task 1
  IF START(1)=0 THEN ;Robot task 1 started
    DO L35(OFF) ;ERROR OFF
    DO L38(OFF) ;SHOME OFF
    DO L39(ON) ;SAUTO ON
    DO L40(ON) ;SATOO ON
  ENDIF
ENDIF
ENDIF
;Continual running
IF L40(OFF) AND L36(OFF) AND L39(ON) THEN ;Not possible during automatic
  operation execution or during home return
  IF CONTINUE(1) =0 THEN ;Robot task 1 continual operation
    DO L35(OFF) ;ERROR OFF
    DO L38(ON) ;SATOO ON
  ENDIF
ENDIF
RET
137ON ;Home return
IF L34(OFF) THEN ;Not possible during automatic operation
  IF L40(ON) THEN ;Processing during automatic operation
    IF STEP(1)=0 THEN ;Step termination
      DO L40(OFF) ;SATOO OFF
      DO L39(OFF) ;SAUTO OFF
      DO L35(OFF) ;ERROR OFF
      DO L36(ON) ;SMAN ON
      GO 10
    ENDIF
  ENDIF
ENDIF
DO L35(OF) ;ERROR OFF
DO L36(ON) ;SMAN ON
DO L37(ON) ;PERET ON
DO L34(ON) ;PREADY confirmation
DO L37(OFF) ;PERET OFF
DO L34(ON) ;Home return started
IF HOMING(1)=0 THEN ;Robot task 1 home return
  DO L34(OFF) ;Home return ended
  DO L38(ON) ;SHOME ON
ENDIF
ENDIF
10 RET
END
8-3-2 Input/Output Allocation

**Input side**

<table>
<thead>
<tr>
<th>I(3-4)</th>
<th>PROG</th>
<th>(Program type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I33</td>
<td>PROG0</td>
<td>(Program type 0)</td>
</tr>
<tr>
<td>I34</td>
<td>PROG1</td>
<td>(Program type 1)</td>
</tr>
<tr>
<td>I35</td>
<td>PROG2</td>
<td>(Program type 2)</td>
</tr>
<tr>
<td>I36</td>
<td>PROG3</td>
<td>(Program type 3)</td>
</tr>
<tr>
<td>I37</td>
<td>PRET</td>
<td>(Home return start)</td>
</tr>
<tr>
<td>I38</td>
<td>PREADY</td>
<td>(Peripheral device home position)</td>
</tr>
<tr>
<td>I39</td>
<td>PSTART</td>
<td>(Automatic operation start)</td>
</tr>
<tr>
<td>I40</td>
<td>PSTEP</td>
<td>(Step termination)</td>
</tr>
</tbody>
</table>

**Output side**

<table>
<thead>
<tr>
<th>L(3-4)</th>
<th>HOME</th>
<th>(Returning to home position)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L34</td>
<td>ERROR</td>
<td>(Robot error)</td>
</tr>
<tr>
<td>L35</td>
<td>SMAN</td>
<td>(Manual mode)</td>
</tr>
<tr>
<td>L36</td>
<td>PERET</td>
<td>(Peripheral device home return)</td>
</tr>
<tr>
<td>L37</td>
<td>SHOME</td>
<td>(Home position)</td>
</tr>
<tr>
<td>L38</td>
<td>SAUTO</td>
<td>(Execution mode)</td>
</tr>
<tr>
<td>L39</td>
<td>SATDO</td>
<td>(Automatic operation being executed)</td>
</tr>
</tbody>
</table>
### 8-3-3 Time Chart (Example of robot control with peripheral devices)

#### Conventional I/O Sequence

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>SYS RUN</td>
<td>ON</td>
</tr>
<tr>
<td>SI 1</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Pret**

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRET</td>
<td>ON</td>
</tr>
<tr>
<td>I 37</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Pstart**

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSTART</td>
<td>ON</td>
</tr>
<tr>
<td>I 39</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Pstep**

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSTEP</td>
<td>ON</td>
</tr>
<tr>
<td>I 40</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Prog 0**

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROG 0</td>
<td>ON</td>
</tr>
<tr>
<td>I 33</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Prog 1**

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROG 1</td>
<td>ON</td>
</tr>
<tr>
<td>I 34</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Prog 2**

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROG 2</td>
<td>ON</td>
</tr>
<tr>
<td>I 35</td>
<td>OFF</td>
</tr>
</tbody>
</table>

**Prog 3**

<table>
<thead>
<tr>
<th>Signal</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROG 3</td>
<td>ON</td>
</tr>
<tr>
<td>I 36</td>
<td>OFF</td>
</tr>
</tbody>
</table>

#### Program Type Sampling

For **Prog 3, 2, 1, 0**

\[
(0, 1, 0, 0)
\]

The robot starts to move by the program type 5.

For **Prog 3, 2, 1, 0**

\[
(1 0 1 0)
\]

The robot starts to move by the program type 11.

This is an operating sequence to change the program type.

---

**NOTE:**

These signals are sent from the user sequence or host computer to the robot.

Output signal from the robot to the user
8-4 System Programs Controled from PLC

8-4-1 Program Contents

This program is a sample program to control robot tasks from PLC task.

1. System task program

******************************************************************************
System task sample program
******************************************************************************

Method of usage

Automatic operation execution
   Set the type number in the PLC task's K01C keep channel and turn on the
   PLC tasks's K0001 keep relay to start program execution and turn on the
   L39 automatic operation execution signal.

Continual automatic operation
   Turn the K0002 keep relay on when in the automatic operation mode to start
   continual execution and switch on the L39 automatic operation execution
   signal.

Step termination
   Turn K0000 keep relay on when in the automatic operation execution mode to
   terminate the step and switch on the L37 step termination signal and
   switch off the L39 automatic operation execution signal.

Home return (delete if not necessary)
   Turn the K0003 keep relay on to switch L40 and return to the home
   position, and L40 is switched off when ended.

Error reset
   Turn the K0004 keep relay on to reset an error and cancel the error
   signal.

INIT ; Initialization (the program must have INIT as the header)
INT:1,TYPEx

FOR I = 1 TO 5
   POUT(I,0)
NEXT
INITEND ; Command to end initialization

EMG

DO L37(OFF)
DO L38(OFF)
DO L39(OFF)
DO L40(OFF)
RET ; The module is ended with RET
ERROR

; Processing for errors
DO L37(OFF)
DO L38(OFF)
DO L39(OFF)
DO L40(OFF)
RET

INFO.0ON

; Step termination
IF STOP(1)=0 THEN ; Robot 1 step termination
    DO L39(OFF) ; Automatic operation execution
        ; termination
    DO L37(ON) ; Step termination
ENDIF
RET

INFO.1ON

; Automatic operation
TYPE=INP(1)&000F ; Type number acquisition
IF TYPESET(1,TYPE) = 0 THEN ; Program type set in robot 1
    IF START(1) = 0 THEN ; Program started
        DO L38(ON) ; Automatic operation
        DO L39(ON) ; Automatic operation execution
        DO L37(OFF) ; Step termination cancelled
    ENDIF
ENDIF
RET

INFO.2ON

; Continual running
IF CONTINUE(1) = 0 THEN ; Robot 1 continual operation
    DO L39(ON) ; Automatic operation execution
    DO L37(OFF) ; Step termination cancelled
ENDIF
RET

INFO.3ON

; Home return
DO L37(OFF) ; Step termination cancelled
DO L38(OFF) ; Automatic operation cancelled
DO L40(ON) ; Home return started
I = HOMING(1) ; Robot 1 home return
DO L40(OFF) ; Home return ended
ENDIF
RET

INFO.4ON

; Error reset
RSTERR
RET

END
2. PLC task program

- ★Keep relay
  - K0000 Robot step termination
  - K0001 Robot automatic operation start
  - K0002 Robot step start
  - K0003 Robot home return
  - K0004 Robot error reset

- ★Keep channel
  - K01C Robot program type

- ★Standard relays
  - K0100 PROG0
  - K0101 PROG1
  - K0102 PROG2
  - K0103 PROG3

;Automatic operation execution

R0000=138*"L39*"L40*/R0000 ;Program automatic operation execution input
;Not possible during automatic operation or
;during home return

;PROG0 substituted
BSET(K01C,0,133)= R0000

;PROG1 substituted
BSET(K01C,1,134)= R0000

;PROG2 substituted
BSET(K01C,2,135)= R0000

;PROG3 substituted
BSET(K01C,3,136)= R0000

T000(10)=R0000

;Step termination
K0000=137*"L39 ;Step termination input

;Continual running
K0002=139*"L38*"L39*"L40 ;Continual running (Not possible during automatic
;operation execution or during home return)

;Home return
K0003=140*"L39*"L40 ;Home return (Not possible during automatic
;operation execution or during home return)

;Error reset
K0004=136 ;Error reset
### 8-4-2 Input/Output Allocation

**Input side**

<table>
<thead>
<tr>
<th>I32</th>
<th>ERRRST</th>
<th>(Error reset)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I33</td>
<td>PROG0</td>
<td>(Program type 0)</td>
</tr>
<tr>
<td>I34</td>
<td>PROG1</td>
<td>(Program type 1)</td>
</tr>
<tr>
<td>I35</td>
<td>PROG2</td>
<td>(Program type 2)</td>
</tr>
<tr>
<td>I36</td>
<td>PROG3</td>
<td>(Program type 3)</td>
</tr>
<tr>
<td>I37</td>
<td>PSTEP</td>
<td>(Program step termination)</td>
</tr>
<tr>
<td>I38</td>
<td>PSTART</td>
<td>(Program automatic operation execution)</td>
</tr>
<tr>
<td>I39</td>
<td>STPSTAT</td>
<td>(Program continual execution)</td>
</tr>
<tr>
<td>I40</td>
<td>PRET</td>
<td>(Robot home return start)</td>
</tr>
</tbody>
</table>

**Output side**

<table>
<thead>
<tr>
<th>L37</th>
<th>STEP</th>
<th>(Program step being terminated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L38</td>
<td>SAUTO</td>
<td>(Execution mode)</td>
</tr>
<tr>
<td>L39</td>
<td>SATDO</td>
<td>(Automatic operation being executed)</td>
</tr>
<tr>
<td>L40</td>
<td>HOMING</td>
<td>(Robot returning to home position)</td>
</tr>
</tbody>
</table>
### 8-4-3 Time Chart (Example of robot control with peripheral devices)

<table>
<thead>
<tr>
<th></th>
<th>SYS RUN</th>
<th>ON</th>
</tr>
</thead>
<tbody>
<tr>
<td>SI 1</td>
<td>OFF</td>
<td></td>
</tr>
</tbody>
</table>

- **PRET ON**
  - **I 40 OFF**
    - **HOMING**

- **PSTART ON**
  - **I 38 OFF**
    - **HOMING Turned OFF**
    - **SAUTO**
    - **SATDO**
    - **SATDO Turned OFF**
    - **STEP**

- **PSTEP ON**
  - **I 37 OFF**

- **PROG 0 ON**
  - **I 33 OFF**

- **PROG 1 ON**
  - **I 34 OFF**

- **PROG 2 ON**
  - **I 35 OFF**

- **PROG 3 ON**
  - **I 36 OFF**

### Program Type Sampling

- **PROG 3, 2, 1, 0**
  - **(0, 1, 0, 0)**
  - The robot starts to move by the program type 5.

- **PROG 3, 2, 1, 0**
  - **(1 0 1 0)**
  - The robot starts to move by the program type 11.

This is an operating sequence to change the program type.

---

**NOTE:**

Output signal from the robot to the user