LOCTITE

EQUIPMENT OPERATION MANUAL

LOCTITE® SCARA-N ROBOT

S440N Series

Quick Start

Thank you for purchasing this Loctite® SCARA-N Robot.

● **Read this manual thoroughly in order to properly use this robot.**
 Be sure to read "For Your Safety" before you use the robot. It will protect you from possible dangers during operation.

● **After having read this manual, keep it in a handy place so that you or the operator can refer to it whenever necessary.**

FOR YOUR SAFETY

Safety Precautions

The precautions in this manual are provided for the customer to make the best use of this product safely, and to provide preventive measures against injury to the customer or damage to property.

・・・・・ **Be sure to follow the instructions**・・・・・

Various symbols are used in this manual. Please read the following explanations of what each symbol stands for.

● **Symbols Indicating the Degree of Damage or Danger**

The following symbols indicate the degree of damage or danger which may be incurred if you neglect the safety notes.

⚠ **Warnings**	These "Warnings" indicate the possibility of death or serious injury.
⚠ **Cautions**	These "Cautions" indicate the possibility of accidental injury or damage to property.

● **Symbols Indicating Type of Danger and Preventive Measures**

The following symbols indicate the type of safety measure that should be taken.

△	Indicates the type of safety measure that should be taken.
⚠	Take care. (general caution)
🚫	Indicates prohibition.
🚫	Never do this. (general prohibition)
🚫	Do not disassemble, modify or repair.
🚫	Do not touch. (contact prohibition)
●	Indicates necessity.
❗	Be sure to follow instructions.
⚡	Be sure to unplug power cord from wall outlet.
⏚	Be sure to check grounding.

FOR YOUR SAFETY

⚠ Warnings

Be sure to unplug the power cord from the wall outlet if the robot will remain unused for long periods of time. Gathered dust could lead to fire.
Be sure to shut off the power supply before removing the power cord.

Keep the emergency stop switch within reach of an operator while teaching or running the robot.
Failure to do so may cause danger since the robot cannot be stopped immediately and safely.

Regularly check that the I/O-S circuits and emergency stop switch work properly.
Failure to do so may cause danger since the robot cannot be stopped immediately and safely.

Check the mounting screws regularly so that they are always firmly tightened.
Loose screws may cause injury or breakdown.

Power the unit only with the rated voltage.
Excessive voltage can cause fire or malfunction of the unit.

Do not sprinkle water or oil on the robot, operation box, or power cord.
Contact with water or oil can cause electric shock, fire, or malfunction of the unit. IP Protection Rating is "IP20."

FOR YOUR SAFETY

## ■ INSTALLATION ■

⚠ Warnings

Always use a safety barrier.
A person entering the robot's maximum operating range may be injured. **Install an interlock that triggers an emergency stop when the gate is opened at the entry gate of the safety barrier, using the I/O-S connector included in package.** Ensure there is no other way of entering the restricted area. Furthermore, **put up a "No Entry" or "No Operating" warning sign** in a clearly visible position.

Example
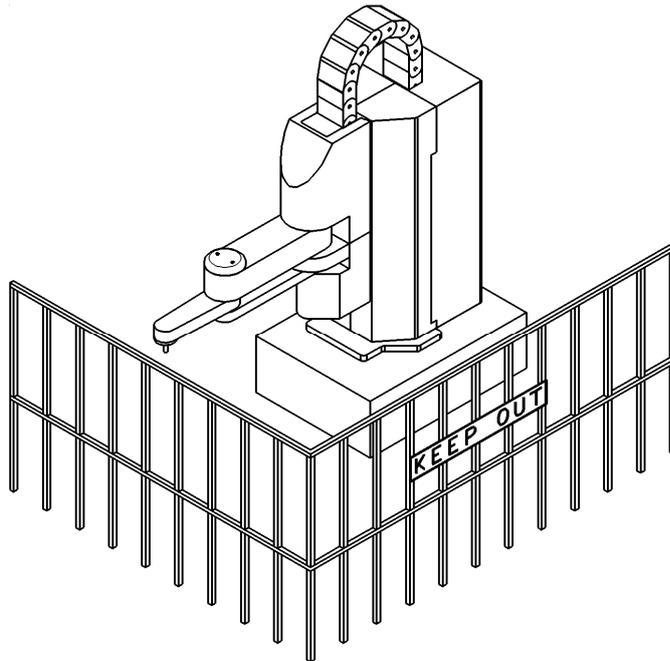
Install a safety barrier of adequate strength so as to protect the operator from moving tools and flying objects.
Always use protective wear (helmet, protective gloves, protective glasses, and protective footwear) when going inside the safety barrier.

Take adequate precautions against objects the robot is gripping flying or falling off **taking into account the object's size, weight, temperature and chemical composition.**

FOR YOUR SAFETY

⚠ Warnings

Confirm that the robot is properly grounded before use.
Insufficient grounding can cause electric shock, fire, malfunction, or breakdown.

Plug the power cord into the wall outlet firmly.
Incomplete insertion into the wall outlet makes the plug hot and can cause fire.
Check that the plug is not covered with dust.
Be sure to shut off the power supply before connecting the power cord to the robot.

Install the robot in a place which can endure its weight and conditions while running.
Placing the unit in an insufficient or unstable surface may cause the unit to fall, overturn, or breakdown. This could result in operator injury.

Do not block the air intake on the lower part of the back of the robot (18mm above the floor.) This may cause overheating or fire.

Do not attempt to disassemble or modify the robot.
This may lead to electric shocks or fire.

Be sure to use within the voltage range indicated on the unit.
Failure to do so may cause electric shock or fire.

Do not use the unit where flammable or corrosive gas is present.
Leaked gas accumulated around the unit can cause fire or explosion.

Place the unit in a well-ventilated area for the health and safety of the operator.

Turn off the unit before inserting and removing cables.
Failure to do so may result in electric shock, fire, or malfunction of the unit.

FOR YOUR SAFETY

⚠ Warnings

Be sure to confirm that all the air tubes are connected correctly and firmly.

Use the robot in an environment between 0 to 40 degrees centigrade with a humidity of 20 to 90 percent without condensation.
Failure to do so may result in malfunction. IP Protection Rating is "IP20."

Use the robot in an environment where no electric noise is present.
Electric noise may cause malfunction or breakdown.

Be sure to secure the movable parts of the robot before transportation.
Failure to do so may result in injury or breakdown.

Do not bump or jar the unit while it is being transported or installed.
This can cause breakdowns.

Use the robot in an environment where it is not exposed to direct sunlight.
Direct sunlight may cause malfunction or breakdown.

Be sure to confirm that tools such as the electric screwdriver unit, etc. are properly connected.
Failure to do so may result in injury or breakdown.

Be sure to check the wiring to the main unit.
Improper wiring may result in malfunction or breakdown.

Keep the emergency stop switch within reach of an operator.
Failure to do so may cause danger since the robot cannot be stopped immediately and safely.

Be sure to shut off the power supply before plugging in the power cord.

FOR YOUR SAFETY

⚠ Cautions

Place the operation box on a flat surface more than 80 cm above the floor so that it is easier to operate it.

- -

Use the unit in an environment that is not dusty or damp.
Dust and dampness may lead to breakdown or malfunction.
IP Protection Rating is "IP20."

FOR YOUR SAFETY

■ WORKING ENVIRONMENT ■

⚠ Warnings

When you lubricate or inspect the unit, unplug the power cord from the robot.
Failure to do so may result in electric shock or injury.
Be sure to shut off the power supply before removing the power cord from the robot.

When going inside the safety barrier, **place a "Do Not Operate" sign** on the start switch.

Keep the emergency stop switch within reach of an operator while teaching and running the robot.
Failure to do so may cause danger since the robot cannot be stopped immediately and safely.

Install a safety barrier of adequate strength so as to protect the operator from moving tools and flying objects.
Always use protective wear (helmet, protective gloves, protective glasses, and protective footwear) when going inside the safety barrier.

Be sure to confirm that all the air tubes are connected correctly and firmly.

Always be aware of the robot's movement, even in the teaching mode.
Careful attention will protect the operator from injury.

FOR YOUR SAFETY

■ DURING OPERATION ■

⚠ Warnings

❗ When operations are taking place within the safety barrier, **ensure no one enters the robot's maximum operating range.**

❗ If you must go inside the safety barrier, be certain to **push the emergency stop switch** and **put a "Do Not Operate" sign** on the start switch.

❗ When starting the robot, check that, **no one is within the safety barrier and no object will interfere with the robot operating.**

❗ **Under no circumstances should you go inside the safety barrier or place your hands or head inside the safety barrier while the robot is operating.**

❗ **If anything unusual (e.g. a burning smell or abnormal sound) occurs, stop operation and unplug the cable immediately. Contact the dealer from which you purchased the robot or the office listed on the last page of this manual.**
Continuous use without repair can cause electric shock, fire, or breakdown of the unit.

❗ **Keep the emergency stop switch within reach of an operator while teaching and running the robot.**
Failure to do so may cause danger since the robot cannot be stopped immediately and safely.

PREFACE

The Loctite® SCARA-N Robot S440N Series is a new low cost, high performance robot. The combined use of pulse motors and special micro step driving circuits saves you energy and space.

There are several manuals pertaining to this robot.

Setup	This manual explains how to set up the robot. ● Be sure to read this manual.
Maintenance	This manual explains how to maintain the robot. ● Be sure to read this manual.
Basic Instructions	This manual provides safety precautions, part names, and the basic knowledge necessary to operate the robot.
Quick Start	This manual explains the actual operation of the robot with simple running samples.
Teaching Pendant Operation	This manual explains how to operate the robot via the teaching pendant.
PC Operation	This manual explains how to operate the robot from a computer (LR C-Points.)
Features I	This manual explains point teaching.
Features II	This manual explains commands, variables, and functions.
Features III	This manual explains features such as run mode parameters, sequencer program, etc.
External Control I (I/O-SYS)	This manual explains the I/O-SYS control.
External Control II (COM Communication)	This manual explains the COM communication control system (COM1 – COM3.)
Specifications	This manual provides comprehensive specifications, including mechanical or electrical requirements.

Note: The product specifications in these manuals may differ from those of the robot you have received due to product improvement.

Please be sure to follow the instructions described in these manuals. Proper use of the robot will ensure continued functionality and high performance.
The contents described in this manual are based on the standard application. Menu items may vary depending on models.

"For Your Safety" is also provided so that the operator can make the best use of this robot safely. This book includes preventive measures that can be taken against injury to the operator or damage to property.   Please be sure to read "For Your Safety" before using the robot.

Be sure to shut off the power supply before plugging in the power cord.

BE SURE TO MAKE A PROPER GROUNDING WHEN YOU INSTALL THE ROBOT.

Be sure to save data whenever it is added or modified. **Otherwise, changes will not be saved if the power to the robot is cut off.**
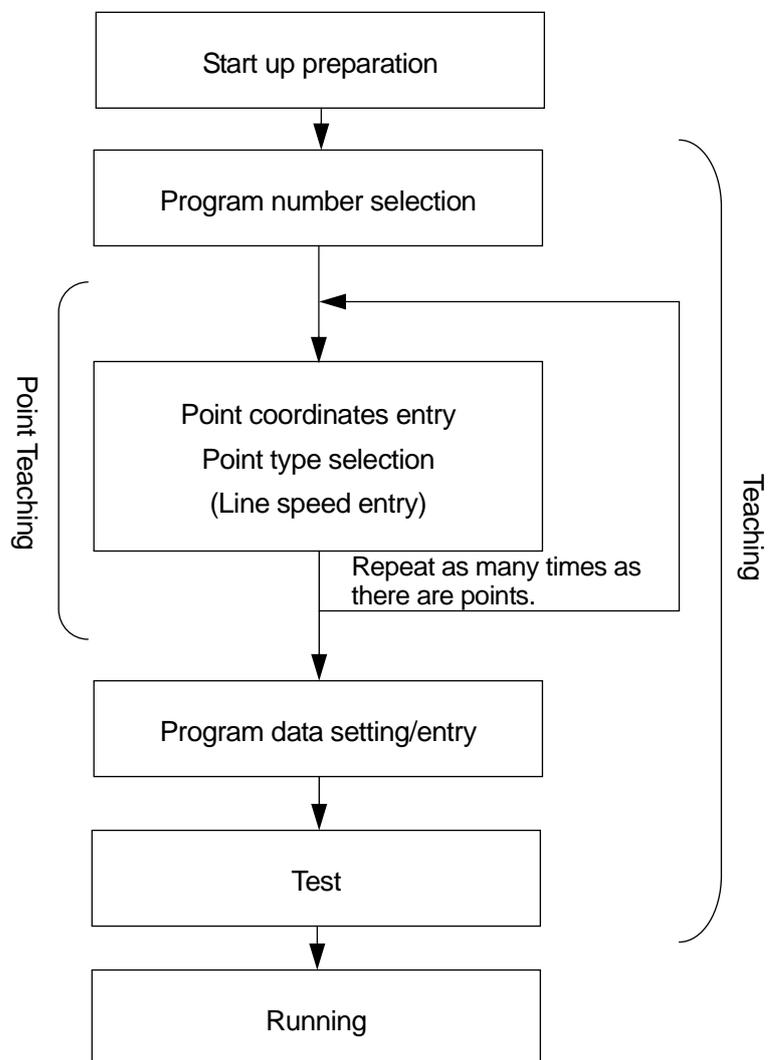
CONTENTS

1 . **OPERATION PROCESS**

To run the robot, certain operations such as teaching are necessary.

The running procedure is as follows:

- You can execute "Program Data Setting/Entry" before "Point Teaching."

```
┌─────────────────────────────┐
│     Start up preparation     │
└─────────────────────────────┘
               │
               ▼
┌─────────────────────────────┐
│  Program number selection    │
└─────────────────────────────┘
               │
               ▼
┌─────────────────────────────┐
│     Point coordinates entry  │
│      Point type selection    │
│       (Line speed entry)     │
└─────────────────────────────┘
         Repeat as many times as
         there are points.
               │
               ▼
┌─────────────────────────────┐
│  Program data setting/entry  │
└─────────────────────────────┘
               │
               ▼
┌─────────────────────────────┐
│            Test              │
└─────────────────────────────┘
               │
               ▼
┌─────────────────────────────┐
│          Running             │
└─────────────────────────────┘
```

Point Teaching

Teaching

２．HOW TO OPERATE THE SCARA-N ROBOT (1)

This section shows you how to run a simple program and gives you a chance to operate the robot.

The first program shifts the tool unit between the following two points.

[Point Number]	[Coordinates]	[Point Type]
0001	RX: 70 mm, RY: 190 mm, RZ: 30 mm, R: 0 deg	PTP Point
0002	RX: -70 mm, RY: 210 mm, RZ: 30 mm, R: 0 deg	PTP Point

2.1   Preparation

1) Read the instruction manuals "Setup" and "Maintenance" thoroughly to ensure the safe installation of the robot.   In this example, both the teaching pendant and the operation box are connected to the body.

> ⚠ **Warning**
> Be sure to take protective measures including installing an area sensor or a safety barrier to avoid injury.
> Confirm that the unit is properly grounded to avoid possible electric shock.

2) For safety purposes, confirm that no person is inside the safety barrier.

3) Select "TEACH" using the select key switch on the operation box. (TEACH: Teaching mode)

4) Turn the power breaker on the rear of the robot ON. (Power ON)

5) Press the Motor ON switch on the operation box. (Motor ON)

6) Press the F.4 key while pressing down the enable switch on the teaching pendant to execute mechanical initialization.

[Teaching Mode], is used for various settings and to create programs.

2.2　Teaching

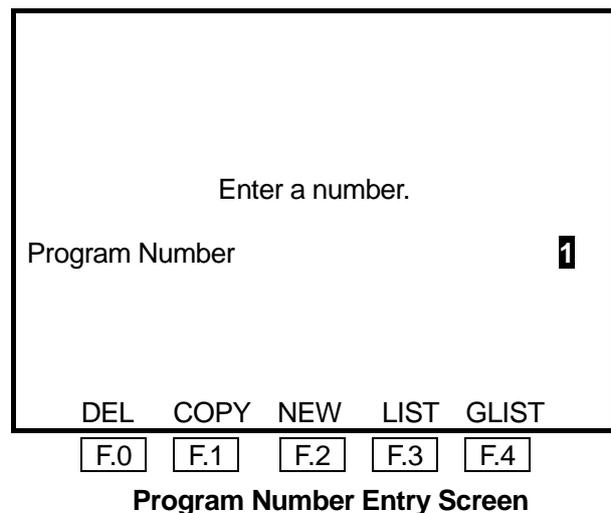### 2.2.1　Program Number Selection

In this example, select the Program Number 3 (not entered.)

1)　First, select a program number for teaching.

If there is no registered program, the Program Number entry screen will appear when the teaching mode is started up. (See right)

If the Program Number entry screen does not appear even after starting up the teaching mode, press the PRG.NO key.

```
┌─────────────────────────────────────┐
│                                     │
│                                     │
│          Enter a number.            │
│                                     │
│  Program Number              1      │
│                                     │
│                                     │
│    DEL   COPY  NEW   LIST  GLIST    │
└─────────────────────────────────────┘
     F.0    F.1    F.2   F.3   F.4
```
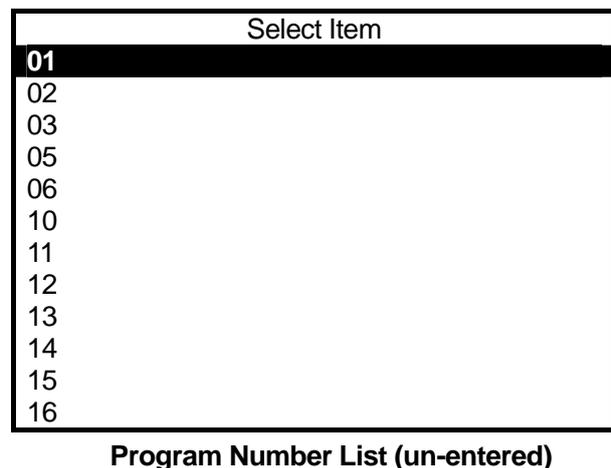**Program Number Entry Screen**

2)　When the Program Number entry screen is displayed, press the F.2 (NEW) key.　The un-entered program number list will appear. (See right)

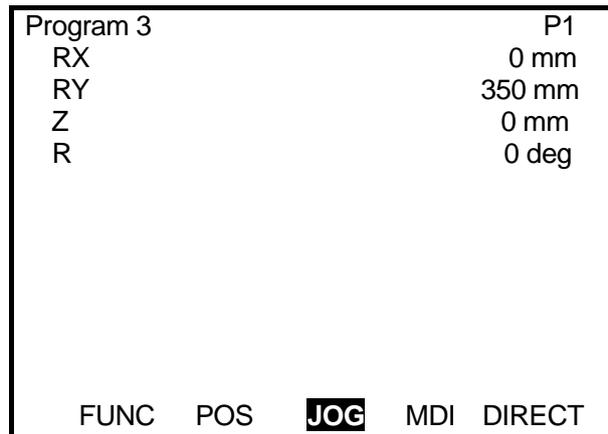In this case, press the CURSOR↓ key twice to highlight [03] and then press the ENTR key.

The highlight will shift downward every time the CURSOR↓ key is pressed.

```
┌─────────────────────────────────────┐
│            Select Item              │
│ 01                                  │
│ 02                                  │
│ 03                                  │
│ 05                                  │
│ 06                                  │
│ 10                                  │
│ 11                                  │
│ 12                                  │
│ 13                                  │
│ 14                                  │
│ 15                                  │
│ 16                                  │
└─────────────────────────────────────┘
```
Program Number List (un-entered)

- **[Select] is to highlight a certain item and press the ENTR key (fix it.)**
- While the Program Number entry screen is displayed, press the F.3 (LIST) key.　The registered program number list will appear.
- You can enter a program number for teaching directly on the Program Number entry screen.

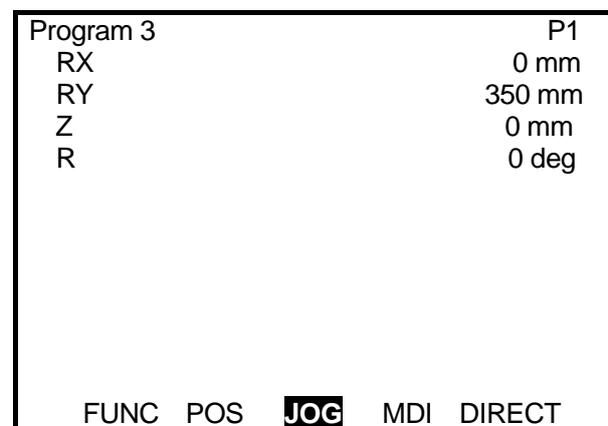3) After selecting the program number, the new position entry screen for Point Number 1 will appear. (See right)

```
Program 3                          P1
  RX                            0 mm
  RY                          350 mm
  Z                             0 mm
  R                             0 deg




        FUNC    POS    JOG    MDI   DIRECT
```
New Position Entry Screen

2.2.2 Point Position Entry

1) The new position entry screen for Point Number 1 in the selected program will appear. (See right)
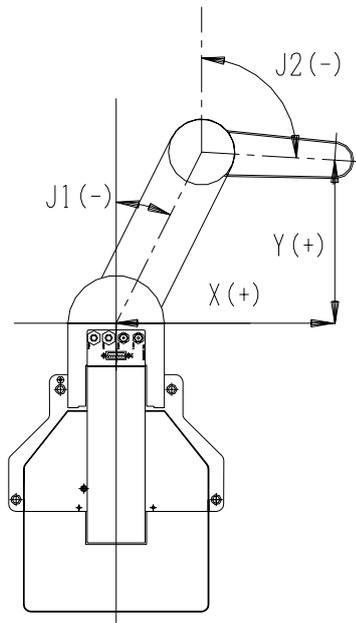
The current position entry mode is highlighted on the last line of the position entry screen. ([JOG], [MDI], or [DIRECT])

```
Program 3                          P1
  RX                            0 mm
  RY                          350 mm
  Z                             0 mm
  R                             0 deg




        FUNC    POS    JOG    MDI   DIRECT
         F.0    F.1    F.2    F.3    F.4
```
New Position Entry Screen

• [RX] and [RY] on the position entry screen stand for the X-Y Righty.
[LX] and [LY] stand for the X-Y Lefty. If the J1-J2 expression is selected, [J1], [J2], and corresponding angles are displayed on the screen.

• To change the Arm coordinate system from the X-Y Righty to X-Y Lefty, press the F.1 (POS) key and select [Change to Lefty (LX,LY).] To change the Arm coordinate system from the J1-J2 Righty to X-Y Lefty, select [Change to X-Y Expression], press the F.1 (POS) key again, and then select [Change to Lefty (LX,LY).] (See the illustration on the next page)
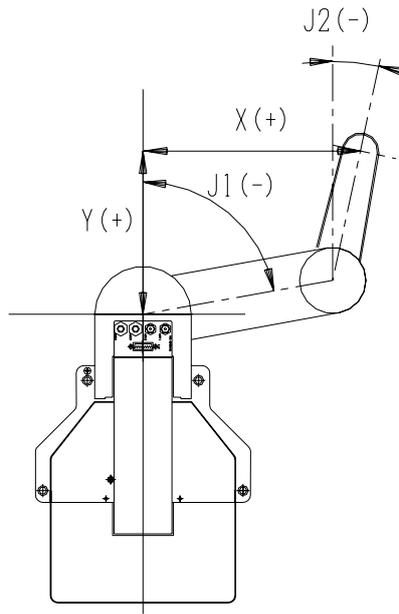
Lefty   Righty

2) Next, enter the coordinates of the point. In this example, select the JOG mode. Between [JOG], [MDI], and [DIRECT] on the last line of the LCD, the currently selected position entry mode is highlighted. If [JOG] is not highlighted, press the ⎡F.2⎤ key.
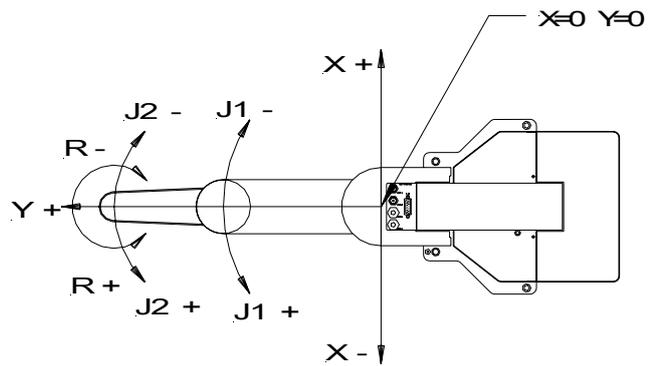
Then, enter the position coordinates of the Point 1.
Shift each Arm to the desired position (coordinates) using the following keys **while pressing the enable switch on the teaching pendant.** The current position (coordinates) is displayed on the LCD. After shifting the desired position, press the ⎡J.ENTR⎤ key to fix the coordinates.
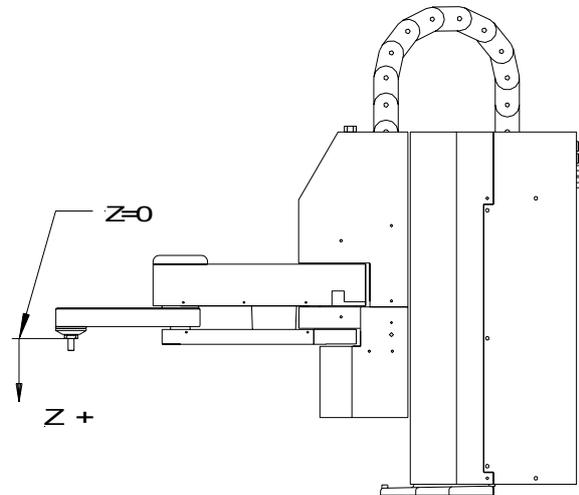
Point Number	Coordinates	Point Type
1	RX 70 mm, RY 300 mm, Z 80 mm, R 0 deg	PTP Point

J1/X-→ .... Shifts each Arm in the –X direction.

←J1/X+ .... Shifts each Arm in the +X direction.

↑J2/Y- .... Shifts each Arm in the –Y direction.

J2/Y+↓ .... Shifts each Arm in the +Y direction.

↑Z .... Shifts each Arm in the –Z direction.

↓Z .... Shifts each Arm in the +Z direction.

R- .... Rotates the R-Axis in the –R direction.

R+ .... Rotates the R-Axis in the +R direction.

● You can enter the Arm shifting distance (each time the above JOG keys are pressed) and speed (when the keys are kept pressed) in the customizing mode.

JOG SPEED .... Changes the Arm shifting speed when the JOG key is held down between Low (low speed), Middle (medium speed) and High (high speed).

J.ENTR .... Fixes the coordinates.   Displays the Point Type selection screen when entering a new position. Returns to the setting screen (base screen) when modifying a position.

<div style="border: 2px solid black; padding: 10px;">

⚠ **Caution**   Do not enter the robot's restricted area while it is running.

</div>

● The Arm movement in the JOG mode is limited by the **move area limit**.   If the J1 and J2 Axes will not exceed a certain angle, check [Move Area Limit] in the program data setting menu.

● There are three position entry modes: **JOG mode**, **MDI mode**, and **DIRECT mode**.
  To switch between each mode, press the following keys on the position entry screen.

   ・ JOG mode: F.2 key   (Invalid if the power to the robot is OFF)

   ・ MDI mode: F.3 key

   ・ DIRECT mode: F.4 key

2.2.3 Point Type

1) After entering the coordinates, press the
   J.ENTR key (fix it.)
   The Point Type selection screen will
   appear. (See right)

2) Select [PTP Point] for the point.

<div style="border: 2px solid black; padding: 10px;">

Program 3   P1
PTP Point
CP Start Point
CP Passing Point
CP Stop Point
CP Arc Point
CP End Point
PTP Evasion Point
CP Circle Point

</div>

● You can create point types in the customizing mode.   Depending on the customizing mode data, the Point Type selection screen may be different from the above example.

3) After fixing the point type, the new position entry screen for the next point (current point number + 1) will appear.
   Repeating the same steps as Point 1, register Point 2 according to the following settings.

Point Number	Coordinates	Point Type
2	RX –150 mm, RY 200 mm, Z 80 mm, R 0 deg	PTP Point

2.2.4 Work Home Position Entry

Enter the following work home position coordinates.

Point Number	Coordinates
Work Home	X 350 mm, Y 200 mm, Z 50 mm, R 0 deg

1)   Register the work home position.
The work home is the position where the
tool unit waits to start the next operation.

Press the | MENU | key.
The Teaching Mode menu will appear.
(See right)
Select [Program Data Settings.]

```
                Teaching Mode Menu
Program Data Settings
Condition Data Settings
Common Data Settings
Additional Function Data
Point Job Settings
Sequencer Settings
Run Mode Parameter
Teaching Data Copy, Delete, Conversion
```

● Depending on the settings created in the customizing mode, the teaching mode menu may be different from the above example.
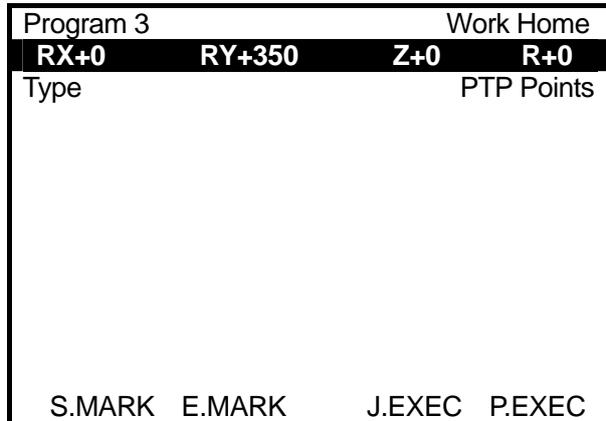
2)   The Program Data Settings menu will
appear. (See right)

Select [Work Home.]

```
Program 3
Program Name
Work Home
Cycle Mode                  1 Cycle Playback
PTP Condition
CP Condition
Tool Data
Move Area Limit
Position Data Type                Absolute
```

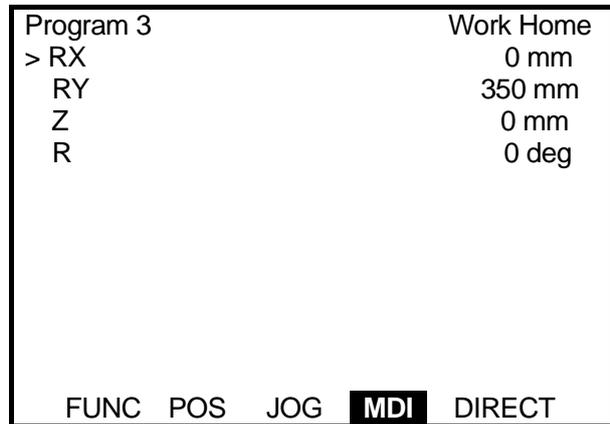3) The Work Home setting screen will appear. (See right)

   Select the coordinates line.

```
Program 3                    Work Home
 RX+0        RY+350      Z+0      R+0
Type                         PTP Points




     S.MARK   E.MARK      J.EXEC   P.EXEC
```

Work Home Setting Screen

4) The position entry screen will appear. (See right)
   In this example, enter the coordinates in the MDI mode.

   The currently selected position entry mode ([JOG], [MDI] or [DIRECT]) on the last line of the screen will be highlighted. If [MDI] is not highlighted, press the F.3 key.

```
Program 3                    Work Home
> RX                           0 mm
  RY                         350 mm
  Z                            0 mm
  R                            0 deg




  FUNC   POS    JOG    MDI   DIRECT
   F.0    F.1    F.2    F.3    F.4
```

Position Entry Screen

A ">" mark indicates the item which the cursor is pointing to.   Enter the coordinates using the following keys.   After entering all the coordinates X, Y, Z, and R, press the J.ENTR key to fix them.

1 - 0 ....Overwrites the figure under the cursor with the number pressed.   If the cursor is hidden, the selected number will be entered as the last digit.

. ...Enters a decimal point.   This key is invalid if the figure already contains a decimal point or no decimal fraction is possible.

CLEAR ....Clears the entire value.   The value becomes 0 (zero.)

DEL .... Deletes the figure or decimal point under the cursor.
The cursor and the figure on the left side of the cursor then shift rightward.　However, a decimal point cannot be deleted if the figure will exceed the entry range without the decimal point.
If there is no cursor, the lowest figure of the decimal fraction will be deleted and the figures will shift rightward.

F.3 .... Each time this key is pressed, the enterable item (indicated by the "**>**" mark) changes in the order **X → Y → Z → R → X**.

CURSOR↑ .... Shifts the cursor upward.

CURSOR↓ .... Shifts the cursor downward.

CURSOR← .... Shifts the cursor leftward.

CURSOR→ .... Shifts the cursor rightward.

GO .... Press this key while pressing the enable switch.　Each Arm will shift to the coordinates displayed on the LCD. (Invalid when the power to the robot is OFF)

⚠ **Caution**　　Do not enter the robot's restricted area while it is running.

J.ENTR .... Fixes coordinates.　When entering a new position, displays the point type selection screen.　When modifying a position, returns to the setting screen (base screen.)

● You can shift each Arm using the GO key on the point setting screen.

❗ Be sure to save data whenever it is added or modified. **Otherwise, changes will not be saved if the power to the robot is cut off.**
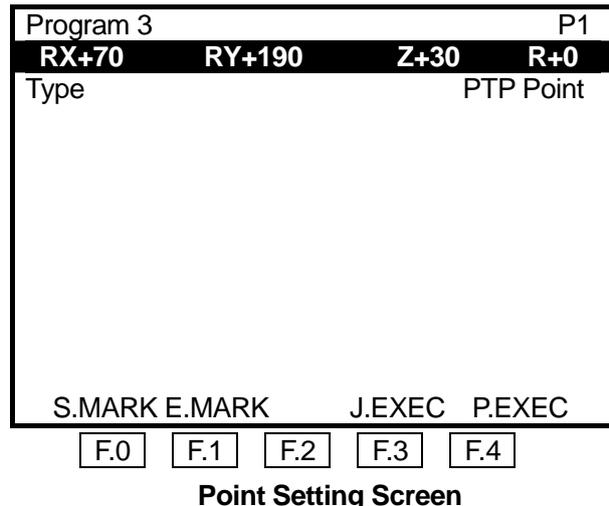For how to save data, see "5. SAVE."

2.3   Program Test

After completing all the program data settings and point teaching, execute the program test.

2.3.1 Point Run

1) Press   the   CURSOR →   key   to highlight the setting screen for Point 1. (See right)

```
Program 3                              P1
RX+70      RY+190        Z+30      R+0
Type                            PTP Point




    S.MARK E.MARK        J.EXEC   P.EXEC
     F.0     F.1     F.2     F.3     F.4
```
Point Setting Screen

2) Press the F.4 (P.EXEC) key.   The robot will run on the displayed point (Point 1) and then the screen will change to the setting screen for the previous point.
    After pressing the F.4   (P.EXEC) key, execute the test run on Point 2.   Check if the tool center positions on Points 1 and 2 are the same as when entering the position.
    After executing the test run on Point 2 (last point), the screen will change to the setting screen for the work home (where the tool unit waits to start the next operation.)

⚠ **Caution**   Do not enter the robot's restricted area while it is running.

●   If point coordinates are outside of the robot operation range or move area limit, a position error occurs.

   If the angle made by the J1 and J2 Arms exceeds ±150 degrees, it is recognized as an "out of range" error even when the J1 or J2 Axis is inside of the move area limit. If the angle made by the J1 and J2 Axes is the same as the move area limit, an "out of range" error may occur.

2.3.2 Checking Data

1) Press the ⎢ MONITOR ⎟ key to display
    the Test menu. (See right)

```
                    Test Menu
Checking Data
Test Run
IO Test
Test Run (Check IO)




```

2) Select [Checking Data.]
    The shifting range and point type of the
    program will be checked.
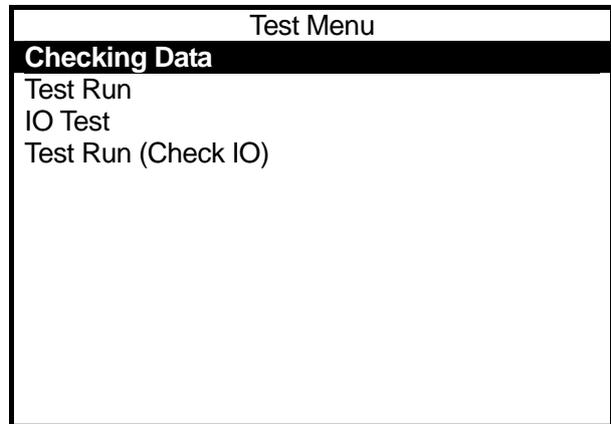
3) If no error has been detected, the screen
    shown on the right will appear.
    If an error has been detected, the error
    type and error point number will be
    displayed.

```
Program 1                  Checking Data



                    OK



```
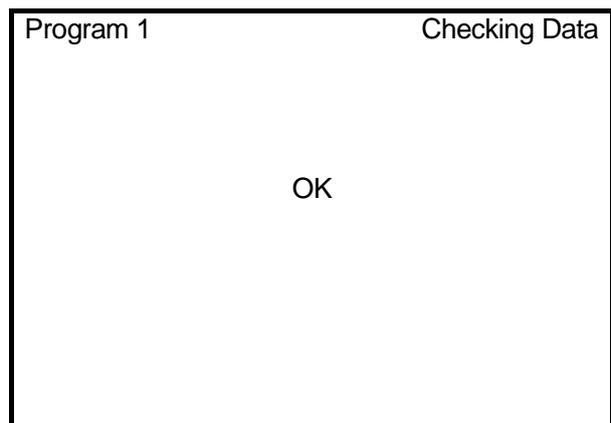
2.3.3 Test

Select [Test Run] from the Test menu and press the ⎡F.4⎤ (START) key while pressing down the enable switch.   Test run is executed.

For your safety, the maximum speed is limited to 250 mm/s in the [Test Run], however, the robot will execute one cycle of operation exactly the same way as the actual operation.

When registering a new program or modifying an existing program, be sure to check the data and then execute the [Test Run] before actual operation.

> ⚠ **Caution**   Do not enter the robot's restricted area while it is running.

● If point coordinates are outside of the robot operation range or move area limit, a position error occurs.

If the angle made by the J1 and J2 Arms exceeds ±150 degrees, it is recognized as an "out of range" error even when the J1 or J2 Axis is inside of the move area limit. If the angle made by the J1 and J2 Axes is the same as the move area limit, an "out of range" error may occur.

USEFUL KEY FUNCTIONS

■ EDIT key: Point setting screen or new position entry screen

Using this key, you can insert or delete points.
You can also delete, move, or copy a series of designated points (point block.)

■ GO key: Point setting screen or MDI mode

When coordinates displayed on the LCD do not correspond to the actual tool center point position, press this key while pressing the enable switch.   Each Arm will shift to the position displayed on the LCD.

■ F.3 (J.EXEC) key: Point setting screen

Press this key while pressing the enable switch.   The "point job" set to the current point will be executed.

■ F.4 (P.EXEC) key: Point setting screen

Press this key while pressing the enable switch.   The robot will run on the current point and then the screen will change to the setting screen for the next point.

■ F.1 key: In position entry

Using this key, you can switch:
● between [X-Y] and [J1-J2]
● between [X-Y Righty] and [X-Y Lefty] (in JOG mode and MDI mode)
● between [Free … Axis] and [Hold … Axis] (in DIRECT mode)

■ CURSOR ← / CURSOR → key: Point setting screen

Using this key, you can display the setting screen for the previous/next point.
Press this key while pressing the enable switch.   The screen will change to the setting screen for the previous/next point and then each Arm will shift to the position coordinates displayed on the screen.

３．HOW TO OPERATE THE SCARA-N ROBOT (2)

In this chapter, how to change the "PTP Condition" (in the program registered in the previous chapter "2. How to operate the SCARA-N robot (1)") and how to execute a point job on a point will be explained.

The "PTP Condition" is one of the items included in the program data.   It affects the shifting conditions (e.g. speed) for the PTP drive in a program.

The "Point Job Data" to be executed on a point is not the data to be entered directly to a point.   To execute a job on a point, register the "Point Job Data" separately from programs or points, and then set the "Point Job Data" number to a point and select the number. In this way, you can select the same "Point Job Data" from multiple points and programs.

First, register the point job data.   Next, select the point job numbers to be set to each point.

In this example, a pick and place operation will be executed.

Settings for the tool attached to the unit are as follows:

Hand Tool
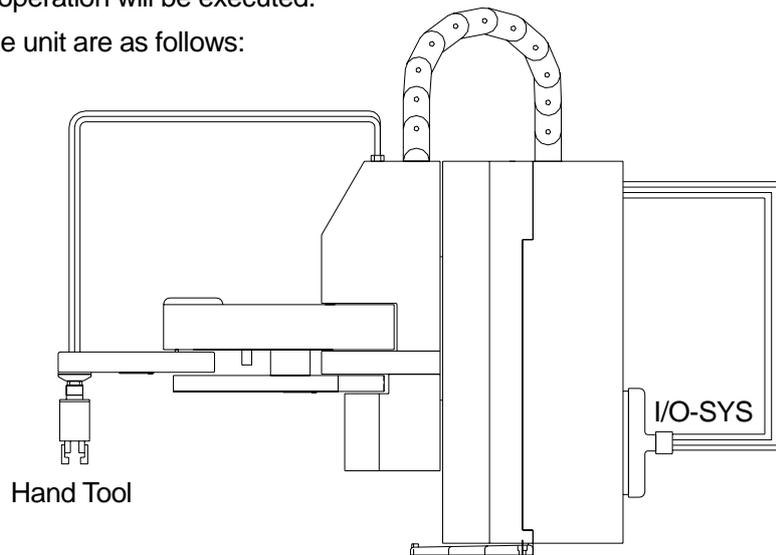
I/O-SYS

I/O-SYS	
Output	
sysOut15	sysOut16
ON Pulse	-
Output	
sysOut15	sysOut16
-	ON Pulse

→   Pick   Then   →

→   Place   Then   →

I/O-SYS	
Input	
sysIn15	sysIn16
ON	OFF
Input	
sysIn15	sysIn16
OFF	ON

3.1 Preparation

Start up the robot in the teaching mode with reference to the previous chapter "2.1 Preparation."
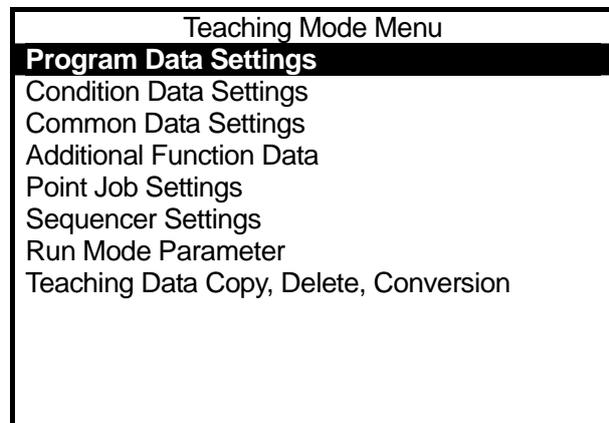If the program displayed on the screen is different from that you created in the previous chapter ("2. How to Operate the SCARA-N Robot (1)"), press the $\boxed{\text{PRG.NO}}$ key and enter the program number that you created in the previous chapter.

3.2 Program Data Settings

Program data is used to control programs.   In this example, set "PTP Speed" in the "PTP Condition" to 20%.
The speed of the tool center point will be 20% of the maximum speed when shifting from a point to another point.

1) Change the "PTP Speed" in the "PTP Condition" menu.
   Press the $\boxed{\text{MENU}}$ key.
   The Teaching Mode menu will appear. (See right)
   Select [Program Data Settings.]

```
┌─────────────────────────────────────────┐
│          Teaching Mode Menu              │
│ ▐Program Data Settings▌                  │
│ Condition Data Settings                  │
│ Common Data Settings                     │
│ Additional Function Data                 │
│ Point Job Settings                       │
│ Sequencer Settings                       │
│ Run Mode Parameter                       │
│ Teaching Data Copy, Delete, Conversion   │
│                                          │
│                                          │
│                                          │
└─────────────────────────────────────────┘
```

● Depending on the settings in the customizing mode, the Teaching Mode menu may be different from the above screen.

2) The Program Data Settings menu will appear. (See right)
Select [PTP Condition.]

```
Program 3
Program Name
Work Home
Cycle Mode                 1 Cycle Playback
PTP Condition
CP Condition
Tool Data
Move Area Limit
Position Data Type               Absolute
```

3) The PTP Condition setting screen will appear. (See right)
Select [PTP Speed.]

```
Program 3                   PTP Condition
PTP Speed                           100%
R-Axis Rotate Speed                 100%
R-Axis Acceleration                 100%
                          Relative Mode
Z Move Height                   100 mm
Z Up Distance                   100 mm
Z Down Distance                 100 mm
```
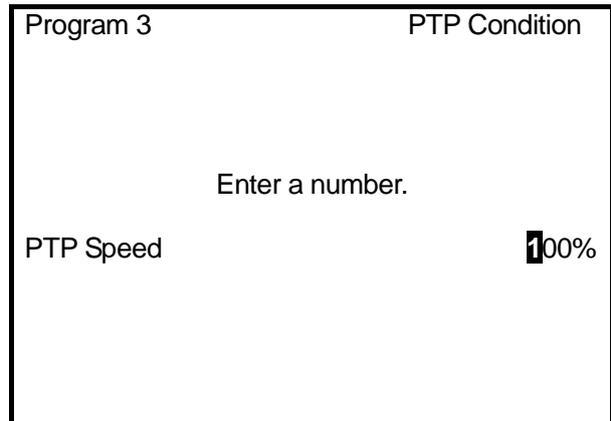
● Depending on the settings, the displayed items on the PTP Condition setting screen will change as follows:

[Relative Mode] → [Absolute Mode], [Z Move Height] → [Horizontal Move Pos'n],

[Z Up Distance] → [Start Horizontal], [Z Down Distance] → [Start Down Pos'n]

In this case, select [Absolute Mode] and change it to [Relative Mode.]   The other three items will change accordingly.

4) The PTP Speed entry screen will appear.
   (See right)
   Press the ┃ CLEAR ┃, ┃ 2 ┃, and ┃ 0 ┃ keys
   to enter 20%.
   Press the ┃ ENTR ┃ key to fix it.
   The screen will return to the PTP
   Condition setting screen.

```
┌─────────────────────────────────────────┐
│ Program 3                  PTP Condition │
│                                          │
│                                          │
│                                          │
│                 Enter a number.          │
│                                          │
│ PTP Speed                           100% │
│                                          │
│                                          │
│                                          │
│                                          │
└─────────────────────────────────────────┘
```

● The recommended PTP speed setting is 20%. You can increase the speed after checking the actual operation.

3.3   Teaching: Point Job

In this example, select point job numbers 5 and 6 (un-entered) and register the following point jobs to them.

- Point Job Number 5

    (Pick: The job will be completed after outputting ON pulse to "sysOut15" and confirming the inputs to "sysIn15" and "sysIn16.")

Output ON pulse to sysOut15 (0.1sec)
Wait Condition (until the followings become "true")
   sysIn15   ON Input
   sysIn16   OFF Input
End of Condition

```
Point Job                              5
001 puls #sysOut15,100
002 waitCond
003     ld #sysIn15
004     ani #sysIn16
005 endWait
006
```

- Point Job Number 6

    (Place: The job will be completed after outputting ON pulse to "sysOut16" and confirming the inputs to "sysIn16" and "sysIn15.")

Output ON pulse to sysOut16 (0.1sec)
Wait Condition (until the followings become "true")
   sysIn16   ON Input
   sysIn15   OFF Input
End of Condition

```
Point Job                              6
001 puls #sysOut16,100
002 waitCond
003     ld #sysIn16
004     ani #sysIn15
005 endWait
006
```

3.3.1 Point Job Data Number Selection

1) Press the SHIFT + ESC keys to enter the base condition (to display the point setting screen.)

2) Press the MENU key to display the Teaching Mode menu. Select [Point Job Settings.]
   ● Depending on the settings in the customizing mode, the [Point Job Settings] will not appear on the Teaching Mode menu.

3) The Point Job Number entry screen will appear. Press the F.1 (NEW) key.

4) The un-entered point job numbers list will appear.
   In this case, select the point job number 5 first.
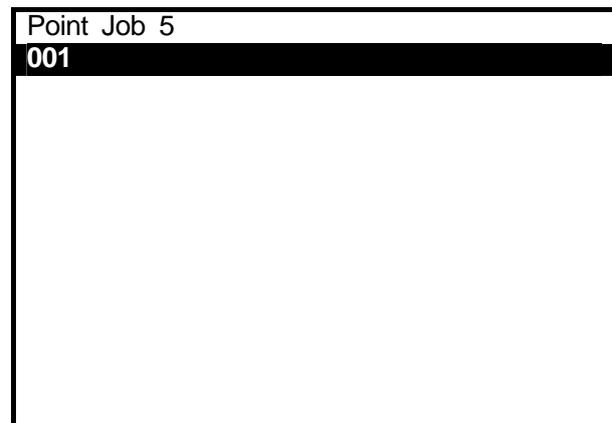   ● To display the registered point job numbers list, press the F.3 (LIST) key.

3.3.2 Output Command

Enter a command to output ON pulse (0.1 sec) to [sysOut15.]

```
Point Job 5
001
```

1) After entering or selecting the point job number, the Point Job setting screen will appear. (See right)

   [001] is a command number.
   Select the command number [001.]

```
         Select Category
ON/OFF Output Control
if Branch, Wait Condition
Condition
Delay, Data In, Wait Start
Pallet Control
Execute Flow Control
for, repeat
Move
LCD Control
COM Input/Output
Variable, Comment, System Control
Camera, Z Adjustment
```
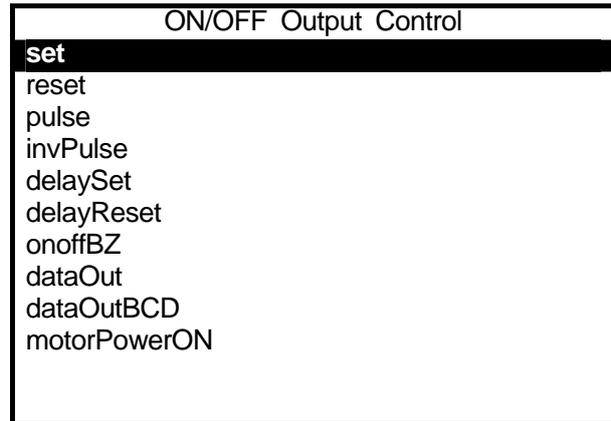
2) After selecting the command number, the Point Job Command Category selection screen will appear. (See right)
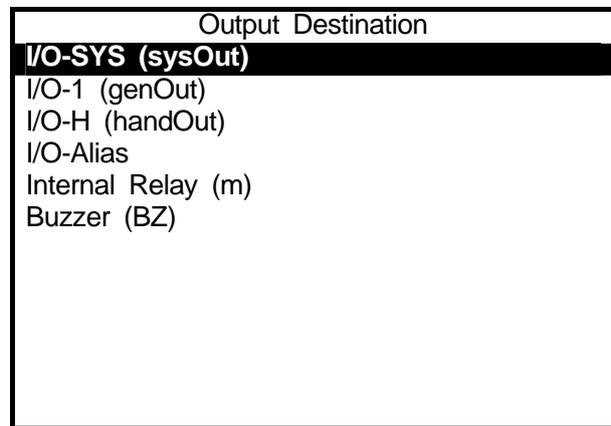
   Select [ON/OFF Output Control.]
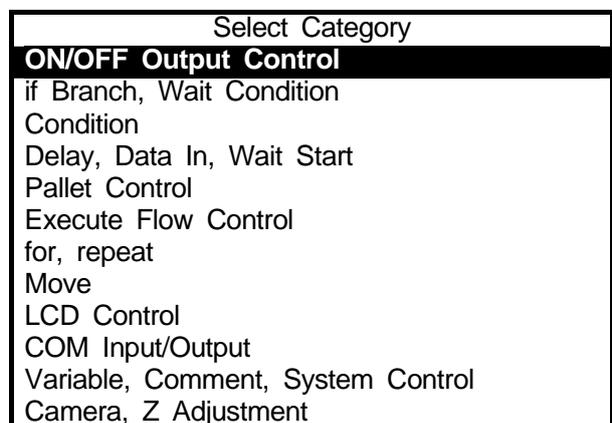
3) After selecting the command category, the Command Selection screen will appear. (See right)

Select [pulse.]

```
                ON/OFF  Output  Control
set
reset
pulse
invPulse
delaySet
delayReset
onoffBZ
dataOut
dataOutBCD
motorPowerON
```

4) After selecting the point job command, the Parameter selection screen (the Output Destination screen in this example) will appear. (See right)

Select [I/O-SYS (sysOut).]

```
                Output  Destination
I/O-SYS  (sysOut)
I/O-1  (genOut)
I/O-H  (handOut)
I/O-Alias
Internal  Relay  (m)
Buzzer  (BZ)
```
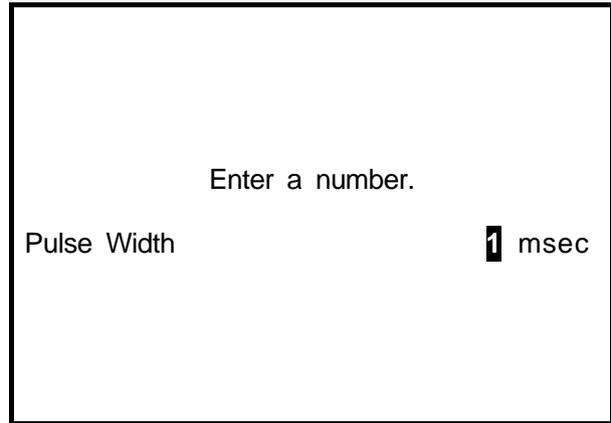
5) After selecting the output destination, the Output Number entry screen will appear. (See right)

Enter "15" as the output number.

```



                Enter  a  number.

I/O-SYS  Output  Number                      15


```
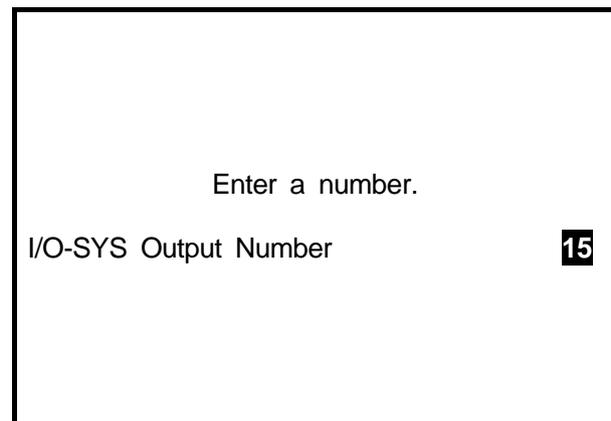
6) The pulse command requires two
    parameters (output destination and
    pulse width.)
    After entering the output number, the
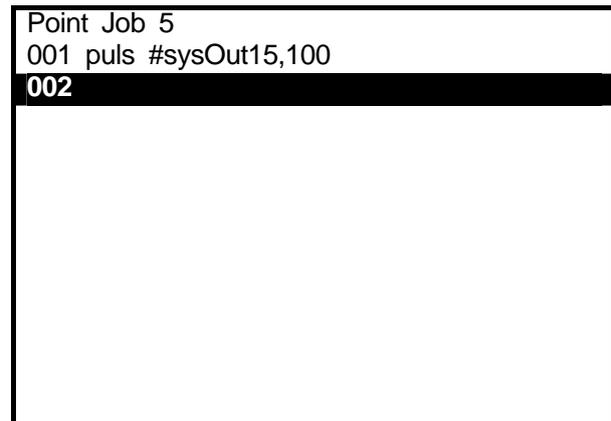   Pulse Width entry screen will appear.
    (See right)

    Enter "100." (0.1 sec = 100 msec)

```
┌─────────────────────────────────────┐
│                                     │
│                                     │
│                                     │
│           Enter  a  number.         │
│                                     │
│  Pulse  Width                 1 msec│
│                                     │
│                                     │
│                                     │
└─────────────────────────────────────┘
```
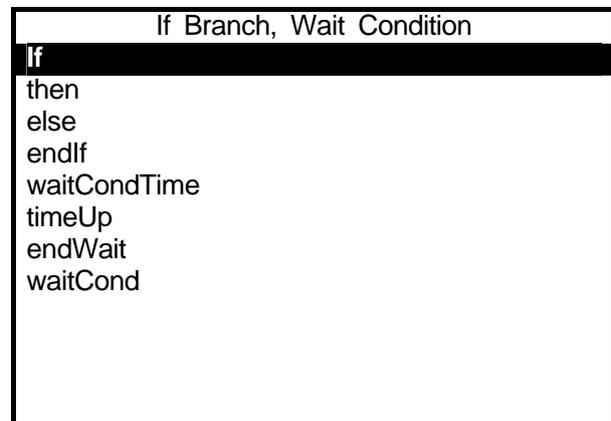
3.3.3 Wait Condition Command

Enter a wait condition command [waitCond.]   This command is used to wait until the condition
command result, between this command and the [endWait] command, becomes "true."

1) After entering all the necessary
    parameters, the screen will return to the
    Point Job setting screen. (See right)
    The command set to the Command
    Number 001 will be displayed.
    Select Command Number 002.

```
┌─────────────────────────────────────┐
│ Point  Job  5                       │
│ 001  puls  #sysOut15,100            │
│ 002                                 │
│                                     │
│                                     │
│                                     │
│                                     │
│                                     │
│                                     │
│                                     │
└─────────────────────────────────────┘
```

2) After entering the command number, the
    Point Job Command Category selection
    screen will appear.
    Select [if Branch, Wait Condition.]

3) After selecting the command category,
    the Command selection screen will
    appear. (See right)
    Select [waitCond.]
    This command requires no parameters.
    The screen will return to the point setting
    screen.

```
┌─────────────────────────────────────┐
│        If  Branch,  Wait  Condition │
│ If                                  │
│ then                                │
│ else                                │
│ endIf                               │
│ waitCondTime                        │
│ timeUp                              │
│ endWait                             │
│ waitCond                            │
│                                     │
│                                     │
│                                     │
└─────────────────────────────────────┘
```

3.3.4 Condition Command

Enter a condition command.

1)   Select Command Number 003.

```
                   Condition
 ld
 ldi
 and
 ani
 or
 ori
 anb
 orb
```

2)   Select [Condition] form the Point Job
     Command Category selection screen.

3)   Select [ld] from the Command selection
     screen. (See right)

4)   After selecting the point job command,
     the Parameter selection screen (in this
     example, the Input Destination selection
     screen) will appear. (See right)
     Select [I/O-SYS (sysIn).]

```
                 Input  Source
 I/O-SYS  (sysIn)
 I/O-1  (genIn)
 I/O-SYS  (sysOut)
 I/O-1  (genOut)
 IO-Alias
 System  Flag  (sysFlag)
 Internal  Relay  (mv)
 Keep  Relay  (mkv)
 Sequencer  Timer  (seqT)
 Sequencer  Counter  (seqC)
 Pallet  (palletFlag)
 Expression
```

5)   After selecting [I/O-SYS (sysIn)], the
     Input Number entry screen will appear.
     Enter "1" as the input number.
     The screen will return to the point setting
     screen.

6)   Select Command Number 004 from the Point Job setting screen.   Repeat the above steps 2 – 5
     according to the following settings.

  ● Point Job Command Category: [Condition]
  ● Point Job Command: [ani]
  ● Parameter Selection: [I/O-SYS (sysIn)], Number "16"

Enter an end command for a wait condition [endWait.]

Select Command Number 005.
Select [if Branch, Wait Condition] from the Point Job Command Category selection screen, and then select [endWait] from the Command selection screen.

If the screen display is as shown on the right, the teaching for Point Job Number 5 is completed.

Press the ⌷ESC⌷ key.   The screen will return to the Teaching Mode menu.

```
Point Job                            5
001 puls #sysOut15,100
002 waitCond
003    ld #sysIn15
004    ani #sysIn16
005 endWait
006
```

Using the above mentioned process, register Point Job Number 6.

If the screen display is as shown on the right, the teaching for Point Job Number 6 is completed.

Press the ⌷ESC⌷ key. The screen will return to the Teaching Mode menu.

```
Point Job                            6
001 puls #sysOut16,100
002 waitCond
003    ld #sysIn16
004    ani #sysIn15
005 endWait
006
```

3.4　Point Data Modification

In this example, change the point job number created in the previous chapter "2. How to Operate the SCARA-N robot (1)" to the point job number created in the previous section "3.3. Teaching: Point Job."

Point Number	Point Job Number
1	5
2	6

1) Press the SHIFT + ESC keys.
The point setting screen will appear.
If the setting screen is not for Point 1,

   press the CURSOR→ / CURSOR←

   key to display the desired screen.

   Then press the CURSOR↓ key to shift

   the highlight to a blank line (under the [Type].)
   The settable point job or additional functions to the point will be listed. (See right)

```
Program 3                              P1
 RX+70      RY+190      Z+30      R+0
Type                            PTP Point
Condition Number
Job before Moving Number
Job while Moving Number
Point Job Number
PTP Condition Number
Tool Data Number
Pallet Routine Number
Execute Condition Number
Workpiece Adjustment Number
S.MARK E.MARK           J.EXEC P.EXEC
```

2) Select [Point Job Number] from the setting screen.
The Point Job Number entry screen will appear. (See right)
Enter the point job number that you want to set (in this example, enter "5") and press the ENTR key to fix it.
The screen will return to the point setting screen.

```
Program 3                              P1




              Enter a number.

Point Job                              1



   DEL   COPY  NEW    LIST  VIEW
   F.0    F.1    F.2    F.3    F.4
```

● While the Point Job Number entry screen is displayed, press the F.2 (NEW) key to display the un-entered point job data list. To display the registered point job data list, press the F.3 (LIST) key.
If you press the F.0 (DEL) key, the point job displayed on the Point Job Number entry screen will be deleted.　If you press the F.1 (COPY) key, the point job displayed on the Point Job Number entry screen will be copied to another point job number.

3) Display the setting screen for Point 2 and change the point job number to "6" as same as the example for Point 1.
The point data modification is now completed.

3.5   Program Test

After changing the point job numbers, execute the point run, data check, and test run according to the procedure described in the "2.3. Program Test."
When registering a new program or modifying an existing program, be sure to check the data and then execute the [Test Run] before actual operation.

⚠ **Caution**   Do not enter the robot's restricted area while it is running.

3.6   Running

Run the registered program.

3.6.1 Mode Change

Turn the select key switch on the operation box to [RUN.] The operation mode changes to run mode.

Select the operation mode by turning the select key switch on the operation box.

- Run Mode................Starts programs running by the start switch on the operation box.
- External Run Mode.....Starts programs running by the external signal (I/O-SYS or COM1.)
- Teaching Mode...........For creating programs.
- Administration Mode....For administration and maintenance
  (Select this mode from the mode menu in teaching mode.)
- Customizing Mode.......For creating the data that is used to compose programs
  (Select this mode from the Administration menu in the administration mode.)
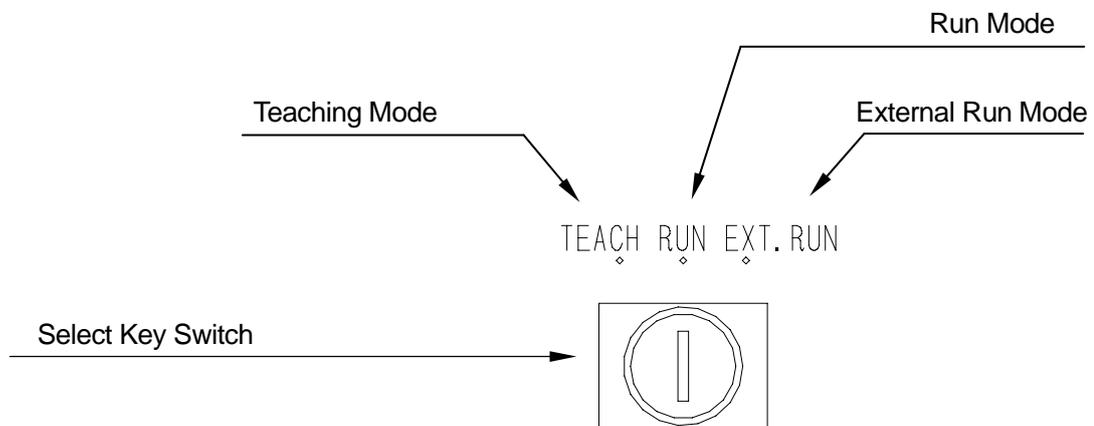
The teaching pendant LED lights indicate the current mode.

- M. POWER: Motor power ON
- RUN: Run Mode/Ext. Run Mode
- TEACH: Teaching Mode
- CUSTOM: Customizing Mode
- ADMIN: Administration Mode

3.6.2 Start

Press the start switch on the operation box. The robot starts running the program.

- Be sure to execute a test run before you run a new program.
- If the start switch is pressed while the program is running, the robot will stop when shifting to the PTP drive.　To restart the robot, press the start switch again.　Depending on the [Parameter (Playback)] settings (if [sysIn1] in the [I/O-SYS Function Assignment] menu is set to [Start]), the robot will not stop if the start switch is pressed.

> ⚠ **Caution**　Do not enter the robot's restricted area while it is running.

3.6.3 Emergency Stop

Emergency stop is the function to stop operation immediately due to unexpected accidents.
Emergency stop can be activated using the following methods. When the emergency stop switch is pressed the motor power (power to the motor) turns OFF and the robot stops running.

- By pressing the emergency stop switch on the operation box.
- By pressing the emergency stop switch on the teaching pendant.

How to Release: Turn the pressed emergency stop switch clockwise.
　　　　　　　To turn the power ON, press the Power ON switch on the operation box or
　　　　　　　the ⎡ SERVO ⎤ key on the teaching pendant.

４．HOW TO OPERATE THE SCARA-N ROBOT (3)

In this chapter, how to register a program in the CP drive will be explained.

The program contains the following five points.
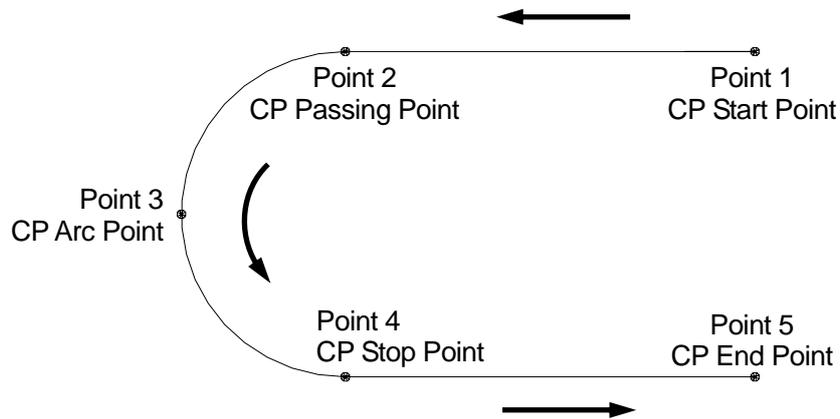
4.1 Program Number Selection

In this example, register Program Number 04 (un-entered.)   Select the Program Number 04 according to the procedure described in the "2.2.1. Program Number Selection."
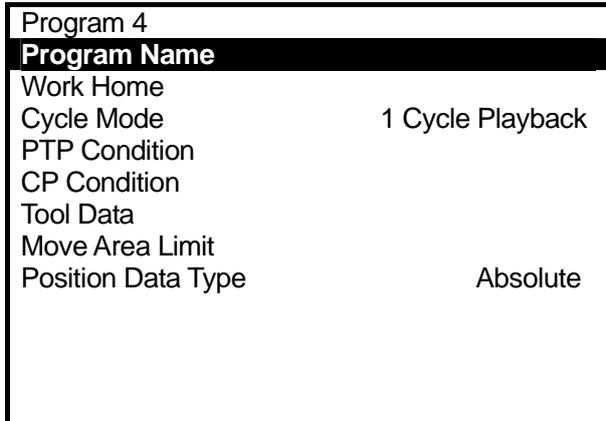
4.2 Program Data Settings

Enter the work home and then name the program.

First, enter the following work home coordinates according to the procedure described in the "2.2.4. Work Home Position Entry."

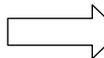| Point Number	Coordinates
Work Home	X 40 mm, Y 170 mm, Z 30 mm, R 0 deg

Next, name the program.

1) Select [Program Name] from the Program Data Setting menu. (See right)

```
Program 4
Program Name
Work Home
Cycle Mode                    1 Cycle Playback
PTP Condition
CP Condition
Tool Data
Move Area Limit
Position Data Type                    Absolute
```
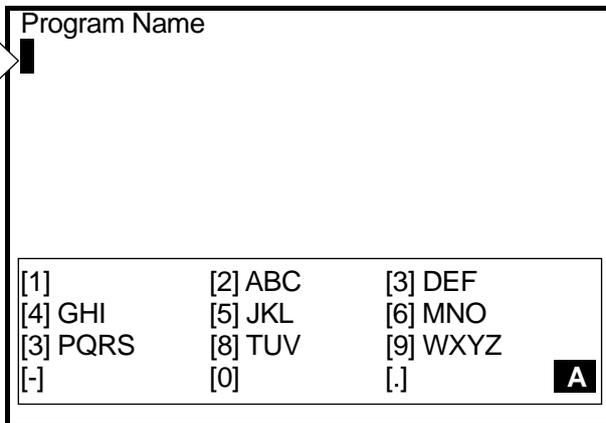
2) The Character entry screen will appear. (See right)

Character string display

Enter characters using the following keys. After entering the name, press the ENTR key to exit the character entry. The entered character string will be set as a program name and then the screen will return to the Program Data setting screen.

```
Program Name




[1]            [2] ABC        [3] DEF
[4] GHI        [5] JKL        [6] MNO
[3] PQRS       [8] TUV        [9] WXYZ
[-]            [0]            [.]        A
```

Character Entry Screen

0 - 9 +/- . ···· The corresponding characters will be entered according to the character assignment list on the screen. In the example above, if you press the 2 key once, the letter "A" will be entered. If you press the key twice, the letter "B" will be entered. If you want to enter the letters "AB", press the CURSOR→ key after entering the letter "A." Then shift the cursor rightward and enter "B." Any key which no character is assigned to, like [1] above, is invalid.

ESC ················· Returns to the previous screen (without registering the character string.)

ENTR ················· End the character string entry and registration.

| F.4 | Each time this key is pressed, the types of character assignment will switch in this order: **English uppercase characters → English lowercase characters → numbers → symbols → English uppercase characters** |

| SHIFT + F.4 | Each time this key is pressed, the types of character assignment will switch in this order: **English uppercase characters ← English lowercase characters ← numbers ← symbols ←English uppercase characters** |

| CURSOR↑ | Shifts the cursor upward (in the character string.) |

| CURSOR↓ | Shifts the cursor downward (in the character string.) |

| CURSOR← | Shifts the cursor leftward (in the character string.) |

| CURSOR→ | Shifts the cursor rightward (in the character string.) |

| SHIFT + CURSOR↑ | Shifts the cursor to the uppermost line. |

| SHIFT + CURSOR↓ | Shifts the cursor to the lowermost line. |

| SHIFT + CURSOR ← | Shifts the cursor to the top of the character string. |

| SHIFT | + | CURSOR → | .... Shifts the cursor to the end of the character string.

| DEL | .... Deletes a character under the cursor.   If the cursor is on the rightmost of the character string, the last character will be deleted.

| CLEAR | .... Clears the entire character string.

- 40 to 120 English letters, numbers, and symbols can be used in combination to name the program. (In teaching pendant entry, up to 120 letters can be entered. On PC, up to 40 letters can be entered depending on what character types are used.)

- On the list of programs, up to 36 characters of the program name can be displayed. In Run mode, up to 40 characters of the program name can be displayed. (No further characters can be shown even if more characters have been entered using the teaching pendant.)

4.3   Point Data Entry

4.3.1 Point Position Entry

Enter the coordinates of Point 1.

Point Number	Coordinates	Point Type	Line Speed (mm/s)
1	X 20 mm, Y 190 mm, Z 30 mm, R 0 deg	CP Start Point	40

4.3.2 Point Type

After entering the coordinates, press the ENTR key (to fix it.) The Point Type selection screen will appear. (See right)

Select the point type (in this case, select CP Start Point.)

```
Program 4                          P1
PTP Point
CP Start Point
CP Passing Point
CP Stop Point
CP Arc Point
CP End Point
PTP Evasion Point
CP Circle Point



```

4.3.3 CP Line Speed

If the selected point type is CP Start Point, CP Passing Point, CP Stop Point, CP Arc Point, or CP Circle Point, the CP Line Speed entry screen will appear after fixing the point job number. (See right)

In this case, press the CLEAR , 4 , and 0 keys to enter "40."
Press the ENTR key to fix the number.

```
Program 4                          P1



             Enter  a  number.

CP  Line  Speed                10 mm/s



```

● If you select a point type to shift the next point in the CP drive, you need to enter the CP line speed. If you select a point type to shift the next point in the PTP drive, the CP Line Speed entry screen will not appear. Instead, the new position entry screen for the next point (current point number + 1) will appear.

After fixing the CP line speed, the new position entry screen for the next point (current point number + 1) will appear.

Register Points 2 – 5 according to the following settings. Refer to the above procedure.

Point Number	Coordinates	Point Type	Line Speed (mm/s)
2	X –20 mm, Y 190 mm, Z 30 mm, R 0 deg	CP Passing Point	40
3	X –40 mm, Y 170 mm, Z 30 mm, R 0 deg	CP Arc Point	40
4	X –20 mm, Y 150 mm, Z 30 mm, R 0 deg	CP Stop Point	40
5	X 20 mm, Y 150 mm, Z 30 mm, R 0 deg	CP End Point	-

4.4   Program Test/Test Run

After registering all the points, execute the point run and checking data according to the procedure described in the "2.3. Program Test."

After executing the program test, actually run the registered program according to the procedure described in "3.6. Running."

⚠ **Caution**   Do not enter the robot's restricted area while it is running.

5 . SAVE

Save the registered program and point job data.

Save the teaching data in combination with the customizing data.　The unit of data is called "C & T data."

The C & T data is stored in the robot temporarily, however, **it will be deleted automatically when the power to the robot turns OFF**.　Be sure to "save" when the teaching data or customizing data is modified.

Press the � SHIFT ⎥ + ⎥ ESC ⎥ keys to enter the base condition. (See right)
Press the ⎥ SAVE ⎥ key.

```
┌─────────────────────────────────────────┐
│ Program 4                             P5 │
│ ██RX+20███████RY+150██████Z+30██████R+0██│
│ Type                        CP End Point │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│                                          │
│    S.MARK E.MARK         J.EXEC  P.EXEC  │
└─────────────────────────────────────────┘
```

Example of Point Setting Screen

● To back up the data, send the C & T data from the robot to a PC using the PC software "LR C-Points" (optional) or "LR C-Points Limited Edition" (included on the operation manual CD-ROM.)

● If you use a PC for teaching operation, send the teaching data from the PC to the robot using the "LR C-Points" software. The data sent from the PC will be stored in the robot automatically.

Warranty

Henkel Corporation warrants, to the original Buyer for a period of one (1) year from date of delivery, that the Loctite® Equipment or System sold by it is free from defects in material and workmanship. Henkel will, at its option, replace or repair said defective parts. This warranty is subject to the following exceptions and limitations.

1. Purchaser Responsibilities – The Purchaser shall be responsible for:
    -Maintenance of the equipment as outlined in the Equipment Manual for the product.
    - Inventory of recommended maintenance parts established by Henkel;
    -Notification to Henkel within 6-8 hours of downtime.
    -Any cost of travel or transportation connected with warranty repair.
    -All cost associated with investigating or correcting any failure caused by the purchaser's misuse, neglect or unauthorized alteration or repair.
    -All costs attributed to accident or other factors beyond Henkel's control.

2. A thirty (30) day warranty will be extended on any items subject to normal wear, such as:
    -Pump Seals   -Tubing   -Wear Surfaces of Wiping Rollers
    -O-Rings   -Hoses

Purchased items used in Loctite® dispensing equipment are covered under warranties of their respective manufacturers and are excluded from coverage under this warranty. Typical purchased items are:
-Solenoids   -Electrical Relays   -Refrigeration Units
-Timers   -Fluid Power Cylinders   -Electrical Motors

3. No warranty is extended to perishable items, such as:
    -Fuses   -Dispensing Needles   -Dispensing Nozzles
    -Light Bulbs   -Lamps   -Product Barrels

Henkel reserves the right to make changes in design and/or improvements to its equipment without obligation to include these changes in any equipment previously manufactured.

Henkel's warranty herein is in lieu of and excludes all other warranties of Henkel and its affiliated and related companies (hereinafter the "seller companies"), express, implied, statutory, or otherwise created under applicable law including, but not limited to, any warranty or merchantability and/or fitness for a particular purpose of use. In no event shall the seller and/or the seller companies be liable for any direct, indirect, special, incidental or consequential damages, including, but not limited to, loss of profits. In addition, this warranty shall not apply to any products, which have been subjected to abuse, misuse, improper installation, improper maintenance or operation, electrical failure or abnormal conditions; and to products, which have been tampered with, altered, modified, repaired or reworked by anyone not approved by seller. Buyer's sole and exclusive remedy under this warranty shall be limited to, at seller's discretion, the replacement or repair of any defective product or part thereof, or a refund of the purchase price paid by for the product in exchange for buyer's return of the product to seller, free and clear of any and all liens and encumbrances of any nature.

HENKEL CORPORATION
1001 Trout Brook Crossing
Rocky Hill, CT   06067
1-800 LOCTITE
Tel: 800-562.8483
Fax: (860) 571-5465

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