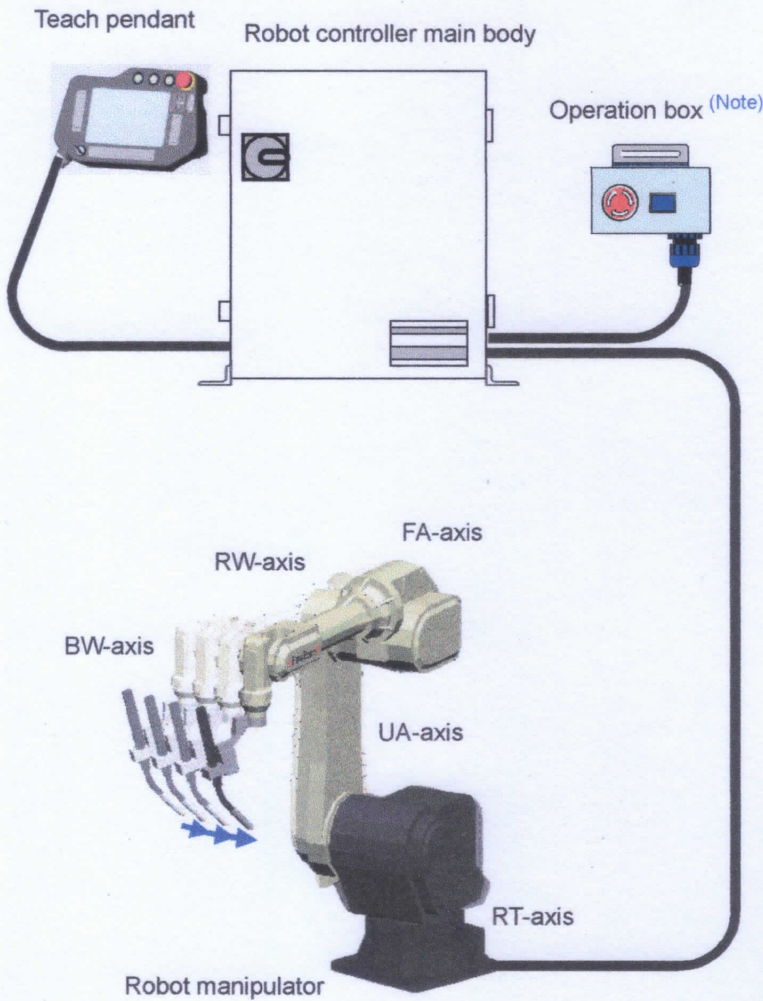




# PANASONIC ROBOT WELDING BASIC TRAINING

## 2. Structure

### 2.1 Parts identification



**Note**

Operation box is standard specification for specified models only, otherwise optional.

Axis name	Definition
RT axis	Rotate Turn
UA axis	Upper Arm
FA axis	Front Arm
RW axis	Rotate Wrist
BW axis	Bent Wrist
TW axis	Twist Wrist

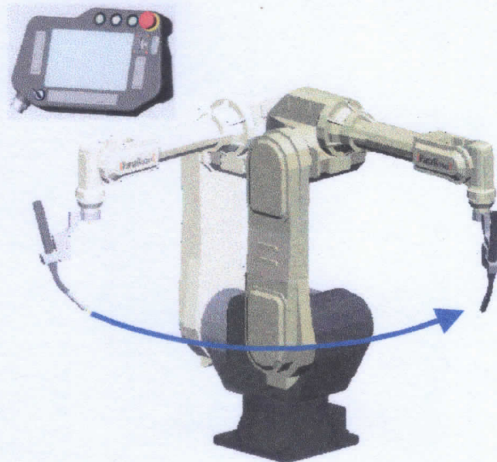
\* Robot on the left figure is VR-008.

### 2.2 Teaching Playback Method

The robot is a teaching playback robot.

A program of robot operation, such as welding or sequential processing, can be created by moving the robot arm. This process, known as "Teaching" can be stored in the controller.

By running the program, the robot executes the series of taught operations (or playback the series of taught operations) repeatedly. Therefore, accurate welding or processing is possible continuously.

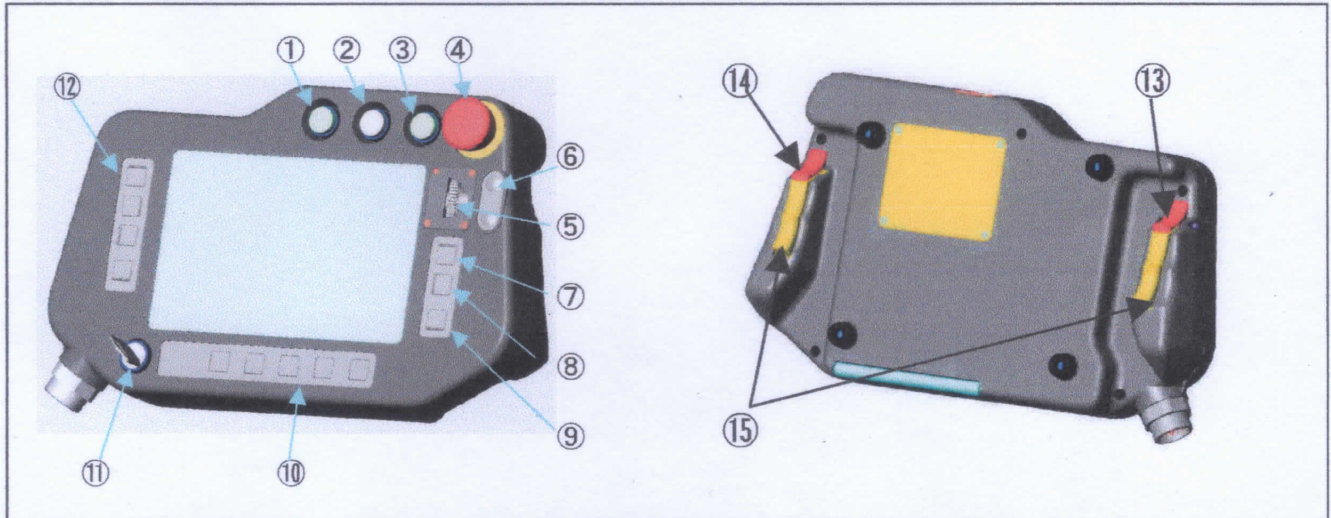


### 3. How to use the Teach pendant

The teach pendant is used to operate the robot in most cases. Make sure that you understand the functions and how to use each switch on the teach pendant thoroughly

before using it.

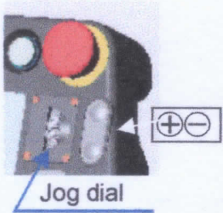
#### 3.1 Functions



- (1) **Start switch**  
This switch starts or restarts robot operation in AUTO mode.
- (2) **Hold switch**  
This switch suspends robot operation with the servo power ON.
- (3) **Servo-ON switch**  
This switch energizes the servo power.
- (4) **Emergency stop switch**  
This switch stops the robot and external axis operation immediately by shutting off the servo power. Turn clockwise to release.
- (5) **Jog dial**  
This dial is used to control movement of the robot arm, the external axis or the cursor on the screen. It is also used to change data or select a choice.
- (6) **+ / - key**  
This key is used to control continuous movement of the robot arm in the same manner as the Jog dial.
- (7) **Enter key**  
This key is used to save or specify a teaching point or a choice in the window in teaching operation.
- (8) **Window change key**  
This key is used to switch an active window if more than one window are displayed at a time.
- (9) **Cancel key**  
This key cancels the current processing such as addition or change of data, and displays the previous screen.
- (10) **User function keys**  
Each key is used to perform as per the user function icon shown above each user function key
- (11) **Mode select switch**  
A two-position switch that allows you to choose which mode (TEACH mode or AUTO mode) you want to work with the robot. The switch key is removable.
- (12) **Function keys**  
Each key is used to perform as per the function icon shown to the right of each function key.
- (13) **L-Shift key**  
Use this key to switch axes of the coordinate system or to move a digit of an input number. Axes will be switched in order of "Main axes", "Wrist axes", and "External axes" (if applied).
- (14) **R-Shift key**  
Use this key as shortcut of functions or to move a digit of an input number. It also changes jogging speed of the jog dial.
- (15) **Deadman switch**  
The servo power is shut off when either switch is released or pressed hard. Hold either one or both switches lightly to turn on the servo power.

# How to use the Teach pendant

## 3.1.1 Jog dial and +/- key



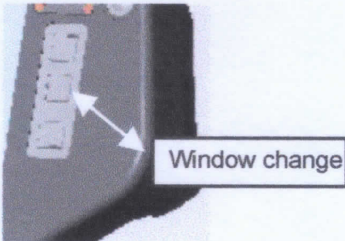
This dial is used to control movement of the robot arm, the external axis or the cursor on the screen. It is also used to change data or select a choice.

The  $\oplus\ominus$  key is used to control continuous movement of the robot arm in the same manner as Jog drag operation.

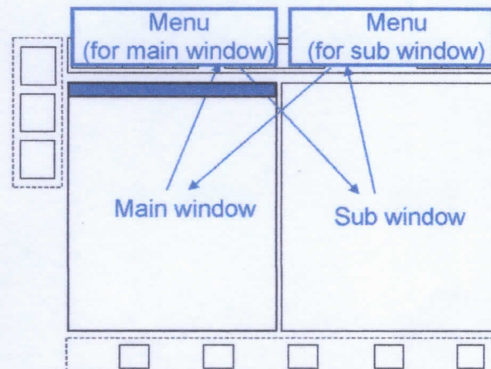
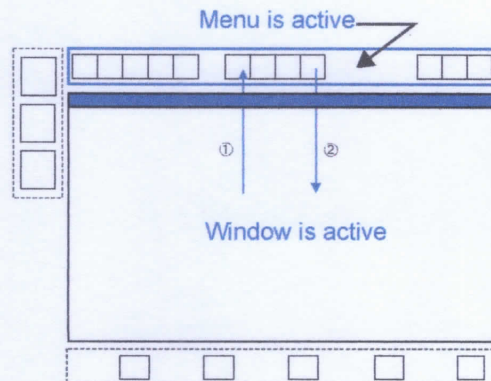
<p><b>Jog up/down</b></p>		<p>To move the robot arm or the external axis                  Jog up: in (+) direction                  Jog down: in (-) direction                  To move the cursor on the screen.                  To change data or select a choice.</p>
<p><b>Click</b></p>		<p>Specify the selected item and save it.</p>
<p><b>Jog drag</b>                  Hold down and then jog up/down.</p>		<p>To retain current operation of the robot arm.                  The jog rotation amount of the dial after pressed determines the change value.                  Stop the jog rotation to release.                  Direction of movement is the same as that for Jog up/down.                  The <math>\oplus\ominus</math> key works in the same manner as Jog drag.</p>

## 3.1.2 Window change key

It switches between menu icon bar and edit window.  
 It switches between the main window and the sub-window.



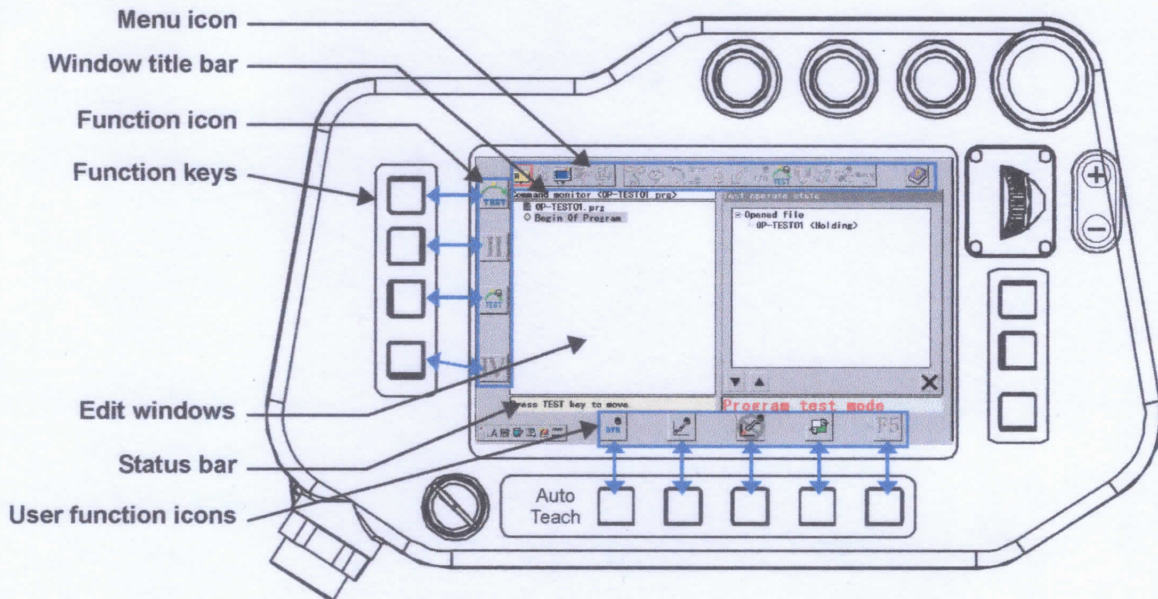
The active window is highlighted.  
 Keys on the teach pendant are effective only to the active window.



## 3.2 How to work on the screen

The teach pendant provides a variety of icons that identify functions on the screen that can make your work easier.


Move the cursor to the icon you want and click the jog dial to display sub-menu icons or to switch windows.




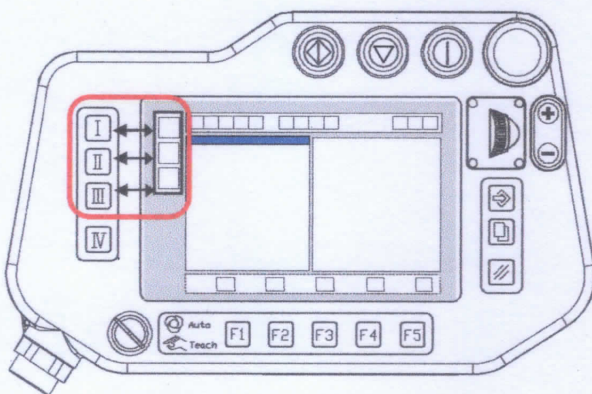
## 3.3 How to switch the external axes (option)













There are two ways to switch functions of the motion function keys between main axes group and external axes

(1) Hold down the **L-shift** key to switch the displays of function keys F1, F2 and F3 from **Robot main axes, Wrist axes to External axes.**



(2) On the menu bar, click  (Robot) and then

 (External axis) icons.




		External axis 1
		External axis 2
		External axis 3
L-shift key to switch functions		
		External axis 4
		External axis 5
		External axis 6

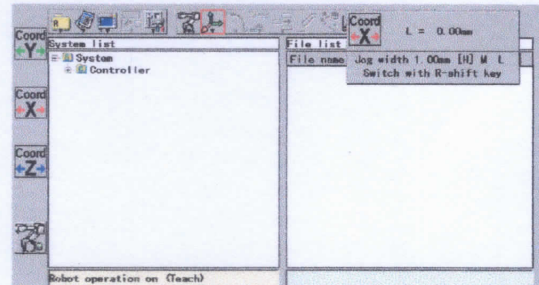
## 5.6 Manual operation

 	<p>Prior to turning ON the servo power make sure that no personnel or nothing to interfere with robot movement is present within the robot work envelope.</p>
---	---

It allows you to move the robot by operating the teach pendant. Those movements won't be recorded.

For safe operation, in teach mode, it is possible to limit the maximum tool offset speed to 15 m/min.

- (1) Click the  (Robot motion) icon to turn ON the lamp on the icon to enable manual operation of the robot.
- (2) While holding down a Function key of the robot motion you want, jog the jog dial to move the corresponding robot arm.  
Release the Function key to stop the movement.





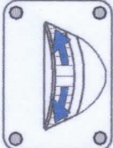
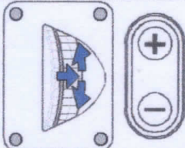
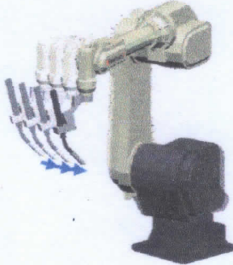
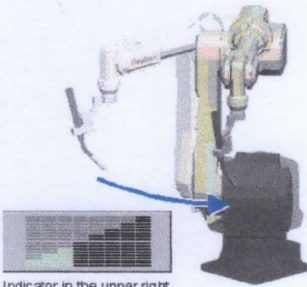
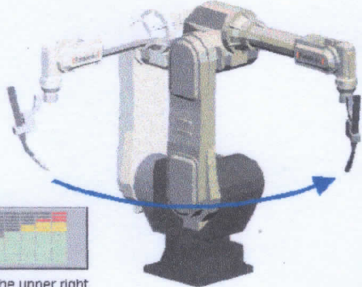
**Note**

Movement of the robot control point (tool center point) is displayed as a numerical value in the upper right corner of the window. Releasing the Function key reset the value to "0".

The joint coordinate system is set as default coordinate system unless otherwise specified. To apply another coordinate system, refer to section "Switch the Coordinate system".

• How the jog dial works

	(Lamp is ON) Moves the robot arm
	(Lamp is OFF) Moves the cursor.

 <p>Jog UP/DOWN</p>	 <p>Jog drag or pressing <math>\oplus</math><math>\ominus</math> key</p>
<p>The robot moves corresponding to the amount of the jog dial rotation.</p> 	<p>Jog the dial a little to move the robot at a low speed and a lot to move it at a high speed.</p> <p>Moving speed at <math>\oplus</math><math>\ominus</math> operation is shown at right upper area of the teach pendant.</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Indicator in the upper right corner of the teach pendant</p> </div> <div style="text-align: center;">  <p>Indicator in the upper right corner of the teach pendant</p> </div> </div>

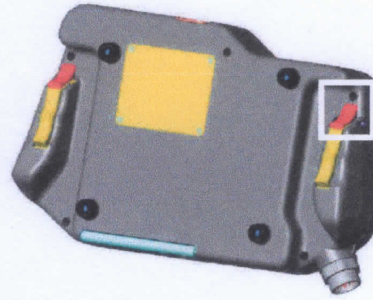
**Note**

Use the R-shift key to switch the jog increment (High, Middle, Low).  
Set the parameter of the amount of the robot movement. (See the advance operation manual for detail.)

## 5.7 Switch the coordinate system

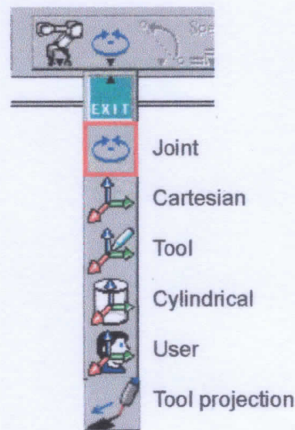
It is possible to change the direction of the motion of the robot arm by selecting a coordinate system.

- There are five coordinate systems to choose from
- Press the L-Shift key to switch the coordinate system. The Robot motion icon switches correspondingly.



### 5.7.1 Robot motion icons and robot movement

Robot motion coordinate system select menu



**Joint coordinate system**  
[Control the robot movement by axis individually.]

Switch functions (with L-Shift key)

**Cartesian coordinate system**  
[Controls the robot movement based on the robot coordinate system]

Switch functions (with L-Shift key)

(W): For welding, (H): For handling

**Tool coordinate system**  
[Controls the robot movement based on the direction of the end tool attached to the manipulator]

Switch functions (with L-Shift key)

(W): For welding, (H): For handling

**User coordinate system**  
[Controls the robot movement based on the coordinate system specified by the user.]

Switch functions (with L-Shift key)

**Cylindrical coordinate system**  
[Controls the robot movement based on the cylindrical coordinate system.]

Switch functions (with L-Shift key)

**Tool projection coordinate system**  
[Moves the robot in the direction of tool projection on a horizontal plane]

Switch functions (with L-Shift key)

(W): For welding, (H): For handling

## 5.9 Teach program programming procedure

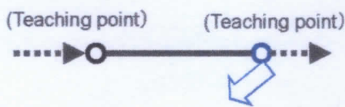
Perform the teaching operation to create a program of teaching data such as robot movement and task procedures.

**[Operation flow]**

- (1) Create a new file (program) where teaching data will be saved.
  - (2) Perform teaching operation to create a program.
  - (3) Perform trace operation to check and correct taught data during or after teaching operation.
  - (4) Edit details during or after completion of teaching or trace operation to complete the program.
- \* Once completed, run the program in AUTO mode to move the robot.

### 5.9.1 Robot movement data.

Movement of robot arms is determined by following taught points stored as "teaching points" in a program. Each point contains position data and data for robot travel method from the teaching point to the next teaching point with or without welding.



<Stored data>

- **Position of the teaching point (coordinate data)**
- **Travel speed toward the teaching point.**
- **Robot operation at the teaching point. (Sequence commands)**
- **Travel method toward the teaching point. (Interpolation)**

**Note**

Normally the first teach point is positioned at the escape point of the robot manipulator.

Interpolation	
<b>PTP (MOVEP)</b> Joint movement	
<b>Linear (MOVEL)</b> The robot follows a straight path from a point to the next.	
<b>Circular (MOVEC)</b> The robot follows a circular path determined by 3 teaching points	
<b>Linear weaving (MOVELW)</b> The robot follows a zigzag course on a straight path.	
<b>Circular weaving (MOVECW)</b> The robot follows a zigzag course on a circular path.	

## 5.10 Create a new file

Prior to teaching, it is necessary to create a file in which teaching points data and robot commands will be saved.

**[File name]** Initially a file name is automatically specified in the file name box. You can either use the name or rename it.

**[Tool]** Specify the tool number in which offset data of the tool attached to the manipulator is stored in.

**[Mechanism]** As for the robot system with external axis, it is possible to classify machinery freely. It is factory set to "1: Mech 1" at delivery.

\* For details of "Tool" and "Mechanism", refer to the operating instructions (advanced operation).

**[User coordinate]** Specify the user coordinate system number to be applied to the new program.

\* This item won't be indicated if the "Switching every program" of the "Select coordinate system" setting is not selected.

- The current user coordinate number is indicated on the program tree. (See figure on the right)

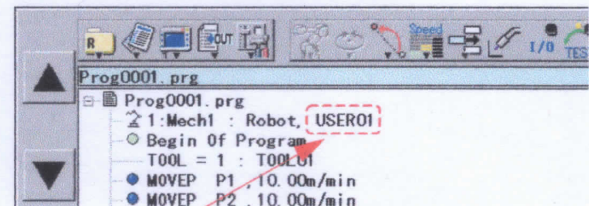
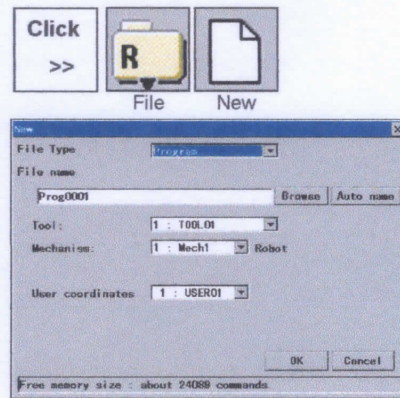
**None:** User coordinate system number "0" (equal to the robot coordinate system).

**1:USER01:** User coordinate system number "1"

**2:USER02:** User coordinate system number "2"

**30:USER30:** User coordinate system number "30"

\*If there is no defined user coordinate, only "None" is selectable.




Current user coordinate number

**[USERxx]:** xx represents the current user coordinate system number.

**[USER?]:** Indicates the user coordinate system currently set becomes invalid. In such case, the user coordinate system #0 is applied.

## 5.11 Teach and save teaching points

When you save a teaching point, data of the robot orientation and the travel method (interpolation, travel speed etc.) are saved at the same time. The interpolation and travel method saved in the teaching point are the travel method from the preceding teaching point to the current teaching point.

- (1) Turn ON the  (Robot motion) icon so as to move the robot manually.
- (2) Bring the edit window to an active state.
- (3) Move the robot to the start point and then press the **Enter** key. The dialog box below appears.
- (4) Change fields in the box if necessary and press the **Enter** key or click the **OK** button to save it as the teaching point.

**[Interpolate]** Specifies an interpolation type between teaching points. For example, MOVEL means that the robot makes linear movement.

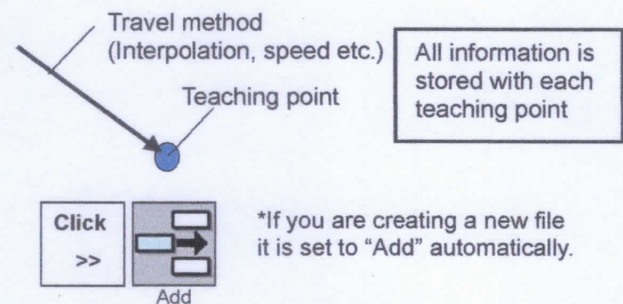
**Air-cut/Weld:** Check the circle for "Weld" for welding operation from the current teaching point to the next teaching point. Otherwise, check the circle of "Air-cut".

**[Position name]** Specifies position variable of the teaching point.

**[Manual speed]** Specifies the robot travel speed from the previous teaching point to the current teaching point.

**[Wrist calculation]** Normally set "0". Or specify 1, 2, 3 or 4 for special calculation.

(This field is not available if the teaching point is "MOVEP")



# Teach mode

## 5.11.1 Move commands for each interpolation

Welding robots	
Move command	Interpolation type
MOVEP	PTP
MOVEL	Linear
MOVEC	Circular
MOVELW	Linear weaving
MOVECW	Circular weaving

Handling robots	
Move command	Interpolation type
MOVEP	PTP
MOVEL	Linear
MOVEC	Circular

\* Move command for amplitude points of weaving interpolations is "WEAVEP"

## 5.11.2 Maximum speed

The robot's maximum speed varies with the applied manipulator model.

Manipulator models	Maximum speed
TA/TB series	180.00 m/min
VR2 series	120.00 m/min

<Remarks>

- (1) In a program with the mechanism using rotation type external axis, if the unit "m/min" is used to teach speed in a MOVE command, the robot calculates the speed using the following calculating formula taking the maximum speed of the applied manipulator as 100%.
 

(Example: Taught speed = 30m/min)

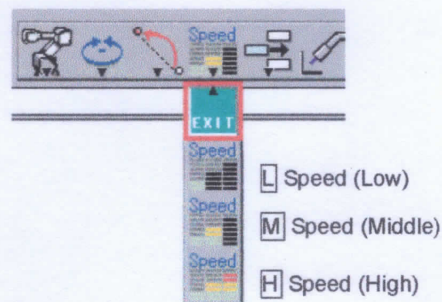
External axis speed =  $\frac{\text{Max. speed of the external axis} \times \text{Taught speed}}{\text{Max. speed of the applied manipulator}}$

  - (Example: Taught speed = 30m/min)30m/min
    - TA/TB series:  $30 \div 180 \times 100 \approx 16.7\%$
    - VR2 series:  $30 \div 120 \times 100 = 25\%$
- (2) In case that a program for TA/TB series manipulator is transferred to a VR2 series manipulator, any MOVE command with a taught speed that exceeds the max. speed of the applied VR2 manipulator will cause the error "E1390: Teach speed is over"

## 5.11.3 Changing speeds


Specify the robot travel speed of the tool center point (arc start point).

Use the icon on the menu bar to switch the speed range.










## 5.14 Trace operation

Trace is used to check the actual position or conditions of taught points which have been saved. With this operation, it is also possible to change teaching point data.

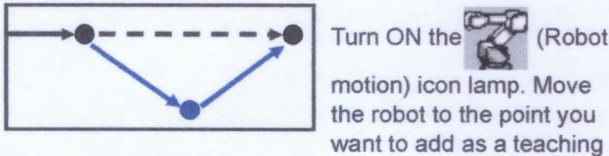
- It use the  (trace) icon and the motion function key to trace points.

### 5.14.1 Starting/Ending trace operation

While holding down the  (Trace forward) or  (Trace backward) function key, press and hold down Jog dial or  key. Then the robot moves forward or backward respectively until it reaches the next teaching point.

- Make sure to press correct combination of keys ( and  or  and ). The robot does not move if wrong combination of keys are pressed.
- The robot stops if the Jog dial or key is released.

### 5.14.2 Adding teaching points



- (1) Bring the edit window to an active state.
- (2) Press the **Enter** key, then the dialog box appears.
- (3) Set parameters in the box if necessary and click the **OK** button to add it as the teaching point below the line where the cursor is positioned.

**[Interpolate]** Specifies an interpolation type between teaching points. For example, MOVEP means that the robot makes linear movement.

#### [Add condition No.]



**ARC-SET:** Welding condition number to be registered automatically to the arc start point.

**CRATER-ON:** Crater condition number to be registered automatically to the arc end point.

**"Browse":** Press to select a number from the condition table.

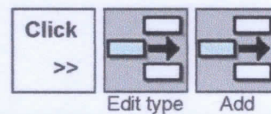
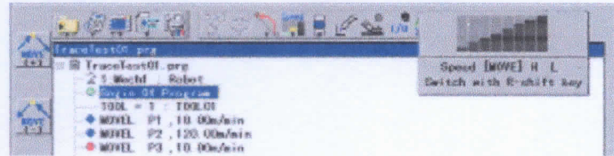
**[Position name]** Specifies position variable of the teaching point.

**[Manual speed]** Specifies the robot travel speed from the previous teaching point to the current teaching point.

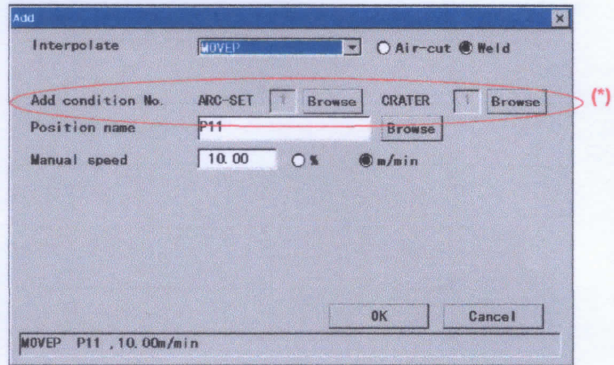
- Trace operation is available while the green lamp of the trace icon is ON () , and not operable while the lamp is OFF ().

#### Switching trace speed:

It is possible to trace a weld section at a speed other than taught speed. Use R-shift key to switchover High/Low of the trace speed settings, which are set in the "Advanced settings."

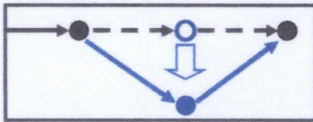


\* "Edit type" icon used in preceding edit operation is shown.



\* "Add condition No." may not be indicated depending on the settings of "Teach settings."

### 5.14.3 Changing teaching points



In trace operation, move the robot to the taught point you want to change. (The cursor moves to the same point in the screen.)

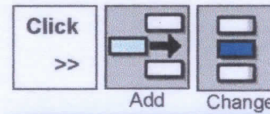
- (1) Bring the edit window to an active state.
- (2) Move the robot to the new position.
- (3) Press the **Enter** key. The dialog box below appears. Set parameters in the box and click the **OK** button to update the teaching point.

**[Interpolate]** Specifies an interpolation type between teaching points. For example, MOVEL means that the robot makes linear movement.

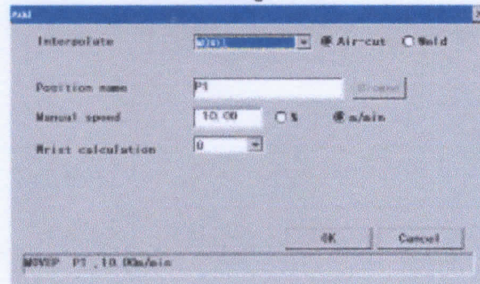
**[Position name]** Specifies position variable of the teaching point.

**[Manual speed]** Specifies the robot travel speed from the previous teaching point to the current teaching point.

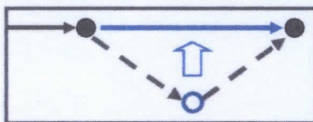
**[Wrist calculation]** Normally set "0". Or specify 1, 2, 3 or 4 for special calculation. (The field is not available if the teaching point is "MOVEP")



\* "Edit type" icon used in preceding edit operation is shown.

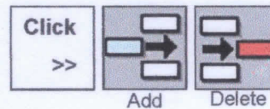


### 5.14.4 Deleting teaching points



In trace operation, move the robot to the taught point you want to delete. (The cursor moves to the same point in the screen.)

- (1) Press the **Enter** key. The dialog box on the right appears.
- (2) Click the **OK** button to delete the point.

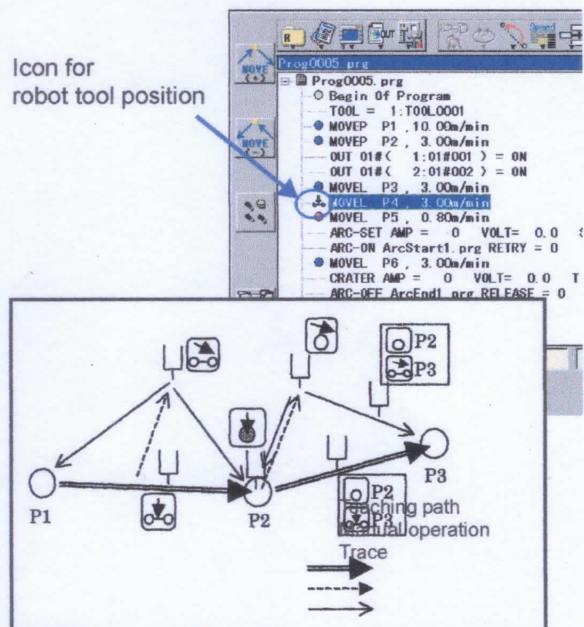


\* "Edit type" icon used in preceding edit operation is shown.

### 5.14.5 Robot position and icons

With the icon in the screen, you can determine the position of the robot tool (the wire tip of the welding torch); whether it is on the teaching point or on the teaching path.

Icon	Robot tool position
	On a teaching point
	Off a teaching point
	On the teaching path
	Out of teaching path.
	None of above



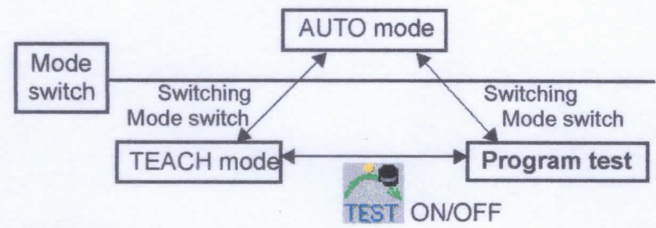
## 5.17 Program test

It is a function to test a program in TEACH mode by performing robot motion, actual welding and override(\*) under the safety condition(\*\*).

- Actual welding is available for testing.
- The robot moves in accordance with the program under the safety condition of TEACH mode, and executes all robot commands including CALL and PARACALL commands.
- Synchronized dual robots motion is available to test.

\*: "Override" is available from the software "J" and later version.


\*\*:"Safety condition of TEACH mode" restricts arm speed to the set value of "Speed limit setting". In this condition, the deadman key is effective. The door stop switch is not effective.



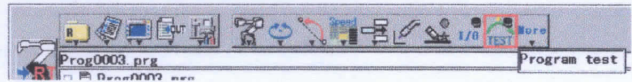
### Note











- Operational details of the Program Test are set in the Advanced settings.
- When the Mode switch is changed to AUTO during Program Test, the operation will go into the AUTO mode with same robot arm position.
- Even if the Mode switch is changed to AUTO from PROGRAM TEST and is returned to TEACH again, the operation is not returned to PROGRAM TEST. It will go normal TEACH mode.












### 5.17.1 Procedures

Turn on  (Program test) icon.

Use "Function keys" and "User function keys" to operate the program test.



Function keys		Both-hand method (Factory setting)	Single-hand method (* See advance setting about settings)
		<ul style="list-style-type: none"> <li>• Press  key and the Jog dial or  key to start the Program test.</li> <li>• Keep both keys pressed to continue the test.</li> </ul>	<ul style="list-style-type: none"> <li>• Press  key to start.</li> <li>• Keep the key pressed to continue the test.</li> </ul>
	-		
		Press the  key to end the program test.	
	-		

User function keys	    
<ul style="list-style-type: none"> <li>• If Arc-test is set to <b>Invalid</b> (advanced setting),  (Arc lock) icon does not appear.</li> <li>• When  (Gas*Wire) icon is pressed during the program test operation, the program test operation is terminated. The operation does not change to "GAS Wire" operation.</li> <li>• When  or  (Program change) key is pressed during the program test operation, the function of the pressed key becomes effective while carrying on the program test operation.</li> <li>• It is not possible to customize the user function keys during the program test operation.</li> <li>• As for handling specifications, the keys such as  and  do not appear.</li> </ul>	