FANUC Robot series

R-30iB Plus/R-30iB Mate Plus/R-30iB Mini Plus CONTROLLER

TABLET UI OPERATOR'S MANUAL

B-84274EN/04

Original Instructions

Thank you very much for purchasing FANUC Robot.

Before using the Robot, be sure to read the "FANUC Robot series SAFETY HANDBOOK (B-80687EN)" and understand the content.

- No part of this manual may be reproduced in any form.
- All specifications and designs are subject to change without notice.

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In this manual, we endeavor to include all pertinent matters. There are, however, a very large number of operations that must not or cannot be performed, and if the manual contained them all, it would be enormous in volume. It is, therefore, requested to assume that any operations that are not explicitly described as being possible are "not possible".

SAFETY PRECAUTIONS

This chapter describes the precautions which must be followed to enable the safe use of the robot. Before using the robot, be sure to read this chapter thoroughly.

For detailed functions of the robot operation, read the relevant operator's manual to understand fully its specification.

For the safety of the operator and the system, follow all safety precautions when operating a robot and its peripheral equipment installed in a work cell.

For safe use of FANUC robots, you must read and follow the instructions in "FANUC Robot series SAFETY HANDBOOK (B-80687EN)".

1 PERSONNEL

Personnel can be classified as follows.

Operator:

- Turns the robot controller power ON/OFF
- Starts the robot program from operator panel

Programmer or Teaching operator:

- Operates the robot
- Teaches the robot inside the safeguarded space

Maintenance technician:

- Operates the robot
- Teaches the robot inside the safeguarded space
- Performs maintenance (repair, adjustment, replacement)
- The operator is not allowed to work in the safeguarded space.
- The programmer or teaching operator and maintenance technician are allowed to work in the safeguarded space. Works carried out in the safeguarded space include transportation, installation, teaching, adjustment, and maintenance.
- To work inside the safeguarded space, the person must be trained on proper robot operation.

Table 1 (a) lists the work outside the safeguarded space. In this table, the symbol "O" means the work allowed to be carried out by the specified personnel.

Table 1 (a) List of work outside the Safeguarded Space

	Operator	Programmer or Teaching operator	Maintenance technician
Turn power ON/OFF to Robot controller	0	0	0
Select operating mode (AUTO/T1/T2)		0	0
Select remote/local mode		0	0
Select robot program with teach pendant		0	0
Select robot program with external device		0	0
Start robot program with operator's panel	0	0	0
Start robot program with teach pendant		0	0
Reset alarm with operator's panel		0	0
Reset alarm with teach pendant		0	0
Set data on teach pendant		0	0
Teaching with teach pendant		0	0
Emergency stop with operator's panel	0	0	0
Emergency stop with teach pendant	0	0	0
Operator's panel maintenance			0
Teach pendant maintenance			0

During robot operation, programming and maintenance, the operator, programmer, teaching operator and maintenance technician take care of their safety using at least the following safety protectors.

- Use clothes, uniform, overall adequate for the work
- Safety shoes
- Helmet

2 DEFINITION OF SAFETY NOTATIONS

To ensure the safety of users and prevent damage to the machine, this manual indicates each precaution on safety with "WARNING" or "CAUTION" according to its severity. Supplementary information is indicated by "NOTE". Read the contents of each "WARNING", "CAUTION" and "NOTE" before using the robot.

Symbol	Definitions
∱WARNING	Used if hazard resulting in the death or serious injury of the user will be expected to occur if he or she fails to follow the approved procedure.
⚠CAUTION	Used if a hazard resulting in the minor or moderate injury of the user, or equipment damage may be expected to occur if he or she fails to follow the approved procedure.
NOTE	Used if a supplementary explanation not related to any of WARNING and CAUTION is to be indicated.

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B-84274EN/04 1. **OVERVIEW**

1 OVERVIEW

This manual will explain about the user interface that can be used on Tablet TP to operate robots. Software option (S527) is needed to use this user interface. For CRX robot series, Table TP can be used without the option.

1.1 PRECAUTIONS FOR TABLET TP USE

1.1.1 Configurations Supported by Tablet TP

The hardware and software configurations supported by Tablet TP are as follows.

- The OS of the supported tablet devices is Android.
- The Tablet TP app supports Android version 9.0 or later.
- iOS is supported only for CRX.
- Use Google Chrome as a browser when using iOS.
- Cannot use USB port on the tablet base (UT1) with iOS.
- Tablet device must have USB Type-C port.
- When using a tablet other than the standard FANUC tablet, it is recommended to use Tablet TP with a device having a screen size of 9 inches or larger.
- Supported languages are English, Japanese and Chinese. The screen is displayed at English when other language is selected.
- Supported languages for Key Sheet are English and Japanese. Key Sheet is displayed at English when other languages are selected.
- Multi-tapping is not supported while using the touch pen that comes with the standard FANUC tablet.
- Tablet UI Editor has following limitations
 - Only icon instructions that is described in "4.3 Icon instructions" can be used for robot program.
 - If you want to teach other instructions, use the text input instructions.
 - Only robots with 6 axes can be programmed.

1.1.2 Options not Available for Tablet TP

Following options are not supported.

- Paint Tool (H596), LR Paint Tool (H558) and functions for Paint Tool
- Wireless accelerometer manufactured by MicroStone co. ltd used by Learning Vibration Control (J573) function and AI Path Control (J574) function
- Robot operation without shift function(J591)
- High speed shift key function (J592)
- TP Hot Swap function (J647)
- No shift jog function (J739)
- Interface panel function (J741)
- TP Mode Select function (J768, S519)
- Interbus DDI Server function (J769)
- iRPickTool/Auto Visual Track Frame setup add-on(J773)
- WeldTip inspection function (J847)
- iRVision 2DV (J901)'s 2D Calibration-free Vision Process
- Panel Wizard (R594)
- iRVision TorchMate (R744)
- EtherNet/IP DN Router (R804)
- Shared TP function (R844)

1. OVERVIEW B-84274EN/04

- Small Hand Guidance (S506) Genkotsu Vision Mastering

B-84274EN/04 2. CONNECTION

2 CONNECTION

This section describes the method to connect the Tablet TP and the controller.

2.1 SETUP

To connect to the controller, you must set the TCP/IP setting on your tablet device.

You will need to set the following as the IP address of your tablet device in order to access the controller.

IP address: 1.1.0.12 Subnet Mask: 255.255.255.0

If you are using the FANUC standard tablet, this setting is done beforehand.

2.2 TABLET TP APP

Tablet TP APP can be used in the Android tablet.

If you are using the FANUC standard tablet, this APP is installed by default.

Tablet TP APP can be downloaded from the Fanuc membership site.

FANUC membership site Japan https://store.member.fanuc.co.jp/fanuc/store/
In the case of regions other than the above, please contact the service base of the neighborhood.

For more information about the installation method of the Tablet TP APP, please look at the attached software update procedure for the CRX series robot.

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2.3 CONNECT TO THE CONTROLLER

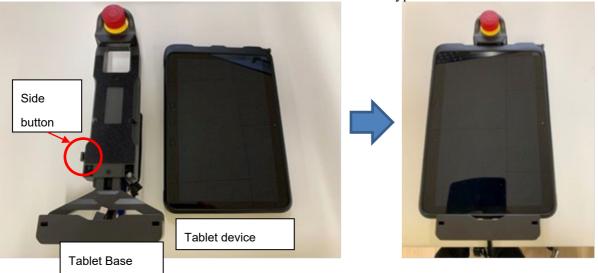
Connection between the tablet device and the controller can be made via the Tablet Base.

Procedure Connect the Tablet Teach Pendant

Step

- 1 Connect the TP cable to the Tablet Base.
- 2 Combine the tablet device and the Tablet Base. Press the side button and stretch the Tablet Base. Fit the tablet device into the Tablet Base.

3 Connect the Tablet Base and the tablet device with the USB-Type C cable.



Procedure Login to the controller

Step

- 1 Turn on the tablet device.
- 2 Start the Tablet TP APP.
- 3 Turn on the controller. When the controller has finished loading, Tablet TP will automatically login to the controller.

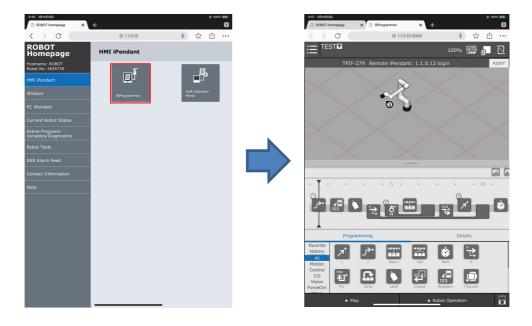


<u>B-84274EN/04</u> 2. CONNECTION

Procedure Login to the controller (for iOS)

Step

- 1 Turn on the controller.
- 2 Turn on the tablet and open Google Chrome app.
- Wait until the controller has finished loading, and enter 1.1.0.10 in URL to open ROBOT Homepage
- 4 Click iRProgrammer on HMI iPendant tab to login to the controller



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2.4 **CHECK THE DATE AND TIME**

Check the date and time on the tablet device and the controller. If the date or time are wrong, set the correct date and time.

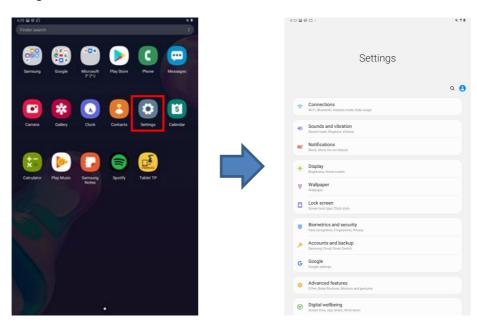
NOTE

If the date and time on the tablet device and the controller are out of sync, the tablet TP screen may be slow to display.

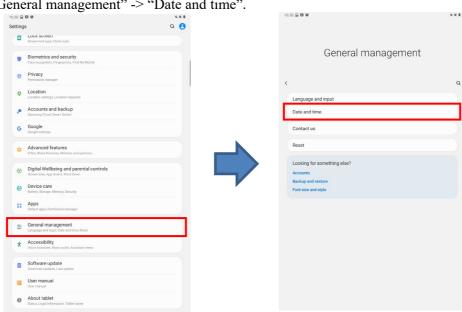
Procedure Check and setup the date and time on the tablet device

Step

Open "Settings" in the tablet device.

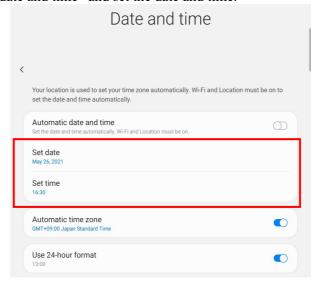


Go to "General management" -> "Date and time".



<u>B-84274EN/04</u> 2. CONNECTION

3 Disable "Automatic date and time" and set the date and time.



NOTE

The procedure to display the date and time setting screen varies depending on the type of tablet device, OS version, etc.

Procedure Check and setup the date and time on the controller

Step

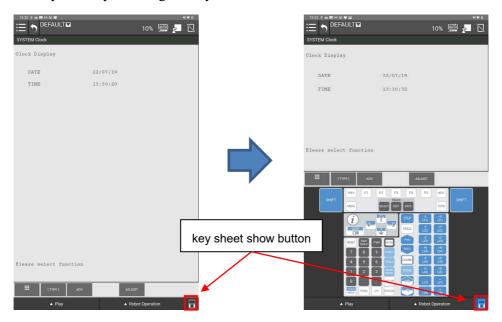
1 Go to "SYSTEM" -> "Clock".



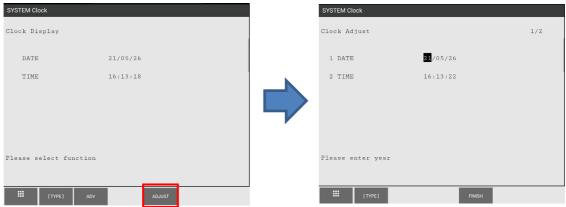


2. CONNECTION B-84274EN/04

2 Show the key sheet by touching the key sheet show button.



3 Select "ADJUST" and set the date and time.



<u>B-84274EN/04</u> 2. CONNECTION

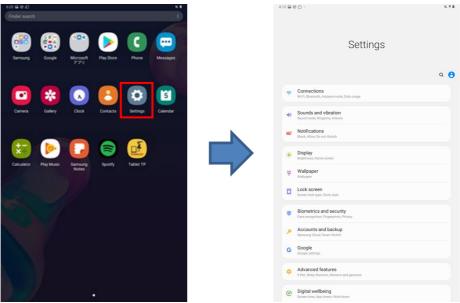
2.5 WHEN THE TABLET TP CANNOT CONNECT TO THE CONTROLLER

If you cannot connect to the controller from the Tablet TP, please confirm the following procedure.

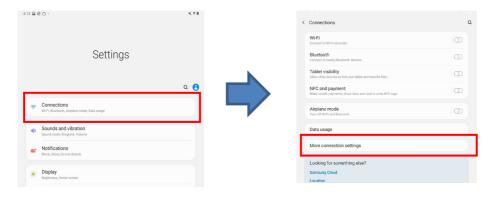
Procedure Setup method of the connection

Step

1 Open "Settings" in the tablet device.

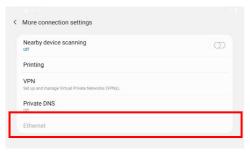


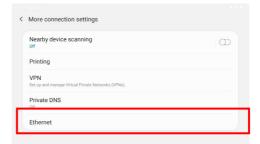
2 Go to "Connections" -> "More connection settings".



3 Confirm "Ethernet". If you cannot select this item, the connection of the tablet device and the controller may have a problem. Please confirm that there is no poor contact at the connection of the TP cable or the USB-Type C cable.

2. CONNECTION B-84274EN/04

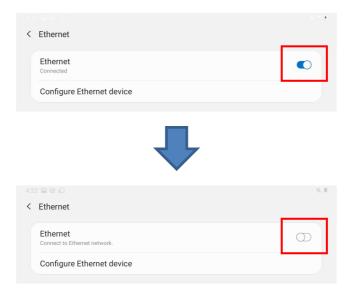




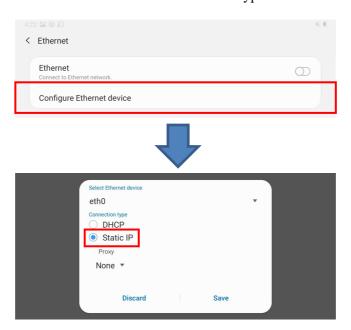
"Ethernet" is not selectable

"Ethernet" is selectable

- 4 Select "Ethernet".
- 5 Disable the Ethernet connection.

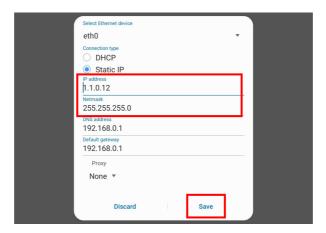


6 Select "Configure Ethernet device" and set the connection type to "Static IP"

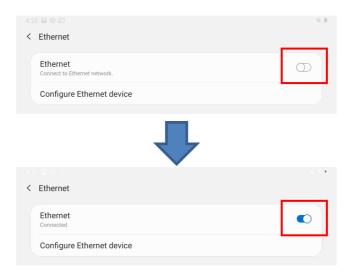


7 Select "Static IP" and set the IP address mentioned in section 2.1.

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8 Enable the Ethernet connection.



9 Start the Tablet TP APP to connect to the controller.

2.6 EMERGENCY STOP

Tablet Teach Pendant has an emergency stop button (TP E-stop) on the Tablet Base. When the Tablet Base is connected to the control unit and operating, the emergency stop button will be lit to meet the requirements of ISO 10218-1. The button's light cannot be turned off as it does not indicate an emergency stop condition.

If the Tablet Teach Pendant is connected to the controller, the following alarm will occur and the robot motion will stop each time the Estop button is pressed.

Table 2.6(a) Alarm of Emergency Stop

	button/signal	Alarm
R-30iB Plus	TP E-stop	SRVO-601 TP/OP E-stop
	OP E-stop	SRVO-601 TP/OP E-stop
	EX E-stop	SRVO-007 External emergency stops
R-30iB Mate Plus	30iB Mate Plus TP E-stop SRVO-602 TP/External E-s	
	OP E-stop	SRVO-001 Operator panel E-stop
	EX E-stop	SRVO-602 TP/EX E-stop
R-30iB Compact Plus	TP E-stop	SRVO-002 Teach pendant E-stop
	OP E-stop	SRVO-001 Operator panel E-stop
	EX E-stop	SRVO-007 External emergency stops

2. CONNECTION B-84274EN/04

	button/signal	Alarm
R-30iB Mini Plus	TP E-stop	SRVO-002 Teach pendant E-stop
	OP E-stop	SRVO-001 Operator panel E-stop
	EX E-stop	SRVO-007 External emergency stops

Please refer to "FANUC ROBOT SAFETY HANDBOOK 4.3 STOP TYPE OF ROBOT" for details of stop type of the robot motion.

2.7 ENABLING DEVICE (DEADMAN SWITCH)

Tablet Teach Pendant has an enabling device (Deadman switch) on Tablet Base. When Tablet TP is connected, the following alarm is occurred.

Table 2.7(a) Alarm of Enabling device

Controller	Enabling device	Alarm
R-30iB Plus	Enabling device (Deadman switch)	SRVO-603 Deadman switch/NTED released
	NTED	SRVO-603 Deadman switch/NTED released
R-30iB Mate Plus	Enabling device (Deadman switch)	SRVO-003 Deadman switch released
R-30iB Compact (Mini) Plus	Enabling device (Deadman switch)	SRVO-003 Deadman switch released
R-30iB Mini Plus	Enabling device (Deadman switch)	SRVO-003 Deadman switch released

Please refer to "FANUC Robot series SAFETY HANDBOOK 4.3 STOP TYPE OF ROBOT" for details of stop types of the robot motion.

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3 TABLET UI

The screen of the Tablet UI can be divided into the following areas.

- Status bar, Menu display
- · Panel display section
- · Screen display / Operation section

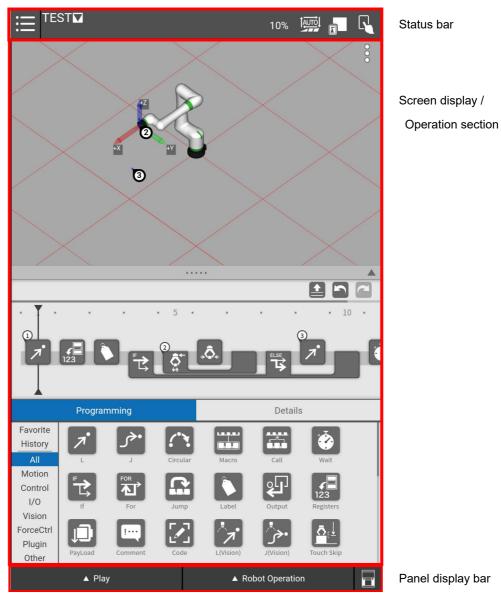


Fig. 3 Tablet UI Screen

Table 3 Tablet UI Screen Lavout

Table 5 Tablet of Screen Layout		
Item Description		
Status bar	Displays the robot's status	
Robot Graphic	Displays the graphic image of the robot.	
	The graphics will change depending on the robot position and attitude.	
Program Line	Displays the selected program with icons.	
	To edit the program, drag & drop an instruction icon from the icon pallet to the	
	program line.	

Item	Description
Icon Pallet	Touch the Programming tab to display the icon pallet.
	The icon instructions supported by this robot will appear in the icon pallet.
	See "4.3 Icon Instructions" for icon instructions supported by this robot.
	Select a section on the left to change the icons shown in the icon pallet.
Instruction Details	Touch the detail tab to display the detail settings of the selected instruction on
	the program line.
	The instruction settings can be changed here.
Play	Displays the execution panel
	The program can be executed, paused and stopped using the execution
	panel.
Robot Operation	Displays the robot operation panel.
	A robot operation can be performed or manual guided teach settings can be
	applied using the robot operation panel.

3.1 STATUS BAR

3.1.1 Status Bar

The status bar has the following functions.

- · Displays the menu.
- Displays the program selected and line being executed.
- An icon to change the selected program.
- Displays the system's state.



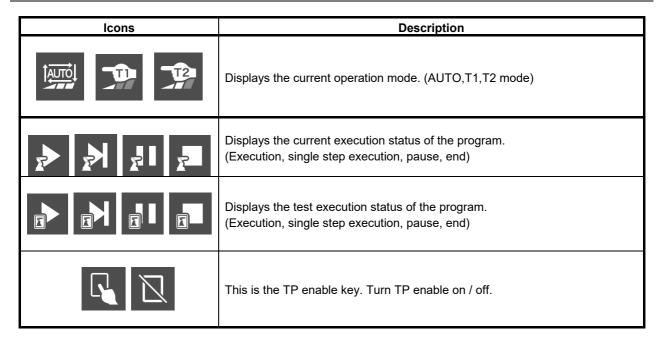
Fig. 3.1.1(a) Status Bar

The description and usage of each icon is described in Table 3.1.1(a).

Table 3.1.1(a) Status Bar Icons

Icons	Description
	Displays menu.
5	Go back to the previous screen.
♂	This is displayed when go back to the previous screen. Go to the next screen.
TEST▼	Displays the program name of the program being edited. A list of programs will display when the icon on the right of the program name is touched. Select a program on the list to change the program to edit.

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Select Program

Touch the icon on the right of the program name to display a list of programs created. Select a program to change the current program.

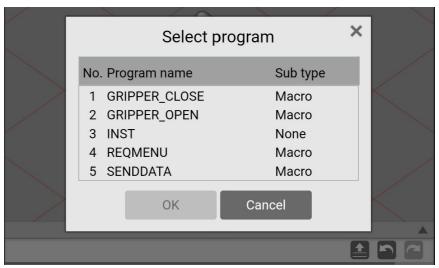


Fig. 3.1.1(b) Program Selection Dialog

Display and Reset Alarm

When an alarm occurs, the alarm message will appear below the status bar.

After the cause of the alarm is removed, touch the reset button to recover from the alarm.



Fig. 3.1.1(c) Alarm Display

If two or more alarms have occurred, a scroll button will show on the left of the RESET button. By touching the scroll button, a list of alarms currently occurring will show under the status bar.



Fig. 3.1.1(d) Alarm Scroll Button

3.1.2 Menu

Touch the menu icon on the status bar to display the menu. In the menu, menu items and a few icons are displayed. When a menu item is touched, the screen display and operation section will switch to the corresponding screen.

The icons in the menu are described in Table 3.1.2(a). For more information about the menu item, see Table 3.1.2(b)



Installation of the optional function is required for some menu items.

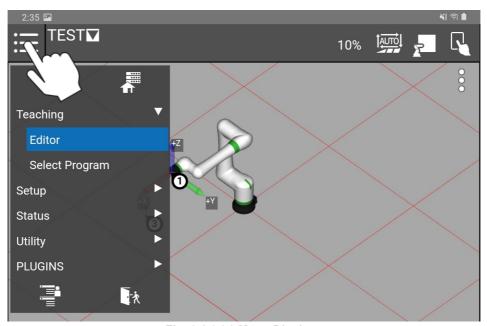


Fig. 3.1.2 (a) Menu Display

Table 3.1.2(a) Icons in Menu

Item	Description
¥ *	Use this icon to switch the menu display format. Constant display and the display when the menu icon is touched can be switched with this icon.
	Displays home screen (editor).
	The Tablet UI menu and compatible menu (equivalent to iPendant) can be switched with this icon.

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Item	Description
本	Disconnects the tablet TP.

Table 3.1.2(b) Description of menus for Tablet UI

Item	Sub Item	ble 3.1.2(b) Description of menus for Tablet UI Description
nem	Sub item	
Production		Users can select, start, stop, and abort programs and reset alarms by touch or voice input.
Teaching	Editor	Users can edit programs.
	Select Program	Users can create and select programs.
Setup	Initial Setup	Initial setup required to start using the robot. Set the time, network, etc.
	Collabo Robot	Initial setup required for Collaborative Robot.
	Setup	Set the tool, payload, etc. Settings for switching to high speed mode.
	UTool Setup	Initial setup for tool attached to robot. Set the tool center position, tool center of mass, etc.
	Utool Payload Identification	Operate the robot to automatically estimate the mass and center of gravity of the load of tools and workpieces attached to the hand. This menu is displayed only in the CRX series robot.
	UFrame Setup	Users can setup the user frame. There are the teaching method and the direct list method.
	Safety (DCS)	Users can change the DCS and Collaborative Robot settings and confirm them.
	Collabo Speed Setup	Users can set the robot's move speed depending on the area of the body the robot might contact with. This menu is displayed only in the CRX series robot.
	EE Interface Setup	Set up EE Interface communication. When the configuration is changed, the robot controller must be re-started to take effect. This menu is displayed only with CRX series robot.
	<i>i</i> RVision	Setup <i>i</i> RVision Vision Data. Different from the vision data screen opened from the "Find" icon, users can make settings equivalent to those of conventional <i>i</i> RVision.
	Force Coordinate Lists	User can setup the frame for force control. This menu is displayed only with CRX series robot.
	Weld Procedure	Weld procedure used in Arc Welding Function can be set.
	Payload Settings	Users can setup payload parameters. And on collaborative robots, users can apply them to dcs safety parameters and do payload confirmation.
Status	Current Position	Indicates the position and posture of the robot in space. There are 2 types of current position display: Joint coordinate values and Cartesian coordinate values.
	Alarm Status	Displays the alarms that are occurring and the history of alarms. Users can check the details of the alarm.
	I/O	Displays I/O status.
	Numeric Register	Users can refer to and set the number of the register.
	Position Register	Users can refer to and set the position data of the position register
	Anlg Meter	Graphically displays the welding current/voltage command value and the returned value at arc welding with Arc Welding Function.

Item	Sub Item	Description
Production		Users can select, start, stop, and abort programs and reset alarms by touch or voice input.
	Torch Angle	Arc Welding Function displays the Work and Travel/Push of the current torch. It will be displayed only when Arc Torch Angle Function (R734) is ordered.
Utility	File	Users can perform file operations on the device.
	File Backup	Users can save the backup data of the robot to a device such as USB memory.
	Image Restore	The backup data can be read.
	Cycle Power	Select the start mode and restart.
Plugins	Install	Users can install the plugin software provided by each peripheral device company in the USB memory.
	Plugin List	Users can view the list and details of installed plugin software and also uninstall plugin software.

3.1.2.1 Limitation

Some items of the Tablet UI menu cannot be displayed on multiple screens. ex) I/O, Numeric Register, a setting screen for plugin software, etc.

3.1.3 Panel

Touch the panel display bar at the bottom of the screen to display the execution panel and robot operation panel.

The bar of the displayed panel turns blue. Touch the panel again to hide the panel.

See "3.3 Manual Robot Operation" and "5.1 Executing a Program" for more information on using the operation panel.

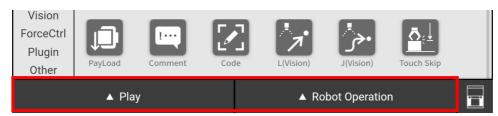


Fig. 3.1.3(a) Panel Display Bar



Fig. 3.1.3(b) Displaying Execution Panel

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3.2 PAYLOAD CONFIRMATION OPERATION AFTER POWER ON

Users must confirm that the payload setting is consistent with the actual payload at least once after power on for controller. This operation is called Payload Confirmation. The robot cannot move before Payload Confirmation.

A pop-up will be displayed on the tablet screen to confirm payload in the following settings.

- After power on for controller
- Touch RESET button when payload confirmation is not completed ("SYST-374 Need to confirm payload" alarm occurs)

If users need to confirm payload in other settings, see "FANUC Robot series OPERATOR'S MANUAL (Collaborative Robot Function) (B-83744EN)".

↑ WARNING

If the payload confirmation operation is performed incorrectly, the external force is not detected correctly and the safety function will not work, and a personal injury could result. When the payload confirmation operation is performed, the actual payload of the robot must be confirmed correctly, and anybody must not contact the robot.

Payload Confirmation Operation

Users can confirm payload using the pop-up by following the steps below.

If Fig. 3.2(a) is displayed, enter the master code number for DCS. If the code number is not correct, the payload confirmation operation is failed.

If the "Password for CONFIRM" is DISABLE in the collaborative robot screen, it is not necessary to enter the code number.



Fig. 3.2(a) Payload Confirmation Popup

- Fig. 3.2(b) is displayed. Confirm the actual payload of the robot hand/tool/workpiece if it is surely equal to payload No X.
 - If No. X is correct, touch Yes and the next question will be displayed
 - Else, touch No and the payload confirmation operations is failed. Change the payload setting and try again.

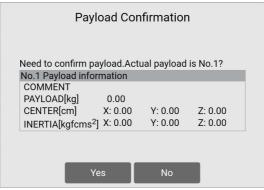


Fig. 3.2(b) Payload Confirmation Popup

Fig. 3.2(c) is displayed. Confirm that nobody is in contact with the robot, no foreign object is on the robot, and there is no external force on the robot. Press OK and the result of the payload confirmation will be displayed.



Fig. 3.2(c) Payload Confirmation Popup

The result of the payload confirmation

"Payload confirmation success"

Payload confirmation operation is completed. You can use the collaborative robot after this.

"Payload confirmation failed"

Remove the external force to the robot and try again. For example, a floor vibration may cause the external force.

Wait few seconds and try again. Payload confirmation can fail soon after power up

3.3 MANUAL ROBOT OPERATION

There are 3 methods to manually operate the robot.

- Jog operation using the robot operation panel soft keys
- MPG Jog operation using the robot operation panel dial (Only in the CRX series robot)
- Direct operation with manual guided teach (Only in the CRX series robot)

This section describes the UIF for the 3 operations.

3.3.1 Jog Operation on a Tablet

Touch the robot operation key in the bottom right of the screen to open the robot operation panel.

Users can select Jog, Manual guided teaching, or MPG Jog from the tabs at the top.

If jog operation is selected the jog buttons are displayed. If the manual guided teach panel or the MPG jog panel is displayed, the operation can be switched to the jog operation by touching the jog on the top tab. Users can jog the robot while sliding the jog button.

<u>B-84274EN/04</u> 3. TABLET UI

Touch the Frame button to switch the jog method between Cartesian, Tool, User or Joint. The TP enable key in the status bar must be ON in order to jog the robot.

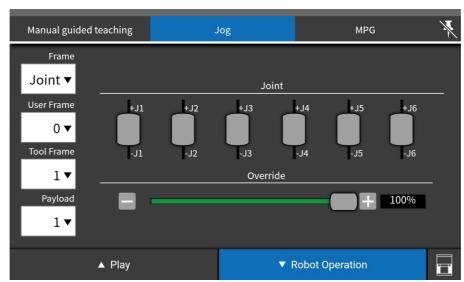


Fig. 3.3.1(a) Jog Panel (Joint)



Fig. 3.3.1(b) Jog Panel (Cartesian)

Table 3.3.1(a) Jog Panel

Button	Description
Manual guided	Change the operation method to manual guided teach.
teaching	Robot operation panel is changed for manual guided teach.
MPG	Change the operation method to MPG Jog.
	Robot operation panel is changed for MPG Jog.
Frame	Choose frame from cartesian, tool, user, and joint.
Tool Frame	Set tool frame number.
User Frame	Set user frame number
Payload	Set active payload number
Override	Users can change the override.
* **	Use this icon to switch the Robot Operation panel display format. Constant display and the display when the Robot Operation key is touched can be switched with this icon.

In multi-group system, group selection tab is displayed on Jog Panel.

Selected group by group selection tab can be jogged.

Also, Users can change Frame, User Frame, Tool Frame, payload in selected group.

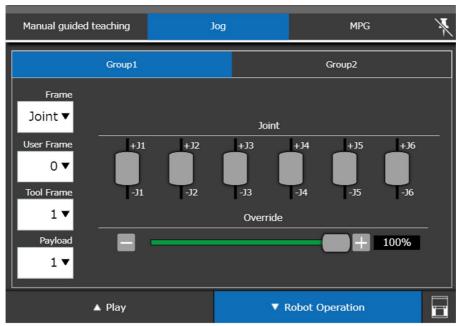


Fig. 3.3.1(c) Jog Panel in multi-group system

3.3.2 MPG Jog

Touch the robot operation key in the bottom right of the screen to open the robot operation panel. Then Touch the MPG Jog key in the upper right of the robot operation panel to open the MPG Jog panel.

MPG Jog is a function to jog the robot by rotating the dial.

The robot can move according to amount of rotation of the dial.

Users can select the magnification of movement amount per 1 scale of the dial by Scaling Factor button. Users can select the direction of robot movement by Motion Dir/Joint button.

MPG Jog can only be used with CRX series. With the models other than CRX series, "MPG" tab is not displayed on the Jog Panel.

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Figure 3.3.2(a) MPG Jog panel(Joint)



Figure 3.3.2(b) MPG Jog panel(Cartesian)

Table 3.3.2(a) Jog Panel

Button	Description
Manual guided	Change the operation method to manual guided teach.
teaching	Robot operation panel is changed for manual guided teach.
Jog	Change the operation method to Jog.
	Robot operation panel is changed for Jog.
Frame	Choose frame from Cartesian, tool, user, and joint.
Tool Frame	Set tool frame number.
User Frame	Set user frame number.
Payload	Set active payload number
Override	Users can change the override.
Motion Dir / joint	Users can select the direction of robot movement.
	If Joint Frame is selected, J1 to J6 buttons are displayed on the MPG jog panel.
	If Cartesian, Tool, or User is selected, X, Y, Z, W, P, R buttons are displayed on the MPG jog
	panel.

Button	Description
Scaling Factor	Users can select the magnification of movement amount per 1 scale of the dial. If liner motion selected, the amount of movement that can be set with each button is as follows. × 1: 0.1mm、× 5: 0.5mm、× 10: 1mm、× 50: 5mm If rotate motion selected, the amount of movement that can be set with each button us as follows. × 1: 0.01°、× 5: 0.05°、× 10: 0.1°、× 50: 0.5°
FANUC	Users can jog the robot at a distance according to the amount of rotation of the dial. If users rotate the dial clockwise, robot will move in the + direction. If users rotate the dial Counterclockwise, robot will move in the – direction. If users touch the center of the dial, MPG jog will stop. Because, the amount of movement changes drastically when users touch the center of the dial. If you want to start MPG jog again, release the dial and touch the dial again.

In multi-group system, group selection tab is displayed on MPG Jog Panel. Selected group by group selection tab can be jogged.

Also, Users can change Frame, User Frame, Tool Frame, payload in selected group.



Figure 3.3.2(c) MPG Jog panel in multi-group system

3.3.2.1 Operation

The operation procedure for the MPG Jog function is as follows.

- On the tablet TP, Touch the robot operation key on the bottom of the screen and press the "MPG Jog" button.
- 2 The TP enable key in the status bar switch to enable.
- 3 Select the coordinate system to jog.
- 4 Select the direction / axis number to jog with the Motion Dir/Joint button.
- 5 Select the Scaling Factor to jog with the Scaling Factor button.
- 6 Rotate the dial in the direction you want to jog.

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3.3.2.2 Notice

• The robot does not move by MPG Jog function when selecting low speed or slow speed as the override.

- The robot does not move by MPG Jog function when increment jog function is enabled.
- To prevent coasting, when override % is small, the robot cannot move the direction specified with the dial.
- To prevent coasting, when rotate the dial quickly, the robot cannot move the direction specified with the dial.

3.3.3 Manual Guided Teach

The manual guided teaching function enables operators to move the robot by pushing it directly.

The manual guided teaching is enabled when the enabling device (deadman switch) is pressed. The correct operation is shown in Fig.3.3.3 (a). The tablet TP (or iPendant) and the robot must be held by the same person.

Correct Operation

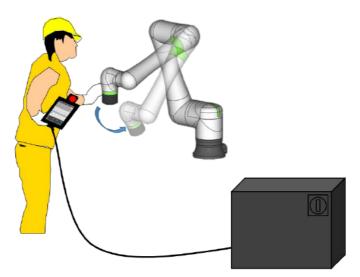


Fig. 3.3.3(a) Correct operation of manual guided teaching

The wrong operation is shown in the Fig.3.3.3 (b). The tablet TP (or iPendant) and the robot are held by two persons.

Wrong Operation

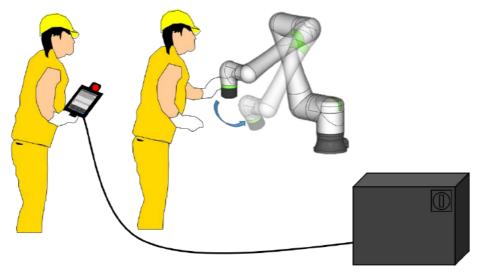


Fig. 3.3.3(b) Wrong operation of manual guided teaching

↑ WARNING

- If payload setting is not appropriate, the robot can move unexpectedly in the manual guided teaching operation. Please confirm before operation that the payload setting is correct, and release the enabling device immediately if unexpected movement occurs.
- The contact stop function is disabled during the manual guided teaching operation. If you feel danger, for example, there is a risk that the work piece collides yourself or the stand etc., please release the enabling device immediately.

3.3.3.1 Operation

- 1 Enable the manual guided teaching function
- On the tablet TP, open the Robot Operation tab on the bottom of the screen and press the "manual guided teaching" button. The panel in Fig. 3.3.3.1(a) is displayed where you can adjust the weight of the operation.

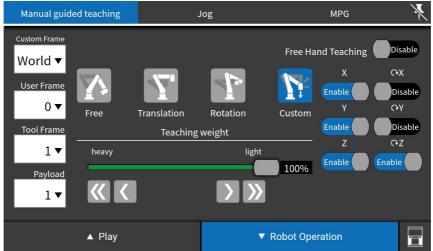


Fig. 3.3.3.1(a) Tablet TP Manual Guided Teaching

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Table3.3.3.1 (a) Manual Guided Teach Panel

Button	Description
Jog	Change the operation method to Jog. Robot operation panel is changed for jog.
MPG	Change the operation method to MPG Jog. Robot operation panel is changed for MPG Jog.
Free	Users can operate all axes without restrictions with Manual guided teaching.
Translation	Users can operate the robot only translation with Manual guided teaching.
Rotation	Users can operate the robot only translation with Manual guided teaching. You can only rotate the posture around the tool coordinate system
Custom	Users can operate the TCP to the selected directions (XYZ of translation and rotation) in the selected frame (World, UTool, or UFrame).
Operation Weight	The weight of manual guided teach operation can be adjusted by sliding the bar. The light setting allows the robot to be operated with weak force. The heavy setting is used to fine-tune the robot position.
Free Hand Teaching	You can move the robot without grasping enabling devices when this switch is Enable. This item appears only when Force Limit Sensitivity is INST or LOW.

In multi-group system, group selection tab is displayed on Manual Guided Teach Panel. Selected group by group selection tab can be operated.

Also, Users can change Frame, User Frame, Tool Frame, payload in selected group.

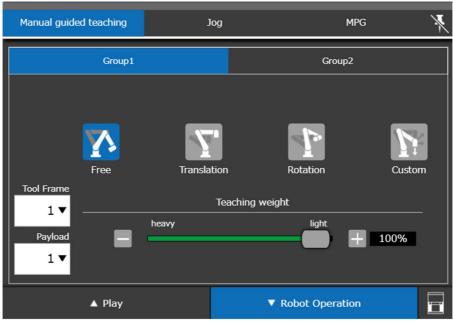


Fig. 3.3.3.1(b) Tablet TP Manual Guided Teaching in multi-group system

If selected group don't support Manual Guided Teaching, this function is not available.

3. TABLET UI B-84274EN/04

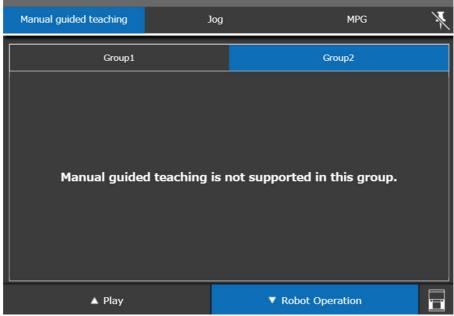


Fig. 3.3.3.1(c) If selected group don't support Manual Guided Teaching

On iPendant, open JOG ASSIST screen, and push the "MANUAL" button.



Fig. 3.3.3.1(b) iPendant Manual Guided Teach

- 2 Press the enabling device in AUTO mode.
- When all conditions are fulfilled, the green LED on the robot starts flashing and you can start moving the robot.

3.3.3.2 Notice

- When TCP or the elbow speed exceeds 1000[mm/s] during manual guided teaching, the robot stops.
- If manual guided teaching doesn't start, please check these conditions.
 - The controller is in AUTO mode.
 - · All alarms are removed.
 - The robot axes are inside of joint limits.
 - Payload confirmation is done.
 - The robot is stopped

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3.3.4 Recovering from Certain Alarms

For certain type of alarms, a pop-up box like the following will show up.



Fig. 3.3.4(a) Pop ups for certain Alarms

When a pop-up box like Fig. 3.3.4(a) shows, users must switch to the Alarm Status Screen and apply some actions. By touching "Alarm Status Screen" in the pop-up box, users can directly switch to the Alarm Status Screen.

Temporarily Reset Alarm

Some alarms must be temporarily reset before removing the cause of the alarm. Such alarms are the following:

```
SRVO-005 Robot overtravel
SRVO-101 Robot overtravel (G: %d)
SRVO-006 Hand broken
SRVO-050 CLALM alarm (G: %d, A: %d)
SRVO-402 DCS Cart. pos. limit (No. %d: %s, G: %d, M: %d) %02x
SRVO-404 DCS Joint pos. limit (No. %d: %s, G: %d, M: %d) %02x
SRVO-491 Collaborative stroke limit (G: %d, A: %s)
SSPC -101 (G: %d) is close to target
SSPC -103 (G: %d) is near to target
```

For more information about alarms, refer to the "FANUC Robot series OPERATOR'S MANUAL (Alarm Code List) (B-83284EN-1)".

When the "Temporarily Reset Alarm" button is touched, users can temporarily reset the alarm for 30 seconds. Jog the robot during the 30 seconds in order to remove the cause of the alarm. After touching the "Temporarily Reset Alarm" button, a pop-up box like Fig. 3.3.4(b) will show. At the bottom of the pop-up box, a timer will count down and users should jog the robot within the given time. If time has run out, the pop-up box will close, but users may touch the "Temporarily Reset Alarm" button again to continue for another 30 seconds.

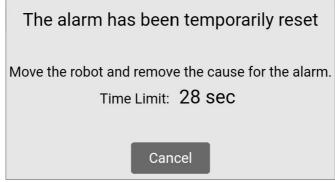


Fig. 3.3.4(b) Temporarily Reset Alarm

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Chain Abnormal Alarm

For chain abnormal alarms, remove the cause of the alarm and then touch the "Chain Reset" button in the Alarm Status Screen. For more information about alarms, refer to the "FANUC Robot series OPERATOR'S MANUAL (Alarm Code List) (B-83284EN-1)".

3.4 KEY SHEET

Tablet Teach Pendant can show a key sheet that imitates the iPendant by touching the key sheet show button.

Please refer to "FANUC Robot series OPERATORS MANUAL (Basic Function) (B-83284EN) 2.3.1

Teach Pendant" for details of each keys.

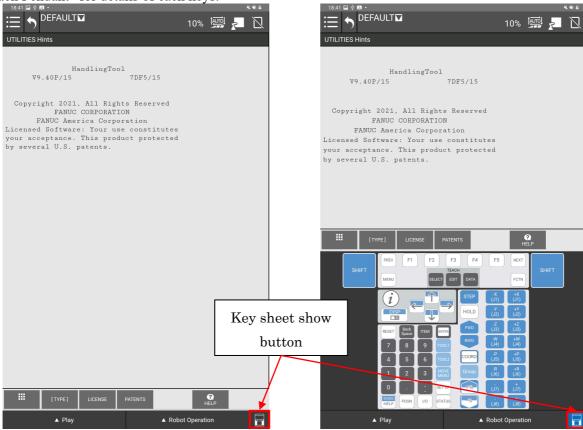


Fig 3.4(a) Show/hide key sheet

B-84274EN/04 3. TABLET UI

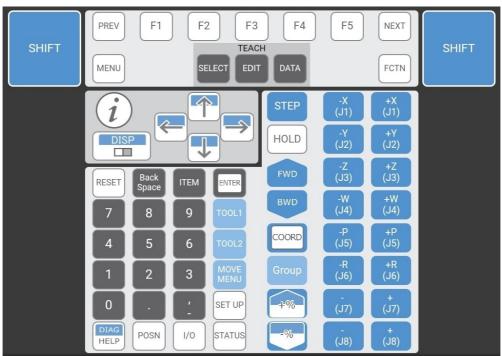


Fig 3.4(b) Key Sheet

Some keys are used with the SHIFT key. You can press the SHIFT key in the following two ways.

- Multi-tap the SHIFT key and another key that needs SHIFT.
- Double-tap the key that needs SHIFT.

3. TABLET UI B-84274EN/04

3.4.1 Jog Operation and Program Execution

3.4.1.1 Jog operation

If you want to jog the robot, you have to press the SHIFT and Jog key. You can press the SHIFT and Jog key in the following two ways.

- Tap the Jog Key while pressing the SHIFT key.
- Double-tap the Jog Key.

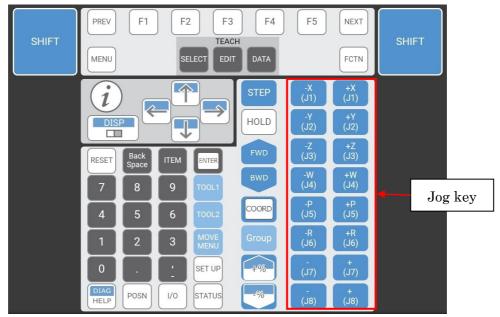


Fig 3.4.1.1(a) Jog key

Please refer to "FANUC Robot series OPERATORS MANUAL (Basic Function) (B-83284EN) 5.2.3 Moving the Robot by Jog Feed" for details of Jog operation.



Jog operation must be executed with the robot in sight.

B-84274EN/04 3. TABLET UI

3.4.1.2 Program execution

If you want to execute the program, you have to press the SHIFT and FWD/BWD key. You can press the SHIFT and FWD/BWD key in the following two ways.

- Tap FWD or BWD Key while pressing the SHIFT key.
- Double-tap the FWD or BWD Key.

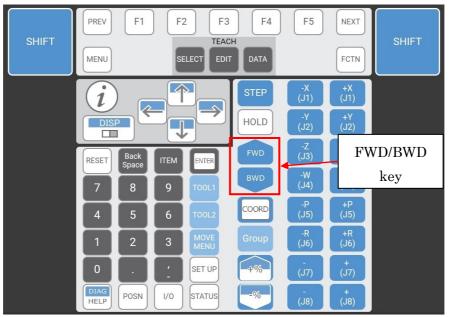


Fig 3.4.1.2(a) FWD/BWD key

↑ WARNING

- 1 Verify that the selected program and line number is correct before running a program.
- 2 When you start running programs using Tablet Teach Pendant in AUTO mode, you must strictly adhere to the following precautions.
 - Running programs must be executed from outside of the safeguarded space.
 - You must check that no one is inside in the safety fence.

Please refer to "FANUC Robot series OPERATORS MANUAL (Basic Function) (B-83284EN) 6.2 EXECUTING A PROGRAM" for details.

4 TEACHING

4.1 CREATE PROGRAM

A program can be created in the Select Program screen.

Push Select Program in the Tablet UI menu to display the Select Program screen.

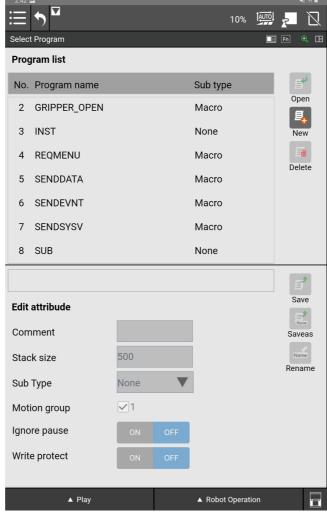


Fig. 4.1(a) Program Select Screen

Click the New button on the screen to display Fig. 4.1(b).

Enter the program name and touch OK.



Fig. 4.1(b) Enter Program Name Dialog

A dialog to edit the program attributes will display in Fig. 4.1(c).

Edit the program attributes and touch OK to create the program. The screen will move to the Editor screen.

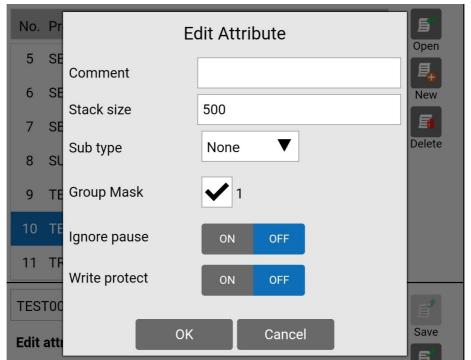


Fig. 4.1(c) Edit Attribute Dialog

4.2 EDIT PROGRAM

Select the home icon from the menu or the editor from the CRX menu, and the screen in Fig. 4.2(a) will display. On this screen, programs can be edited and some of the basic robot operation can be performed. This screen consists of the contents shown in Table 4.2(a).

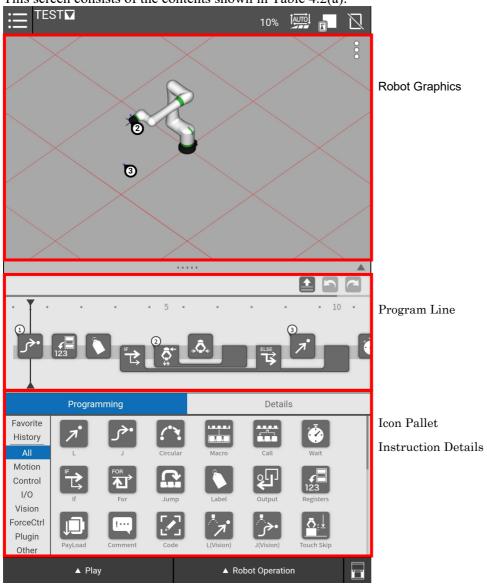


Fig. 4.2(a) Tablet UI Screen

Table 4.2(a) Tablet UI Screen Structure

ltem	Description
Robot Graphics	Displays graphic image of the robot.
	The graphics will change depending on the robot position and attitude.
Program Line	Displays the selected program with icons.
	To edit the program, drag & drop an instruction icon from the icon pallet to the
	program line.
Icon Pallet	Touch the Programming tab to display the icon pallet.
	The icon instructions supported by this robot will appear in the icon pallet.
	See "4.3 Icon Instructions" for icon instructions supported by this robot.
	Select a section on the left to change the icons shown in the icon pallet.

Item	Description
Instruction Details	Touch the detail tab to display the detail settings of the selected instruction on
	the program line.
	The instruction settings can be changed here.

Add Instruction

Edit the program using icon instructions.

Drag & drop the icon instructions in the icon pallet to the program line to add instructions.



Fig. 4.2(b) Add Instructions

Edit the Instruction Parameters

Touch the icon instruction displayed on the program line to display the detail settings. The icon will turn to blue when selected. In the detail settings, the selected instruction's parameter can be checked and modified.

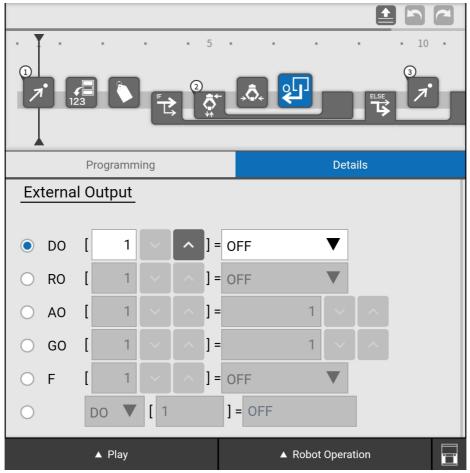


Fig. 4.2(c) Detail Settings

Teach Position Data

Position data is taught in the motion instruction detail settings.

Click the "Touch Up" button to enter the current position. The position data may also be entered directly.

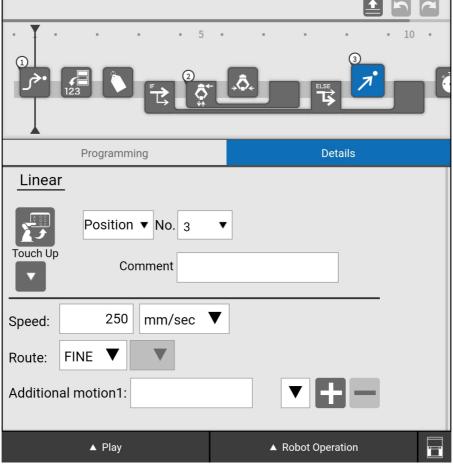


Fig. 4.2(d) Teach Position

Touch the button next to the comment to display the position's numeric data.

Users can directly change the position, attitude, configuration, and coordinate system number. Touch the Cartesian / Joint button to switch the format of the displayed position data.

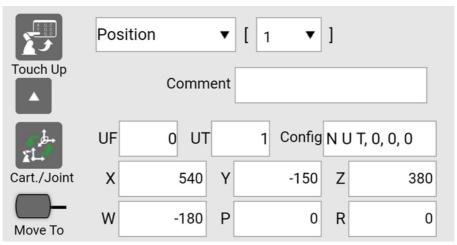


Fig. 4.2(e) Position data

Table 4.2(b) Position Table Button

Button	Description
Touch Up	Teach current position
Move To	Slide the bar to the right to move to the taught position. To move the robot turn on the TP enable key in the status bar.
Cart./Joint	The format of the displayed position data can be switched between Cartesian and Joint.
٧	Touch the button to display the details of the position data.

In multi-group system, group selection tab is displayed in the position data.

In group selection tab, groups are displayed that is set as motion group in this program.

Users can directly change the position, attitude, configuration, and coordinate system number of selected group. Touch the Cartesian / Joint button to switch the format of the displayed position data of selected group.

If slide the Move To bar to the right, only selected group is moved.

If press the Touch Up button, current position of all groups are taught.

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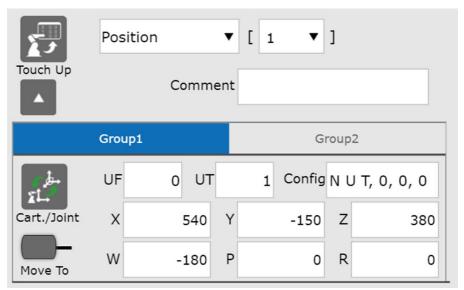


Fig. 4.2(f) Position data in multi-group system

Operation on Program Line

• Delete Instructions

Drag & drop the instruction outside program line to delete instruction.

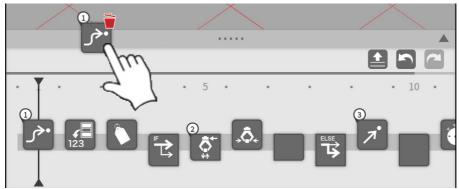


Fig. 4.2(g) Delete Instruction

To delete multiple instructions, touch and hold the icon. The screen shown in Fig. 4.2(f) should display.



Fig. 4.2(h) Select Instruction

Set the range to be deleted and touch the garbage icon to delete the instructions.



Fig. 4.2(i) Select Instructions

· Copy and Paste Instructions

After touching and holding the icon instruction, set the range and touch the copy icon.



Fig. 4.2(j) Copy Icon Instructions

Drag & drop the icon instruction to the copy destination and the instructions in the selected range will be pasted.

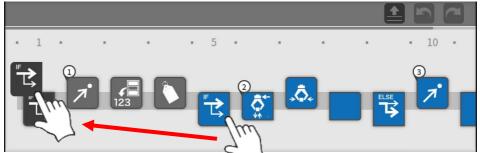


Fig. 4.2(k) Copy Instruction

• Open / Close IF and FOR instructions

To open and close the instruction, touch and hold the IF or FOR icon and touch the Open / Close button.



Fig. 4.2(I) Close IF instruction

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Table 4.2(c) Program Line Buttons

Button	Description
	Undo editing operations such as changing or deleting instructions.
~	Returns to the state before the undo operation.
Ť	Deletes icon instructions.
	Copy and paste icon instructions.
0	Cut and paste icon instructions.
1 +	Open and close specific icon instructions.

4.3 ICON INSTRUCTIONS

This section describes the icon commands supported by the tablet UI.

- 4.3.1 Linear Motion
- 4.3.2 Joint Motion
- 4.3.3 Circular
- 4.3.4 Macro
- 4.3.5 Call
- 4.3.6 Wait
- 4.3.7 IF
- 4.3.8 FOR
- 4.3.9 Jump
- 4.3.10 Label
- 4.3.11 Output
- 4.3.12 Registers
- 4.3.13 Payload
- 4.3.14 Frame
- 4.3.15 Comment
- 4.3.16 Text Code
- 4.3.17 Touch Skip (CRX series only)
- 4.3.18 Basic Pick / Place
- 4.3.19 Align

- 4.3.20 Palletize
- 4.3.21 Extended Palletize
- 4.3.22 Open Hand
- 4.3.23 Close Hand
- 4.3.24 Path Teach
- 4.3.25 Basic Arc
- 4.3.26 Basic Weave
- 4.3.27 Weld Point(Liner)
- 4.3.28 Weld Point(Circle)
- 4.3.29 HandleTeach
- 4.3.30 Weld Start(Motion)
- 4.3.31 Weld Start(Standalone)
- 4.3.32 Weld End(Motion)
- 4.3.33 Weld End(Standalone)
- 4.3.34 Multi-pass Welding
- 4.3.35 Variable Payload Compensation
- 4.3.36 Switch to Low Sensitivity (CRX series only)

4.3.1 Linear Motion

The linear motion instruction controls the path of the tool center point (TCP) from a start point to an end point.



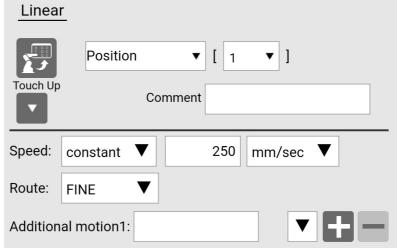


Fig. 4.3.1(a) L Icon

Fig. 4.3.1(b) Detail Settings

Touch ▼ next to Position to change between the position and position register.

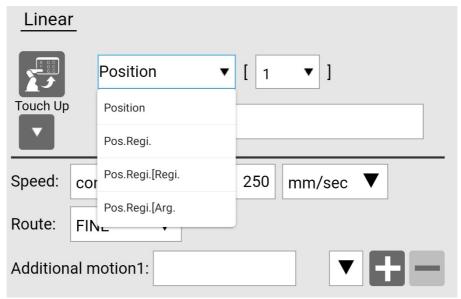


Fig. 4.3.1(c) Switch between position and position register

Users can enter additional motion instructions as text. Touch +/- button to increase/decrease the number of additional motion instructions.

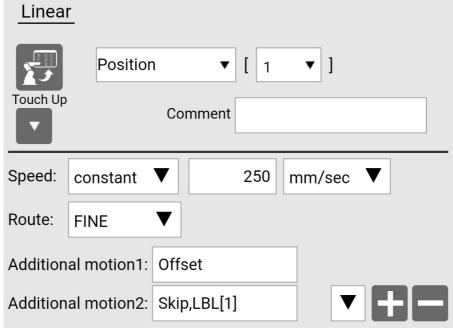


Fig. 4.3.1(d) Additional Motion Instructions

4.3.2 Joint Motion

The joint motion instruction is the basic instruction for moving the robot to a specified position.

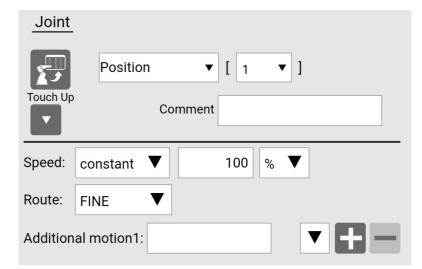


Fig. 4.3.2(a) J Icon

Fig. 4.3.2(b) Detail Setting

Touch ▼ next to position to change between position and position register.

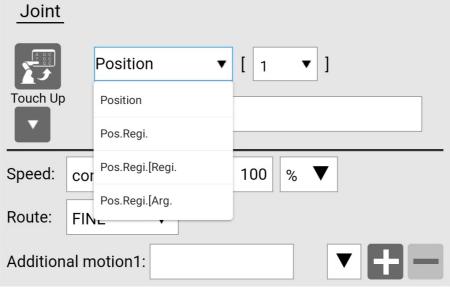


Fig. 4.3.2(c) Switch between position and position register

Users can enter additional motion instructions as text. Touch the +/- button to increase/decrease the number of additional motion instructions.

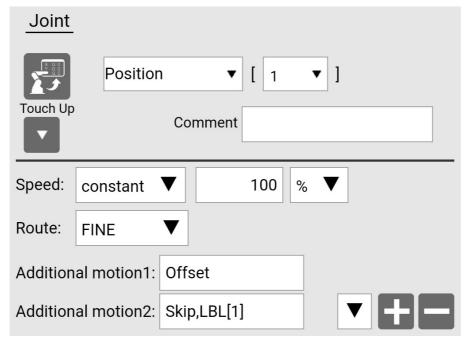


Fig. 4.3.2(d) Additional Motion Instructions

4.3.3 Circular

Circular arc movement is a movement method in which the movement trajectory of the tool tip point is controlled by a circular arc from the movement start point through the via point to the end point. Set the via point to the upper location information and the end point to the lower location information. If you drag and drop an arc instruction, the via point and end point will be registered as the current robot position.

The method of registering location information is the same as in 4.3.1 Linear and 4.3.2 Joint.

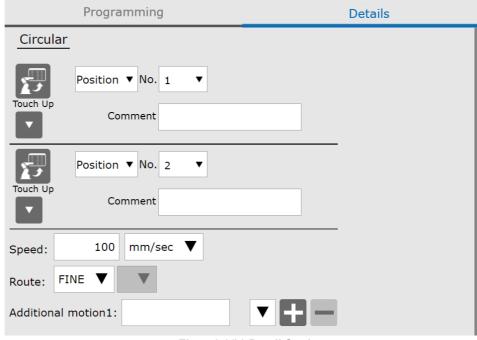


Fig. 4.3.3(a) Circular Icon

Fig. 4.3.3(b) Detail Setting

! WARNING

This instruction may operate at a speed exceeding the speed set by the speed clamp function. (not support speed clamp)

4.3.4 **Macro**

The macro instruction is used to register a program consisting a sequence of instruction as one instruction and to call such programs (Macro program) upon execution.





Fig. 4.3.4(a) Macro Icon

Fig. 4.3.4(b) Detail Settings

Users can choose a macro program by touching the program selection box. A list of macro programs will show under the program selection box.

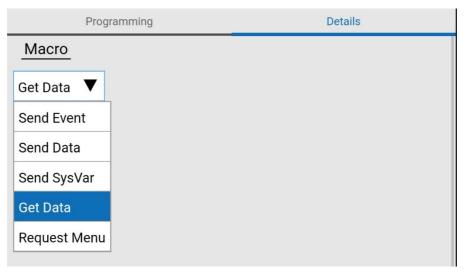


Fig. 4.3.4(c) Choosing the macro instruction

4.3.5 Call

The call instruction is used to execute another program (subprogram) defined in the detail settings. Upon call, the sub program's first line is executed. After the subprogram has been executed, the next line in the main program is executed.



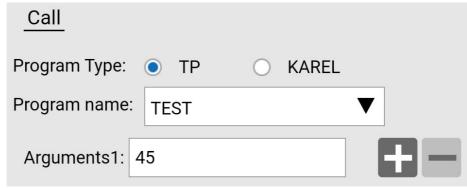


Fig. 4.3.5(a) Call Icon

Fig. 4.3.5(b) Detail Settings

Users can choose the subprogram from a program list by touching the program selection box. Users can also define an argument and use its value in the sub program. Users can define the value through text input or by touching the +/- key.

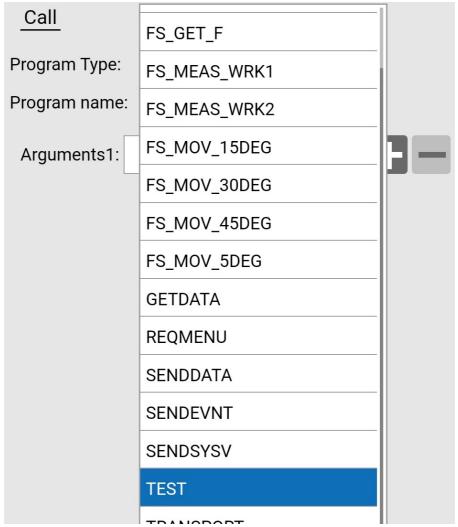


Fig. 4.3.5(c) Choosing a program from the program selection box

4.3.6 Wait

The wait instruction is used to suspend the execution of a program for a specified time or until a certain condition is met.





Fig. 4.3.6(a) Wait Icon

Fig. 4.3.6(b) Detail Settings

Check the button of the item to be used and specify the time or set the condition.

If you cannot set the condition in the center item, you can use the item below to enter the condition as text.



Fig. 4.3.6(c) Choosing conditions for the wait instruction

4.3.7 IF

The IF instruction is used to conditionally execute specified instructions. This instruction will be represented as a bracket on the program line. (Fig. 4.3.7(a)) If the condition defined in the detail settings is TRUE, the instructions between the IF and ELSE will be executed. If the condition defined in the detail settings is FALSE, the instructions after ELSE will be executed.

Backward execution is allowed on IF block and area within bracket. Backward execution is prohibited on ELSE block and end block.



Fig.4.3.7(a) IF Instruction



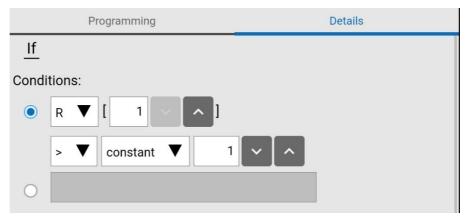


Fig. 4.3.7(b) IF Icon

Fig. 4.3.7(c) Detail Settings

The first item is used for simple conditions. Users can type more complex conditions in the second item.

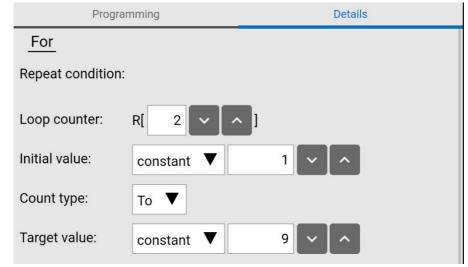


Fig. 4.3.7(d) Text Input to Define Condition

4.3.8 FOR

The FOR instruction is used to repeat the enclosed section for a certain number of times. This instruction will be represented as a bracket on the program line.

Backward execution is prohibited on FOR instruction. However, backward execution on instructions within bracket is allowed.



FOR FOR

Fig. 4.3.8(a) FOR icon

Fig. 4.3.8(b) Detail Settings

Set the following in detail screen.

• Loop Counter: Set register number to be used for the FOR loop.

• Initial value : When the FOR instruction is executed for the first time,

the register is initialized with this value.

• Count type : Select "To" to increment for each loop, "DownTo" to decrement for each loop.

• Target value : The loop exit when the register value exceeds this value.

When the set value is Fig. 4.3.8(b), the section surrounded by the FOR instruction in Fig. 4.3.8(c) is repeated 9 times.



Fig. 4.3.8(c) For Instruction

4.3.9 Jump

When a jump instruction is executed, it branches from a line in the program to the specified label.



Fig. 4.3.9(a) Jump Icon

Fig. 4.3.9(b) Detail Settings

By touching the label number, user can select from the label numbers that have already been set.

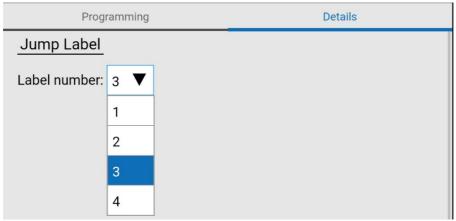


Fig. 4.3.9(c) Choosing the label number

4.3.10 Label

The label instruction is used to specify a branch location in the program. Combine this instruction with the jump instruction.



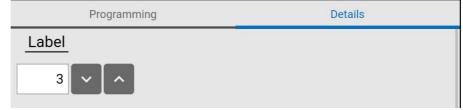


Fig. 4.3.10(a) Label Icon

Fig. 4.3.10(b) Detail Settings

4.3.11 Output

The output instruction is used to change the state of signals that are outputted to peripheral devices.

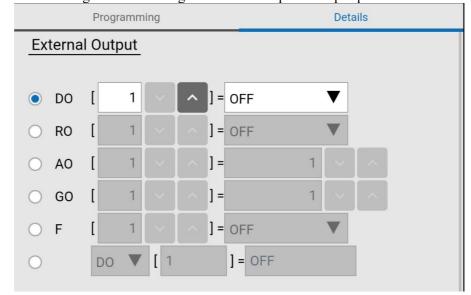


Fig. 4.3.11(a) Output Icon

Fig. 4.3.11(b) Detail Settings

Use the last item for other output signals or to define more complex logics.

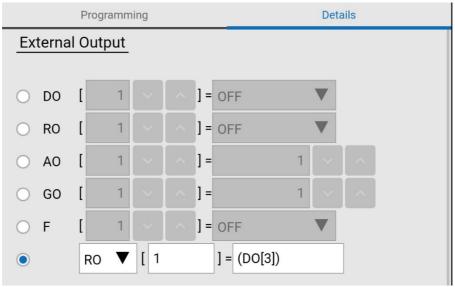


Fig. 4.3.11(c) Text input to define logics for output signals

4.3.12 Registers

The register instruction is used to perform arithmetic operations on registers.



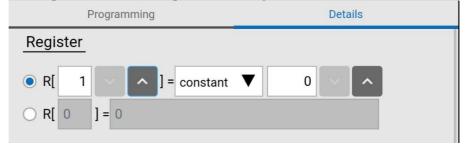


Fig. 4.3.12(a) Registers Icon

Fig. 4.3.12(b) Detail Settings

If you cannot set the contents in the upper item, you can enter text in the lower item.

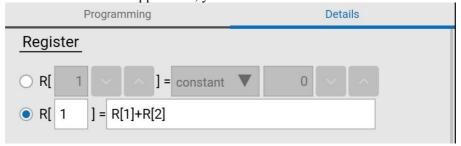


Fig. 4.3.12(c) Text input for register commands

4.3.13 Payload

The payload setting instruction is used to switch the payload data (payload schedule number).





Fig. 4.3.13(a) Payload Icon

Fig. 4.3.13(b) Detail Settings

4.3.14 Frame

The frame instruction is used to change the setting of the Cartesian coordinate system by which the robot works. There are two kinds of frame instructions

- Frame setup instruction The definition of the specified frame is changed.
- Frame select instruction The frame number being selected is changed.

Frame Setup Instruction

The tool frame setup instruction changes the setting of the tool frame specified by the tool frame number in this instruction.

The user frame setup instruction changes the setting of the user frame specified by the user frame number in this instruction.



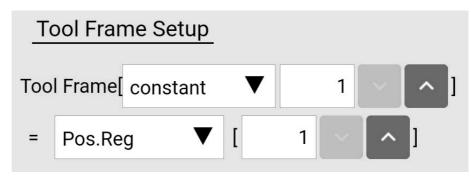


Fig. 4.3.14(a)
Tool Frame Setup Icon

Fig. 4.3.14(b) Detail Settings



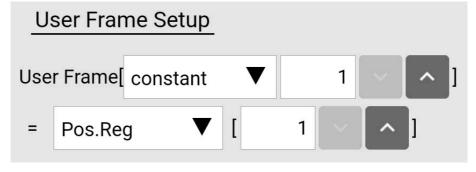


Fig. 4.3.14(c)
User Frame Setup Icon

Fig. 4.3.14(d) Detail Settings

Frame Select Instruction

The tool frame select instruction changes the current tool frame number.

The user frame select instruction changes the current user frame number.



Fig. 4.3.14(e)
Tool Frame Select Icon



Fig. 4.3.14(f) Detail Settings

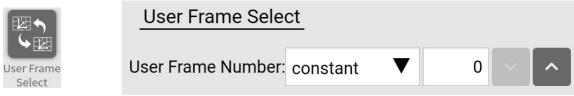


Fig. 4.3.14(g)
User Frame Select Icon

Fig. 4.3.14(h) Detail Settings

4.3.15 Comment

The comment instruction is used to include comments on the program line.



Fig. 4.3.15(a)
Comment Icon

Fig. 4.3.15(b) Detail Settings

The characters set in comment instruction is displayed in the program line as shown in Fig. 4.3.15(c).

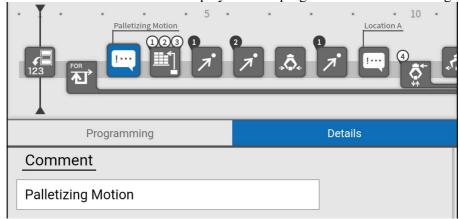


Fig. 4.3.15(c) Program Line Display of Comments

4.3.16 Text Code

The text instruction is used to include program instructions that are not included in the icon instructions.

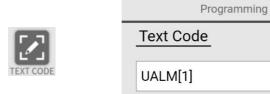


Fig. 4.3.16(a) Text Code Icon

Fig. 4.3.16(b) Detail Settings

Details

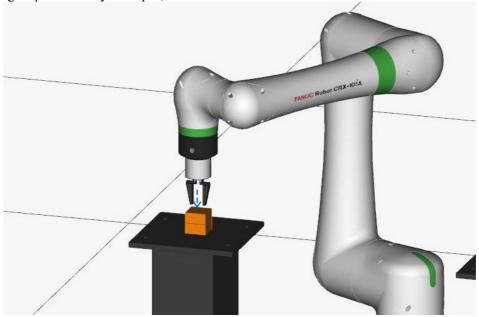
4.3.17 Touch Skip (CRX series only)

Touch Skip instruction is a move instruction that moves toward the destination position and ends the move when detecting contact.

You can use this for such applications to detect the height of overlapping objects, such as Stacking/Destacking.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction.

If the motion group is not only Group 1, this instruction is not available.

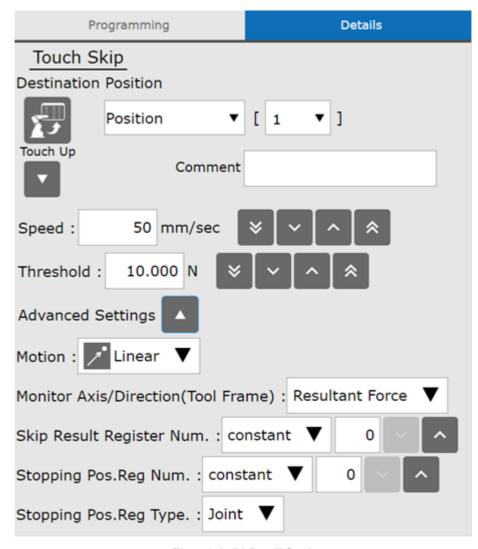


NOTE

- Collaborative robot has a feature of the contact stop function that stops the
 program when detecting a certain amount of external force. If the contact stop
 function works during Touch Skip, Touch Skip instruction will stop with alarming.
- If you use Touch Skip instruction, please reduce the speed so that the force at contact doesn't grow a level that will cause the contact stop.

↑ WARNING

- If it sandwiches a person between the robot and the peripheral equipment, there is a risk of injury.
 - For more information, please refer to NOTE TO DESIGN THE COLLABORATIVE WORKSPACE in MECHANICAL UNIT OPERATOR'S MANUAL.
- If the contact stop function is disabled and Touch Skip instruction is used, the
 robot may not stop even if the external force exceeds the limit, and severe
 personal injury may occur in the unlikely event that it doesn't. When designing a
 robot system that disables the contact stop function, it is necessary to conduct a
 thorough risk assessment of the entire robot system in consideration of the fact
 disabling the contact stop function.



Touch Skip

Fig. 4.3.17(a) Touch Skip Icon

Fig. 4.3.17(b) Detail Settings

In the detail settings, you can apply the following settings.

Item	Description
Destination Position	Teach the destination position.
Speed	Set the speed when moving to the destination position.
Threshold	Set the threshold of external force when detecting contact.
Advanced Settings	See below.

If you touch Advanced Settings button, you will see the items those allows you to change some behavior of this instruction.

You don't need to use them basically, but you can change them.

In Advanced Settings, you can apply the following settings.

Item	Description
Motion	You can change the move type to the destination position to Joint motion. The default is a
	Linear motion.
Monitor	You can specify the component of force/torque for monitoring when detecting contact.
Axis/Direction	You can select from the X, Y, Z components of the force applied to the tool tip in the tool
	frame, the resultant force, or the torque applied to each axis.
	The default is the resultant force.

Item	Description
Skip Result Register Num.	You can output the result of whether it skipped the motion before reaching the destination position to the register of the specified number. The value of the register of the specified number will be 1 if it skips the motion and 0 if it does not.
	The default is 0 that doesn't output the result.
Stopping Pos. Reg Num.	You can output the contact detecting position, the position when it skipped the motion, to the position register of the specified number. It outputs to the position register of the specified number. The default is 0 that doesn't output the result.
Stopping Pos. Reg Format.	You can change the format of the stopping position register to Cartesian. The default is Joint.

4.3.18 Basic Pick/Place

The basic pick/place instruction is used to pick and place workpieces.

Place hand open/close instruction inside the bracket to pick and place workpieces.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction. However, backward execution within bracket is allowed.

If the motion group is not only Group 1, this instruction is not available.

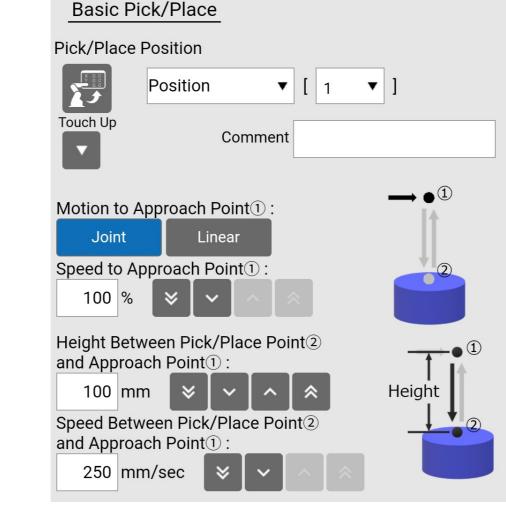


Fig. 4.3.18(a)
Basic Pick/Place Icon

Fig. 4.3.18(b) Detail Settings

In the detail settings, users should apply the following settings:

• Position : Teach the position to pick and place.

• Motion to Approach : Set the motion format up to the approach point.

• Speed to Approach: Set the speed up to the approach point.

Height[mm]: Set the height when moving to and away from the taught position.
Speed[mm/sec]: Set the speed when moving to and away from the taught position.

An example using the Pick/Place instruction is shown in Fig. 4.3.18(c). At the start of the bracket, the robot will move to the taught position defined in the detail settings. At the end of the bracket, the robot will move to the height defined in the detail settings.

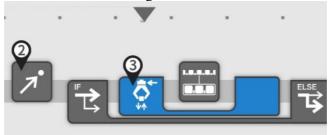


Fig. 4.3.18(c) Basic Pick/Place Instruction

4.3.19 Align

The align instruction is used to align workpieces and to take aligned workpieces. This instruction outputs the stack points and approach/retraction points to the position register. The position register is then used to align workpieces and take aligned workpieces.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction.

If the motion group is not only Group 1, this instruction is not available.

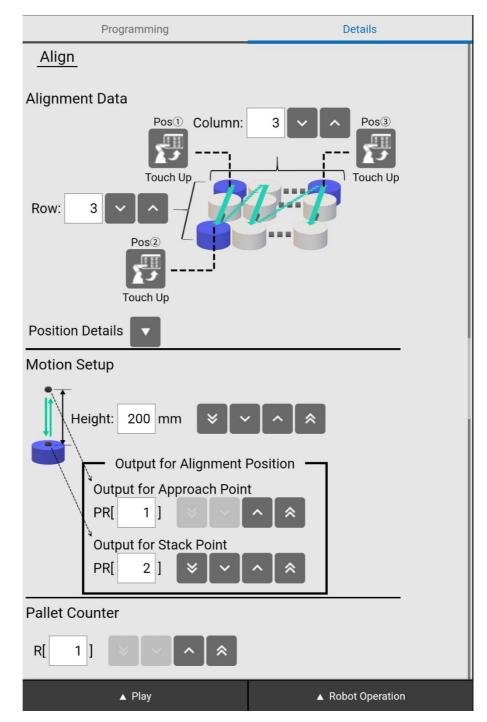


Fig. 4.3.19(a) Align Icon

Fig. 4.3.19(b) Detail Settings

In the detail settings, users should apply the following settings:

• Three Position Points: Users should teach the three positions

Height[mm]: Users should set the height when moving to and away from the stack points.
Position Register: Users should choose the position register for saving the stack points and

Tostion register. Osers should enough the position register for saving the stack

approach/retract points.

• Counter Register: Users should choose a register to count the number of times the align

instruction has been executed.

In order to teach the three position points, move the robot to the three position points and touch the Touch up button at each position point. Users can also directly teach these points in the position detail settings.



Fig. 4.3.19(c) Position Detail Settings

Sample Program

In this sample program, the robot will pick and place workpieces. After the counter register is initialized to 0, the FOR instruction controls the robot to pick and place multiple workpieces.



Fig. 4.3.19(d) Sample Program

4.3.20 Palletize

The palletize instruction is used to stack or unload workpieces by teaching few representative positions.

This instruction outputs the stack points and approach/retraction points to the position register. The position register is then used to palletize workpieces.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction.

If the motion group is not only Group 1, this instruction is not available.

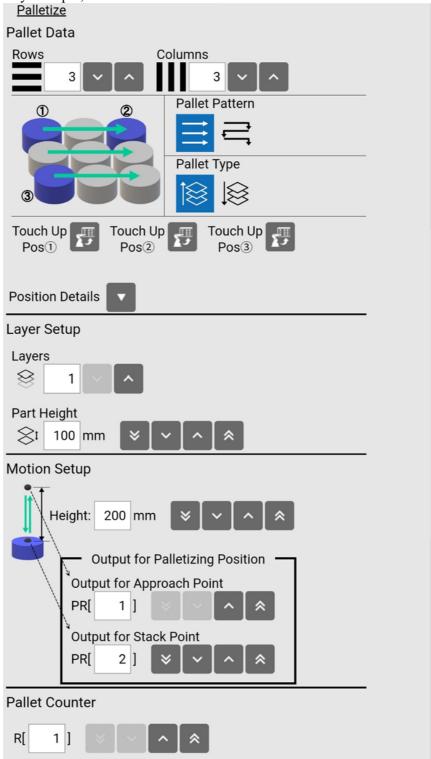




Fig. 4.3.20(b) Detail Settings

In the detail settings, users should apply the following settings:

Rows/Columns: Set the number of work-pieces to line up
 Pallet Pattern: Set the order in which to line the work-pieces
 Pallet Type: Choose between palletization and depalletization

• Three Position Points: Users should teach the three positions shown in detail screen

• Number of Layer: Set the number of layers to palletize / depalletize

• Part Height: Set the work-pieces height

Height[mm]: Users should set the height when moving to and away from the stack points
Position Register: Users should choose the position register for saving the stack points and

approach/retract points

• Counter Register: Users should choose a register to count the number of times the palletize

instruction has been executed

In order to teach the three position points, move the robot to the three position points and touch the Touch up button at each position point. Users can also directly teach these points in the position detail settings. To access the position detail settings, touch the arrow next to the "Position details".

Sample Program

When the user adds palletizing instruction to the program, Fig. 4.3.20(c) will be displayed. If the user selects "Yes" the sample program in Fig. 4.3.20(d) will be inserted. If the user selects "No" only the palletizing instruction is added to the program.

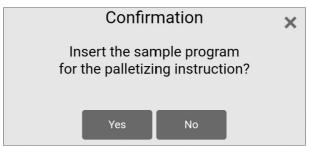


Fig. 4.3.20(c) Palletizing Instruction Popup



Fig. 4.3.20(d) Sample Program

4.3.21 Extended Palletize

The extended palletize instruction is used to stack or unload workpieces by teaching few representative positions. This instruction adds alternate stacking and separator handling functions to the palletizing instruction. This instruction outputs the stack points and approach/retraction points to the position register. The position register is then used to palletize workpieces.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction.

If the motion group is not only Group 1, this instruction is not available.

NOTE

When the stack size of the caller program is the default value this instruction cannot be executed. Please try increasing the stack size from the program select screen in the order of 800, 1000.



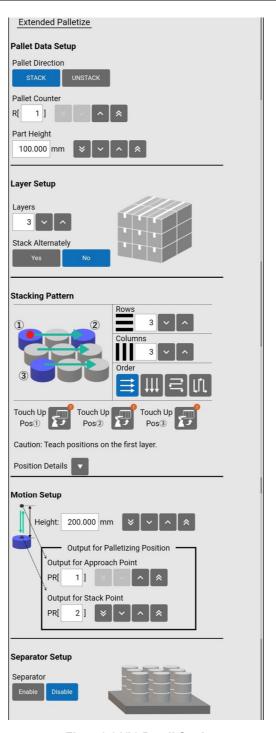


Fig. 4.3.21(a)
Extended Palletize Icon

Fig. 4.3.21(b) Detail Settings

In the detail settings, users should apply the following settings:

- Pallet Type : Choose between palletization and depalletization.
- Counter Register : Set the register number and order in which to line the work-pieces.

• Pallet Type: Choose between palletization and initialize to 0 before executing instruction.

Increments register for each execution of extended palletize instruction.

• Number of Layers : Set the number of layers to palletize / depalletize.

• Part Height : Set the parts height.

• Position Register : Set the position register number for stack, approach, retract positions.

• Stack Alternately: Set to "Yes" to use different patterns to stack alternately.

Rows/Columns: Set the number of work-pieces to line up.
 Pallet Order: Set the order in which to line the work-pieces.
 Three Position Points: Teach the three positions shown in detail screen.

• Separator : Set the usage of separators.

• Separator Start : Enter the number of layers above which user needs to start placing separators.

• Per Separator Layer: Set the number of separators to be placed every other step from the set

number of Separator Start.

• Separator Height: Set height of separator.

• Register for Separator : Set the register number for branching between palletizing motion

and separator handling.

Stack Alternately

Set the usage of alternately stacking with "Yes" or "No".

For the same stacking pattern, the setting screen shown in Fig. 4.3.21(c) (left) will be displayed. For alternately stacking patterns, the setting screen shown in Fig. 4.3.21(c) (right) will be displayed. In order to teach the three position points, move the robot to the three position points and touch the Touch up button at each position point. Users can also directly teach these points in the position detail settings. To access the position detail settings, touch the arrow next to the "Position details".

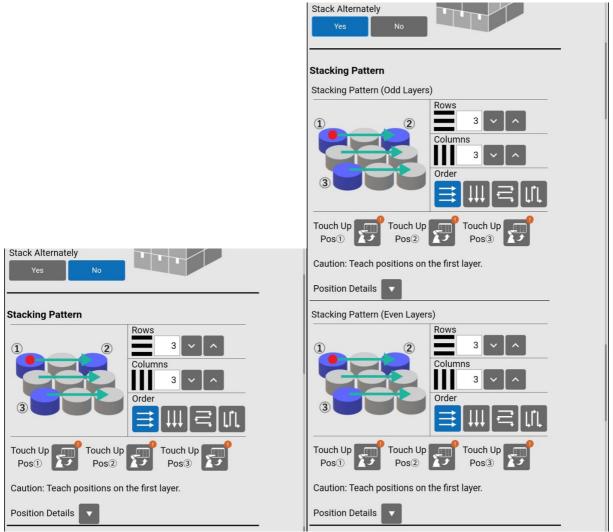


Fig. 4.3.21(c) Set Stacking Method

Separator Settings

Add or remove separators such as slip sheets.

If there are no separators, the setting screen shown in Fig. 4.3.21(d) (left) will be displayed.

If there are separators, the setting screen shown in Fig. 4.3.21(d) (right) will be displayed.

In order to teach the three position points, move the robot to the three position points and touch the Touch up button at each position point. Users can also directly teach these points in the position detail settings. To access the position detail settings, touch the arrow next to the "Position details".

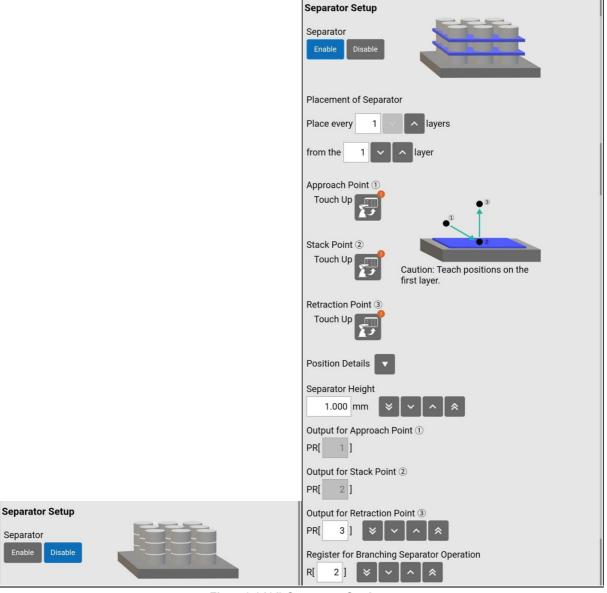


Fig. 4.3.21(d) Separator Settings

Sample Program

When the extended palletizing instruction is added to the program, Fig. 4.3.21(e) will be displayed. When "Yes" is selected, a popup window will appear shown in figure 4.3.21(f). When "No" is selected, only the extended palletizing instruction is added.

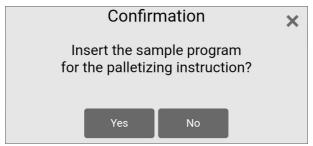


Fig. 4.3.21(e) Extended Palletizing Instruction Popup

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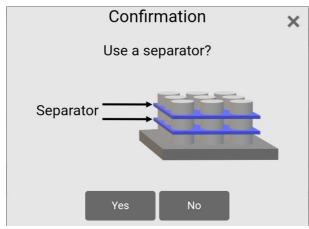


Fig. 4.3.21(f) Separator Usage Popup

When "Yes" is selected in the pop-up of Figure 4.3.21(f), the sample program in Figure 4.3.21(g) will be inserted. When "No" is selected, the sample program in Figure 4.3.21(h) will be inserted.

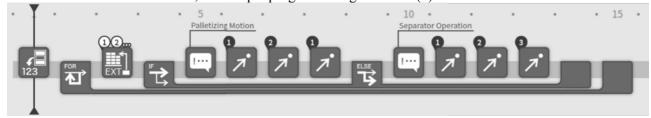


Fig. 4.3.21(g) Sample Program for Separator

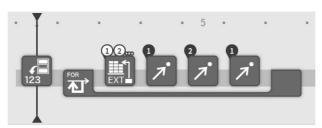


Fig. 4.3.21(h) Sample Program for no Separator

4.3.22 Open Hand

Open hand instruction is used to open the robot hand.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction.



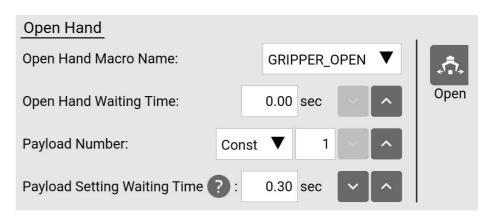


Fig. 4.3.22(a) Open Hand Icon

Fig. 4.3.22(b) Detail Settings

In the detail settings, users should apply the following settings:

• Open Hand Macro name: Set the macro name to execute and open the robot hand

• Open Hand Waiting Time: Set the time to wait until hand is opened

• Payload Number: Set the payload number to switch the payload data

• Payload Setting Waiting Time: Set the time to wait until payload is switched.

If the payload is switched when gravity compensation is enabled, the robot will move for a certain period of time to correct he amount of arm deflection. The robot may vibrate if the appropriate payload setting waiting time is not set.

If the user touches Open, the pop-up below will be displayed.

If the user selects "Yes" the macro set in the open hand instruction will be executed to open hand.

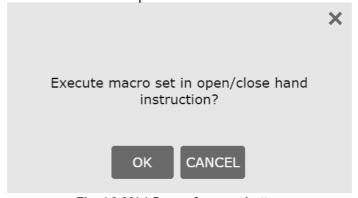


Fig. 4.3.22(c) Popup for open button

4.3.23 Close Hand

Close hand instruction is used to close the robot hand.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction.



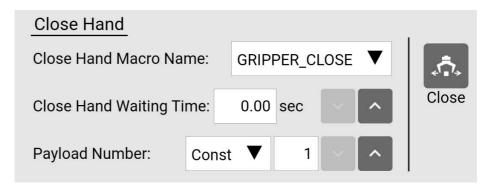


Fig. 4.3.23(a)
Close Hand Icon

Fig. 4.3.23(b) Detail Settings

In the detail settings, users should apply the following settings:

Macro name: Set the macro name to execute and close the robot hand
Payload Number: Set the payload number to switch the payload data
Waiting Time: Set the time to wait while hand is closed

If user touches Close, the pop-up below will be displayed.

If the user selects "Yes" the macro set in the close hand instruction will be executed to close hand.

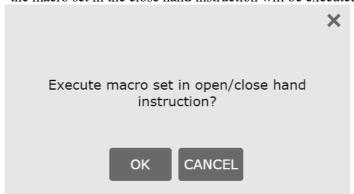


Fig. 4.3.23(c) Popup for close button

4.3.24 Path Teach

Path teach instructions can be used to record the coordinates of the robot being moved in manual guided teaching at regular intervals.

Drag and drop the locus teaching icon to display the recording setting and recording wizard.

Please follow the wizard.

This command is available only for robots that can use Manual Guide teaching.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction. However, backward execution within bracket is allowed.

If the motion group is not only Group 1, this instruction is not available.

NOTE

This instruction is available only for robots that can use manual guided teaching. This instruction is not available if the robot has extended axis.

This instruction is not available in tracking program.

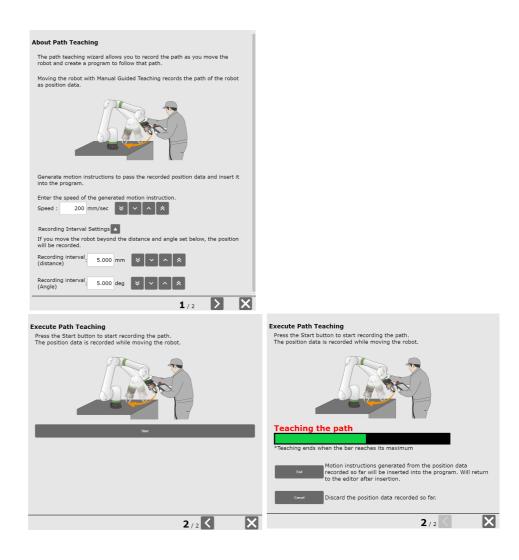




Fig. 4.3.24(a)
Path Teach Icon

Fig. 4.3.24(b) Wizard setting

4.3.25 Basic Arc

Basic Arc instruction is available if you have included the optional functions for arc welding.

You can execute arc welding by setting weld start/end position, weld mode, weld schedules.

Perform are welding from the start position to the end positon via some weld points.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction. However, backward execution within bracket is allowed.

If the motion group is not only Group 1, this instruction is not available.

NOTE

If the Multi-pass Weld function option is installed, it is not displayed in the icon pallet. In that case, "Weld Start(Motion)" and "Weld End(Motion)" are taught instead of "Basic Arc" in Manual Guided Teaching Handle.

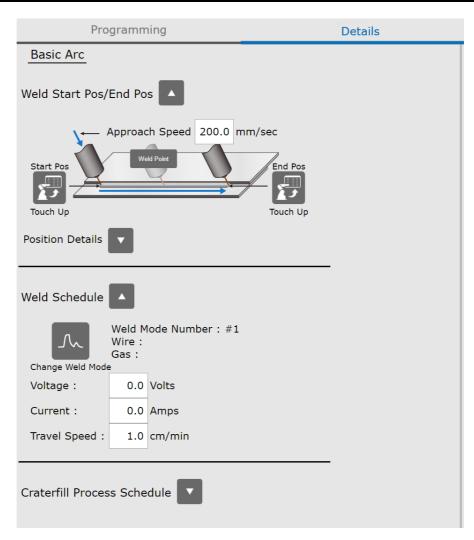




Fig. 4.3.25(a)
Basic Arc Icon

Fig. 4.3.25(b) Detail Settings

4.3.26 Basic Weave

Basic Weave instruction is available if you have included the optional functions for arc welding. Add weaving motion to Basic Arc instruction and perform arc welding.

Backward execution is prohibited from this instruction. Also, backward execution is prohibited during the execution of this instruction. However, backward execution within bracket is allowed.

If the motion group is not only Group 1, this instruction is not available.

NOTE

If the Multi-pass Weld function option is installed, it is not displayed in the icon pallet.

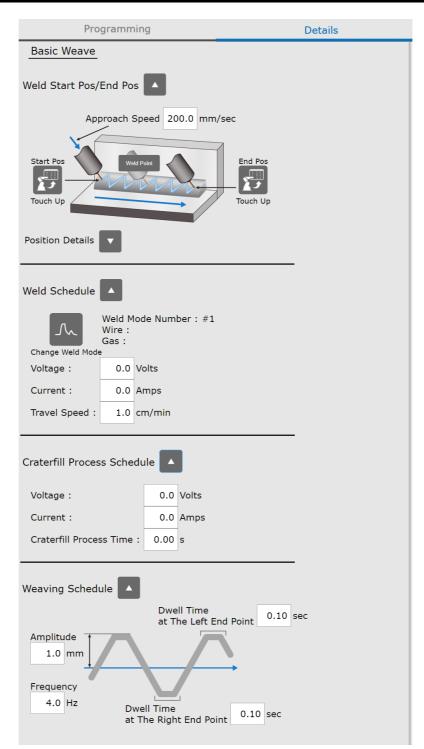




Fig. 4.3.26(a)
Basic Weave Icon

Fig. 4.3.26(b) Detail Settings

4.3.27 Weld Point(Liner)

This weld point instruction is used in the Basic Arc bracket or Basic Weave bracket. Set the transit point. Move linearly from the previous position to the weld point set by this instruction. Move at the speed set as the Travel Speed of the Basic Arc or the Basic Weave.



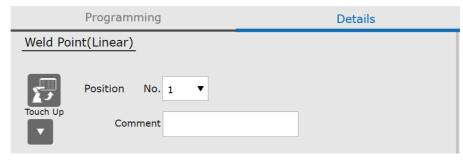


Fig. 4.3.27(a) Weld Point(L) Icon

Fig. 4.3.27(b) Detail Settings

4.3.28 Weld Point(Circle)

This weld point instruction is used in the Basic Arc bracket or Basic Weave bracket.

Set the transit point. Move the previous position and the two weld points set by this instruction in a circular motion. Move at the speed set as the Travel Speed of the Basic Arc or the Basic Weave.

*Note that this instruction operates at a speed exceeding the speed set by the speed clamp function. (not support speed clamp)

⚠ WARNING

This instruction may operate at a speed exceeding the speed set by the speed clamp function. (not support speed clamp)





Fig. 4.3.28(a) Weld Point(C) Icon

Fig. 4.3.28(b) Detail Settings

4.3.29 HandleTeach

HandleTeach is the instruction to specify the welding path using the handle attached to the CRX tip. If the motion group is not only Group 1, this instruction is not available.

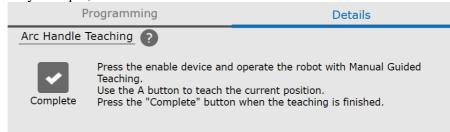


Fig. 4.3.29(a) HandleTeach Icon

Fig. 4.3.29(b) Detail Settings

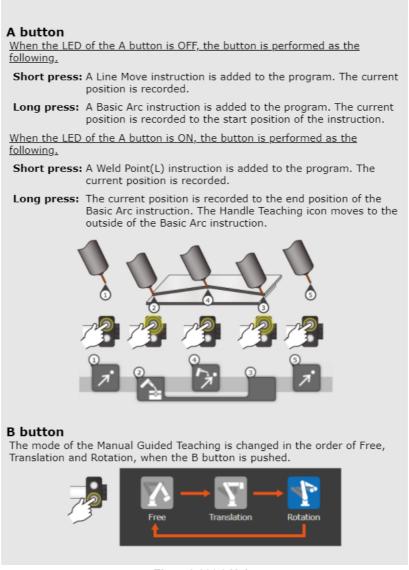


Fig. 4.3.29(c) Help

4.3.30 Weld Start(Motion)

Weld Start(Motion) is an instruction to move to the welding start position with a linear motion and start welding. Execute welding with the set Weld Procedure and Weld Schedule. Linear Motion can be set at the Weld Start(Motion). Refer to "9.5 Weld Start(Motion/Standalone)", "Weld End(Motion/Standalone)".

NOTE

- 1 Screen structure differs depending on the installed option.
- 2 It is displayed in the icon palette if the Multi-pass Weld option is installed.



Fig. 4.3.30(a)
Weld Start(Motion) icon

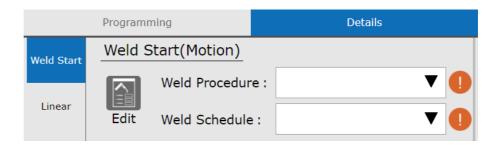


Fig. 4.3.30(b) Detail Settings of Weld Start

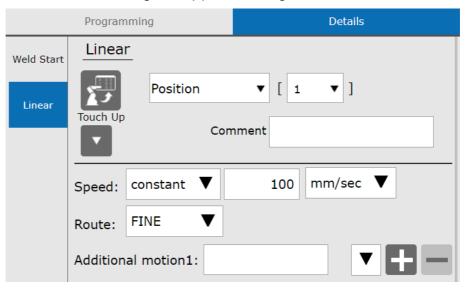


Fig. 4.3.30(c) Detail Settings of Linear Motion

NOTE

With Weld Start(Motion) icon, travel speed of the linear motion can be set in addition to the setting items with Weld Point(Linear) icon.

4.3.31 Weld Start(Standalone)

Weld Start(Standalone) is an instruction to start welding. Execute welding with the set Weld Procedure and Weld Schedule. The Linear Motion cannot be set with the Weld Start(Standalone). Refer to "9.5 Weld Start(Motion/ Standalone)", "Weld End(Motion/ Standalone)".

NOTE

- 1 Screen structure differs depending on the installed option.
- 2 It is displayed in the icon palette if the Multi-pass Weld option is installed.



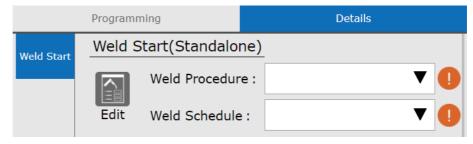


Fig. 4.3.31(a)
Weld Start(Standalone) icon

Fig. 4.3.31(b) Detail Settings of Weld Start

4.3.32 Weld End(Motion)

Weld End(Motion) is an instruction to move to the welding end position with a linear motion and end welding. Execute welding with the set Weld Procedure and Weld Schedule. Linear Motion can be set at the Weld End(Motion). Refer to "9.5 Weld Start(Motion/Standalone)", "Weld End(Motion/Standalone)".

NOTE

- 1 Screen structure differs depending on the installed option.
- 2 It is displayed in the icon palette if the Multi-pass Weld option is installed.



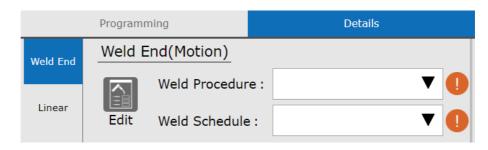


Fig. 4.3.32(a)
Weld End(Motion) icon

Fig. 4.3.32(b) Detail Settings of Weld End

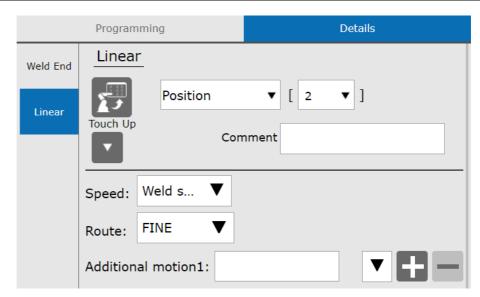


Fig. 4.3.32(c) Detail Settings of Linear Motion

NOTE

With Weld End(Motion) icon, travel speed of the linear motion can be set in addition to the setting items with Weld Point(Linear) icon.

4.3.33 Weld End(Standalone)

Weld End(Standalone) is an instruction to end welding. Execute welding with the set Weld Procedure and Weld Schedule. The Linear Motion cannot be set with the Weld End(Standalone). Refer to "9.5 Weld Start(Motion/Standalone)", "Weld End(Motion/Standalone)".

NOTE

- 1 Screen structure differs depending on the installed option.
- 2 It is displayed in the icon palette if the Multi-pass Weld option is installed.



Fig. 4.3.33(a)
Weld End(Standalone) icon

Fig. 4.3.33(b) Detail Settings of Weld End

Details

4.3.34 Multi-pass Welding

By setting the Weld Procedure (Multi-pass data type) and the Start Register number, instructions that is needed for the Multi-pass welding will automatically be expanded to the program line. Refer to "9.7 MULTI-PASS WELDING".

NOTE

- 1 Screen structure differs depending on the installed option.
- 2 It is displayed in the icon palette if the Multi-pass Weld option is installed.

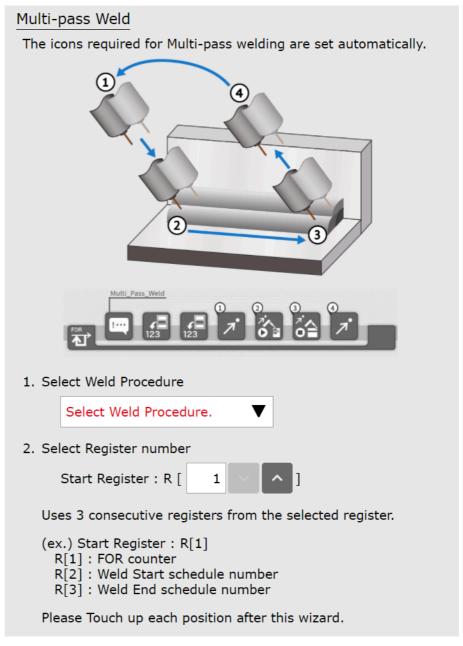


Fig. 4.3.34(a) Multi-pass Weld icon

Fig. 4.3.34(b) Wizard

4.3.35 Variable Payload Compensation

Variable Payload Compensation is for collaborative robots when used with application that has loads acting on the robot.

For the motion within the bracket, this instruction records the load acting one the robot, then compensates the recorded load in the subsequent execution, thus avoiding the payload error that can be caused by detecting the loads as external force.

To use the instruction, please enable the "Use Payload Comp" from the Collaborative robot tab in DCS menu

For restrictions of the Variable Payload Compensation, please also refer to the section for the VARIABLE PAYLOAD COMPENSATION FUNCTION in the OPERATOR'S MANUAL for Collaborative Robot Function.



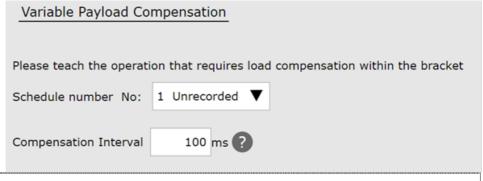


Fig. 4.3.35(a)	
Payload Comp Ice	on

Fig. 4.3.35(b) Detail Settings (Before Record)

Item	Description
Schedule number	Teach different number for different motion to compensate.
Compensation Interval	Interval for compensation. It can record for interval x 1000.

Record:

- 1. Teach motion instructions to compensate within the Payload Comp bracket, and set schedule number and compensation interval.
- 2. Confirm that payload settings and actual loads on the robot is same as those to compensate.
- 3. Execute the program.

When the load is recorded, Details change. (When update is disabled (default), threshold and rate are not displayed.)

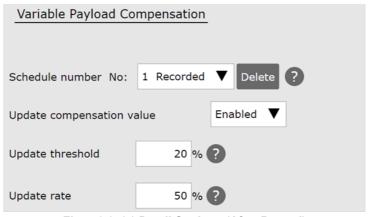


Fig. 4.3.35(c) Detail Settings (After Record)

Item	Description
Schedule number	Teach different number for different motion to compensate.
Update compensation value	Disabled: compensate with the recorded value. Enabled: update the compensation value while compensating with the recorded value. When enabled, it takes more time than when disabled.
Update threshold	The threshold for updating the compensation value. When the difference between the external force during the execution and the recorded compensation value is always less than the threshold (% of the contact stop threshold) within the bracket, the compensation value is updated. When set to 0, it will not be updated.
Update rate	The percentage with which to update the compensation value. It sets the percentage of the external force during the execution, with which to update the compensation value. e.g. set to 10 % and the new compensation value will be 90% of the old value + the 10% of the external force. Set to 100% and the external force will be the new compensation value. Set to 0% and it will not be updated.

Compensate:

1. Execute the program with the recorded schedule, and loads will be compensated.

Update:

When the loads changed, enable Update compensation value, and update the compensation data.

- 1. Enable "Update compensation value" and set "Update threshold" and "Update rate."
- 2. Execute the program in the same way as for record or compensation.

4.3.36 Switch to Low Sensitivity (CRX series only)

The instruction "Switch to Low Sensitivity" changes the Force Limit Sensitivity from NORMAL to LOW temporarily. This instruction can be used for force applying applications. The force limit sensitivity changes to LOW within the bracket.

For restrictions of the Force Limit Sensitivity, please also refer to the section for the Force Limit Sensitivity in the OPERATOR'S MANUAL for Collaborative Robot Function.

NOTE

- 1 To use this instruction, please set Force Limit Sensitivity to INST from the Collaborative robot screen in DCS menu.
- 2 The force limit sensitivity is kept NORMAL in conditions below
 - 2.1 The program is aborted.
 - 2.2 Backward execution
 - 2.3 The program started from the line in the middle of the bracket.



Fig. 4.3.36(a) Switch to Low Sensitivity Icon <u>B-84274EN/04</u> 4. **TEACHING**

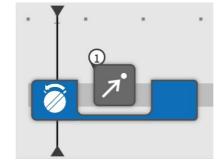


Fig. 4.3.36(b) Switch to Low Sensitivity Insctruction

4.4 ROBOT GRAPHICS

In Robot Graphics area, users can check the current position and attitude of the robot as graphics.

4.4.1 Robot Graphics Menu

Users can operate the Robot Graphics in the menu.

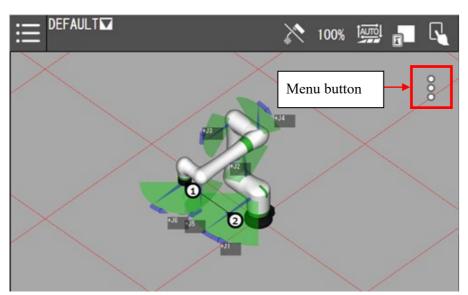


Fig. 4.4.1(a) Robot Graphics area

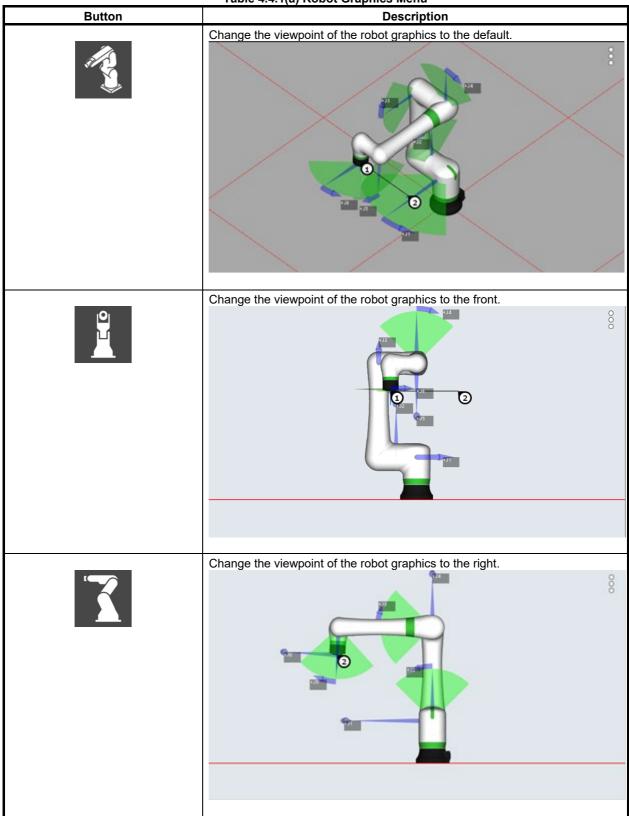
Press menu button to display the Robot Graphics Menu.

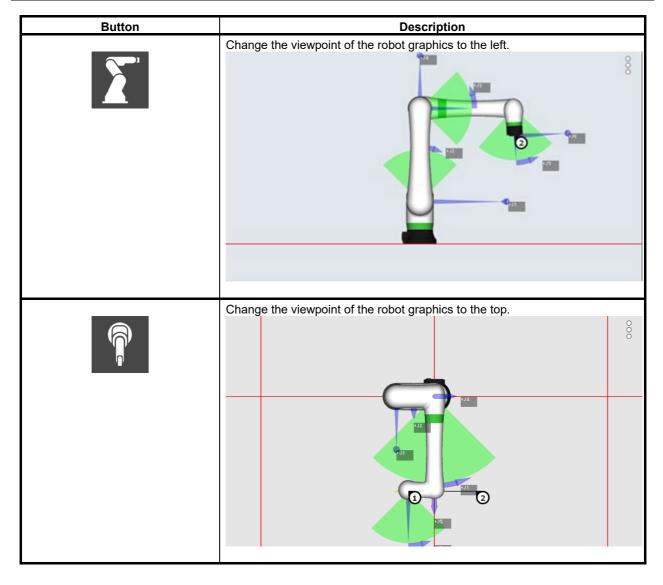


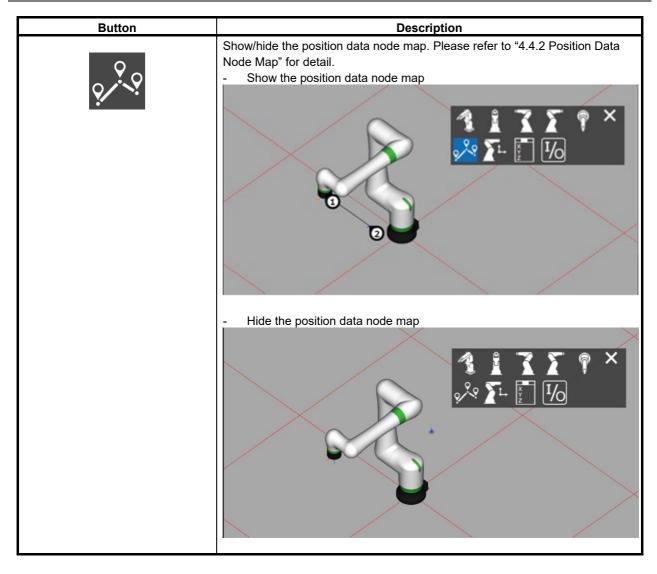
Fig. 4.4.1(b) Robot Graphics Menu

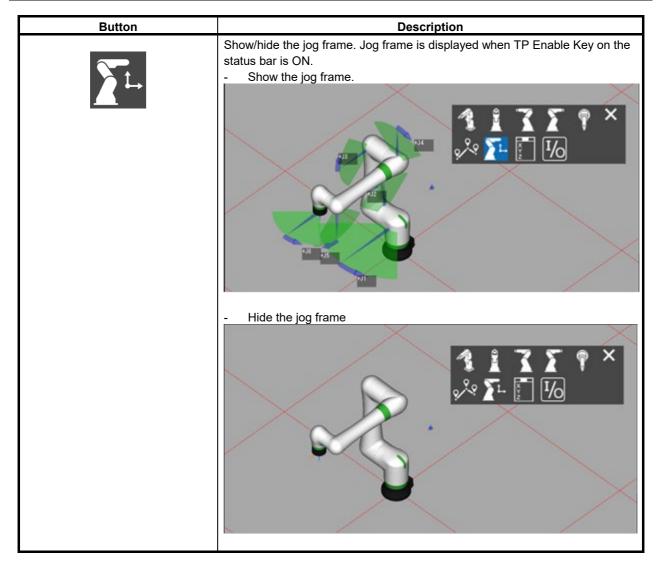
In Robot Graphics Menu, users can do the following operation.

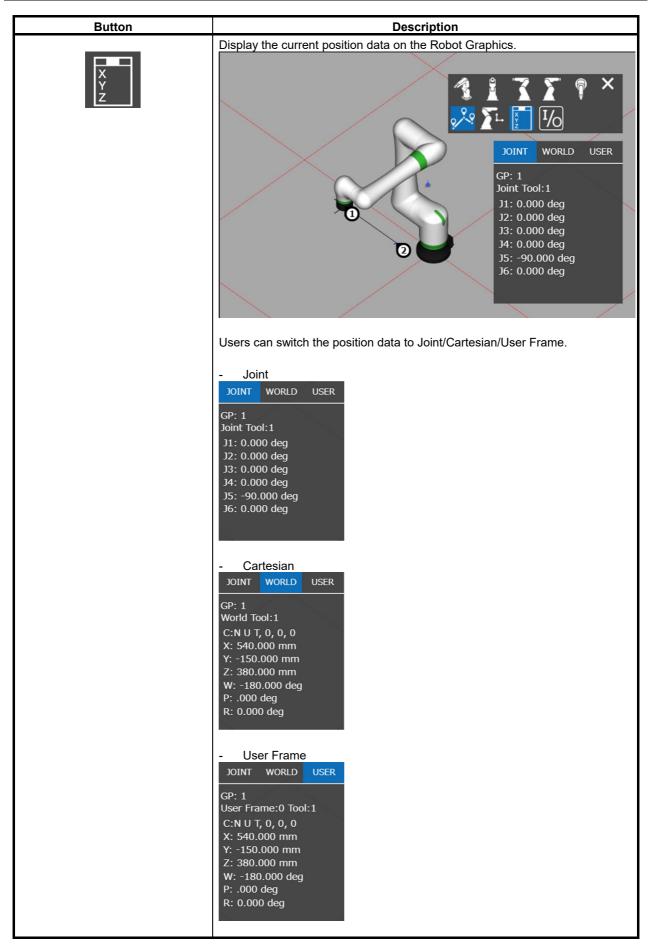
Table 4.4.1(a) Robot Graphics Menu

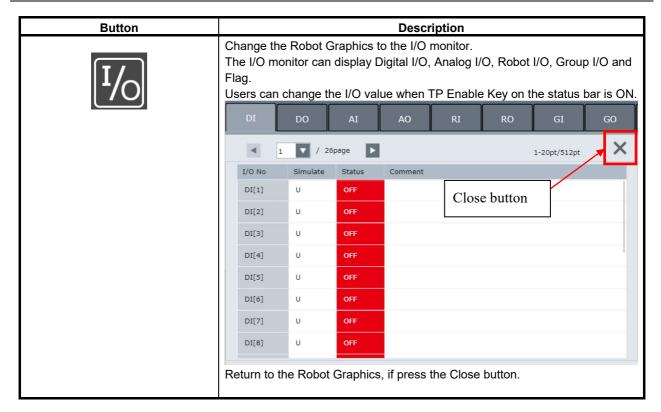












4.4.2 Position Data Node Map

Robot Graphics shows all positions of the specific motion instruction as nodes and connect them with lines. Each node has its position number.

The motion instructions supporting node map are as follows.

- Linear motion
- Joint motion

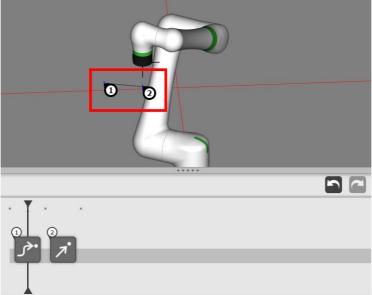


Fig. 4.4.2(a) Position data node map

The design of positon data displayed in Robot Graphics varies according to the kinds of position data.





Fig. 4.4.2(b) Position data

Fig. 4.4.2(c) Positon Register

⚠ CAUTION

- 1 The position data of the instruction that does not support node map are not displayed.
- 2 Node map connects two nodes of the supported motion instruction in descending order. Therefore, it is sometimes different from the real motion path.
- 3 When INC, OFFSET, or Position Register is used in a motion statement or when frame number is changed in a program, the node will be displayed in the different position from the actual position.

4.5 PROGRAM FILTER FUNCTION

This function filters program list displayed on program list screen. Only programs starting from registered word can be displayed on program list screen.

4.5.1 Register Program Name

1. Press Select Program in the Tablet UI menu to display the Select Program screen.

2. Press the "Add" button in Select Program screen.

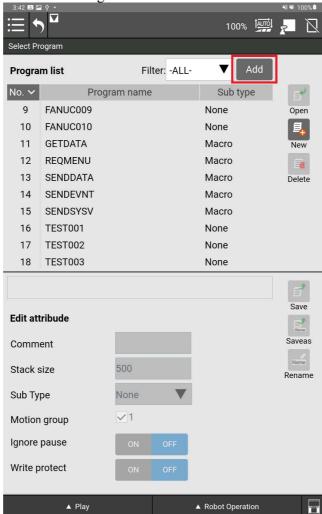


Fig. 4.5.1(a) Program Select Screen

<u>B-84274EN/04</u> 4. **TEACHING**

3. Press the text input field in table and input characters for program filter. The maximum number of characters are 21.

4. Press the "Save" button and register the program name.

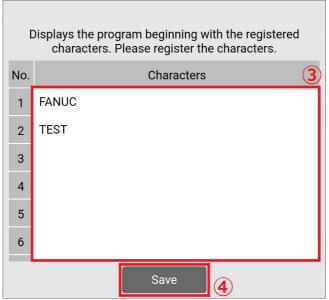


Fig. 4.5.2(b) Program Name Input Popup

4.5.2 Filter Program Name

1. Press Select Program in the Tablet UI menu to display the Select Program screen.

2. Press the list field next to the "Add" button in Select Program screen.

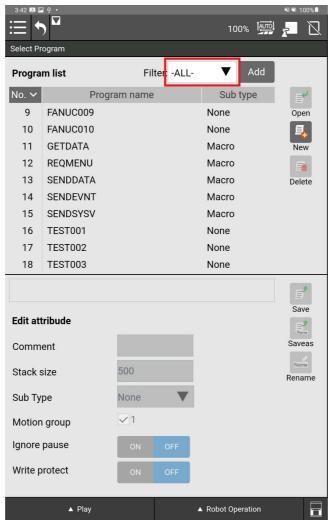


Fig. 4.5.2(a) Program Select Screen

3. Select the filter for program name from the list.

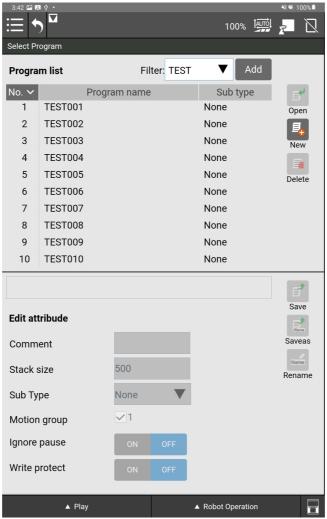


Fig. 4.5.2(b) Program Filter

4.6 LIMITATIONS OF TABLET UI EDITOR

The following limitations apply to the Tablet UI Editor.

- The program that is set with a motion group cannot be edited when using the robot other than the 6 axes robot.
- The program that is set with a motion group cannot be edited when using the multi-group system.
- The program that has more than 880 icons cannot be displayed.

5 EXECUTING A PROGRAM

5.1 EXECUTING A PROGRAM

Touch the "Play" key on the bottom left of the screen to show the Execution Panel. Various buttons in the Execution Panel allow the user to control the execution process of a program.

What is shown in the Execution Panel depends on the status of the TP enable key represented at the status bar.

When the TP enable key is turned on, the following Execution Panel is shown.

A program can be executed by sliding the Run button to the right. While the Run button is kept to the right, the program will continue executing. To pause the program, release the Run button or slide it back to the center.

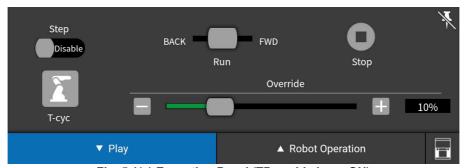
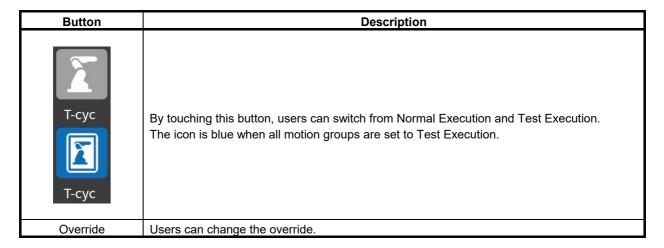


Fig. 5.1(a) Execution Panel (TP enable key: ON)

Table 5.1(a) Buttons in the Execution Panel

Button	Description
BACK Run	To execute the program forwards, slide the Run button to the right. To execute the program backwards, slide the Run button to the left. To pause a program, slide the Run button back to the center. However, some instructions cannot be executed backwards.
Stop	By touching this button, the current execution will stop.
Step Disable Step Enable	When this button is disabled, all steps of the program will be executed continuously. When this button is enabled, the program will be executed step by step.



When the TP enable key is turned off, the following Execution Panel is shown.

When you slide the Run button, a warning dialog will show. By touching "Yes" in the warning dialog, the program will start executing.

Note that in this execution panel, the program will continue executing even though the Run button is released. Furthermore, even if the user switches to a different screen, the program will still continue executing in the background. To pause the program, touch the Pause button.

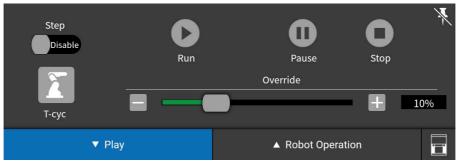


Fig. 5.1(b) Execution Panel (TP enable key: OFF)

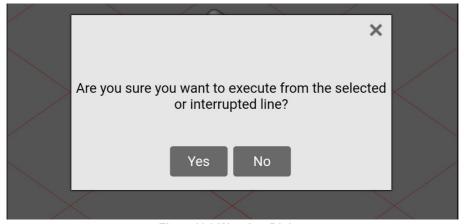


Fig. 5.1(c) Warning Dialog

Table 5.1(b) Buttons in the Execution Panel

Button	Description
Run	By touching this button, all steps of the program will be executed continuously. In other words, the program will be executed in the Continuous test mode.

Button	Description
Pause	By touching this button, the current execution will halt.
Stop	By touching this button, the current execution will stop.
Step Disable Step Enable	When this button is disabled all steps of the program will be executed continuously. When this button is enabled, the program will be executed step by step.
T-cyc T-cyc	By touching this button, users can switch from Normal Execution and Test Execution. The icon is blue when all motion groups are set to Test Execution.
Override	Users can change the override.

Users can change which line to start the execution by sliding the Execution bar above the program line. After moving the Execution bar to the user's preferred line, touch the Run button and a warning dialog should show. Choose OK and touch the Run button again to start the execution.



Fig. 5.1(d) Move the Execution bar

When a program is executed, an icon in the status bar will change like the following:



Fig. 5.1(e) Execution Status

⚠ WARNING

Check the program and the program line before executing the program.

The following pop-up will show whenever the execution switches between Normal Execution and Test Execution.

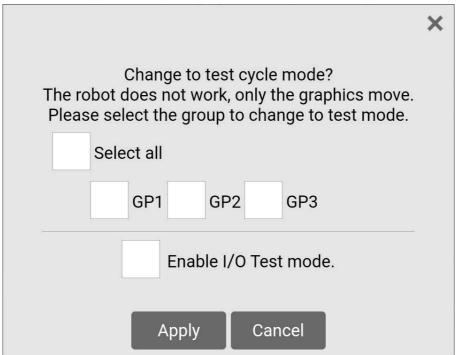


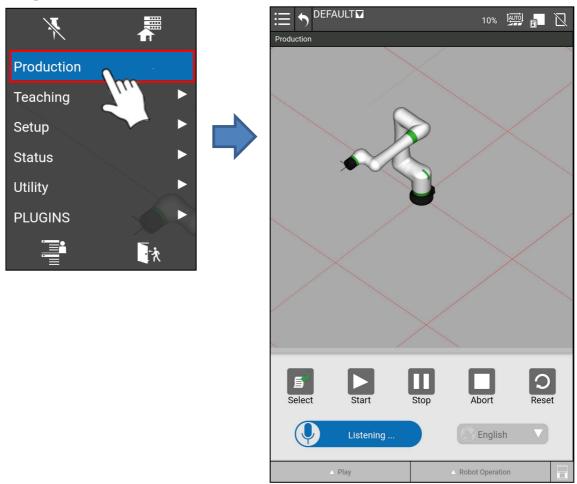
Fig. 5.1(f) Test Execution Mode and I/O Test Mode

Changes the specified motion group to the test execution mode. Check the motion group to be changed to the test execution mode and apply. To set all the operation groups to the test execution mode check "Select all".

The checkbox for "Enable I/O Test mode" allows users to specify whether to communicate with peripheral devices via Digital I/O, Analog I/O, Group I/O and Robot I/O signal lines. By enabling I/O Test Mode, the robot will not send or receive Digital I/O and Analog I/O signals with peripheral devices. All the signals will be given the simulated flag (S) and these flags cannot be released until the I/O Test Mode is disabled. To disable the I/O Test mode, touch the T-cyc button after switching to Test Execution and then leave the checkbox unchecked for "Enable I/O Test mode".

5.2 PRODUCTION SCREEN

By touching "Production" from the CRX menu, the Production screen will be display. On this screen, you can select, execute, pause, abort programs, and reset alarms. Each button can be operated by touch or voice input.



5.2.1 Preparation

The following preparations are required to use voice recognition on the Production screen. Preparations require the tablet device to be connected to the Internet.

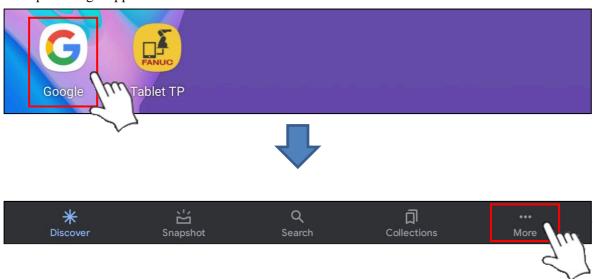
NOTE

- The robot software version V9.40P/32 or later is required.
- Tablet TP app V1.16 or later is required.
- · This screen is displayed only with CRX series robot.
- · Voice recognition is available in Japanese and English.

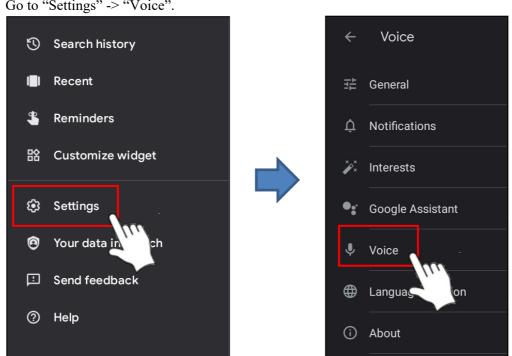
Procedure Install language data for voice recognition

Step

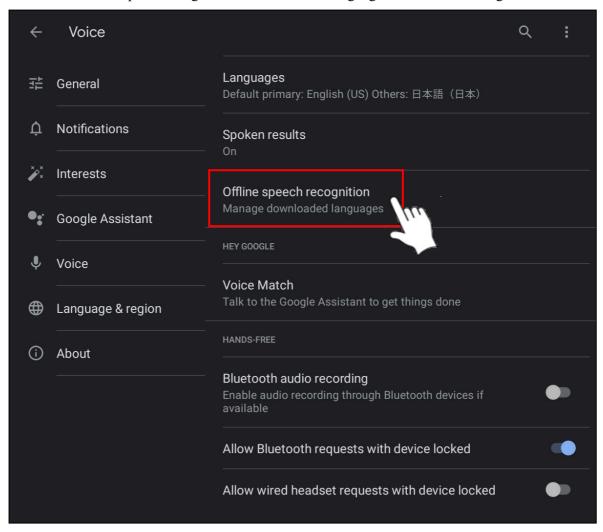
- Connect the tablet device to the Internet.
- Open Google app and select "More".



Go to "Settings" -> "Voice". 3



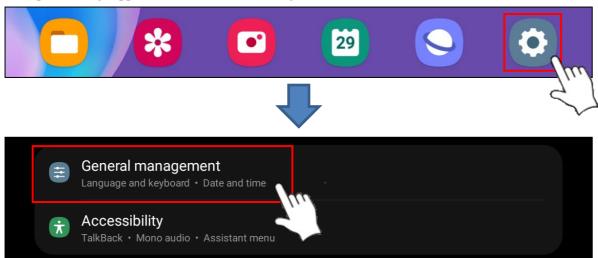
4 Select "Offline speech recognition" and download language data for voice recognition.



Procedure Install language data for text-to-speech

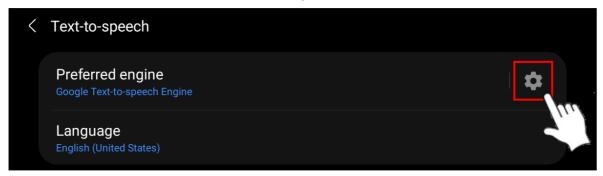
Step

- Connect the tablet device to the Internet.
- 2 Open Settings app and select "General management".



3 Select "Text-to-speech" and open setting for "Preferred engine".





4 Select "Install voice data" and download language data for text-to-speech.



5.2.2 Operation

When the Production screen is displayed for the first time, the pop-up will appear to confirm permission to record audio. Please select "While using the app" or "Only this time". If you select "Deny", voice recognition is not available.



If audio recording is allowed, the Production screen will be display with voice recognition enabled. The Execution panel, the Robot Operation panel, and Key Sheet cannot be displayed on the Production screen. The description and usage of each icon is described in Table 5.2.2.

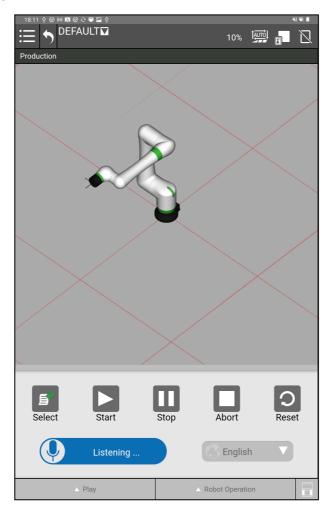


Table 5.2.2 Production Screen Layout

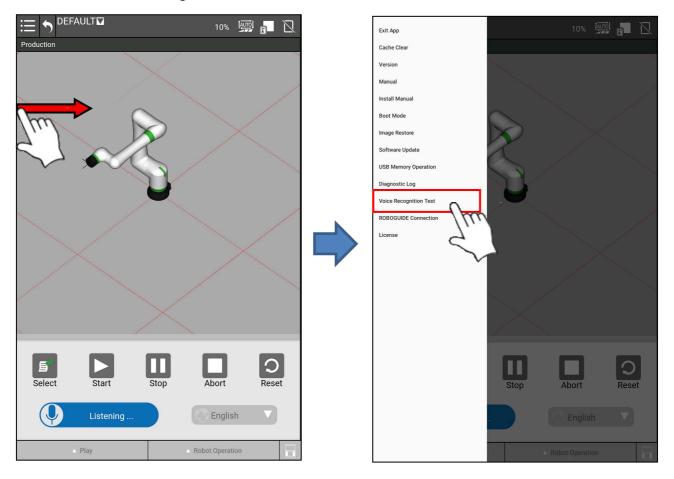
Item Description Select button Touch the select button to display a list of programs created pop-up. Select a program from the pop-up to change the current program. × Select program Program name Comment DEFAULT 2 GETDATA Get PC Data 3 REQMENU Request PC ... 4 **SENDDATA** Send PC Data SENDEVNT Send PC Event 5 Cancel The following voice input commands are supported. "OK FANUC Select <comment>" Select Select the program with matching the program comment. "OK FANUC Select <number>" Select the program with matching the program number. "OK FANUC Select" Display a list of programs created pop-up. Voice input commands during pop-up display "Next" "Previous" Scroll the list. "OK" Select the program at the cursor position and close the list. "Cancel" Close the list. "<number>" Position the cursor on the program with matching the program number. Start button Touch the start button to display a waning dialog. By touching the "Yes" in warning dialog, the currently selected program will start execution. × Do you want to start a program? The following voice input commands are supported. "OK FANUC Start" Starts execution of the currently selected program. Voice input commands during a warning dialog display "Yes" Starts execution of the currently selected program and close a warning dialog. "No" Close a warning dialog.

Item	Description
Stop	Stop button Touch the stop button to pause the current execution.
	The following voice input commands are supported. • "OK FANUC Stop" Pause the current execution.
	Abort button Touch the abort button to stop the current execution.
Abort	The following voice input commands are supported. • "OK FANUC Abort" Stop the current execution.
Reset	Reset button Touch the reset button to recover from the alarm.
	The following voice input commands are supported. • "OK FANUC Reset" Recover from the alarm.
Listening Disabled	Voice recognition status icon Touch the voice recognition status icon to enable/disable voice recognition. Blue: voice recognition is enabled Gray: voice recognition is disabled
English Japanese English	Voice recognition language selection box Touch voice recognition language selection box to display a list of voice recognition language. Accepts voice input commands in the selected language. You can switch languages only when voice recognition is disabled.

5.2.3 Voice Recognition Test Mode

When voice recognition is enabled on the Production screen, you can switch to the voice recognition test mode by following the steps. You can check the recognition results by voice input during the voice recognition test mode. During this mode, voice input commands are not executed.

Slide the left end of the screen towards the right to display the drawer menu. Select "Voice Recognition Test" from the drawer menu.



2 The pop-up for voice recognition test is display.

The recognition results by voice input will be displayed on this pop-up.



6 PLUGIN FUNCTION

6.1 OVERVIEW OF PLUGIN FUNCTION

The Plugin function provides the way for the user to load the Plugin software, which is provided by a peripheral equipment supplier, to a FANUC robot. Together with the standardized mechanical and electrical interface, this feature makes the connection and installation of peripheral equipment simple and easy.

Fig. 6.1 (a) shows the overview of the plugin software. This uses a gripper as an example, but the plugin may be provided for any application, such as sensor system, vision system, and so forth.

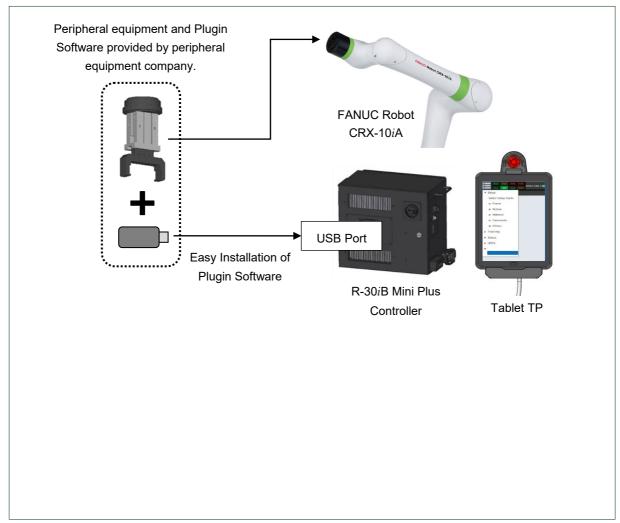


Fig 6.1 (a) Overview of Plugin Software Installation

The following two screens are what the user would see. Installation of the plugin software, and its management can be done in these screens.

Install screen

This screen enables the user to install the Plugin software using a USB memory.

Plugin List screen

This screen shows a list of the installed plugins and detail profile information. This screen also let you uninstall the installed plugin.

↑ CAUTION

- 1 When connect the peripheral device compatible to Plugin, please ensure to complete the installation of plugin software before connecting the device to EE connector. If you connect the device before installation, the device might be broken
- 2 When insert or remove the peripheral device connected to the EE connector, please ensure to turn off the robot controller.

6.2 INSTALL SCREEN OF PLUGIN

A plugin software that has been developed by a peripheral equipment provider can be easily installed using a USB memory. Installation of plugin software is done in the "Install" screen. The screen shows the detail information of the plugin software to be installed, such as the name of the provider of the plugin, the name of the equipment supported, software version number, etc. By installing a plugin software, new screens specifically for the equipment and new program instructions to control the equipment may be added, and also the system may be set up for the equipment, such as tool frame, payload setting, etc.

The following shows the procedure to install a plugin.

Procedure Installing a Plugin Software

Procedure

1 Tap the menu icon on the status bar, and you will see the menu similar to the following.



Fig 6.2 (a) Menu displayed when the menu icon is tapped (English / Japanese)

Tap the "Install" item under "Plugins", and you will see the "Install" screen as shown in Fig. 6.2 (b). The screen shows the information that is stored in the USB memory, such as the name of the plugin install package file, and the detail information of the plugin software.



Fig 6.2 (b) Install Screen (English / Japanese)

- 3 Tap the "Install" button at the bottom right of the screen to start the installation process.
- 4 The following screen will be displayed when the installation processing is done.

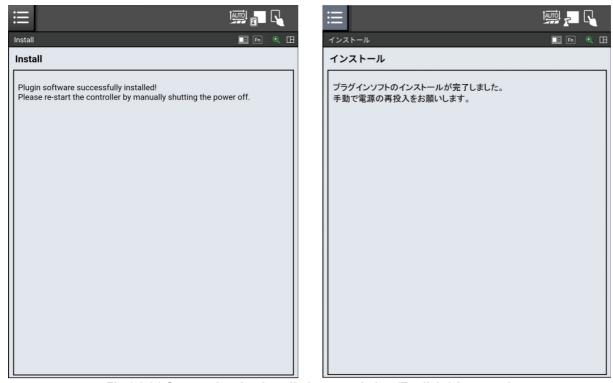


Fig 6.2 (c) Screen showing Installation completion (English / Japanese)

5 Please re-start the controller by manually shutting down the controller power.

6.3 PLUGIN LIST SCREEN

The Plugin List Screen shows a list of installed Plugin software with the detail information of each plugin. You may also uninstall (delete) a plugin software on this screen.

- 1 A list of installed plugin software
- 2 Detail information of a selected plugin software
- 3 Uninstall operation of an installed plugin software

Procedure Displaying a List of Installed Plugin Software

Procedure

1 Touch the menu icon on the status bar, and you will see the menu similar to the following.



Fig 6.3 (a) Menu displayed when the menu icon is tapped (English / Japanese)

2 Tap the "Plugin List" item under "Plugins", and you will see the "Plugin List" screen as shown in Fig. 6.3 (b).





Fig 6.3 (b) Plugin List screen (English / Japanese)

- Tap an item in the list to select a plugin software, and you will see the detail information of the selected plugin in the lower half of the screen.
- 4 You can uninstall the selected plugin by tapping the "Uninstall" button on the bottom right of the screen.
- The following screen will be displayed when the uninstallation processing is done. Please re-start the controller by manually shutting down the controller power.



Fig 6.3 (c) Completion of Uninstall Operation (English / Japanese)

6.4 LIMITATIONS OF PLUGIN FUNCTION

The following limitations apply to Plugin Function.

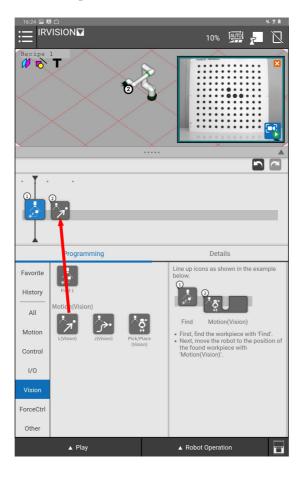
- This feature is only available for 7DF5 series (V9.40P) software.
- Tablet TP is required for this feature.
- This feature is only available on FANUC Robot CRX-10iA, CRX-10iA/L.

7 VISION FUNCTION

You can use the vision function, which detects the position of the objects using the camera and offsets the robot motion, by using the "Find" icon and various motion command icons with vision offset on the tablet UI.

This chapter describes how to use the vision function on the tablet UI. For the overview and details of the vision function, see "*i*RVision OPERATOR'S MANUAL (Reference) B-83914EN" and "*i*RVision 2D Camera Application OPERATOR'S MANUAL B-83914EN-2".

When adding the vision function to the Program Line, you can easily find the vision-related icons by opening the "Vision" section in the icon pallet on the editor screen.



7.1 "FIND" ICON

The "Find" icon allows you to create the following applications that use the vision function:

- Application to offset the position of one fixed 2D camera
- Application to offset the position of one 2D camera equipped with arm tooling
- Application to offset the position of one fixed 3DV sensor
- Application to offset the position of one 3DV sensor equipped with arm tooling

7.1.1 Setup Flow

You can detect the workpiece using the "Find" icon and offset the taught motion by as much as the workpiece was shifted. Use the following setup flow.

To set the "Find" icon, the calibration grid is normally used. If you use a fixed camera, you need to mount the calibration grid on the robot end of arm tooling in advance.

1. Adding the "Find" icon	
-	
2. Camera Initial Setup	
_	Ţ.
3. Detection Setup	
-	\Box
4. Snap Position Setup	
_	Ţ.
5. Vision Offset Position Setup	

B-84274EN/04 7. VISION FUNCTION

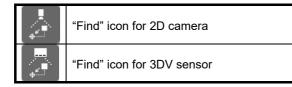
7.1.2 78410 ^ Adding the "Find" Icon

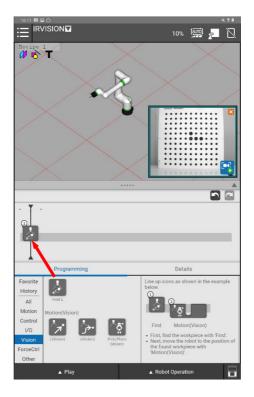
First, add the "Find" icon to the Program Line.

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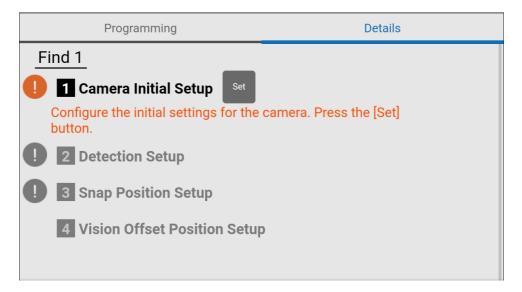
The icon pallet displays as many "Find" icons as the number of the connected 2D cameras and the connected 3DV sensors.

The appearances of "Find" icons are different by the device to use: a 2D camera or a 3DV sensor. To the Program Line, add the icon for the type of device you want to use.





Touching the "Find" icon on the Program Line displays the Details screen of the "Find" icon. Set the items in ascending order. The mark is displayed on an item that has not been configured or taught yet. The mark is displayed for an item that has been already configured or taught.



In addition, the snapped image of the camera corresponding to the touched "Find" icon is displayed on the lower-right of 4D graphics area in the editor. The live image of the corresponding camera is displayed right after the "Find" icon on the Program Line is touched, however, the still image of the found result is displayed after the process of the "Find" icon is executed.



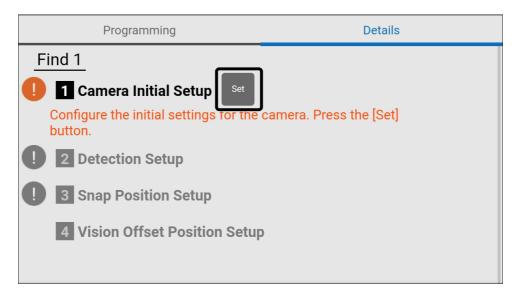
Table 7.1.2 Layout of Camera Image Display Area

rabio fina Layout of Gamora imago Biopiay finoa	
ltem	Description
button	Enables / Disables the live display of camera image. The button turns blue when the live display is enabled, and turns gray when the live display is disabled. The live display is automatically disabled after "Find" is executed.
button	Hides the Camera Image Display Area. If you display the Camera Image Display Area again, touch something other than "Find" on the Program Line once, and then touch "Find" again.

7.1.3 Camera Initial Setup

If you open the Details screen after adding the "Find" icon to the Program Line, the following screen appears. Touch the "Set" button of "Camera Initial Setup" and configure the initial settings for the camera.

Though the following description of the initial setting flow is based on the 2D camera screen, you can setup a 3DV sensor in the same way.



Screen layout

The screen layout of the camera initial setup is as follows.

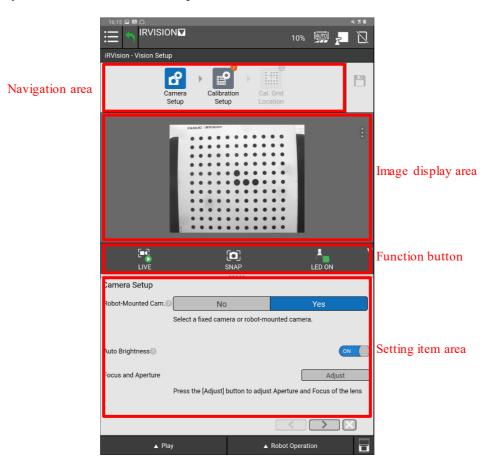
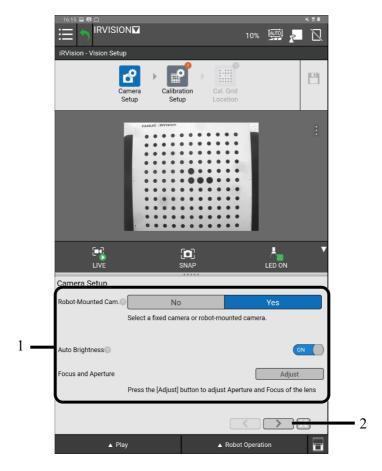


Table 7.1.3 Layout of the Camera Data Screen

Item	Description
Navigation area	Displays the camera data setup procedures in the order from left to right.
	The icon of the current setup procedure is displayed in blue, and the "!" icon is
	displayed on procedures that have not been completed yet.
Image display area	Displays the image snapped by the camera.
Function button	Used to operate the camera and lighting LED.
Setting item area	Displays the setting items in each setup procedure for camera data.

ltem	Description
button	Saves the camera data.
button	Goes back to the last setup procedure for camera data.
button	Goes to the next setup procedure for camera data.
button	Cancels the camera data setting change.
"FINISH" button	Appears when the setup is completed. This button saves the data and returns to the editor screen.

Camera Setup



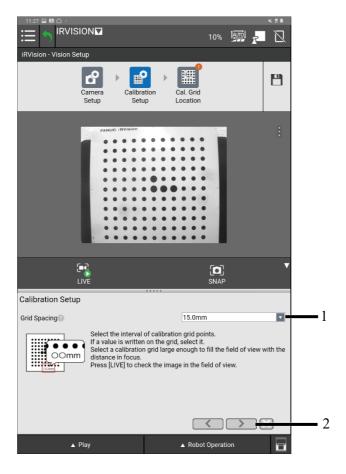
Select the camera and camera mounting method to be used and adjust the lens focus and aperture as needed.

M MEMO

For a 3DV sensor, the adjustment of the lens focus and aperture are not necessary because they have been adjusted prior to shipment.

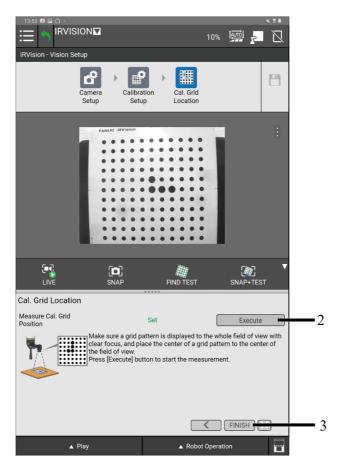
2 Touch ">" to go to the next setup procedure.

Calibration Setup



- Select the grid spacing of the calibration grid to be used from the available choices in the "Grid Spacing" drop-down box.
- 2 Touch ">" to go to the next setup procedure.

Cal. Grid Location



- Move the robot to a position where the center of the camera faces the center of the calibration grid almost straight so that the image comes into focus.
- 2 Touch the "Execute" button. The robot starts moving and measuring the calibration grid.

↑ CAUTION

The robot moves during measurement. Decrease the override speed and make sure that no person or object remains inside the motion range of the robot before measurement. After starting measurement, increase the override speed after confirming that there is no problem.

M MEMO

During measurement, press the "MEASURE HERE" button if an interference between the robot and a peripheral device is likely to occur. By pressing "MEASURE HERE," you can stop the robot from completing its move to the measurement position and the current position will then become the measurement position.

If the setup procedures have been completed up to calibration, "FINISH" appears. Touch "FINISH" to finish the camera initial setup.

Otherwise, touch ">" to go to the next setup procedure.

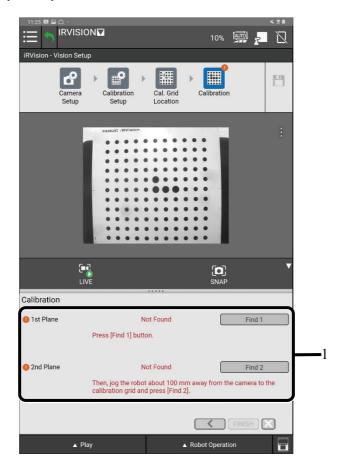
7. VISION FUNCTION

! CAUTION

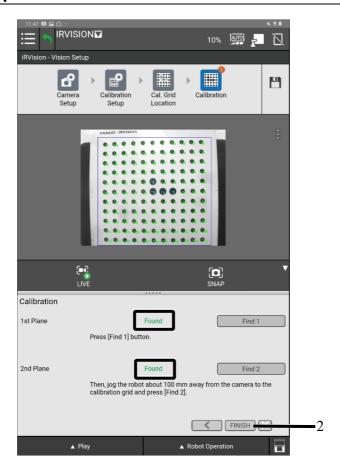
If the automatic camera calibration fails at "Cal. Grid Location", the "Calibration" icon for a 2D camera or the "Mounting Pos. Setup" icon for a 3DV sensor is additionally displayed.

Calibration

"Calibration" is displayed only when the automatic calibration fails at "Cal. Grid Location".



Find "1st Plane" and "2nd Plane" according to the instructions on the screen. 1

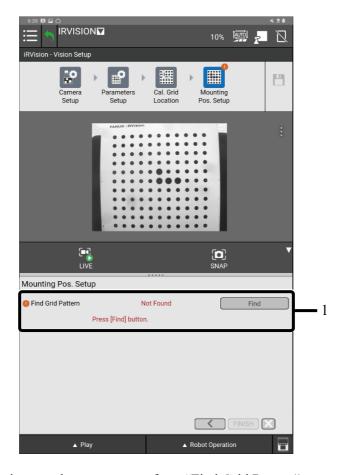


When "Found" is displayed in green for "1st plane" and "2nd Plane", touch "FINISH".

7. VISION FUNCTION

Mounting Pos. Setup

"Mounting Pos.Setup" is displayed only when the automatic calibration fails at "Cal. Grid Location".



- Follow the instructions on the screen to perform "Find Grid Pattern".
- When "Found" is displayed in green text at "Find Grid Pattern", touch "FINISH".

7.1.4 Detection Setup

When you finish the camera initial setup and open the "Find" icon Details screen, the "Create" button associated with "Detection Setup" will become available to touch.

Touch the "Create" button associated with "Detection Setup" to go to the setting screen of the vision process. On this screen, you will configure the workpiece detection settings.

№ MEMO

Though the description of the detection setting flow here is based on the 2D camera screen, you can setup a 3DV sensor in the same way.



Screen layout

The screen layout of the vision process setup is as follows.

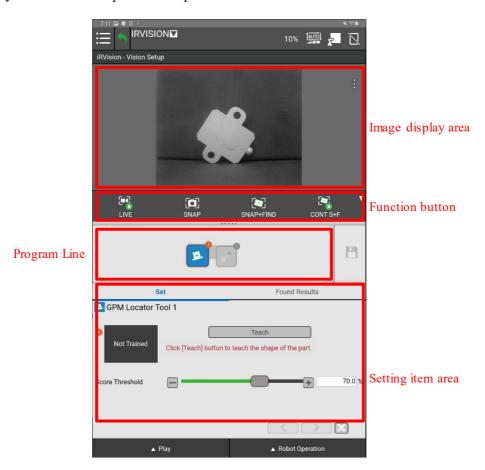
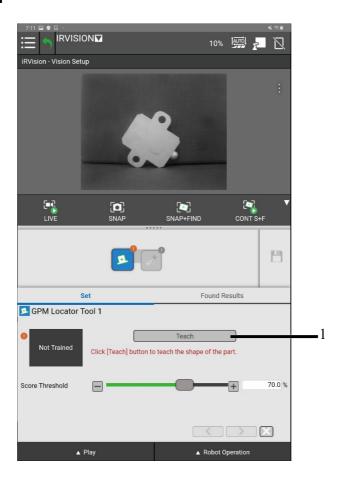


Table 7.1.4(a) Screen Layout of the Vision Process Setup

Item	Description
Image display area	Displays the image snapped by the camera.
Function button	Used to operate the camera and vision process.
Program Line	Displays the vision processes and the command tool icons, which are the components of the vision processes. The icon of the current process/command tool is displayed in blue, and the "!" icon is displayed on processes/command tools that have not been configured yet.
Setting item area	Displays the setting items of the vision process/command tool. Changing the tab allows you to check the find test results.
button	Saves the vision process.
button	Goes back to the setting screen of the last vision process/command tool.
button	Goes to the setting screen of the next vision process/command tool.
button	Cancels the vision process/command tool setting change.
"FINISH" button	Appears when the setup is completed. This button saves the data and returns to the editor screen.

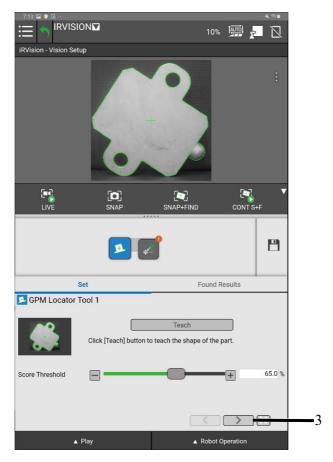
GPM Locator Tool



1 Touch the "Teach" button.



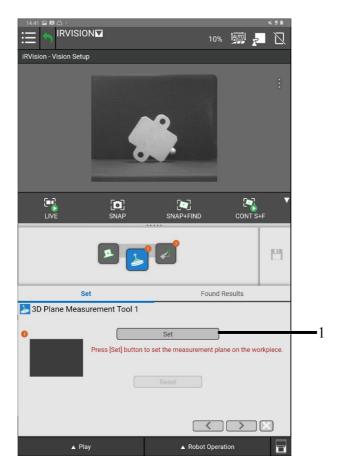
When the guide opens, teach the model according to the instructions on the guide.



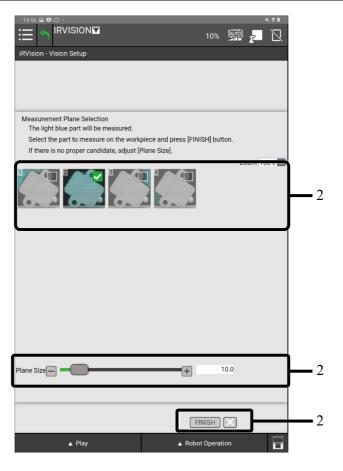
3 Touch ">" to go to the next command tool.

3D Plane Measurement Tool

The following settings are for a 3DV sensor. If you are working with a 2D camera, go to the setting of the Offset Data Calculation Tool.

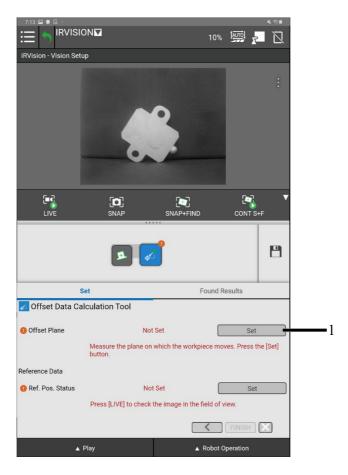


1 Touch the "Set" button.



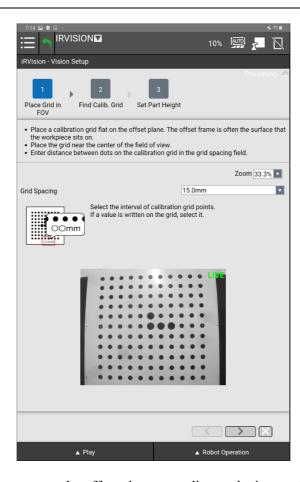
The candidates for places to perform the 3D measurement are displayed. Select a place to perform the 3D measurement of the workpiece and touch "FINISH" to go to the next command tool. If a place you want to measure does not appear as a candidate, adjust "Plane Size". If a desired place to measure does not appear however "Plane Size" is adjusted, touch "X".

Offset Data Calculation Tool



1 Touch the "Set" button for "Offset Plane".

For a 3DV sensor, settings for an offset plane are not necessary. Go to Step 4 to set "Ref. Pos. Status".



When the guide opens, measure the offset plane according to the instructions on the guide.

⚠ CAUTION

Use the calibration grid to measure the offset plane.

3 When you finish measuring the offset plane, place the workpiece in the detection reference position.



4 Touch the "Set" button for "Ref. Pos. Status".



5 When "Set" is displayed in green for "Ref. Pos. Status", touch "FINISH".

↑ CAUTION

Afterward, do not move the workpiece until robot motion teaching is completed. In addition, do not change the position of the camera until the teaching of the snap position is completed.

"Find" icon setting items after the detection setup is completed

When you finish the detection setup, the Details screen of the "Find" icon is displayed as follows.

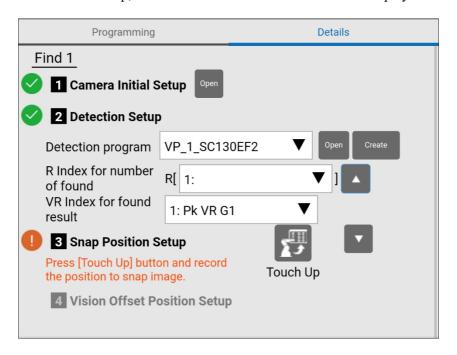


Table 7.1.4(b) Setting Items That Can Be Configured after the Detection Setup Is Completed

Item	Description
Detection program	This is the vision process used for detection. When you touch the drop-down box, you can select a created vision process from the list.
. 0	When you touch "Open", you can edit the selected vision process. When you touch the "Create" button, you can create a new vision process used for detection.
	This is the register number for the register which stores the number of workpieces detected in the vision process. When you touch the drop-down box, you can select a register number from the list.
R Index for number of found	The register set in this item is used to create a robot program that uses a conditional branch to check if any workpiece was detected or not (whether the register value is "0" or "1 or above"). For specific usage examples, see "7.3.3 Action for when the workpiece is not detected" and "7.3.4 Performing the work for Multiple workpieces".
button	Shows or hides the detailed setting items of the detection setup.

Table 7.1.4(c) Detailed Setting Items

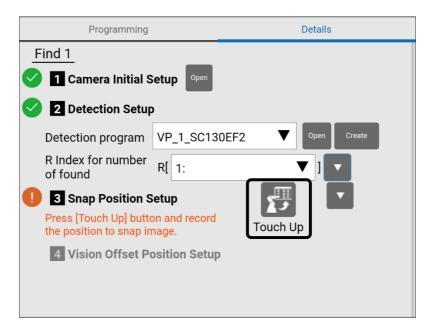
Item	Description
R Index for found result	This is the register number where the detection results of the vision process
R illuex for fourid result	are stored. You normally do not need to change the automatically set value.

7.1.5 Snap Position Setup

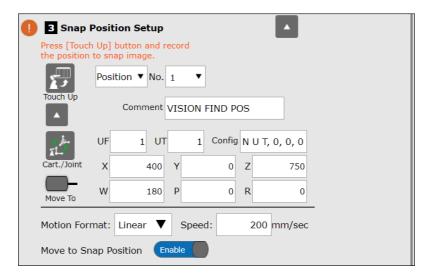
When you finish the camera initial setup and the detection setup and open the Details screen of the "Find" icon, the button associated with "Snap Position Setup" will become available to touch. Touch and teach the snap position. Normally, set the robot position when the detection setup was completed as the snap position.

↑ CAUTION

If the distance between the workpiece and the camera is changed after you completed the detection settings, the workpiece will not be detected. Do not change the distance between the workpiece and the camera.



Touching the " ∇ " button on the right side on the item displays the detail setup items associated with the snap position.



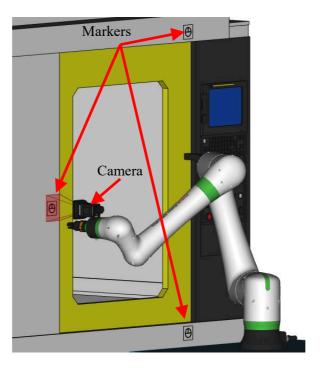
In cases where the robot doesn't need to be moved to the snap position, touch the "Move to Snap Position" toggle switch so that it changes to "Disable".

For the other displayed items and the other operation procedures, refer to "7.5.1 Linear (Vision)".

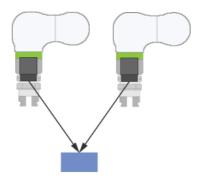
7.2 "3-MARKER RUNTIME OFFSET" ICON

The "3-Marker Runtime Offset" icon is used to offset the positional shift in a work area by snapping each of three markers placed on the work area in stereo and measuring their positions in 3D.

In a scenario where work is performed on machining equipment with a collaborative robot mounted on a cart, by teaching the robot to measure the markers placed in predetermined positions near the work area, the robot's operation can be offset so that it performs work in the correct position on the machining equipment even if the cart's position shifts.



Example application of 3-Marker Runtime Offset: Marker placement example



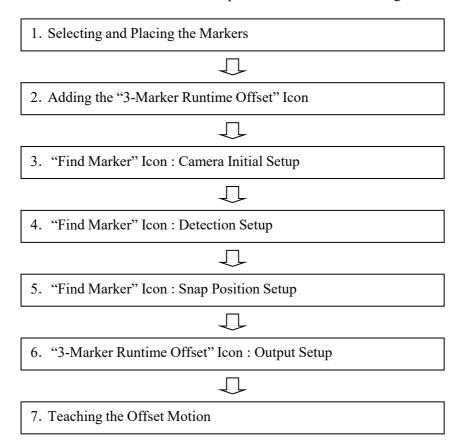
Concept diagram of stereo snapping

⚠ CAUTION

- 1 To use the "3-Marker Runtime Offset" icon, the "iRVision Marker Offset Function" option (S531) is required.
- 2 "3-Marker Runtime Offset" and the marker measurement performed with the "Find Marker" icon use the 2D camera mounted on the wrist unit of the robot. The 3D vision sensor and the fixed 2D camera cannot be used.

7.2.1 Setup Flow

The setup of the "3-Marker Runtime Offset" icon is performed with the following flow.



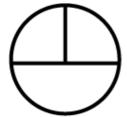
7.2.2 Selecting and Placing Markers

Selecting markers

Specific markers are detected in the processing of the "3-Marker Runtime Offset", therefore, they must can be seen from the camera on the robot. Additionally, the shape of the markers must meet the following conditions.

- The features to be taught are on the same plane.
- The target has a geometry for which any rotation of $\pm 90^{\circ}$ or so can be identified. (It is preferable not to be rotationally symmetric as the left shape in "Examples of appropriate marker shape")
- The target has a geometry whose size can be identified.

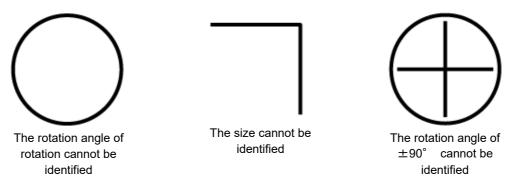
Examples of appropriate and inappropriate shapes are shown below.







Examples of appropriate marker shapes

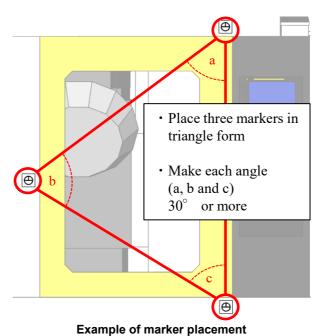


Examples of inappropriate marker shapes

Placing markers

Markers should be placed in the work area in a manner that meets the following conditions.

- Markers are placed as far apart from each other as possible.
- All angles of the triangle formed by the three points should be 30° or more; the three markers should not be placed on the same line.



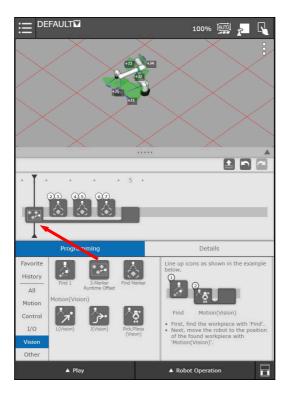
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7.2.3 Adding the "3-Marker Runtime Offset" Icon

Add the "3-Marker Runtime Offset" icon to the Program Line.

When the "3-Marker Runtime Offset" icon is added, three "Find Marker" icons are automatically added inside of it.



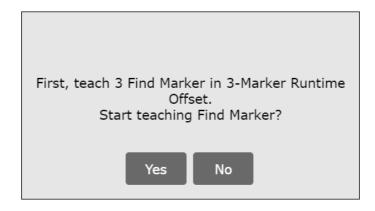
Also, the following popup is displayed when the icon is added. If you touch "Yes", the Details screen associated with the "Find Marker" icon will be displayed. For details about the settings for the "Find Marker" icon, see "7.2.4 "Find Marker" Icon Setup and Teaching".

If you do not want to open the "Find Marker" icon Details screen, touch "No".



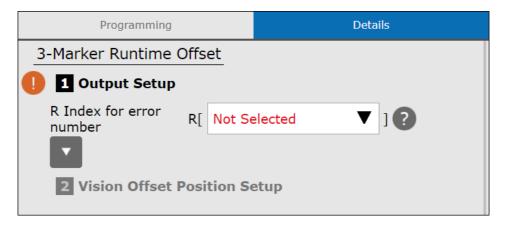
↑ CAUTION

Teach "3-Marker Runtime Offset" and the "Find Marker" icons in each sequential set, and do not teach several sets at the same time.

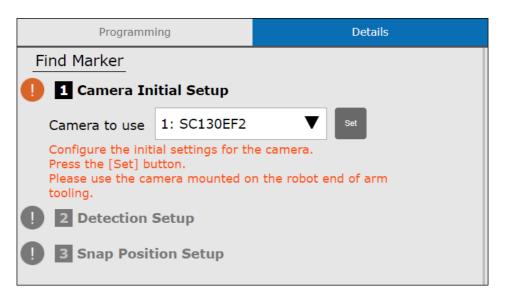


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If you touch an icon on the Program Line, the lower part of the screen switches to the Details screen for that icon. Configure the settings in order, starting from the item at the top. The mark is displayed on items that have not been set or taught. The mark is displayed on items that are complete.



Details screen for 3-Marker Runtime Offset



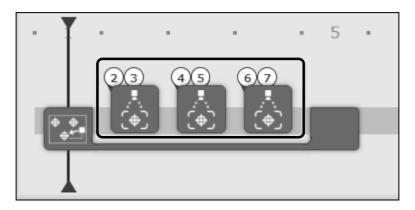
Details screen for Find Marker

B-84274EN/04 7. VISION FUNCTION

7.2.4 "Find Marker" Icon Setup and Teaching

After adding the "3-Marker Runtime Offset" and touching "Yes" in the displayed popup, the setup screen for the "Find Marker" icons will be displayed.

"Find Marker" icons can be set by touching the "Find Marker" icon within the "3-Marker Runtime Offset" icon, in case you closed the popup by touching "No".

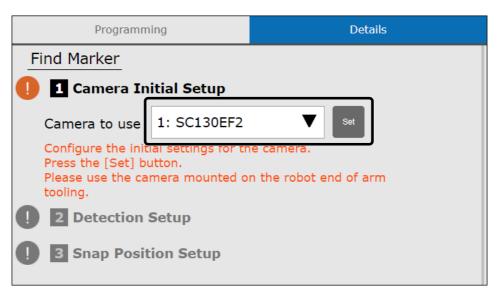


7.2.4.1 Camera Initial Setup

Open the Details screen for "Find Marker", and first perform the initial setup for the camera.

In "Camera to use" under "Camera Initial Setup", select the camera to use, and then touch the "Set" button.

For the second and subsequent "Find Marker" icons, the same camera data will be used if you select the same camera in "Camera to use", so you will not need to perform the initial setup again.



For details about the camera initial setup procedure, see "7.1.3 Camera Initial Setup".

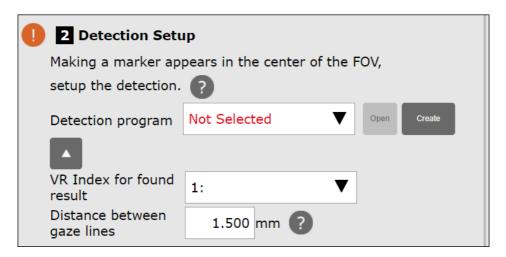
✓ MEMO

- 1 If only one 2D camera is connected to the controller, that camera is automatically selected in "Camera to use".
- 2 If the camera data for the camera selected in "Camera to use" has already been created, the "Open" button is displayed instead of the "Set" button. Touch this button if, for example, the mounting position of the camera has been changed and the camera data needs to be modified.

7.2.4.2 Detection Setup

After you complete the camera initial setup and return to the "Find Marker" Details screen, "Detection Setup" can be edited.

In addition to setting up the detection program to use for marker detection, the output destination for detection results and tolerance values for the distance between lines of sight are set up here as necessary.



Setting Items

Table 7.2.4.2 Setting Items for Detection Setup

Table 7.2.4.2 Setting Items for Detection Setup	
Description	
This is the vision process used for detection.	
When you touch the drop-down box, you can select an existing vision process	
from the list that uses "Camera to use" in "Camera Initial Setup".	
If you touch "Open", you can edit the vision process selected in the	
drop-down box.	
If you touch the "Create" button, you can create a new vision process to use	
for detection.	
If there is no vision process that uses "Camera to use" in "Camera Initial	
Setup", only the "Create" button is displayed.	
Show/hide the detailed setting items for detection setup.	
Specify the vision register where the detection results of the detection	
program will be output. The default value is 1.	
Normally, this setting does not need to be changed.	
With the "Find Marker" icon, the markers around the work area are snapped	
from different left-right positions, but the two gaze lines from each position to	
the marker do not actually cross perfectly due to slight error. Here, the	
threshold is set where the gaze lines are considered to be crossing when they	
reach a certain distance apart. The default value is 1.5.	
Normally, this setting does not need to be changed.	

7. VISION FUNCTION

7.2.4.3 Creating the Detection Program

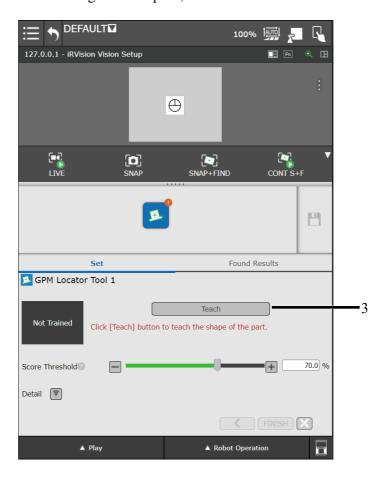
Create the vision process that will be used to detect the markers.

- 1 Jog the robot so that a marker placed in the work area is centered in the camera's field of view.
- 2 In "Detection Setup", touch the "Create" button.

MEMO

If you want to use an existing vision process to perform detection, select the vision process you want to use from the pull-down list instead of touching the "Create" button. Vision processes that use the camera selected in "Camera to use" in "Camera Initial Setup" are displayed in the pull-down list. It is possible to select the same vision process for the second and subsequent "Find Marker" icons as for the first. However, to achieve reliable marker detection, it is recommended that you create and teach a detection program for each of the three "Find Marker" icons.

When the GPM Locator Tool settings screen opens, touch the "Teach" button.

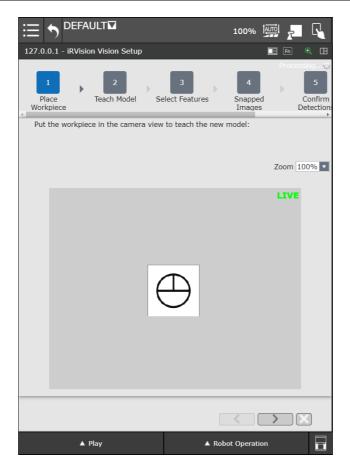


4 When the guide opens, teach the marker as the model according to the instructions on the guide.

✓ MEMO

When teaching the model, multiple snapped images of the marker are added. When doing so, detection can be made more stable by adding the following kinds of model images.

- 1 Use a similar field of view to that which will be used when executing actual marker detection.
- 2 Snap images of the marker located both at the left and right ends of the field of view.



5 When teaching the model is complete, touch the "FINISH" button.

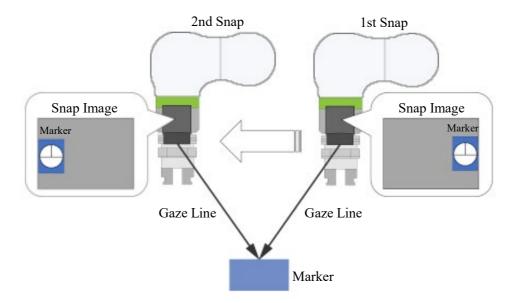
7.2.4.4 Snap Position Setup

Teach two positions where the marker will be snapped. As shown in the following figure, move and teach the robot so that the marker appears on the right end of the field of view where the first image is snapped (1st Snap) and that it appears on the left end of the field of view for the position where the second image is snapped (2nd Snap).

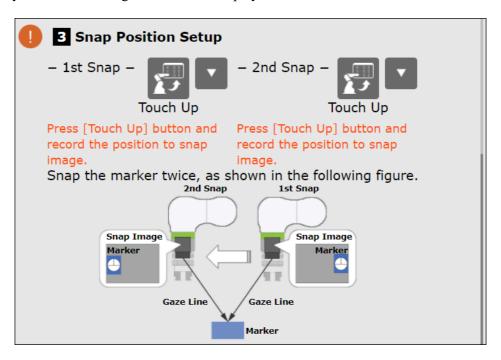
✓ MEMO

When the snap position is memorized, detecting the marker and calculating its position are performed, and the reference position of 3-Marker Runtime Offset is set automatically once all three Find Markers have been taught.

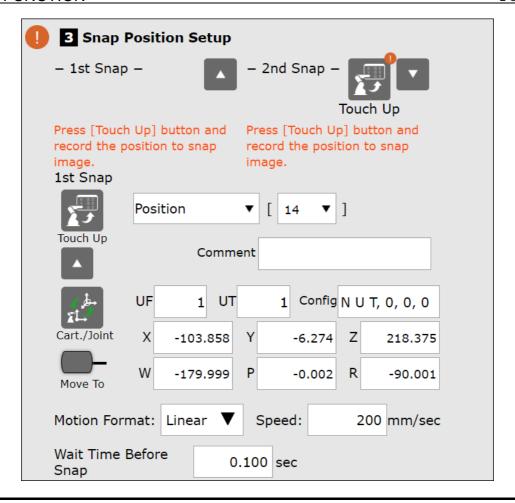
After teaching the snap position, do not move the robot base or the marker until teaching offset motion is complete.



Adjust the position of the robot by looking at the live image of the camera selected in "Camera to use" that is displayed in the lower-right of the robot display area in the editor.



Touching the " ∇ " button on the right side of the item displays the detail setup items of the snap position. For the displayed items and the operation procedures, refer to "7.5.1 Linear (Vision)".



MEMO

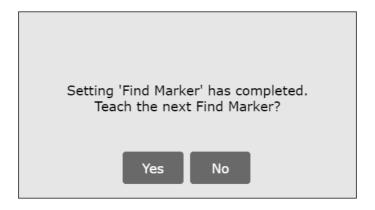
In the "Wait Time Before Snap", set the length of time to wait before the marker is snapped after the robot moves to the snap position.

The default value is 0.1 (seconds).

The purpose of this setting is to wait for any residual vibration from the robot movement to subside before snapping the marker, in order to perform correct measurement.

This completes the setup for one of the "Find Marker" icons.

When the snap position teaching is complete, the following popup is displayed. Touch "Yes" to display the Details screen for the next "Find Marker" icon. Perform setup and teaching for all three of the "Find Marker" icons.

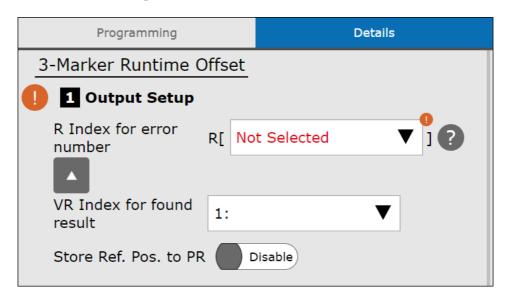


When teaching for the third "Find Marker" icon is complete, the following popup is displayed. Touch "Yes" to continue to the Details screen of the "3-Marker Runtime Offset" icon.



7.2.5 Output Setup

On the Details screen of the "3-Marker Runtime Offset" icon, specify the setup items such as the register number where error number is output.



Setting Items

Table 7.2.5 Setting items for Output Setup

ltem	Description
R Index for error number	Set the register number to where error numbers will be output. If an error occurs while executing the "3-Marker Runtime Offset" icon or one of the "Find Marker" icons surrounded by that icon, the error number will be output to the register specified here.
button	Show/hide the detailed setting items for output setup.
VR Index for found result	Specify the vision register number where the detection results of the detection program will be output. The default value is 1. Normally, this setting does not need to be changed. If "Use the specified found result" is selected instead of "Use the latest found result" for the offset operation (such as "Linear (Vision)") that is executed after the "3-Marker Runtime Offset", you need to specify the same number specified in "VR Index for found result".

Item	Description
Store Ref. Pos. to PR	To save the reference position to the position register, turn ON the toggle switch and specify the destination position register number in the drop-down box that appears. If the other reference position of "3-Marker Runtime Offset" icon is already saved in the set position register, use the existing information of the position register as a reference position without setting a new one.

⚠ CAUTION

- 1 Once the "Store Ref. Pos. to PR" toggle switch turned ON and then turn it OFF again, the reference position data is initialized, so the reference position needs to be set again.
- Even if an inappropriate position data is in the position register specified in the "Store Ref. Pos. to PR", the position data will be used as the reference position and the robot does not operate properly. Specify the position register that stores the reference position set in "3-Marker Runtime Offset", or specify an unused position register and set a reference position anew.

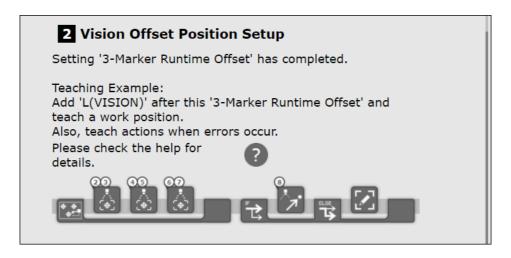
7.2.6 Teaching the Offset Motion

When the teaching of all the "Find Marker" icons and the "3-Marker Runtime Offset" icon is complete, add a motion command icon with vision offset to the Program Line and teach the offset motion.

⚠ CAUTION

Do not move the robot or the markers from the position at the end of teaching of the "3-Marker Runtime Offset" icon (the positional relation between the robot base and the object on which the markers were placed) until teaching the offset motion is complete.

This positional relation is called the "reference position".



No.

MEMO

1 In case the placement of the markers changes, or the offset position needs to be taught again, the reference position needs to be set again. If you need to set the reference position again, tap the "▽" button that was displayed after teaching "3-Marker Runtime Offset" icon was completed, and then touch the "Execute" button in "Reset Ref. Pos.". The robot will move, and the reference position will be set again. After that, teach the offset position again. However, "Reset Ref. Pos." cannot be executed in any modes other than the CRX Auto mode.

To change the snap positions of the markers (for example, after changing the marker positions, the markers no longer fit in the current field of view of the snap positions), re-teach the snap positions of the Find Markers before executing "Reset Ref. Pos.".

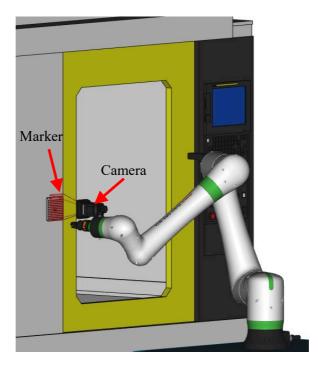
2 If a "3-Marker Runtime Offset" icon is copied, the reference position is shared with the source of copy.

7.3 "1-MARKER RUNTIME OFFSET" ICON

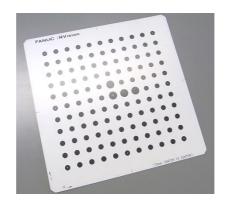
The "1-Marker Runtime Offset" icon is used to offset the positional shift of a work area by measuring the 3D position and orientation of a marker (calibration grid) placed in the work area.

In a scenario where work is performed on machining equipment with a collaborative robot mounted on a cart, by teaching the robot to measure the markers placed in predetermined positions near the work area, the robot's operation can be offset so that it performs work in the correct position on the machining equipment even if the cart's position shifts.

Compared with the "3-Marker Runtime Offset" icon, teaching is simpler with this icon, and the position shift of a work area can be offset in less time. However, a calibration grid must be used to measure the amount of offset rather than an arbitrary marker.



Example application of 1-Marker Runtime Offset: Marker placement example



Marker (calibration grid) used with 1-Marker Runtime Offset

⚠ CAUTION

- 1 To use the "1-Marker Runtime Offset" icon, the "*i*RVision Marker Offset Function" option (S531) is required.
- 2 The use of a 2D camera or 3DV sensor mounted on the wrist unit of the robot is recommended with the "1-Marker Runtime Offset" icon. A fixed 2D camera or 3DV sensor can also be used, but the [Prioritize Cycle Time] setting described in "7.3.6 Snap Position Setup" is not displayed, and the offset error will be larger. In this manual, unless otherwise noted, explanations assume the use of a robot-mounted 2D camera or 3DV sensor.

7.3.1 Setup Flow

The setup of the "1-Marker Runtime Offset" icon is performed with the following flow.

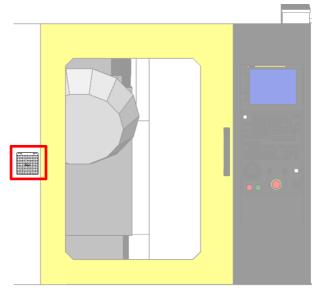
1. Placing the Marker
Ţ
2. Adding the "1-Marker Runtime Offset" Icon
Ţ
3. Camera Initial Setup
Ţ.
4. Detection Setup
Ţ
5. Snap Position Setup
Ţ
6. Teaching the Offset Motion

7.3.2 Placing the Marker

The marker is placed near the work area. The marker must be placed in a position where the positional relationship with the work area does not vary, and where the marker is easy to be snapped by the camera. However, to increase offset accuracy, it is preferable to place the marker in the following ways.

- 1 Minimize the standoff in the area where the marker can be detected
- 2 As close to the work area (offset position) as possible

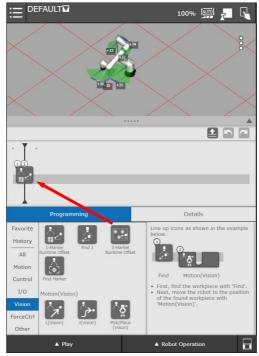
When a small-sized (narrow grid spacing) calibration grid is used, the limitations on placement position are reduced.



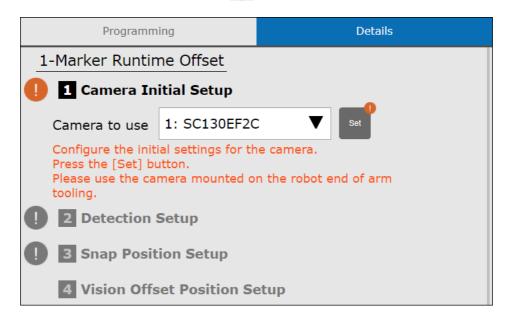
Example of marker placement

7.3.3 Adding the "1-Marker Runtime Offset" Icon

Add the "1-Marker Runtime Offset" icon to the Program Line.



If you touch an icon on the Program Line, the lower part of the screen switches to the Details screen for that icon. Configure the settings in order, starting from the item at the top. The mark is displayed on items that have not been set or taught. The mark is displayed on items that are complete.

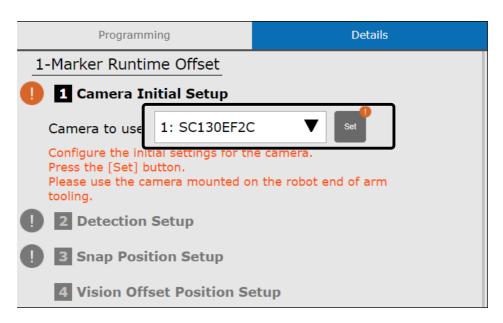


Details screen for 1-Marker Runtime Offset

7.3.4 Camera Initial Setup

Open the Details screen for the "1-Marker Runtime Offset" icon, and first perform the initial setup for the camera.

In "Camera to use" under "Camera Initial Setup", select the camera to use, and then touch the "Set" button.



For details about the camera initial setup procedure, see "7.1.3 Camera Initial Setup".

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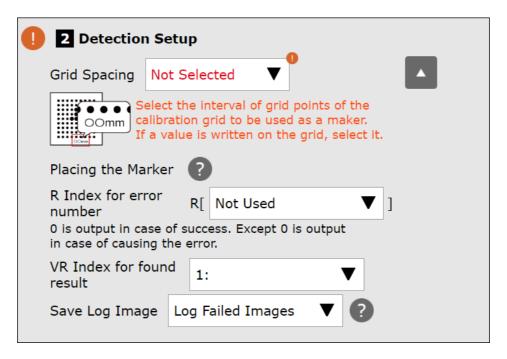
1 If only one 2D camera or 3DV sensor is connected to the controller, that camera is automatically selected in "Camera to use".

- 2 If the camera data for the camera selected in "Camera to use" has already been created, the "Open" button is displayed instead of the "Set" button. Touch this button if, for example, the mounting position of the camera has been changed and the camera data needs to be modified.
- 3 To achieve consistent offset accuracy, enabling [Adjust Brightness] in the camera data is recommended.
 - Also, large dots on the marker sometimes fail to be detected when LED lighting is used. In that case, change the [LED Type] setting to [None].

7.3.5 Detection Setup

After you complete the camera initial setup and return to the "1-Marker Runtime Offset" Details screen, "Detection Setup" can be edited.

In addition to setting the dot pitch of the calibration grid being used as a marker, the output destinations for error numbers and detection results as well as how the image history is saved are set up here as necessary.



Setting Items

Table 7.3.5 Setting Items for Detection Setup

Item	Description
Grid Spacing	Select the grid spacing (interval between dots) of the calibration grid being used as a marker. If the grid spacing is written on the calibration grid, select that value. If [Override with the following value] is selected from the options, a text box appears where the grid spacing can be entered and you can set a grid spacing that is not listed in the options.
▼ ✓ ▲ button	Show/hide the detailed setting items for detection setup.

ltem	Description
	Set the register number to where error numbers will be output. The default value is [Not Used].
	When a result is output with no problems, "0" is output to the register
R Index for error number	specified here. If an error occurs, some other number will be output to the
	register.
	If [Not Used] is selected, error numbers are not output, and the program
	execution is stopped when an error occurs.
	Specify the vision register number where the detection results of the detection
VR Index for found result	program will be output. The default value is 1.
	Normally, this setting does not need to be changed.
	Select whether to record an image log when the program is executed.
	However, if the settings in i RVision Vision Config are configured not to retain
	the Vision Log, then no image log is recorded regardless of the value of this
	setting.
	[Do Not Log]
Save Log Image	No image log is recorded.
	[Log Failed Images]
	An image is recorded in the log only when nothing is detected on the
	workpiece.
	[Log All Images]
	Record all images in the log.

7.3.6 Snap Position Setup

Teach the position where the marker will be snapped.

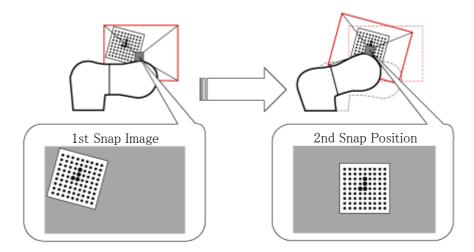
Move the robot Hand (tool) to a position where the marker fills the camera's field of view as much as possible while retaining focus, and record that as the snap position.

Adjust the position of the robot by looking at the live feed from the camera selected in "Camera to use" that is displayed in the lower-right of the robot display area in the editor.



- When the snap position is taught, marker detection and position calculations are performed, and the positional relationship with the robot is automatically memorized. This positional relationship is called the "reference position". After teaching the snap position, do not move the robot base or the marker until teaching the offset motion is complete, except for when it is necessary to re-set the reference position.
- 2 Offset accuracy is increased by minimizing the standoff in the area where the marker can be detected.

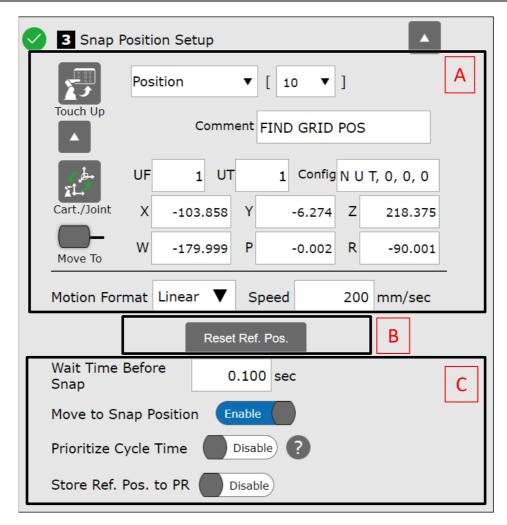
At the time of executing this command in default, the robot moves to the snap position and performs the first snap then moves to the position where the snap position is offset by vision to improve the offset accuracy.



Initially, items are displayed as shown in the following figure, but detailed setting items for the snap position can be displayed by touching the " ∇ " button to the right of the [Touch Up] button.



The detailed settings can roughly be divided into detailed settings for the snap position (A in the figure below), the [Reset Ref. Pos.] button (B in the figure below), and detailed settings for snap motion (C in the figure below).



Detailed Settings for the Snap Position

For the displayed items and the operation procedures, refer to "7.5.1 Linear (Vision)"

[Reset Ref. Pos.]

After the robot's position has been adjusted, for example in the snap position detailed settings, and it is necessary to re-set that position as the reference position, tap the [Reset Ref. Pos.] button.

Only the reference for the snap position after vision offset, used when snapping the marker during actual execution of the program, is reset.

⚠ CAUTION

When the reference position has been re-set, it is necessary to re-teach the offset motion.

Detailed Settings for Snap Operation

The settings for the operation when the robot moves to the snap position during robot program execution can be changed.

Table 7.3.6 Detailed Setting Items for Snap Operation

ltem	Description
Wait Time Before Snap	Set the length of time to wait before the marker is snapped after the robot moves to the snap position. The default value is 0.1 (seconds). The purpose of this setting is to wait for any residual vibration from the robot movement to subside before snapping the marker, in order to perform correct measurement.

Item	Description
Move to Snap Position	Set whether to move the robot to the snap position. The default value is [Enable]. If it is not necessary to move the robot to the snap position when snapping the calibration grid, touch the toggle switch to change it to [Disable].
	This item is displayed only when snap position setup has been completed. Set whether to omit some motions to prioritize the cycle time when snapping the marker. The default value is [Disable].
Prioritize Cycle Time	In the initial configuration, after the robot moves to the snap position for the marker and snaps the first image, it moves to the position derived by applying vision offset to the snap position and snaps a second image to improve the offset accuracy. If [Prioritize Cycle Time] is set to [Enable], robot movement from the first snap position is omitted to shorten the cycle time, but the offset error will increase. To perform precise offset motion, it is recommended that you specify [Disable]. This setting is displayed only when a robot-mounted 2D camera or 3DV sensor is used.
Store Ref. Pos. to PR	To save the reference position to the position register, turn ON the toggle switch and specify the destination position register number in the drop-down box that appears. If the other reference position of "1-Marker Runtime Offset" icon is already saved in the set position register, use the existing information of the position register as a reference position without setting a new one.

⚠ CAUTION

- 1 Once the "Store Ref. Pos. to PR" toggle switch turned ON and then turn it OFF again, the position number of the "1-Marker Runtime Offset" will automatically be renumbered. This number cannot be specified by the user.
 - The position data will also be initialized, so you need to teach the position and set the reference position again.
- 2 Even if an inappropriate position data is in the position register specified in the "Store Ref. Pos. to PR", the position data will be used as the reference position and the robot does not operate properly.
 - Specify the position register that stores the reference position set in "1-Marker Runtime Offset", or specify an unused position register and set a reference position anew.

When [Move to Snap Position] is set to [Disable], only [Move to Snap Position] is displayed and the other items are hidden, as the following shows.



When the snap position setup is complete, the following popup is displayed.

The snap position was taught. Then teach robot position to be offset by vision.

Note: At the time of execution this command, the robot moves a little from the taught snap position.

If measuring the marker fails, the following popup is displayed. Either adjust the snap position so that the marker fits within the camera FOV, or review the LED settings and exposure settings for the camera being used.



Make sure the grid pattern fits within the image. If the dots do not be found, change the use of LED lightning from the setting screen of the camera setup.

7.3.7 **Teaching the Offset Motion**

When the teaching of the "1-Marker Runtime Offset" icon is complete, add a motion command icon with vision offset to the Program Line and teach the offset motion.



⚠ CAUTION

Do not move the robot or the marker from the positions they were in (the reference positions) at the completion of teaching the "1-Marker Runtime Offset" icon until teaching the offset motion is complete.



⋒ **MEMO**

- 1 In case the placement of the markers changes, or the offset motion is going to be taught again, teach the offset motion again after tapping the [Reset Ref. Pos.] button in the detailed settings of [Snap Position Setup] and the calibration grid has been detected.
 - To change the snap position of the marker (for example, after changing the marker positions or when the marker no longer fits in the current field of view of the snap position), re-teach the snap position.
- 2 If a "1-Marker Runtime Offset" icon is copied, the reference position is shared with the source of copy.

7.3.8 When the Offset Error Is Large

If the offset error of the offset motion is large, check the following points.

- 1 Camera calibration was performed correctly.
- 2 The marker displayed in the image display area is not blurry.
- The marker displayed in the image display area is not too small relative to the entire image display 3 area.
- 4 The marker and the camera are not too far apart.
- [Adjust Brightness] is enabled in the camera data.
- When "Snap Position Setup" was performed and when a line is executed, there are no major changes 6 in the brightness around the marker.
- 7 Things other than dots on the marker are not being misdetected as dots.
- 8 The number of detected dots is not too small.
- 9 [Prioritize Cycle Time] is not disabled in the "Snap Position Setup" settings.
- 10 The grid spacing that was set is the same as what is printed on the marker.
- 11 [Wait Time Before Snap] is not too short.

Set the position and

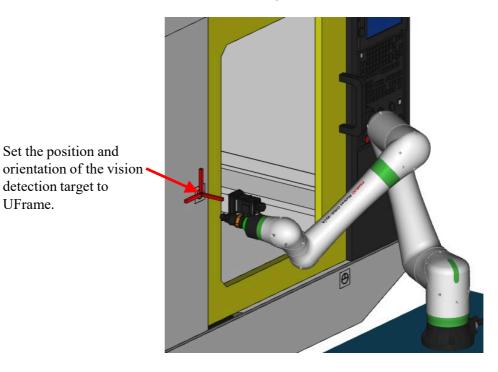
detection target to

UFrame.

The marker and the work area (offset position) are not too far apart.

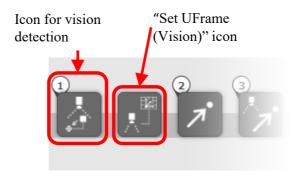
7.4 "SET UFRAME (VISION)" ICON

"Set UFrame (Vision)" icon is used to set the 3D position and orientation of the found target (detected by icon to detect the vision such as "FIND" icon) as the origin of the UFrame.

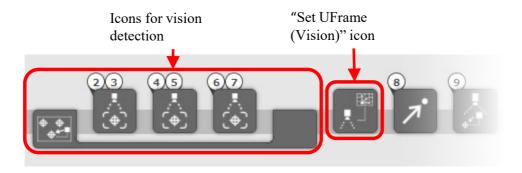


Concept diagram of "Set UFrame (Vision)" Icon

Add the "Set UFrame (Vision)" icon to the Program Line as follows so that it will be executed after the vision detection icon.



"Set UFrame (Vision)" icon placement example 1: Place after the single vision detection icon



"Set UFrame (Vision)" icon placement example 2: Place after the vision detection icons used in the set

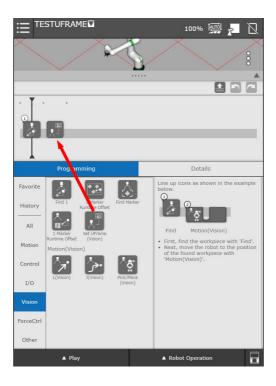
⚠ CAUTION

"Set UFrame (Vision)" icon does not perform vision detection and refers to the vision register. Therefore, execute the vision detection with vision detection icon beforehand and output the detection result to the specified vision register. Refer to the section for each icon that perform the vision detection, and set to use the intended vision register.

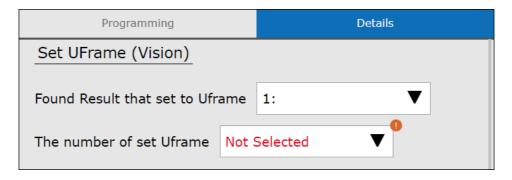
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7.4.1 Add and set the "Set UFrame (Vision)" Icon

Add the "Set UFrame (Vision)" icon to the Program Line so that it will be executed after the vision detection icon.



If you touch an icon on the Program Line, the lower part of the screen switches to the Details screen for that icon. The mark is displayed on items that have not been set. Check also if there is no need to change items that do not displays mark.



The setting items are as follows.

Table 7.4.1 Setting Items for "Set UFrame (Vision)" Icon

ruble 7.4.1 Setting items for Set of fullic (Vision) feet	
Items	Description
Found Result that set to Uframe	Select the vision register number where the detection result to be set as the origin of UFrame is output. The default value is 1. The vision detection icon needs to be placed and set before executing the "Set UFrame (Vision)" icon to output the detection result to the relevant vision register.
The number of set Uframe	Select the UFrame number to output the position and orientation of the vision detection result.

7.5 MOTION COMMAND ICONS WITH VISION OFFSET

To move the robot according to the position detected by vision, you need to teach the robot motion by adding motion command icons with vision offset to the Program Line instead of using normal motion command icons.

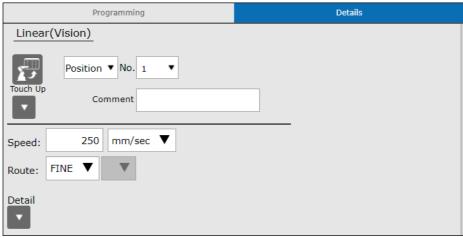
The subsequent sections describe the types and functions of motion command icons used with vision offset.

7.5.1 Linear (Vision)

The linear (vision) instruction controls the path of the tool center point (TCP) from a start point to the end point offset by vision.

When teaching the end point, teach the end point with the target object for the vision detection placed in the reference position.

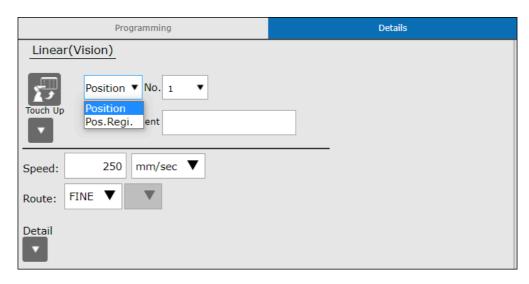




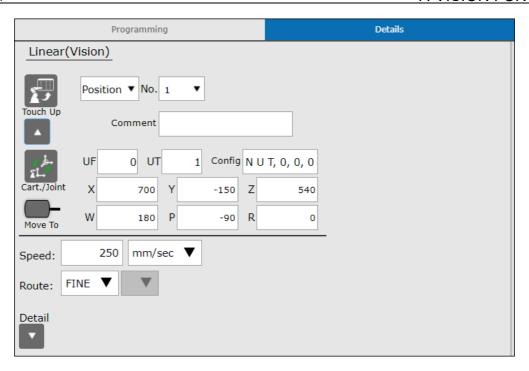
L (Vision) Icon

Detail Settings

Touch "▼" in the pull-down list with "Position" displayed to change between position and position register.



Touch the " ∇ " button under the "Touch Up" button to display the position's numeric data. Users can directly change the position, orientation, configuration, and coordinate system number. Touch the "Cart. / Joint" button to switch the format of the displayed position data.



Touch " ∇ " under "Detail" to display the detailed setting items area. The detailed setting items are as follows.

[Use the latest found result]

Calculates the offset values using the latest vision detection result.

Either this item or "Use the specified found result" can be selected. This item is selected in the default configuration.

[Use the specified found result]

Calculates the offset values using the vision detection result stored in the specified vision register number. When this item is selected, a pull-down list is displayed to select the vision register number.

For this method, you need to use the vision-detection processing icon to specify the vision register numbers in which detection results are stored.

Either this item or "Use the latest found result" can be selected.

[Additional motion]

Specify additional motion instructions for robot motion. Touch "▼" next to the text box to display a pull-down list to select the additional motion instructions. The selected additional motion instructions will be displayed in the text box.

Touch the "+" / "-" button to increase/decrease the number of additional motion instructions. In the default configuration, there is one additional motion instruction field with no settings.

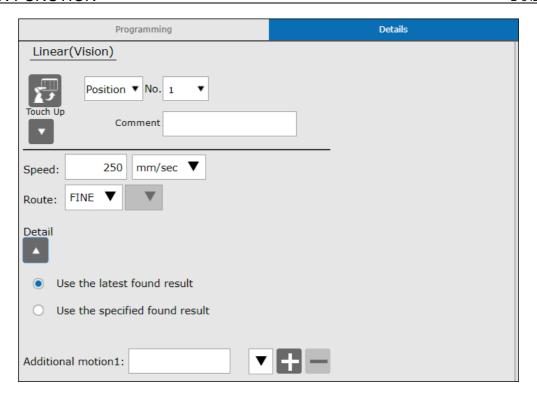


Table 7.5.1 Buttons for Detail Settings for Linear (Vision)

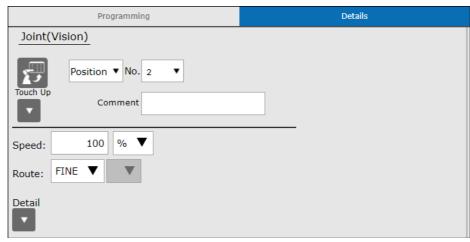
Button	Description
Touch Up	Teach the current position.
Move To	The robot moves to the taught position while the bar is slid to the right. To move the robot, turn on the TP enable key in the status bar.
Cart./Joint	The format of the displayed position data can be switched between Cartesian and Joint.
7,1	Shows or hides the position data and "Detail" area.

7.5.2 Joint (Vision)

The joint (vision) instruction is the basic instruction for moving the robot to the position offset by vision. With the joint motion instruction, the tool center point (TCP) normally moves non-linearly.

When teaching the position, teach the position with the target object for the vision detection placed in the reference position.

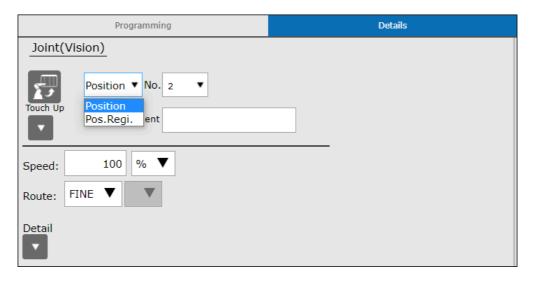




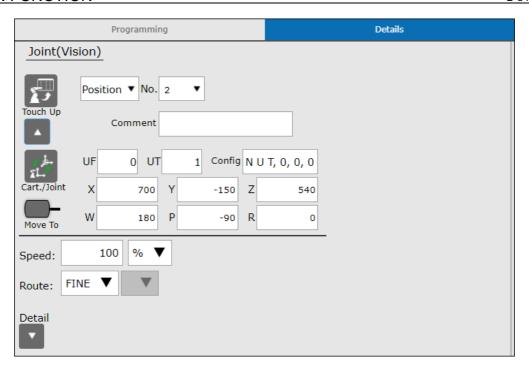
J (Vision) Icon

Detail Settings

Touch "▼" in the pull-down list with "Position" displayed to change between position and position register.



Touch the " ∇ " button under the "Touch Up" button to display the position's numeric data. Users can directly change the position, orientation, configuration, and coordinate system number. Touch the "Cart. / Joint" button to switch the format of the displayed position data.



Touch "∇" under "Detail" to display the detailed setting items area.

[Use the latest found result]

Calculates the offset values using the latest vision detection result.

Either this item or "Use the specified found result" can be selected. This item is selected in the default configuration.

[Use the specified found result]

Calculates the offset values using the vision detection result stored in the specified vision register number. When this item is selected, a pull-down list is displayed to select the vision register number.

For this method, you need to use the vision-detection processing icon to specify the vision register numbers in which detection results are stored.

Either this item or "Use the latest found result" can be selected.

[Additional motion]

Specify additional motion instructions for robot motion. Touch " ∇ " next to the text box to display a pull-down list to select the additional motion instructions. The selected additional motion instructions will be displayed in the text box.

Touch the "+" / "-" button to increase/decrease the number of additional motion instructions.

In the default configuration, there is one additional motion instruction field with no settings.

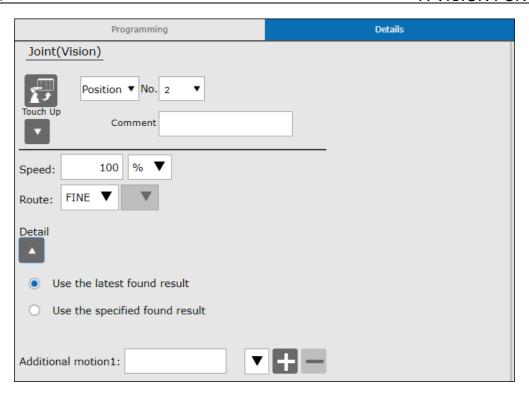


Table 7.5.2 Buttons for Detail Settings for Joint (Vision)

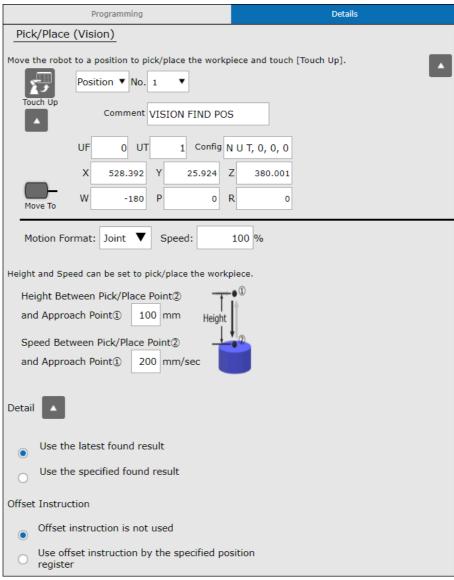
Button	Description
Touch Up	Teach the current position.
Move To	The robot moves to the taught position while the bar is slide to the right. To move the robot, turn on the TP enable key in the status bar.
Cart./Joint	The format of the displayed position data can be switched between Cartesian and Joint.
▼ , ▲	Shows or hides the position data and "Detail" area.

7.5.3 Pick/Place (Vision)

The pick/place instruction is used to pick and place the workpiece detected by vision.

Add the hand open/close instructions inside the bracket to pick and place the workpiece.

When teaching the positions where the workpiece is picked up and placed down, teach the positions with the workpiece placed in the reference position.





Pick/Place Icon

Detail Settings

In the Details screen, users should apply the following settings:

· Position: Users should teach the positions to pick and place.

For the displayed items and the operation procedures, refer to "7.3.1 Linear

(Vision)".

However, the format of position data cannot be switched to Joint in this screen.

Height[mm]: Users should set the height when moving to and away from the taught position.
Speed[mm/sec]: Users should set the speed when moving to and away from the taught position.

Additionally, touching " ∇ " to the right of "Detail" displays the detailed setting items area as shown in "7.3.1 Linear (Vision)" and "Offset Instruction" setting area. Select either of the following methods in "Offset Instruction" setting area.

[Offset instruction is not used]

Uses only the vision detection result for the pick/place position offset.

This method is selected in the default configuration.

[Use offset instruction by the specified position register]

When offsetting the pick/place position, shifts the position by the specified value of position register, not only the vision detection result.

The pull-down list to specify the position register is displayed when this method is selected.

Example

An example using the pick/place (vision) instruction is shown in the figure below.

At the start of the bracket, the robot will move to the taught position defined in the detail settings. At the end of the bracket, the robot will move to the height defined in the detail settings.



7.6 **EXAMPLES OF TEACHING VISION OFFSET MOTION**

The subsequent sections describe the typical program components and creation methods using the "Find" icon and motion command icons with vision offset.

! CAUTION

Do not move the workpiece from the reference position until the teaching process is complete. The reference position for each icon is as follows.

- "Find" icon
 - The position of the workpiece when the reference position is taught in the offset data calculation tool
- "3-Marker Runtime Offset" icon The positional relation between the robot base and the object on which the markers were placed when setting up the icon was completed

7.6.1 Teaching the Motion for the Workpiece Detected by Vision

After setting the "Find" icon, teach the robot motion for the workpiece detected by vision.



Example of an icon layout on the Program Line:

- 1 Move the robot to a position where the actual work is performed for the workpiece.
- Add the "L(VISION)" icon right after the "Find" icon on the Program Line. 2

Touch the icon on the Program Line to open the setting screen.

To change the position, move the robot to a new position and touch "Touch Up".

⋒ **MEMO**

If you want to correct the robot's operation based on the marker positions detected by the "3-Marker Runtime Offset" icon, read "'Find' icon" in the above procedure as "'3-Marker Runtime Offset' icon", and perform teaching.

7.6.2 Teaching the Grabbing Motion for the Workpiece Detected by Vision

The "Pick/Place (Vision)" icon allows you to easily teach the picking motion for the workpiece detected by vision.



Example of an icon layout on the Program Line:

- 1 Move the robot to the position for picking the workpiece (the Pick Position).
- Add the "Pick/Place (Vision)" icon to the Program Line.
 This icon creates a U-shaped area ("bracket") on the Program Line.
- Touch the icon on the Program Line to open the setting screen.

 To change the position, move the robot to a new position and touch "Touch Up".
- 4 Add the icon to open/close the arm tooling inside the bracket created by the icon.

7.6.3 Action for when the Workpiece is / is not Detected

Use the following procedure to add actions for when the workpiece is or is not detected.



Example of an icon layout on the Program Line:

- Touch the Find" icon to open the setting screen. Note the numeric register number selected for "R Index for number of found" in "2 Detection Setup". This will be used in Step 3 below.
- 2 Add the "IF" icon right after the icon.

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Touch the icon to open the setting screen and set the action to be taken when the workpiece is detected. When a workpiece is detected, the numeric register from Step 1 above will have a value of 1 or greater.

- 4 In the bracketed area following the icon, add the action to be taken when the workpiece is detected. See the box marked "a" in the figure above.
- In the bracketed area following the icon, add the action to be taken when the workpiece is not detected. See the box marked "b" in the figure above.

MEMO

The processing for when an error occurs with the "3-Marker Runtime Offset" icon can be taught with a procedure like the one above.

Since motion does not stop with an alarm when an error occurs during "3-Marker Runtime Offset" icon processing, error processing needs to be taught. Pay attention to the following differences when teaching.

- 1 Read "Find" in the above procedure as "3-Marker Runtime Offset' icon".
- 2 In step 1, note the register number in "R Index of error number" in "1 Output Setup" on the settings screen of the "3-Marker Runtime Offset" icon.
- 3 In step 3, set the condition when marker offset is successful (the register set in "R Index for error number" will have a value of 0).

In error processing for the "3-Marker Runtime Offset" icon, it is possible to change the processing according to the type of error. For example, processing for when a marker cannot be detected can be added as follows.

- 4 Add the 🚼 icon to the b part in the figure above.
- 5 Set the condition for when a marker is not detected (the register set in "R Index for error number" has a value of 1413).
- 6 Add actions in the bracketed area following the circle icon and in the bracketed area following the circle icon.

7.6.4 Performing the Work for Multiple Workpieces

Use the following procedure to perform the work on multiple workpieces, such as removing all workpieces.



Example of an icon layout on the Program Line:

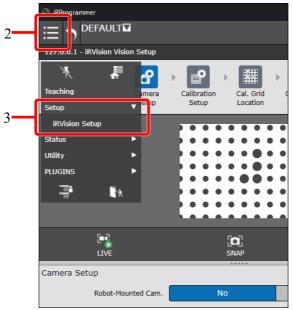
- 1 Add the LABEL" icon right before the if "Find" icon on the Program Line.
- 2 Touch the icon on the Program Line to open the setting screen and set the label number.
- Touch the icon to open the setting screen. Note the numeric register number selected for "R Index for number of found" for "2 Detection Setup". This will be used in Step 5 below.
- 4 Add the "IF" icon right after the icon on the Program Line.
- Touch the icon to open the setting screen and set the action to be taken when the workpiece is detected. When a workpiece is detected, the numeric register from Step 3 above will have a value of 1 or greater.
- In the bracketed area following the icon, add the action to be taken when the workpiece is detected. Then add the "JUMP" icon. See the box marked "a" in the figure above.
- 7 Touch the icon to open the setting screen and set the operation to jump to the label set in procedure 2.
- In the bracketed area following the detected. See the box marked "b" in the figure above.

B-84274EN/04 7. VISION FUNCTION

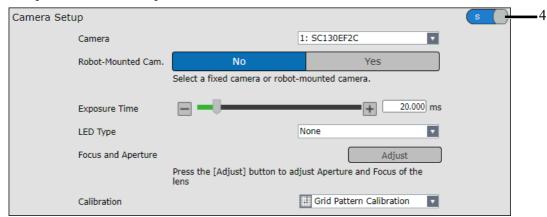
7.7 DETAIL SETTINGS FOR *i*RVision

When you perform the camera initial setup or the detection setup by following the guide on the Details screen of the vision instruction icon, such as the "Find" icon, only the often-used setting items are displayed by default. However, you can set the same items as displayed in the "Vision Setup" using iRVision from PCs or iPendant by the following procedure.

Open the screen of the camera initial setup or the detection setup from the vision instruction icon such as the "Find" icon.



- 2 Touch the button on the status bar.
- 3 Select "Setup" > "iRVision Setup".



4 To display the setting items for the advanced mode, touch the toggle switch when "S" is displayed so that it changes to "D".

M MEMO

- 1 To restore the displayed items to the default state of Tablet UI, touch the button to return to the Details screen of the icon you opened, and open the screen of the camera initial setup or the detection setup.
- 2 The "Vision Setup" screen will be displayed on Tablet UI if you use procedure 2, without opening the screen of the camera initial setup or the detection setup.

8 FORCE CONTROL FUNCTION

You can use the force control function on the tablet UI and this chapter describes how to use it. Only the CRX supports "Force Control" icon.

For the overview and details of the force control function, see "Force Sensor OPERATOR'S MANUAL B-83934EN".

8.1 APPLICATIONS THAT CAN BE CREATED WITH THE FORCE CONTROL ICON

The command icons located on the "ForceCtrl" tab can be used to create the following applications.

- "Force.Push" icon: Constant force push function
- "Force.Insert" icon: Insert function
- "Force.FaceMatch" icon: Face match function
- "Force.PhaseMatch" icon: Phase match function
- "Force.Contouring start" icon, "Force.Contouring end" icon: Contouring function

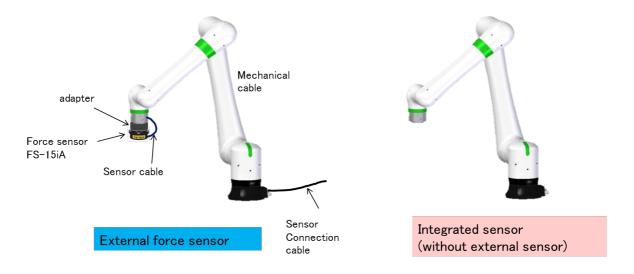
Table 8.1 Force control icons

ltem	Description
	"Force.Push" icon Use this icon to execute the constant force push function.
	"Force.Insert" icon Use this icon to execute the insert function.
	"Force.FaceMatch" icon Use this icon to execute the face match function.
	"Force.PhaseMatch" icon Use this icon to execute the phase match function.
3 →	"Force.Contouring start" icon Use this icon to start the contouring function.
0	"Force.Contouring end" icon Use this icon to end the contouring function.

8.2 HOW TO USE FORCE CONTROL

The "Force Control" icon enables pushing with constant force by a robot.

With the CRX series, there are 2 methods of using force control: using the external force sensor as shown in the figure at left, and using the integrated sensor as shown in the figure at right.





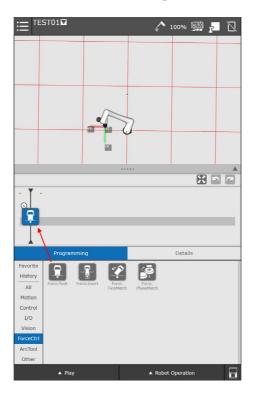
The insert function supports only the "External Force Sensor" method.

Following the steps below for setting.

- 1. Add the "Force Control" icon (8.3).
- 2. Set the parameters on the "Force Control" settings screens.
 - Set the parameters on the "Force.Push" settings screen (8.4).
 - Set the parameters on the "Force.Insert" settings screen (8.5).
 - Set the parameters on the "Force.FaceMatch" settings screen (8.6).
 - Set the parameters on the "Force.PhaseMatch" settings screen (8.7).
 - Set the parameters on the "Force.Contouring start" settings screen (8.8).
 - Set the parameters on the "Force.Contouring end" settings screen (8.9).

8.3 ADD THE "Force Control" ICON

Move the robot by jog operation or manual guided teach to a position where the Force Control is executed. Select the icon displayed in the "ForceCtrl" tab of the icon palette and add it to the program line.



8.4 "FORCE.PUSH" SETTINGS SCREEN

Touching the "Force.Push" icon in the program line changes the bottom of the screen to display the details of the "Force Push" icon. Configure the settings in order starting from the top. The mark is displayed for items that have not yet been set or taught. The mark is displayed for items that have been completed. When the mark remains, the items below that item cannot be set.

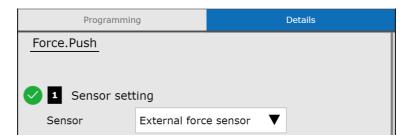
Set in the following order.

- 1. Sensor setting
- 2. Push start position
- 3. Push direction setting or Force control coordinate setting
- 4. Push settings
- 5. Automatic tuning
- 6. Push test

8.4.1 Sensor Setting

If an external force sensor is connected, both "External force sensor" and "Integrated sensor" can be selected. "External force sensor" is selected by default, and the mark is displayed next to it.

If an external force sensor is not connected, it is set as "Integrated sensor" from the beginning and the mark is displayed. In this case, the setting cannot be changed.



8.4.2 Push Start Position

Initially, the robot position at the time when the icon was dropped into the program line is recorded, and the mark is displayed next to it.

The position number and a comment can be input here.

Pressing the "v" button displays the detailed settings for position information, allowing them to be checked or edited. It is also possible to move the robot to that position.



MEMO

When the "Force.Push" icon is executed, the robot moves to this position then the force control is executed.

If the "position after pressing" of the "Push setting" is set as "Return to start position" in 8.4.4, the robot automatically returns to this position when the "Force.Push" icon is finished.

8.4.3 Push Direction Setting or Force Control Coordinate Setting

The setting contents in this subsection differ depending on whether "External force sensor" is selected or "Integrated sensor" is selected in the "Sensor setting".

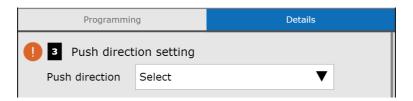
In case of "External force sensor", push direction is set. In case of "Integrated sensor", force control coordinate is set.

The mark is displayed after setting.

(1) External force sensor

The robot's push direction is set in here. Select "Perpendicular to the flange face" or "Not perpendicular to the flange face".

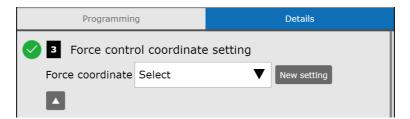
If "Perpendicular to the flange face" is selected, the robot pushes in the direction that is perpendicular to the flange face (+z of a mechanical interface coordinate). Push direction setting is complete. If "Not perpendicular to the flange face" is selected, set a force control coordinate first. Select one of already set force control coordinates or set new one. Select one of already set force control coordinates or set new one. Refer to "8.10 FORCE CONTROL COORDINATE SETTING" on how to newly set a coordinate.



(2) Integrated sensor

Set the force control coordinate. Select one of already set force control coordinates or set new one. Refer to "8.10 FORCE CONTROL COORDINATE SETTING" on how to newly set a coordinate. Pressing the "v" button located under "Force coordinate" displays the detailed settings for the force control coordinate, allowing them to be checked or edited.

Pressing the "Delete" button deletes the set contents.



8.4.4 Push Settings

Set "Pushing Force" and "Pushing Time" of force control. As there is no value at the beginning, input appropriate values here. After the "Pushing Time" has elapsed since the force control began, the force control finishes.

The mark is displayed when suitable values are set for both "Pushing Force" and "Pushing Time".

A pop-up message appears when an unsuitable value is entered.

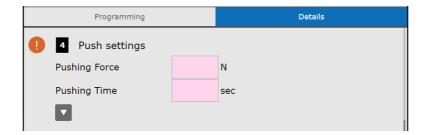
Pressing the "v" button located under "Pushing Time" displays the detailed settings for the "Position after push", allowing them to be checked or edited.

"Position after push"

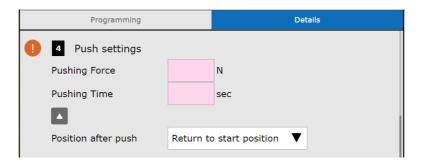
If the "Return to start position" is set, the robot will return to the "Push start position" set in 8.4.2 when the "Force.Push" icon is finished.

If "No return " is set, the position will not be changed when the "Force.Push" icon is finished. The default value is "Return to start position".

Initial Screen



The follow screen will be appeared when you press the "\overline{\sigma}" button.



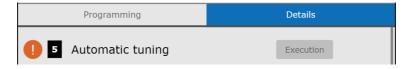
*M***EMO**

As the "Contact Stop function" is enabled for the CRX, the actual push force will be limited to the value that does not stop the robot.

8.4.5 Automatic Tuning

An automatic tuning is done for an appropriate force control motion. If the "Execution" button is touched, the robot actually pushes on a workpiece about 3 to 10 times. The mark is displayed after normal finish

The "Execution" button is enabled when the push settings in the previous section have been completed.



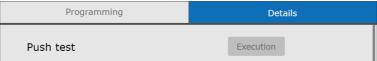
While automatic tuning is in progress, a progress bar is displayed in a pop-up window. When the progress bar reaches the end, a pop-up window appears with the message "Automatic tuning completed". While automatic tuning is in progress, it is possible to select "Cancel" in the pop-up window. If automatic tuning failed, a pop-up window appears with the message "Failed".

MEMO MEMO

A pop-up screen for caution appears before the robot moves.

8.4.6 Push Test

Perform a test to confirm that force control operates correctly. If the "Execution" button is touched, the robot performs actual test operation. The "Execution" button is enabled when automatic tuning has been completed.



While the test is in progress, a pop-up window is displayed. When the test is completed, a pop-up window appears with the message "Execution completed".

If test execution failed, a pop-up window appears with the message "Failed".

8.5 "FORCE.INSERT" SETTINGS SCREEN

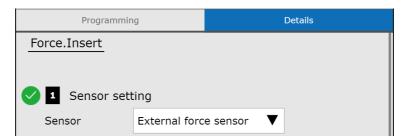
Touching the "Force Insert" icon in the program line changes the bottom of the screen to display the details of the "Force Insert" icon. Configure the settings in order starting from the top. The insert is displayed for items that have not yet been set or taught. The imark is displayed for items that have been completed. When the imark remains, the items below that item cannot be set.

Set in the following order.

- 1. Sensor setting
- 2. Insert start position
- 3. Force control coordinate setting
- 4. Insert settings
- 5. Automatic tuning
- 6. Insert test

8.5.1 Sensor Setting

"Force.Insert" supports only "External force sensor", and the mark is displayed next to it. In this case, the setting cannot be changed.

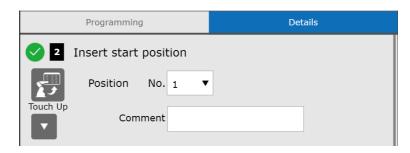


8.5.2 Insert Start Position

Initially, the robot position at the time when the icon was dropped into the program line is recorded, and the mark is displayed next to it.

The position number and a comment can be input here.

Pressing the "v" button displays the detailed settings for position information, allowing them to be checked or edited. It is also possible to move the robot to that position.



*M***EMO**

To execute the "Force.Insert" icon, first move the robot to that position and then execute Force Control.

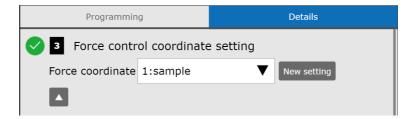
8.5.3 Force Control Coordinate Setting

Set the force control coordinate. Select one of already set force control coordinates or set new one.

The mark is displayed after setting.

Refer to "8.10 FORCE CONTROL COORDINATE SETTING" on how to newly set a coordinate. Pressing the "\overline{\times}" button located under "Force coordinate" displays the detailed settings for the force control coordinate, allowing them to be checked or edited.

Pressing the "Delete" button deletes the set contents.



8.5.4 Insert Settings

Set the force control insert depth. As there is no value at the beginning, input appropriate values here. The mark is displayed when a suitable value is set for "Insertion depth".

Pressing the "v" button located below "Insertion depth" allows "Automatic Pull-out", "Result Output Register No.", and "Retry count" to be set. These settings may be omitted.

"If successful, return to start point."

If "Yes" is set, the robot will return to the "Insert Start Position" set in 8.5.2 after insertion.

If "No" is set, pulling out will not be performed after insertion. The default value is "Yes".

"Result output Reg.No": The set register number has the following values.

Success: 1 Failure: 2 Running: 0

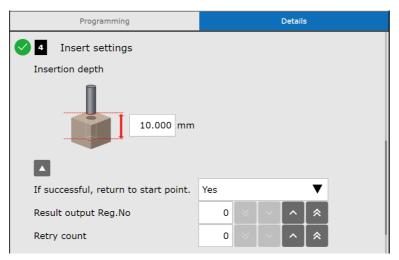
"Retry count"

Maximum number of retries if the insertion fails.

Initial Screen

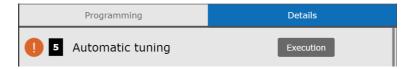


The follow screen will be appeared when you press the "\overline" button.



8.5.5 Automatic Tuning

An automatic tuning is done for an appropriate force control motion. If the "Execution" button is touched, the robot performs actual insert operation 3 to 10 times. The mark is displayed after normal finish. The "Execution" button is enabled when the insert settings in the previous section have been completed.



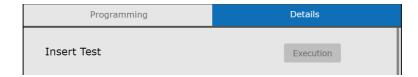
While automatic tuning is in progress, a progress bar is displayed in a pop-up window. When the progress bar reaches the end, a pop-up window appears with the message "Automatic tuning completed". While automatic tuning is in progress, it is possible to select "Cancel" in the pop-up window. If automatic tuning failed, a pop-up window appears with the message "Failed".

MEMO

A warning pop-up window appears before the robot moves.

8.5.6 Insert Test

Perform a test to confirm that Force Control operates correctly. If the "Execution" button is touched, the robot performs actual test operation. The "Execution" button is enabled when automatic tuning has been completed.



While the test is in progress, a pop-up window is displayed. When the test is completed, a pop-up window appears with the message "Execution completed".

If test execution failed, a pop-up window appears with the message "Failed".

8.6 "FORCE.FACEMATCH" SETTINGS SCREEN

Touching the "Force.FaceMatch" icon in the program line changes the bottom of the screen to display the details of the "Force.FaceMatch" icon. Configure the settings in order starting from the top. The mark is displayed for items that have not been set or taught. The mark is displayed for items that have been completed. When the mark remains, the items below that item cannot be set.

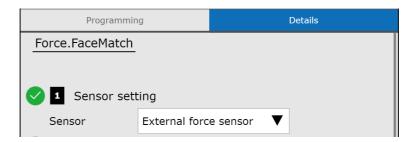
Set in the following order.

- 1. Sensor setting
- 2. Face matching start position
- 3. Force control coordinate setting
- 4. Automatic tuning
- 5. Face matching test

8.6.1 Sensor Setting

If an external force sensor is connected, both "External force sensor" and "Integrated sensor" can be selected. "External force sensor" is selected by default, and the mark is displayed next to it.

If an external force sensor is not connected, it is set as "Integrated sensor" from the beginning and the mark is displayed. In this case, the setting cannot be changed.

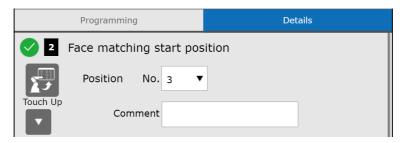


8.6.2 Face Matching Start Position

Initially, the robot position at the time when the icon was dropped into the program line is recorded, and the mark is displayed next to it.

The position number and a comment can be input here.

Pressing the "v" button displays the detailed settings for position information, allowing them to be checked or edited. It is also possible to move the robot to that position.



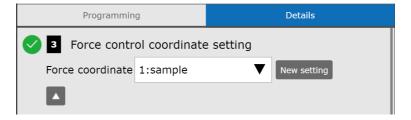
MEMO

To execute the "Force.FaceMatch" icon, first move the robot to that position and then execute Force Control.

8.6.3 Force Control Coordinate Setting

Set the force control coordinate. Select one of already set force control coordinates or set new one. Refer to "8.10 FORCE CONTROL COORDINATE SETTING" on how to newly set a coordinate. Pressing the "v" button located under "Force coordinate" displays the detailed settings for the force control coordinate, allowing them to be checked or edited.

Pressing the "Delete" button deletes the set contents.



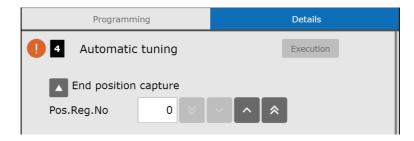
8.6.4 Automatic Tuning

An automatic tuning is done for an appropriate force control motion. If the "Execution" button is touched, the robot performs actual face matching operation 3 to 10 times. The mark is displayed after normal finish

The "Execution" button is enabled when the Force Control system settings in the previous section have been completed.

With "End position capture", the position at the end of face match operation can be recorded in the position register. This operation is not indispensable and should be recorded if you want to move to this position later.

Pressing the "v" button displays the detailed settings for position register number, allowing them to be checked or edited. Specify the position register number used for position recording. If the position register number is 0, the position will not be recorded.



While automatic tuning is in progress, a progress bar is displayed in a pop-up window. When the progress bar reaches the end, a pop-up window appears with the message "Automatic tuning completed". While automatic tuning is in progress, it is possible to select "Cancel" in the pop-up window.

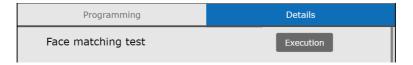
If automatic tuning failed, a pop-up window appears with the message "Failed".

*M***MEMO**

A warning pop-up window appears before the robot moves.

8.6.5 Face Matching Test

Perform a test to confirm that Force Control operates correctly. If the "Execution" button is touched, the robot performs actual test operation. The "Execution" button is enabled when automatic tuning has been completed.



While the test is in progress, a pop-up window is displayed. When the test is completed, a pop-up window appears with the message "Execution completed".

If test execution failed, a pop-up window appears with the message "Failed".

8.7 "FORCE.PHASEMATCH" SETTINGS SCREEN

Touching the "Force.PhaseMatch" icon in the program line changes the bottom of the screen to display the details of the "Force.PhaseMatch" icon. Configure the settings in order starting from the top. The mark is displayed for items that have not been set or taught. The mark is displayed for items that have been completed. When the mark remains, the items below that item cannot be set.

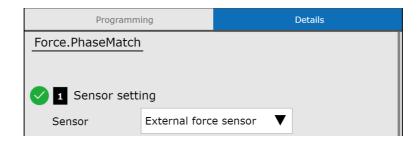
Set in the following order.

- 1. Sensor setting
- 2. Phase matching start position
- 3. Force control coordinate setting
- 4. Phase matching settings
- 5. Automatic tuning
- 6. Phase matching test

8.7.1 Sensor Setting

If an external force sensor is connected, both "External force sensor" and "Integrated sensor" can be selected. "External force sensor" is selected by default, and the mark is displayed next to it.

If an external force sensor is not connected, it is set as "Integrated sensor" from the beginning and the mark is displayed. In this case, the setting cannot be changed.



8.7.2 Phase Matching Start Position

Initially, the robot position at the time when the icon was dropped into the program line is recorded, and the mark is displayed next to it.

The position number and a comment can be input here.

Pressing the "v" button displays the detailed settings for position information, allowing them to be checked or edited. It is also possible to move the robot to that position.



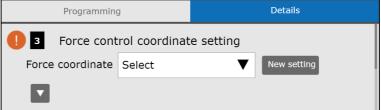
MEMO

When the "Force.PhaseMatch" icon is executed, the robot moves to this position then the force control is executed.

8.7.3 Force Control Coordinate Setting

Set the force control coordinate. Select one of already set force control coordinates or set new one. Refer to "8.10 FORCE CONTROL COORDINATE SETTING" on how to newly set a coordinate. Pressing the "v" button located under "Force coordinate" displays the detailed settings for the force control coordinate, allowing them to be checked or edited.

Pressing the "Delete" button deletes the set contents.



8.7.4 Phase Matching Settings

Set the "Insertion depth" (in the Phase match settings) of force control. As there is no value at the beginning, input appropriate values here. The is displayed when the suitable values are set for "Insertion depth".

Pressing the "v" button located below "Insertion depth" allows "Result Output Register No.", and "Retry count" to be set.

"Result output Reg.No": The set register number has the following values.

Success: 1

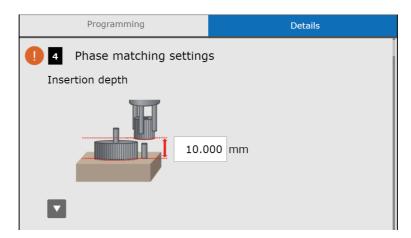
Failure: 2

Running: 0

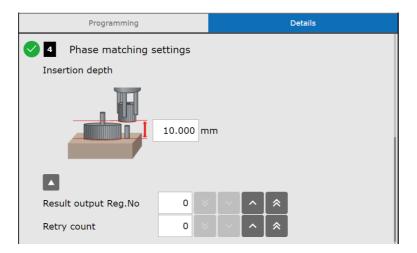
"Retry count"

This is the maximum number of retries when the phase matching fails. If successful, it will end without pulling out at that time.

Initial Screen



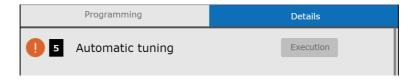
The follow screen will be appeared when you press the "v" button.



8.7.5 Automatic Tuning

An automatic tuning is done for an appropriate force control motion. If the "Execution" button is touched, the robot performs actual phase matching operation 3 to 10 times. The is displayed after normal finish.

The "Execution" button is enabled when the phase matching settings in the previous section have been completed.



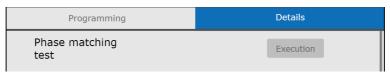
While automatic tuning is in progress, a progress bar is displayed in a pop-up window. When the progress bar reaches the end, a pop-up window appears with the message "Automatic tuning completed". While automatic tuning is in progress, it is possible to select "Cancel" in the pop-up window. If automatic tuning failed, a pop-up window appears with the message "Failed".



A warning pop-up window appears before the robot moves.

8.7.6 Phase Matching Test

Perform a test to confirm that Force Control operates correctly. If the "Execution" button is touched, the robot performs actual test operation. The "Execution" button is enabled when automatic tuning has been completed.



While the test is in progress, a pop-up window is displayed. When the test is completed, a pop-up window appears with the message "Execution completed".

If test execution failed, a pop-up window appears with the message "Failed".

8.8 "FORCE.CONTOURING START" SETTINGS SCREEN

Touching the "Force.Contouring start" icon in the program line changes the bottom of the screen to display the details of the "Force Contouring start" icon. Configure the settings in order starting from the top. The park is displayed for items that have not yet been set or taught. The park is displayed for items that have been completed. When the park remains, the items below that item cannot be set.

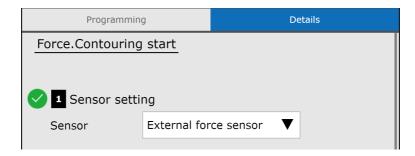
Set in the following order.

- 1 Sensor setting
- 2 Contouring start position
- 3 Push direction setting
- 4 Parameter setting

8.8.1 Sensor setting

If an external force sensor is connected, both "External force sensor" and "Integrated sensor" can be selected. "External force sensor" is selected by default, and the mark is displayed next to it.

If an external force sensor is not connected, it is set as "Integrated sensor" from the beginning and the mark is displayed. In this case, the setting cannot be changed.

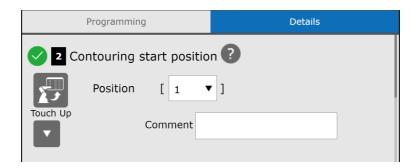


8.8.2 Contouring start position

Initially, the robot position at the time when the icon was dropped into the program line is recorded, and the mark is displayed next to it.

The position number and a comment can be input here.

Pressing the "v" button displays the detailed settings for position information, allowing them to be checked or edited. It is also possible to move the robot to that position.



MEMO

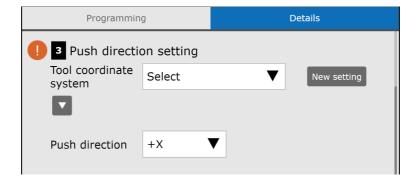
- When the "Force.Contouring start" icon is executed, the robot moves to this position then the force control is executed.
- Pressing the "?" button displays Help screen for the contouring start position.

8.8.3 Push direction setting

Set the tool coordinate system. Select one of already set tool coordinate system or set new one. Pressing the "v" button located under "Tool coordinate system" displays the comments for tool coordinate system or the XYZWPR values, allowing them to be checked.

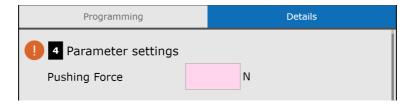
To set a new tool coordinate system or modify the tool coordinate system that has already been taught, press "New setting" button. It will move to the Tool coordinate system screen.

Set the robot's push direction for Push direction setting. The push direction can be selected from 6 directions (+X, -X, +Y, -Y, +Z, -Z). "+X" is selected as a default.



8.8.4 Parameter settings

Set "Pushing Force" of force control. As there is no value at the beginning, input appropriate values here. The mark is displayed when suitable value is set for "Pushing Force".

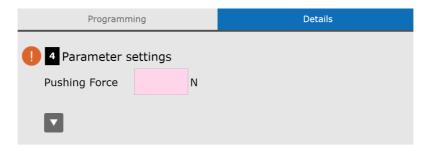


MEMO

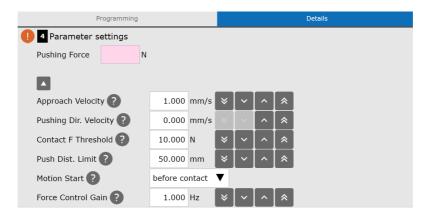
As the "Contact Stop function" is enabled for the CRX, the actual push force will be limited to the value that does not stop the robot.

In addition to the "Pushing Force", parameters such as "Approach Velocity", "Pushing Dir. Velocity", "Contact F Threshold", "Push Dist. Limit", "Motion Start" and "Force Control Gain" are prepared. They are hidden at the beginning, but if you press the "\sum" button under the "Pushing Force", these parameters will be displayed then you can check and edit. The screens are as follows.

Initial Screen



The follow screen will be appeared when you press the "v" button.



The parameters' values shown in the figure above are standard values.

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Even after setting these parameters, if you change the "Sensor setting" (8.8.1) in step 1, all the values will be returned to the standard values.

The following warning message will be output if "Pushing Force < Contact F Threshold" while the "Pushing Force" is being input.

"The entered value of the pushing force is smaller than the set contact force threshold. Do you want to set the contact force threshold to the same value as the pushing force?"

The following warning message will be output if "Pushing Force < Contact F Threshold" while the "Contact F Threshold" is being input.

"The entered contact force threshold is larger than the set value of the pushing force. Please reset the value so that it is smaller than the pushing force." Press the "?" button of each parameter to display the help screen for that parameter. The help screens contain information about parameters, how to use "... and notes.

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8.9 "FORCE.CONTOURING END" SETTINGS SCREEN

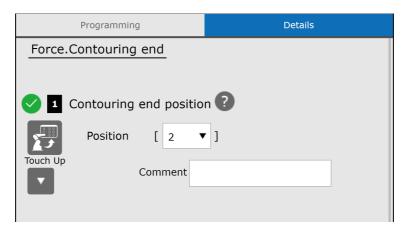
Touching the "Force.Contouring end" icon in the program line changes the bottom of the screen to display the details of the "Force.Contouring end" icon. Set the "Contouring end position" in the detail setting screen.

8.9.1 Contouring end position

Initially, the robot position at the time when the icon was dropped into the program line is recorded, and the mark is displayed next to it.

The position number and a comment can be input here.

Pressing the "v" button displays the detailed settings for position information, allowing them to be checked or edited. It is also possible to move the robot to that position.





Pressing the "?" button displays Help screen for the contouring end position.

8.10 FORCE CONTROL COORDINATE SETTING

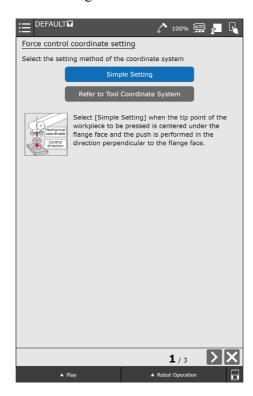
Set the force control coordinate in the following cases.

- 1. "External force sensor" was selected in the sensor setting, and "Not perpendicular to the flange face" was selected for the push direction setting.
- 2. "Integrated sensor" was selected in the sensor setting.

There are 2 setting methods: "Simple Setting" and "Refer to Tool Coordinate System". Select the method and touch the ">" button.

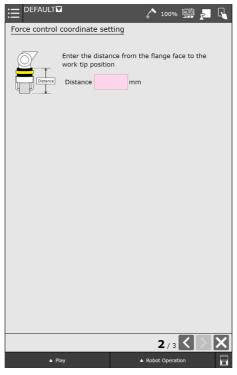
Choose "Simple Setting" when the tip point of the workpiece to be pushed is centered under the robot flange surface and the push is performed in the direction that is perpendicular to the flange face (+Z direction of the mechanical interface coordinate system).

In other cases, select "Refer to Tool Coordinate System". For example, select this when the tip point of the workpiece is not centered under the robot flange (it is offset from the center) or when the push direction is not perpendicular to the robot flange surface.



8.10.1 Simple Setting

Input the length [units: mm] from the robot flange surface to the tip point of the workpiece, then touch the ">" button.



Input a comment and touch the "

" button.

The maximum number of characters that can be entered for a comment is 16. If more characters were entered, the 17th and subsequent characters will be ignored.

The coordinate system is now set. Return to the settings screen.



8.10.2 Refer to Tool Coordinate System

Set the tool coordinate system in "UTool Setup" in advance. Set so that the +Z direction of the coordinate system matches the push direction.

Select the set coordinate system and touch the ">" button.



A comment input window appears in the same way as with simple setting. Input a comment and touch the "v" button.

The coordinate system is now set. Return to the settings screen.

9

ARC WELDING FUNCTION

You can perform arc welding applications by using the arc welding function of Tablet UI on a robot controller with the function of Arc Tool or LR Arc Tool. The status bar and the jog panel change to support arc welding functions. The Fig. 9 shows Tablet UI for arc welding and the Table 9 shows functions applicable to arc welding.

This chapter shows how to use the arc welding functions on Tablet UI. For the overview of arc welding or its details, refer to "Arc Welding Function OPERATOR'S MANUAL B-83284EN-03"

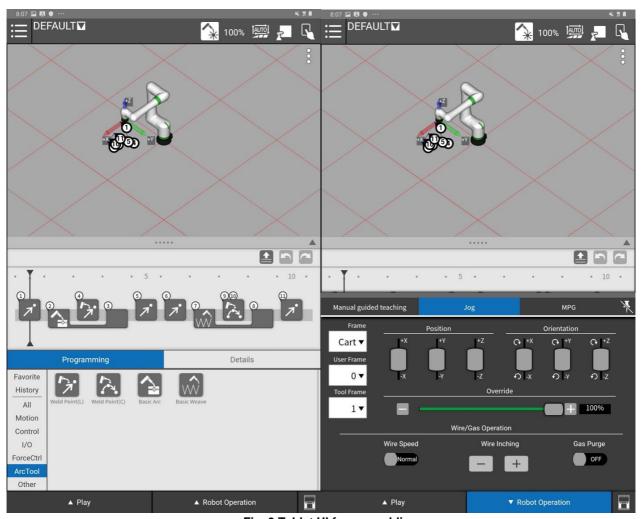


Fig. 9 Tablet UI for arc welding

Table 9 Arc welding functions

Table 9 Arc welding functions			
Location	Item	Description	
Status bar		"Weld Enable/Weld Disable" icon Switch Weld Enable/Weld Disable.	
	Wire Speed Normal	"Wire Speed" button Switch Wire Speed at high speed/normal speed.	
Robot operation panel	Wire Inching	"Wire Inching" button Inch and rewind wire manually.	
	Gas Purge OFF	"Gas Purge" button Purge gas manually.	
Program line/ Icon pallet	Basic Arc	"Basic Arc" icon Perform arc welding. Configure a weld start position, a weld end position and weld schedules.	
	Basic Weave	"Basic Weave" icon Perform weaving welding. Configure a weld start position, a weld end position, weld schedules and weaving schedules.	
	Weld Point(L)	"Weld Point(L)" icon Move linearly in a weld path. This icon is used in the Basic Arc instruction or the Basic Weave instruction. Welding can be done at the speed set in the Basic Arc instruction or the Basic Weave instruction.	
	Weld Point(C)	"Weld Point(C)" icon Move circularly in a weld path. This icon is used in the Basic Arc instruction or the Basic Weave instruction. Welding can be done at the speed set in the Basic Arc instruction or the Basic Weave instruction.	
	Weld Start (Motion)	"Weld Start(Motion)" icon Icon to move to the welding start position with a linear motion and start welding. Execute welding with the set Weld Procedure and Weld Schedule. Linear Motion can be set at the Weld Start(Motion).	
	Weld Start (Standalone)	"Weld Start(Standalone)" icon Icon to start welding. Execute welding with the set Weld Procedure and Weld Schedule. The Linear Motion cannot be set with the Weld Start(Standalone).	
	Weld End (Motion)	"Weld End(Motion)" icon Icon to move to the welding end position with a linear motion and end welding. Execute welding end process with the set Weld Procedure and Weld Schedule. Linear Motion can be set at the Weld End(Motion).	
	Weld End (Standalone)	"Weld End(Standalone)" icon Icon to end welding. Execute welding end process with the set Weld Procedure and Weld Schedule. Linear Motion cannot be set at the Weld End(Standalone).	

Location	Item	Description
Program line/ Icon pallet	Multi-pass Weld	"Multi-pass Weld" icon Icon to execute multi-pass welding. By setting the Weld Procedure (Multi-pass data type) and the Start Register number, instructions that is needed for the Multi-pass welding will automatically be added to the program line.

9.1 ROBOT OPERATION PANEL FOR ARC WELDING

In the UI for arc welding, the "Wire/Gas Operation" field was added on the Robot Operation panel in the UI for arc welding as shown in the Fig. 9.1(a).



Fig. 9.1(a) The "Robot Operation" panel for arc welding

You can inch/rewind wire by pressing the +key or the -key in the "Wire Inching" button shown in the Fig. 9.1(b).

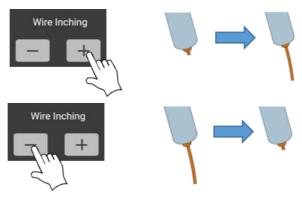


Fig. 9.1(b) The "Wire Inching" button

You can change the wire inching (+) speed to high speed by tapping the "Wire Speed" button shown in the Fig. 9.1(c).





Fig. 9.1(c) The "Wire Speed" button

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You can inch wire manually at a high speed by pressing the + key of the "Wire Inching" for 2s or more at a high speed. Wire rewinding cannot be changed to high speed.

Pressing the "Gas Purge" button shown in the Fig. 9.1(d) toggles ON/OFF. When the Gas Purge button is ON, you can check the flow rate of gas by purging gas.





Fig. 9.1(d) The "Gas Purge" button

*M***EMO**

If you turn the "Gas Purge" button ON and perform gas purging, it will turn off automatically after a preset time.

9.2 APPLICATIONS OF ICONS FOR ARC WELDING

You can create the following applications using the icons for arc welding.

- Using the "Basic Arc" icon, you can configure arc welding conditions and perform desirable arc welding.
- Using the "Basic Weave" icon, you can configure weaving conditions and perform desirable weaving.
- Using the "Multi-pass Weld" icon, you can configure welding conditions and perform desirable multi-pass welding.

Examples of arc welding applications using the "Basic Arc" are shown in the Fig. 9.2(a) and the Fig. 9.2(b). The Fig. 9.2(a) is an example of a linear welding program. It includes only teaching a weld start position and a weld end position. The Fig. 9.2(b) shows an example that a weld point was added to the previous one to change the posture of a torch. By creating an arc welding program, teaching reference positions and setting the weld schedule, the applications for arc welding can be ready as shown in the Fig. 9.2(a) and the Fig. 9.2(b)

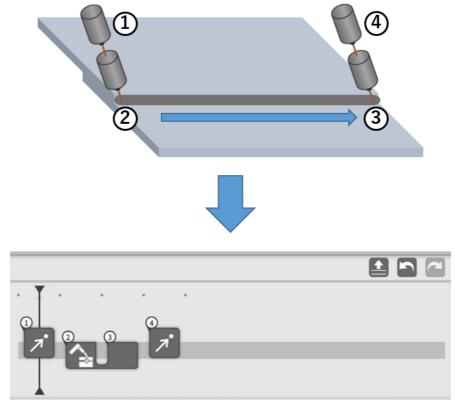


Fig. 9.2(a) An example of arc application 1: an example of liner welding

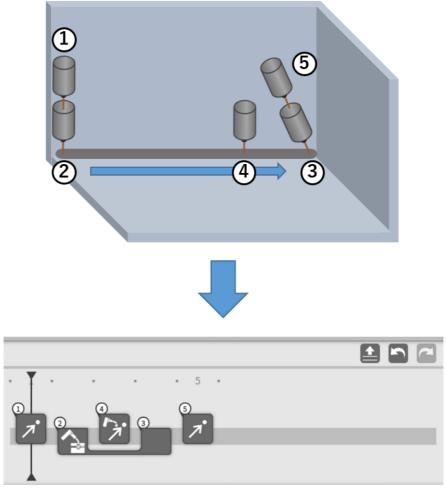


Fig. 9.2(b) An example of arc application 2: Program example of welding with the change of a torch's posture

The example of "Multi-pass Weld" is shown in Fig.9.2(c). "Multi-pass Weld" is a method to widen the weld width by welding the same part multiple times, and it is mainly used for welding thick plate. This can be done by welding multiple times using FOR loop as shown in the above program example. With Tablet UI, the program can easily be created by using the "Multi-pass Weld" command icon.

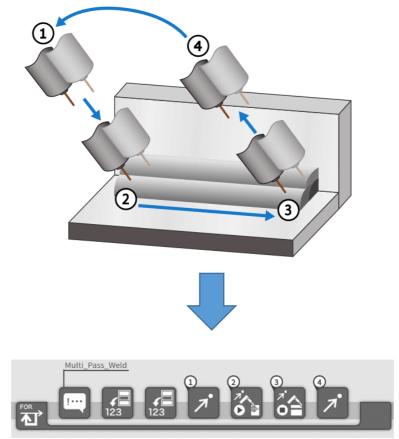


Fig. 9.2(c) An example of arc application 3: Program example of Multi-pass Weld

∅ MEMO

Each icon of "Multi-pass Weld", "Weld Start(Motion/Standalone)" and "Weld End(Motion/Standalone)" is displayed in the icon palette when the Multi-pass Weld function (option: J532 or R794) is installed.

9.3 "BASIC ARC"

Confirm a controller is communicating with a welding power supply when you use the "Basic Arc" icon

9.3.1 Adding the "Basic Arc" Icon

The "Basic Arc" icon is in the "Arc Tool" block in the icon pallet as shown in Fig. 9.3.1(a). To add the icon in the program line, drag and drop it to the program line. When you add the "Basic Arc" to the program line, the icon becomes bracket-shape and the enclosed section is the period of arc welding.

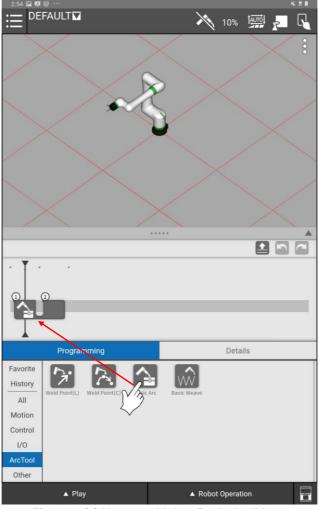


Fig. 9.3.1(a) How to add the "Basic Arc" icon

By tapping the "Basic Arc" icon on the program line, the lower part of the screen switches to the "Details" screen of the "Basic Arc" icon as shown in the Fig. 9.3.1(b). In the "Details" screen of the "Basic Arc", you can teach reference positions and configure the weld schedule.

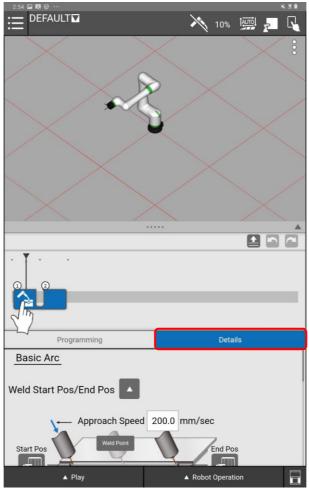
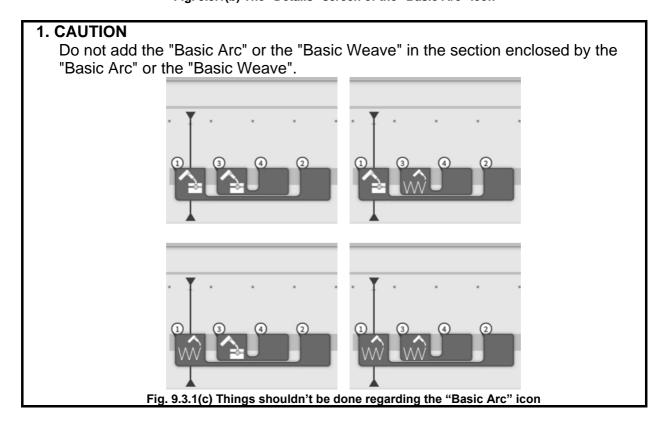


Fig. 9.3.1(b) The "Details" screen of the "Basic Arc" icon



9.3.2 Teaching Reference Positions

As shown in the Fig. 9.3.2, the "Weld Start Pos/End Pos" field is in the upper part of the "Details" screen. You can teach a weld start position and a weld end position in this field.

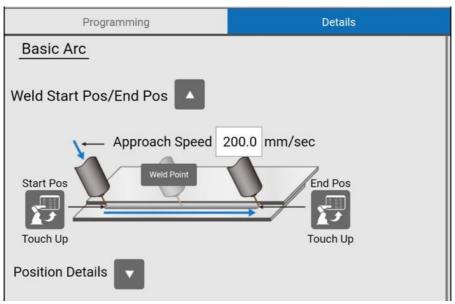


Fig. 9.3.2 The "Weld Start Pos/End Pos" field in the "Details" screen of the "Basic Arc" icon

9.3.2.1 Teaching a welding start/stop position

To record a weld start position and a weld end position, move the robot by a jog operation or a manual guided teach to the position and press the "Touch Up" button shown in the Fig. 9.3.2. To specify the speed between the weld start position and the position before the weld start position, enter the required speed in the "Approach Speed" text box.

CAUTION

A weld start position and a weld end position are set the current robot position when you add the "Basic Arc" icon in the program line. Make sure to record the weld end position each time you add the icon in the programing line. You can record the weld end position by moving robot to the position and touching the "Touch Up" button of the End Pos.

Pay attention to the wire stick-out when you teach reference positions. Set the length of the wire to the same length used to perform the welding.

MEMO

Program is executed in the following order. moves to the weld start position \rightarrow starts welding \rightarrow executes the instructions enclosed by the "Basic Arc" icon \rightarrow moves to the weld end position \rightarrow finishes welding

When you press the part of the Details button, details of the "Start Pos" and the "End Pos" will appear as shown in the Fig. 9.3.2.1. You can also record a weld start position or a weld end position by pressing the "Touch Up" button in this field.

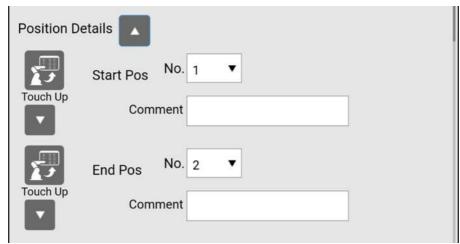


Fig. 9.3.2.1 The "Position Details" screen

9.3.2.2 Adding a weld point

To teach a weld point, add desirable icons in the section enclosed by the "Basic Arc" icon as shown in the Fig. 9.3.2.2. By tapping the "Weld Point" button, a popup appears and it shows how to teach a weld point.

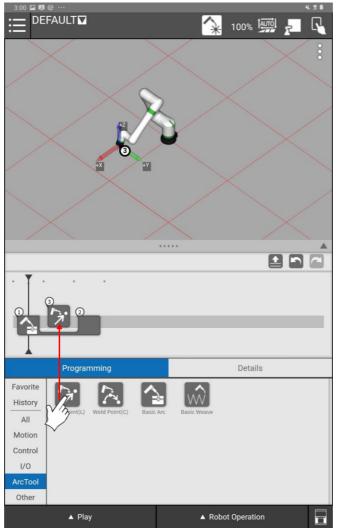


Fig. 9.3.2.2 How to add the "Weld Point" icon

9.3.3 "Weld Schedule" Setting

The "Weld Schedule" field is under the "Weld Start Pos/End Pos" field as shown in the Fig. 9.3.3. In the "Weld Schedule" field, you can select a weld mode and configure the weld schedule. The "Craterfill Process Schedule" field is under the "Weld Schedule" field. In the "Craterfill Process Schedule" field, you can configure the craterfill process schedule.

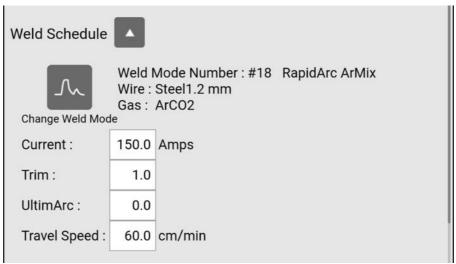


Fig. 9.3.3 The "Weld Schedule" field

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The display of the "Weld Schedule" field may differ from the power supply used.

9.3.3.1 "Weld Mode" setting

Several welding control methods are registered as weld modes in the "Weld Mode" in a power supply. These methods are optimum according to the combination of a wire material, a wire diameter and a gas type. You can choose an optimum method by selecting a Weld Mode Number. The Fig. 9.3.3 shows an example of a weld mode provided in a Lincoln welding power supply. By pressing the "Change Weld Mode" button shown in the Fig. 9.3.3, a popup appears as shown in Fig. 9.3.3.1(a). In this popup, you can change a Weld Mode Number. This popup has 3 tabs.

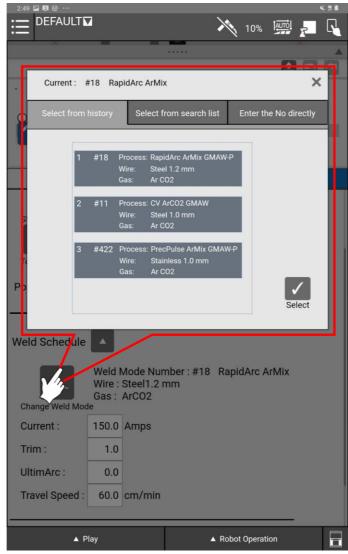


Fig. 9.3.3.1(a) The "Change Weld Mode" popup

1. The "Select from history" tab

In the "Select from history" tab, you can see the weld modes selected before as shown in the Fig. 9.3.3.1(b). By selecting a mode in the history and pressing the Select button, you can change a weld mode.

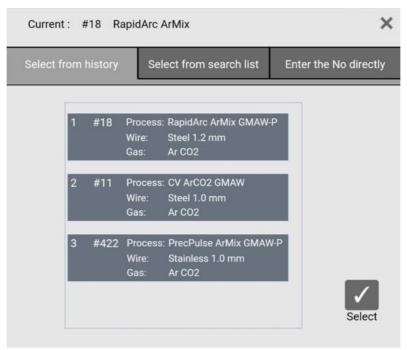


Fig. 9.3.3.1(b) The "Select from history" tab

2. The "Select from search list" tab

In the "Select from search list" tab, by selecting a wire material, a wire diameter and a gas type and pressing the Search button, you can view the search result of the applicable weld modes as shown in the Fig. 9.3.3.1(c). By selecting a Weld Mode Number in the list and pressing the Select button, you can change a weld mode.



Fig. 9.3.3.1(c) The "Select from search list" tab

3. The "Enter the No directly" tab

In the "Enter the No directly" tab, you can search a weld mode by entering a Mode Number as shown in the Fig.9.3.3.1(d). If the number is not present, a warning appears. By pressing the Select button, you can change a weld mode to the one shown in the tab.

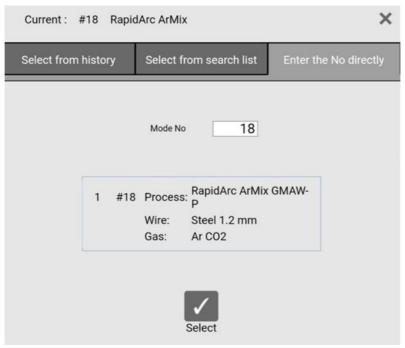


Fig. 9.3.3.1(d) The "Enter the No directly" tab

⚠ CAUTION

When you change a weld mode, the values of the weld schedule such as a current, a voltage etc. are initialized.

When a power supply is Fronius TPS/i, you can select the Weld Schedule Setting Mode. When you set the "Weld Schedule Setting Mode" to "Robot", a setup menu is displayed as shown in the Fig. 9.3.3.1(e) and you can configure the Weld Schedule sent to the power supply in the screen (Special 2 step). By pressing the "Change Weld Mode", you can change Synergic ID.

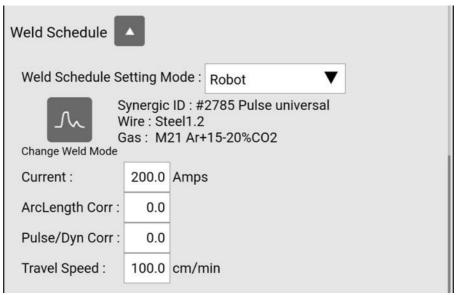


Fig. 9.3.3.1(e) A picture of the Robot mode under the Weld Schedule Setting Mode

When you set "Weld Schedule Setting Mode" to "Weld Equipment", a setup menu is displayed as shown in the Fig. 9.3.3.1(f). In the screen, you can select the Job number and perform the welding in the weld schedule set in a power supply as the Job number (Job Mode).



Fig. 9.3.3.1(f) A picture of the Weld Equipment mode under the Weld Schedule Setting Mode

9.3.3.2 "Weld Schedule" setting

Command values such as a current are shown in the "Weld Schedule" field. You can perform welding in the schedule you define in this field as shown in the Fig. 9.3.3.2.

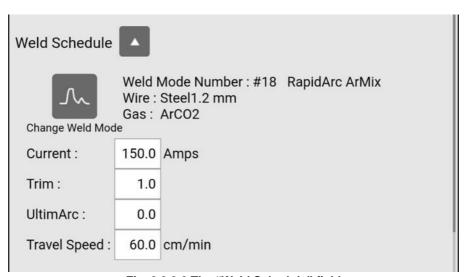


Fig. 9.3.3.2 The "Weld Schedule" field

A warning appears if you enter an instruction value outside the input range. A value is shown in red if you enter an instruction value outside the input range. Make sure to enter a value in input range.



The Travel Speed is set 0.0 initially. If you execute a program without setting the Travel Speed, the alarm occurs and the robot stops. If that happens, finish the program and enter an instruction value in the Travel Speed.

9.3.3.3 "Craterfill Process Schedule" setting

The "Craterfill Process Schedule" field is under the "Weld Schedule" field as shown in Fig. 9.3.3.3. You can see its details by pressing the button. You can perform craterfill in the schedule you define in this field.

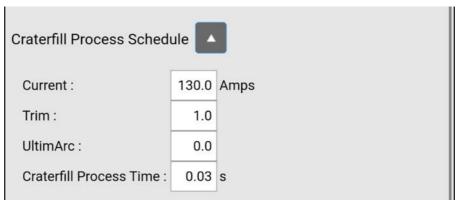


Fig. 9.3.3.3 The "Craterfill Process Schedule" field

A warning appears if you enter an instruction value outside the input range. A value is shown in red if you enter an instruction value outside the input range. Make sure to enter a value in input range. Craterfill Process Time is set 0.00s initially. If the value is 0.00s, craterfill is enabled and cannot be performed. If you enter a value except 0.00s in Craterfill Process Time, craterfill becomes enabled.

9.4 "BASIC WEAVE"

Confirm a controller is communicated with a welding power supply when you use the "Basic Weave" icon.

9.4.1 Adding the "Basic Weave" Icon

The "Basic Weave" icon is in the Arc Weld block in the icon pallet as shown in the Fig. 9.4.1(a). To add it in the program line, drag and drop it to the program line. When you add the "Basic Weave" to the program line, the icon becomes bracket-shape and the enclosed section is the period of arc welding and weaving.

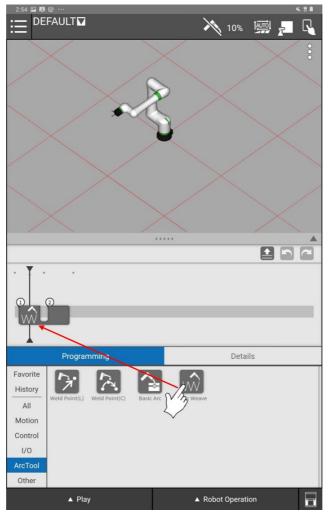


Fig. 9.4.1(a) How to add the "Basic Weave" icon

By tapping the "Basic Weave" icon in the program line, the lower part of the screen switches to the "Details" screen of the "Basic Weave" icon as shown in the Fig. 9.4.1(b). In the "Details" screen, you can teach reference positions and configure the weld schedule.

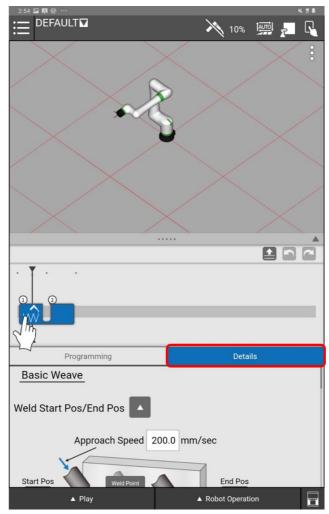


Fig. 9.4.1(b) The "Details" screen of the "Basic Weave" icon

9.4.2 Teaching Reference Positions

As shown in the Fig. 9.4.2, the "Weld Start Pos/End Pos" field is in the upper part of the "Details" screen. You can teach a weld start position and a weld end position in this field.

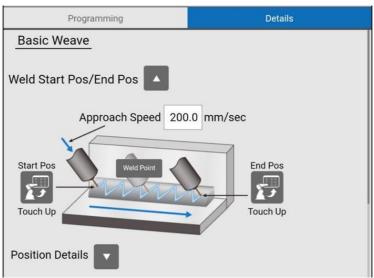


Fig. 9.4.2 The "Weld Start Pos/End Pos" field in the "Details" screen of the "Basic Weave" icon

You can teach reference positions using the "Basic Weave" icon in the same way as using the "Basic Arc" icon. Refer to the section 9.3.2.

9.4.3 "Weld Schedule" Setting

The "Weld Schedule" field is under the "Weld Start Pos/End Pos" field. In this field, you can configure a weld mode and the weld schedule. The "Craterfill Process Schedule" field is under the "Weld Schedule" field. In this field, you can configure the craterfill process schedule.

You can configure the weld schedule in the "Basic Weave" icon in the same way as in the "Basic Arc" icon. Refer to the section 9.3.3.

9.4.4 "Weaving Schedule" Setting

As shown in the Fig. 9.4.4, the "Weaving Schedule" field is under in the "Craterfill Process Schedule" field. You can configure a weaving schedule.

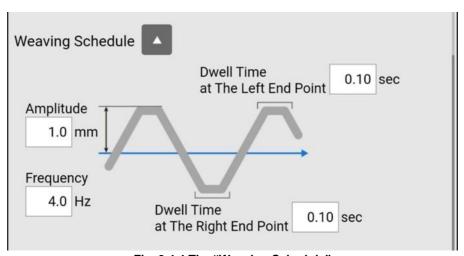


Fig. 9.4.4 The "Weaving Schedule"

A warning popup appears if you enter an instruction value outside the range.



Weaving is limited to a sine wave motion as shown in the Fig. 9.4.4.

9.5 "WELD START(MOTION/STANDALONE)" "WELD END(MOTION/STANDALONE)"

Each icon of "Weld Start(Motion/Standalone)", "Weld End(Motion/Standalone)" is equivalent to "Arc Weld start instruction", "Arc Weld end instruction" of Arc Tool.

Please confirm that the controller is communicating with a welding power supply when you use the "Weld Start(Motion/Standalone)", "Weld End(Motion/Standalone)".

⋒ **MEMO**

Each icon of "Multi-pass Weld", "Weld Start(Motion/Standalone)" and "Weld End(Motion/Standalone)" is displayed in the icon palette when the Multi-pass Weld function (option: J532 or R794) is installed.

9.5.1 Adding the "Weld Start(Motion/Standalone)" and the "Weld End(Motion/Standalone)" lcons

The "Weld Start(Motion)", "Weld Start(Standalone)", "Weld End(Motion)", and "Weld End(Standalone)" icons are in the icon pallet of ArcTool as shown in the Fig. 9.5.1(a).

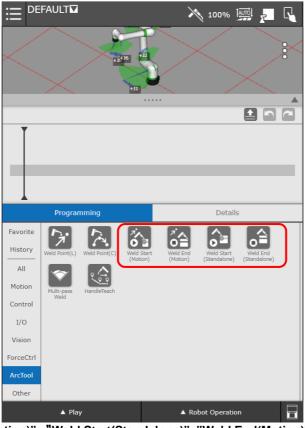


Fig. 9.5.1(a) "Weld Start(Motion)", "Weld Start(Standalone)", "Weld End(Motion)", "Weld End(Standalone)" icons

Drag and drop the instruction icons to the program line to add instructions to the program. Fig. 9.5.1(b) shows an example of dragging and dropping the "Weld Start(Motion)" to the program line.

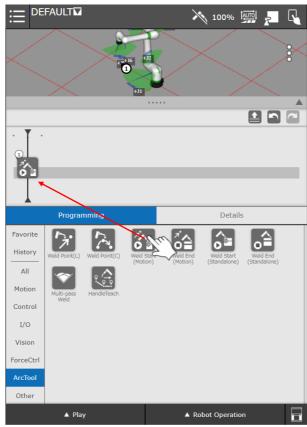


Fig. 9.5.1(b) Adding the "Weld Start(Motion)" icon

By touching the icon in the program line, the lower part of the screen switches to the "Details" screen of the icon as shown in the Fig. 9.5.1(c).

In the "Details" screen, you can set the weld schedule of Weld Start/Weld End.

In the details screen of the "Weld Start(Motion)" or the "Weld End(Motion)" icon, linear motion at the Weld Start/Weld End can be taught in addition to the weld schedule.

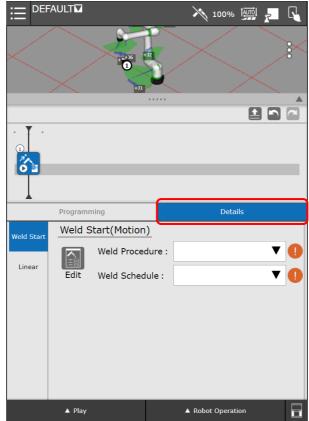


Fig. 9.5.1(c) Example of the Details screen: "Weld Start(Motion)" icon

9.5.2 "Weld Procedure" and "Weld Schedule" Setting

By touching the "Weld Start" tab on the left side of the Motion panel while the "Details" screen is displayed, Weld Procedure and Weld Schedule can be selected.

The Weld Procedure and the Weld Schedule can also be selected with the same operation as above by using "Weld Start(Standalone)", "Weld End(Motion)" and "Weld End(Standalone)". Take the details screen of "Weld Start(Motion)" as an example.

Follow the procedures below for setting.

- 1. Select the weld procedure number from the "Weld Procedure" dropdown box.
- 2. Select the weld schedule from the "Weld Schedule" dropdown box included in the weld procedure selected in procedure 1.

After selecting the "Weld Procedure" and "Weld Schedule", the selected results are displayed in weld schedule details field as shown in the Fig. 9.5.2.



- 1 Weld procedure and weld schedule can be specified by register number. Weld schedule details are not displayed if a user specifies them with register number.

Refer to "9.6 EDITING WELD PROCEDURE" for editing weld procedure and weld schedule.

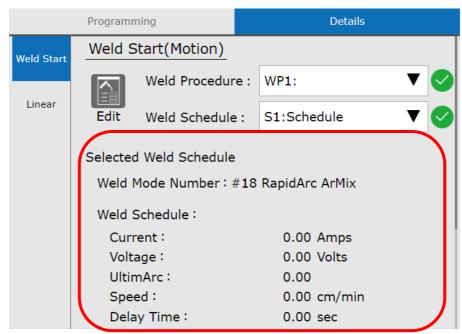


Fig. 9.5.2 Weld Schedule details screen

9.5.3 Teaching a Position, Speed, Additional Motion

In the details screen of the "Weld Start(Motion)" or the "Weld End(Motion)" icon, linear motion at the Weld Start/Weld End can be taught by touching the "Linear Motion" tab on the left side of the Motion panel while the "Details" screen is displayed.

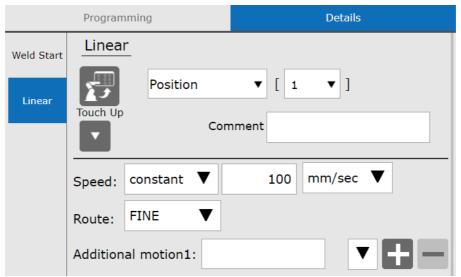


Fig. 9.5.3 Linear Motion Settings

Follow the procedures below to teach a new weld start/weld end motion start position.

- 1. Jog the robot to the start position of weld start/weld end motion.
- 2. Select the position number to record the position with number dropdown box at the right side of "Position".
- 3. Touch "Touch Up" icon to teach the current position.
- 4. Set the motion speed with "Speed".
- 5. Select the route format (FINE/CNT) with "Route".
- 6. Add the "Additional motion" as needed.

Setting items are the same as "L" icon. Refer to "4.3.1 Linear Motion". However, "Weld speed" can be selected in procedure 4 with "Weld Start(Motion)"/"Weld End(Motion)" icon.



MEMO

Instead of teaching a new weld start/weld end motion start position, it can be set by the position or the position register (specify directly or indirectly) that has already been taught.

The start position can also be taught by specify the position's coordinate and format directly.

In that case, do not execute the procedures 1-3 and set the position by referring the description in "4.3.1 Linear Motion" instead.

9.6 EDITING "WELD PROCEDURE"

By touching the "Weld Start" tab in the details screen of the "Weld Start(Motion/Standalone)"/"Weld End(Motion/Standalone)" icon, "Edit" icon of the weld procedure is displayed. To edit the weld procedure, touch the "Edit" icon which will display the weld procedure edit screen.



MEMO

The Weld Procedure edit screen can also be displayed by selecting the "Weld Procedure" on the "Setup" menu.

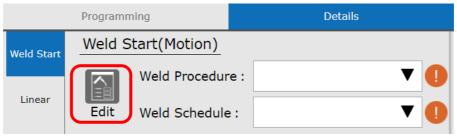


Fig. 9.6(a) "Edit" icon of the weld procedure

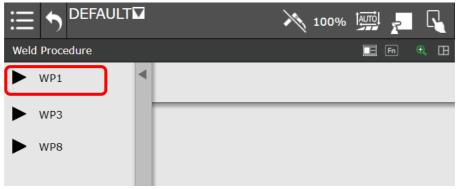


Fig. 9.6(b) Edit screen of the weld procedure

Weld procedure is displayed in tree view on the left side of motion panel. Touch the weld procedure to edit, then the weld modes and weld schedules contained in that weld procedure are displayed.

9.6.1 Weld Procedure Screen

Edit items for weld procedure are displayed at the lower part of the target weld procedure. Setting items are displayed on the right side of the operation panel depending on the selected edit items.

9.6.1.1 Weld Procedure Title

In the title screen of the Weld Procedure, comment input, delete, copy, the setting of the weld procedure can be performed. If there is no created weld procedure, Create new Weld Procedure wizard will be displayed. Select "Standard" or "Multi-pass" for the Data Type.

Table 9.6.1.1 Data Type

Standard	Each weld schedule can be set/edited. It can be used in Weld Start/Weld End instructions.
Multi-pass	Pass (a set of weld schedule and crater schedule) can be set/edited. It can be used in
	Multi-pass Weld instruction.

Refer to "9.6.2 Weld Procedure/Weld Schedule (Pass) Operation" for the details of each operation.

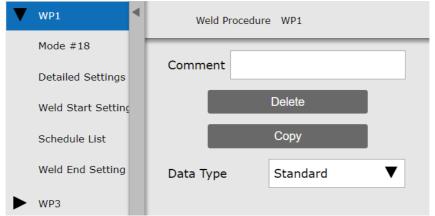


Fig. 9.6.1.1 Title screen of the weld procedure

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- 1 Up to 17 single-byte characters are allowed in Comment field.
- 2 Data Type selection field is displayed when the Multi-pass weld function is enabled.

9.6.1.2 Mode

Weld Mode details can be displayed and edit in Mode screen. For the setting of Weld Mode, refer to "9.3.3.1 "Weld Mode" setting".

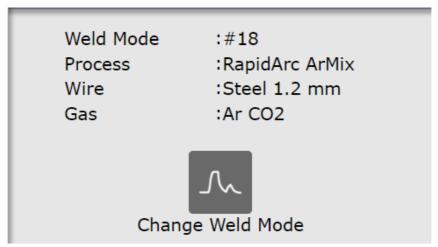


Fig. 9.6.1.2 Mode Screen

9.6.1.3 Detailed Settings

Set Ramping, Torch angles and Tracking Schedule. As for Ramping, touch the toggle switch to enable/disable. Use buttons to display or hide the detail setting items of Torch angles.

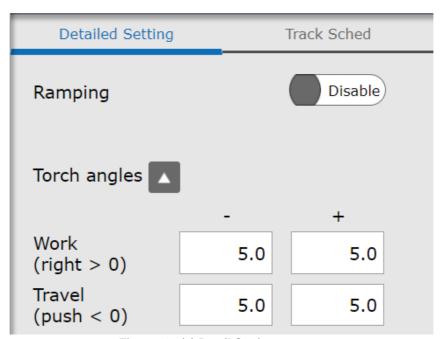


Fig. 9.6.1.3(a) Detail Settings screen

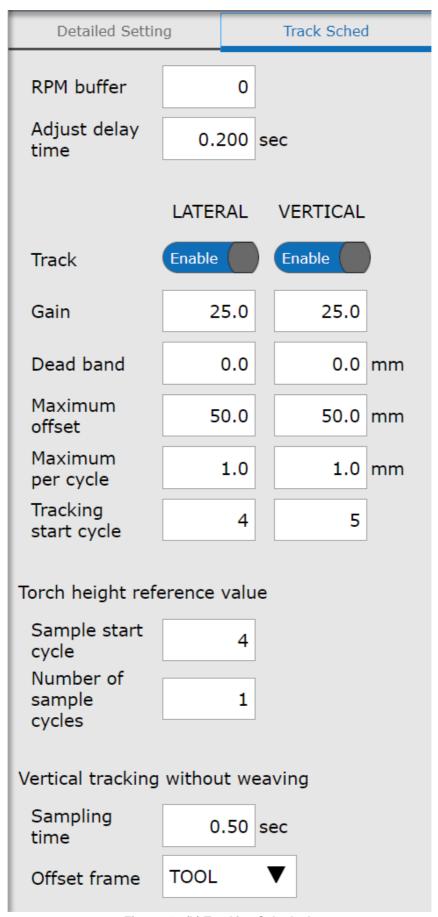


Fig. 9.6.1.3(b) Tracking Sched tab

- Ø I
 - **MEMO**
- 1 "Track Sched" tab is displayed in Detail Settings screen when the Arc Sensor function (J511 or R794) is installed.
- 2 "Torch angles" is an optional function (R734). Details are displayed in Detail Settings screen when the torch angle function is enabled.

9.6.1.4 Weld Start Setting

In the "Welding Command" tab, set Runin and Arc Start Pre-time. The sequence diagram at the top of the screen will be changed according to the settings. As for Arc Start Pre-time, touch the toggle switch to change between Enable/Disable.

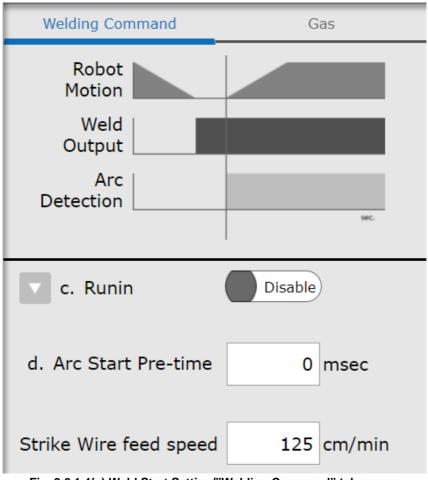


Fig. 9.6.1.4(a) Weld Start Setting/"Welding Command" tab screen

Set "Gas purge" and "Gas preflow" in "Gas" tab. The sequence diagram at the top of the screen will be changed according to the settings.

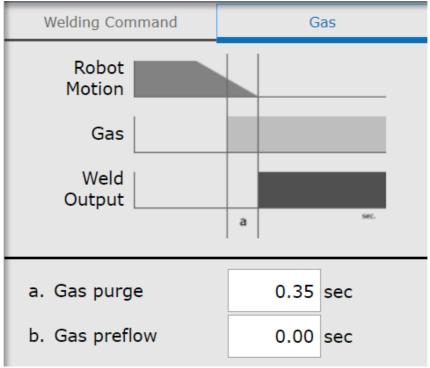


Fig.9.6.1.4(b) Weld Start Setting / "Gas" tab screen

MEMO

Weld Start Setting screen may differ depending on the welding power supply.

9.6.1.5 Schedule List (Pass List)

Displays schedule list when the Weld Procedure Data Type is "Standard". Select the weld schedule to edit, copy, clear and change the number of weld schedule. Displays Pass List when the Weld Procedure Data Type is "Multi-pass". Touch the "Number of Passes" to change the number of passes.

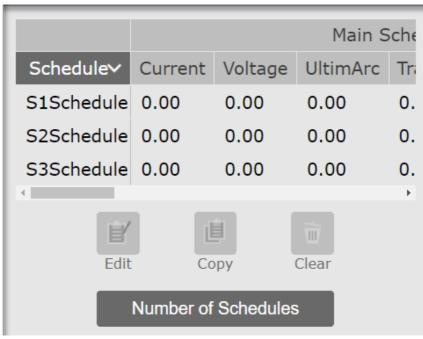


Fig. 9.6.1.5(a) Schedule List screen

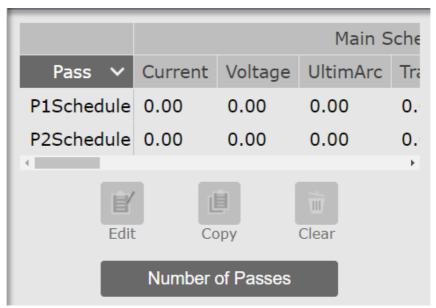


Fig. 9.6.1.5(b) Pass List screen

9.6.1.6 Weld End Setting

Set Burnback, Wire stick resets, and "Arc End pre-time" in "Welding Command" tab. The sequence diagram at the top of the screen will be changed according to the settings.

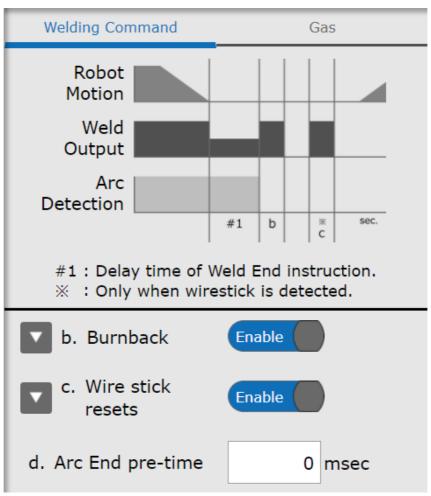


Fig. 9.6.1.6(a) Weld End Setting / Welding Command tab screen

Set Gas postflow in "Gas" tab. The sequence diagram at the top of the screen will be changed according to the settings.

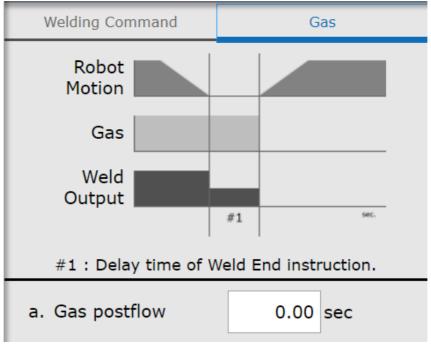


Fig. 9.6.1.6(b) Weld End Setting/Gas tab screen

MEMO

Weld End Setting screen may differ depending on the welding power supply.

9.6.2 Weld Procedure/Weld Schedule (Pass) Operation

This section shows how to operate weld procedure and weld schedule (Pass for Multi-pass welding procedure).

9.6.2.1 Creating new Weld Procedure

To create new weld procedure, use "Add WP" button at the bottom left of the weld procedure edit screen. By touching "Add WP" button, "Create new Weld Procedure" wizard is displayed as shown in Fig. 9.6.2.1(b).

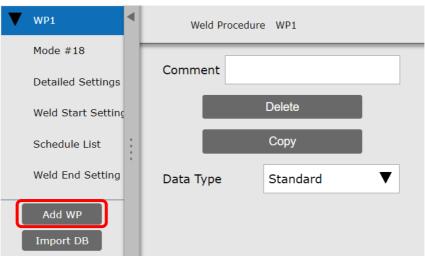


Fig. 9.6.2.1(a) Add WP button

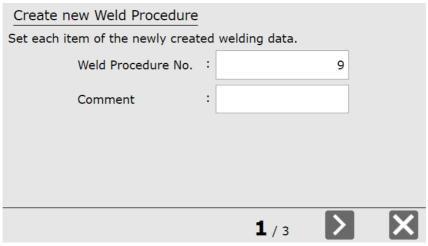
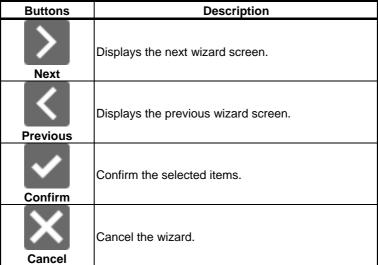


Fig.9.6.2.1(b) Create new Weld Procedure wizard 1

Buttons shown in the table 9.6.2.1(a) are displayed in Create new Weld Procedure wizard. The grayed out button on the wizard page cannot be used.

Set the Weld Procedure No. (required) and Comment (optional) by following the wizard. Touch button when completed.

Table 9.6.2.1(a) Buttons on the Wizard screen





- 1 It is not possible to set a Weld Procedure No. that is already in use for the new one.
- 2 3 weld schedules are included in the new weld procedure.
- 3 Up to 40 weld procedures that can be created.

Select weld mode in Fig. 9.6.2.1(c). By touching the "Select Weld Mode" button, a popup appears to change weld mode.

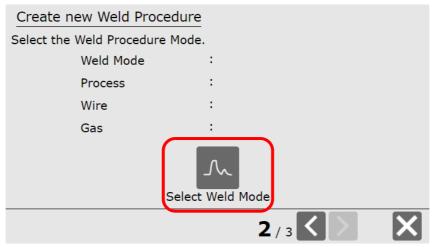


Fig. 9.6.2.1(c) Create new Weld Procedure wizard 2 Weld Mode not selected

Set the weld mode in the appeared popup. Refer to "9.3.3.1 "Weld Mode" setting" for the weld mode setting. Touch button when completed.

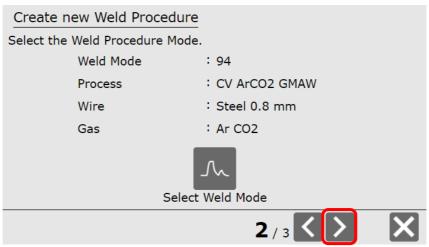


Fig. 9.6.2.1(d) Create new Weld Procedure wizard 2 Select Weld Mode

Weld procedure setting result is displayed as shown in Fig. 9.6.2.1(e). Touch button to create a new weld procedure.

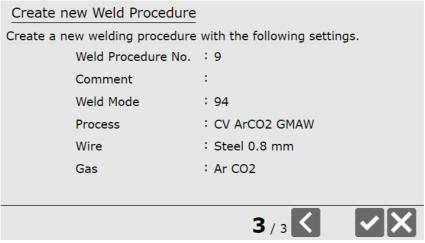


Fig. 9.6.2.1(e) Create new Weld Procedure wizard 3

9.6.2.2 Copying Weld Procedure

Use "Copy" button in the "Weld Procedure" title screen to copy weld procedure.

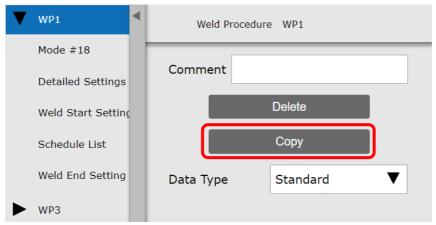


Fig. 9.6.2.2(a) "Copy" button

1. By touching the "Copy" button, the "Copy Weld Procedure" dialog box is displayed.

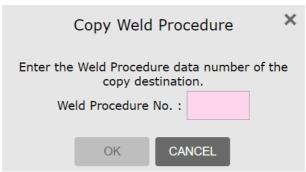


Fig. 9.6.2.2(b) "Copy Weld Procedure" dialog box

2. Enter the Weld Procedure data number of the copy destination.



- 1 It is not possible to set a Weld Procedure No. that is already in use for the copy destination.
- 2 Up to 40 weld procedures that can be created.
- 3. Touch "OK" to start copying the weld procedure. Touch "CANCEL" button or "X" to cancel the copy operation.
- 4. Touch "X" to close the dialog box when the copy is completed.

9.6.2.3 Deleting Weld Procedure

Use "Delete" button in the "Weld Procedure" title screen to delete weld procedure.

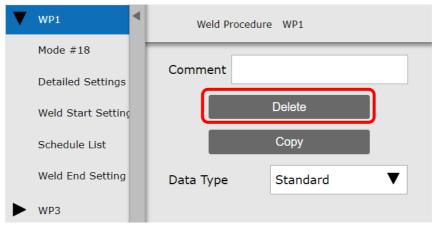


Fig. 9.6.2.3(a) "Delete" button

- 1. By touching the "Delete" button, the "Delete Weld Procedure" dialog box is displayed.
- 2. Touch "OK" to start deleting the weld procedure. Touch "CANCEL" button or "X" to cancel the delete operation.



Fig. 9.6.2.3(b) "Delete Weld Procedure" dialog box

3. Touch "X" to close the dialog box when the deletion is completed.

9.6.2.4 Editing Weld Schedule (Pass)

Weld schedule can be edited on the Schedule List screen.

When the data type is "Multi-pass" welding, Pass List is displayed instead of Schedule List and the pass details can be edited.

1. By touching "Edit" button after selecting schedule (pass), schedule (pass) screen is displayed. Refer to "9.3.3 "Weld Schedule" Setting" for weld schedule.

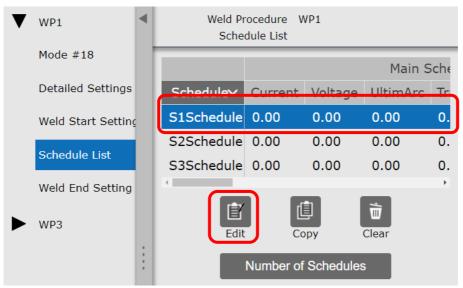


Fig. 9.6.2.4(a) Schedule List "Edit" button

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When the Multi-pass weld function (option: J532 or R794) is installed, the tab such as "Offset" is added on the Schedule List screen.

- 2. Change the settings as needed.
- 3. After editing, touch button to go back to the previous screen.

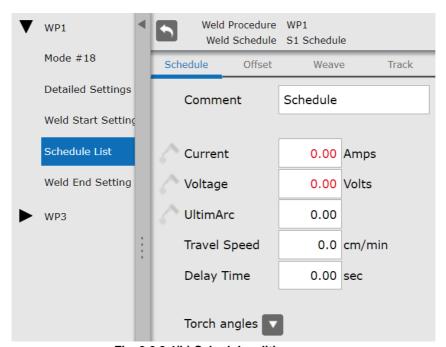


Fig. 9.6.2.4(b) Schedule editing screen

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Weld Schedule (Pass) displayed items differs depending on the option.

9.6.2.5 Copying Weld Schedule (Pass)

Weld procedure can be copied on the Schedule List screen.

Displays Pass List instead of schedule list when the Weld Procedure Data Type is "Multi-pass", and the pass details can be copied.

1. By touching "Copy" button after selecting weld schedule (pass) you want to copy, "Copy Weld Procedure" dialog box is displayed.

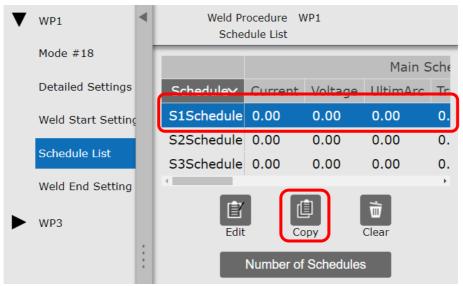


Fig. 9.6.2.5(a) Schedule List screen "Copy" button

2. Select the Weld Schedule (pass) data of the copy destination from pull-down menu.



Fig. 9.6.2.5(b) Weld Schedule selection dialog box

3. By touching "OK" button, "Copy Weld Procedure" confirmation dialog box is displayed. "CANCEL" button or "X" to cancel the copy operation.

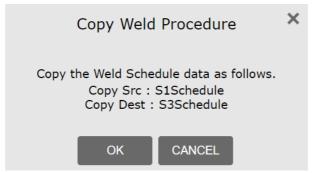


Fig. 9.6.2.5(c) Confirmation dialog box for Weld Schedule selection

- 4. Touch "OK" button to copy Weld Schedule (Pass).
- 5. Touch "X" to close the dialog box.



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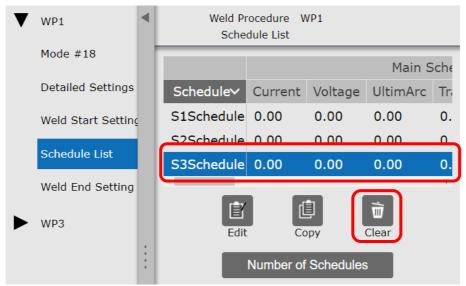
Up to 32 weld schedules (up to 16 for passes) can be included in one weld procedure.

9.6.2.6 Clearing Weld Schedule (Pass)

Weld Schedule can be cleared on Schedule List screen.

Displays Pass List instead of schedule list when the Weld Procedure Data Type is "Multi-pass", and the pass details can be cleared.

1. By touching "Clear" button after selecting weld schedule (pass) you want to delete, "Clear Weld Schedule" dialog box is displayed. Touch "CANCEL" button or "X" to cancel the operation.



9.6.2.6(a) Schedule List screen "Clear" button



9.6.2.6(b) Confirmation dialog box for clearing Weld Schedule

- 2. Touch "OK" to clear the weld procedure.
- 3. Touch "X" to close the dialog box.

9.6.2.7 Changing the Number of Weld Schedule (Pass)

The number of Weld Schedules can be changed on Schedule List screen.

Displays Pass List instead of schedule list when the Weld Procedure Data Type is "Multi-pass", and the number of passes can be changed.

1. By touching the "Number of Schedules (Number of Passes)" button, the "Number of Schedules (Passes)" dialog box is displayed.

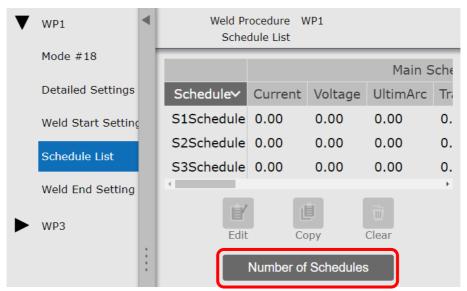


Fig. 9.6.2.7(a) Schedule List screen "Number of Schedules" button

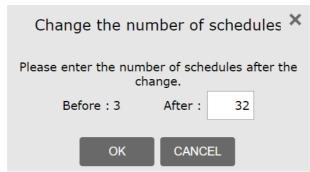


Fig. 9.6.2.7(b) "Change the number of schedules" dialog box

- 2. Enter the number of schedules (passes) after changed.
- 3. By touching the "OK" button, the "Change the number of schedules" confirmation dialog box of weld schedules is displayed. Touch "CANCEL" button or "X" to cancel the operation.

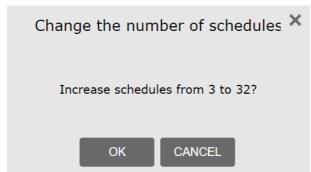


Fig. 9.6.2.7(c) Confirmation dialog box for "Change the number of schedules"

- 4. Touch "OK" button to change the number of weld schedule (pass).
- 5. Touch "X" to close the dialog box.

9.6.3 Importing and Exporting Weld Database

The database files (XML) can be imported from external memory device or exported to the external memory device.

9.6.3.1 Importing Weld Database

The database files (XML) for creating weld procedure can be imported. With this function, database files (XML) which is created offline or exported from another robot controller can be read and reflected to the Weld Procedure. By touching the "Import DB" on weld procedure edit screen, "Weld Database Import" wizard is displayed as shown in Fig. 9.6.3.1(b).

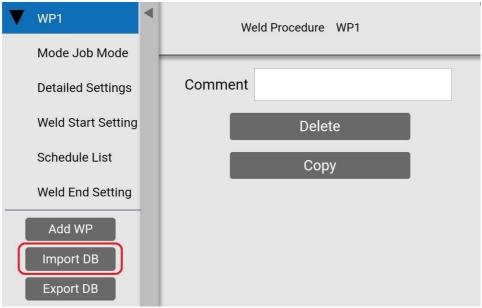


Fig. 9.6.3.1(a) "Import DB" button

Select the device that the weld database files are stored and then touch button. Select "Front Panel USB (UD1)" as an example herein.



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Database files need to be placed in the top directory of the device in advance (directory level UD1:\ for UD1). The database files that are not in the top directory cannot be read.

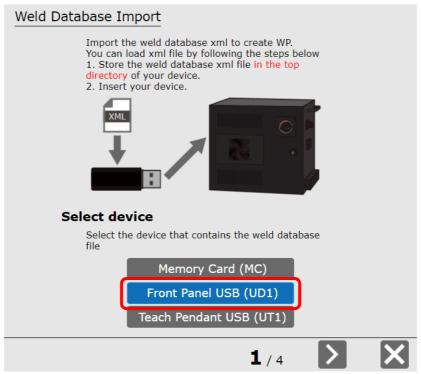


Fig. 9.6.3.1(b) "Weld Database Import" wizard 1

On the screen as shown in Fig. 9.6.3.1(c), select weld database file to import, and then touch button.

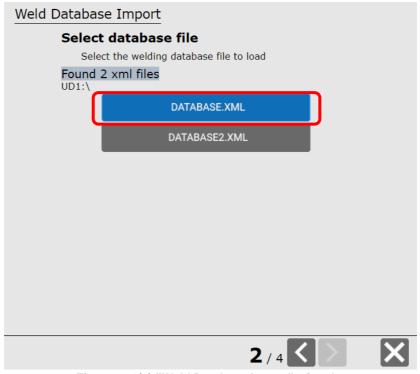


Fig. 9.6.3.1(c) "Weld Database Import" wizard 2

↑ CAUTION

Make sure the number of the letters of the weld database file to import is less than 40. If it overs 40, the weld database file's name can't be displayed correctly.

If the same Weld Procedure No. is already selected on Fig. 9.6.3.1(d), select whether to Overwrite WP or to Skip Data and then touch "Import".

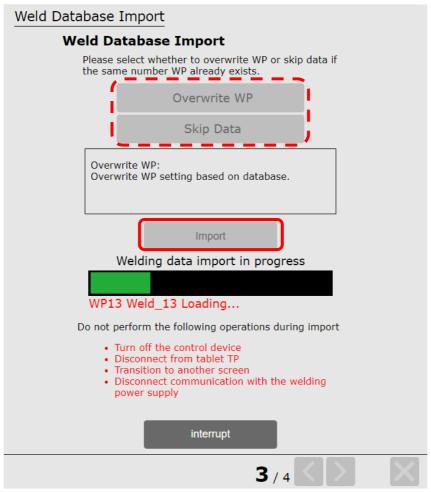


Fig. 9.6.3.1(d) "Weld Database Import" wizard 3

Touch "close" button or "X" button to complete the wizard when importing weld database is completed.

⚠ WARNING

It takes some time to import the database files.

Do not perform the following operations during import.

- Turn off the control device
- Disconnect from tablet TP
- Transition to another screen
- Disconnect communication with the welding power supply

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If the error / warning occurred during import operation, the screen as shown in Fig. 9.6.3.1(e) will be displayed.

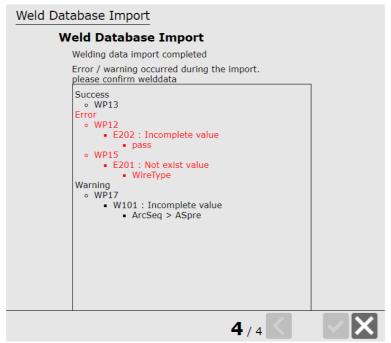


Fig. 9.6.3.1(e) "Weld Database Import" wizard 4

9.6.3.2 Exporting Weld Database

With this function, you can export database file (XML) to external memory device and check it offline and edit. You can also share the weld database file (XML) with other controller through the importing function. By touching the "Export DB" on the weld procedure edit screen on Fig. 9.6.3.2(a), "Weld Database Export" wizard is displayed as shown in Fig. 9.6.3.2(b).

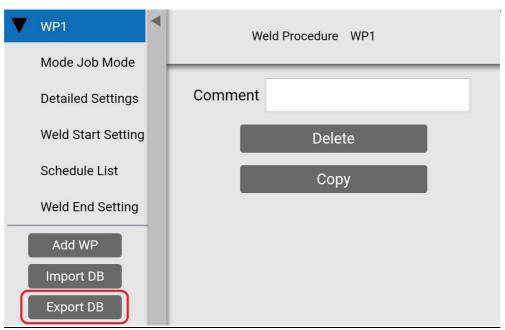


Fig. 9.6.3.2(a) "Export DB" button

Select the device that the weld database files will be exported to and touch button on Fig. 9.6.3.2(b). Select "Front Panel USB (UD1)" as an example herein.



MEMO

Database files are stored in the top directory of an external memory device. (directory level UD1:\ for UD1).

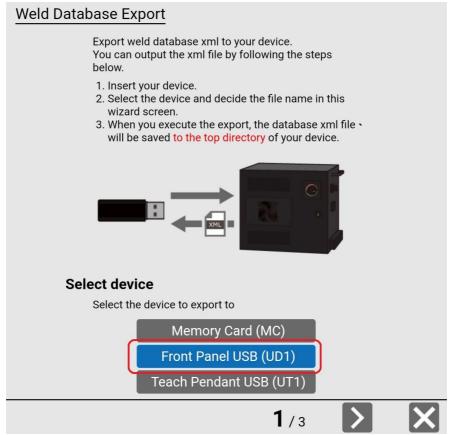


Fig. 9.6.3.2(b) "Weld Database Export" wizard 1

Input the weld database file's name on Fig. 9.6.3.2(c) and then touch "execution" button.

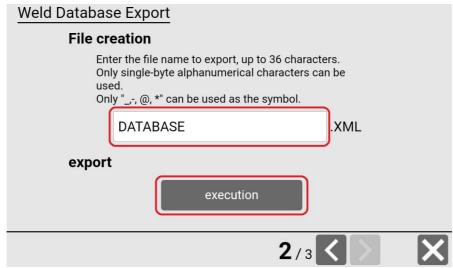


Fig. 9.6.3.2(c) "Weld Database Export" wizard 2-1

If the same name of the exported database already exists in the external memory device, a popup appears as shown in Fig. 9.6.3.2(d). Choose whether to overwrite the database file or to cancel.

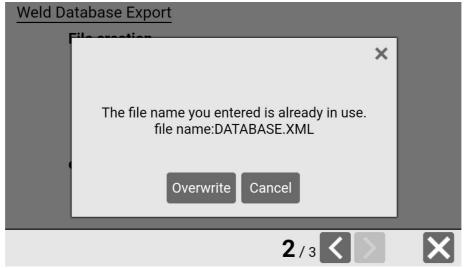


Fig. 9.6.3.2(d) "Weld Database Export" wizard 2-2

Touch "close" button or "X" button to complete "Weld Database Export" wizard when exporting weld database is completed.



If the error / warning occurred during export operation, the screen as shown in Fig. 9.6.3.2(e) will be displayed.

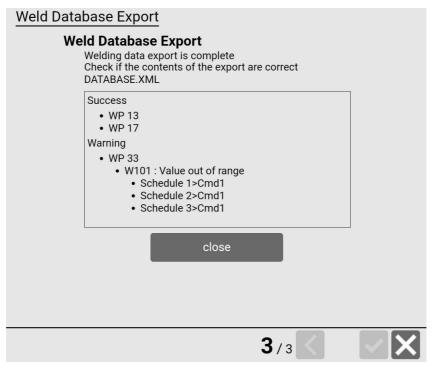


Fig. 9.6.3.2(e) "Weld Database Export" wizard 3

9.7 MULTI-PASS WELD

Please confirm that the controller is communicating with a welding power supply when you use the "Multi-pass Weld".

MEMO

"Multi-pass Weld" icon is displayed in the icon palette when the Multi-pass Weld function (option: J532 or R794) is installed.

9.7.1 Adding the "Multi-pass Weld" Icon

The "Multi-pass Weld" icon is in the Arc Weld block in the icon pallet as shown in the Fig. 9.7.1(a). When you select and add the icon to the program line, "Multi-pass Weld" wizard is displayed as shown in the Fig. 9.7.1(b).

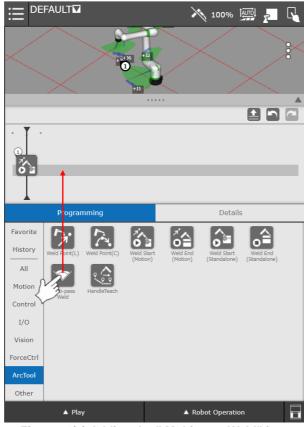


Fig. 9.7.1(a) Adding the "Multi-pass Weld" icon

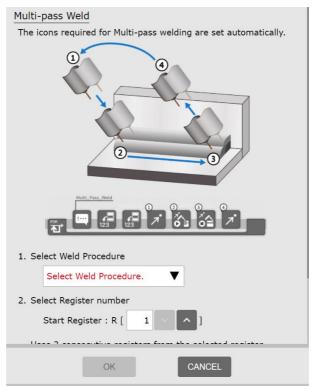


Fig. 9.7.1(b) " Multi-pass Weld" wizard

By following the wizard, select Weld Procedure (Multi-pass weld data type), register number and then touch "OK". Icon instructions that are needed for multi-pass are automatically be arranged in the program line.

MEMO

When there is no Weld Procedure (Multi-pass weld data type), a message appears indicating that there is no Weld Procedure. Create Weld Procedure with Multi-pass weld data type in the weld procedure edit screen.

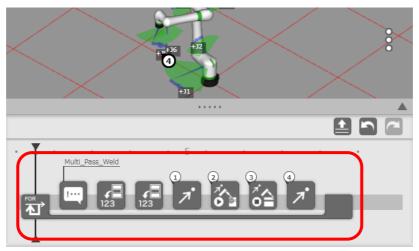
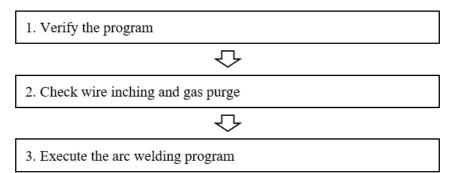


Fig. 9.7.1(c) Instructions automatically arranged in the program line

After that, check the settings of each arranged icon, and then teach the reference position for icons that need to teach the reference position.

9.8 EXECUTING THE ARC WELDING PROGRAM

This chapter shows the settings and the things to check when perform the arc welding applications. Follow the next flow when you perform them. Following the flow will make welding safe.



9.8.1 Confirming the "Weld Enable/Disable" Icon

When you verify a program, confirm welding is enabled or disabled. In the UI for arc welding, the "Weld Enable/Disable" icon is shown in the status bar. Arc welding is enabled when the "Weld Enable/Weld Disable" icon is same to the one shown in the Fig. 9.8.1(a) and arc welding is disabled when it is same to the one shown in the Fig. 9.8.1(b). When you execute the "Basic Arc" instruction or the "Basic Weave" instruction while arc welding is disabled, those cannot be performed. Note even if arc welding is enabled, arc welding cannot be performed when the Step button is Enable.





Fig. 9.8.1(a) "Weld Enable" Icon

Fig. 9.8.1(b) "Weld Enable" Icon

When you tap the "Weld Enable/Weld Disable" icon, a popup appears as shown in Fig. 9.8.1(c). You can switch arc welding enabled/disenabled by tapping the "Weld Enable" icon or the "Weld Disable" icon in the popup.

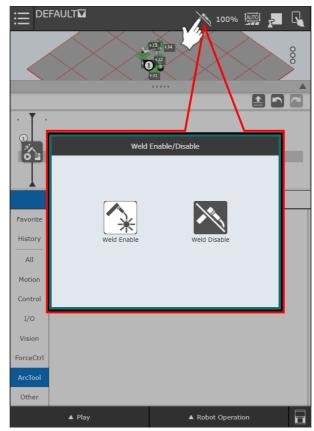


Fig. 9.8.1(c) The "Weld Enable/Disable" popup

! CAUTION

When you check a welding program, make sure to set welding disabled.

9.8.2 Verifying the Program

Once you teach reference positions and set a speed, confirm the program is normal before welding. Confirm the following checklist as shown in the Fig. 9.8.2(a) and verify the program.

- 1. Confirm welding is disabled.
- 2. Check the speed override. Set the speed override a low value initially, increase it gradually while verifying the program.
- 3. Confirm the TP enable switch is ON.
- 4. Execute the program.

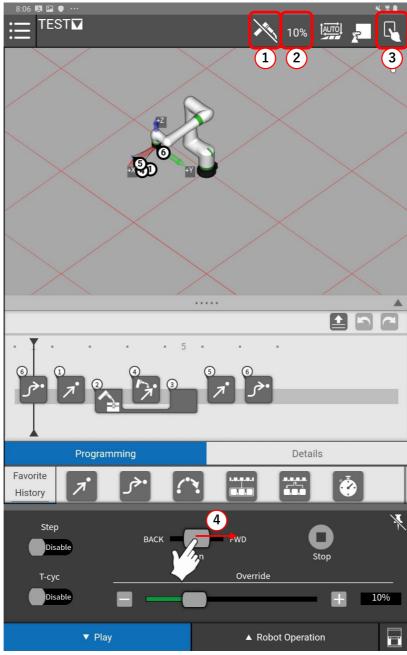


Fig. 9.8.2(a) The checklist before verifying the program

MEMO

When T-cyc is Enable (Test Execution), the program can be verified moving the virtual robot in the Robot Graphics screen instead of moving the robot. For the details of Test Execution, refer to the section 5.1.

*M***EMO**

When the Step button is Enable (Step Execution), you cannot perform welding. For the details of Step Execution, refer to the section 5.1.

9.8.3 Checking Wire Inching and Gas Purging

Before welding, make sure wire inching and gas purging can be normally performed. You can confirm the setting of the Wire/Gas operation in the Robot Operation panel shown in the Fig. 9.8.3. For the details of the Wire/Gas operation, refer to the section 9.1.



Fig. 9.8.3 The Robot Operation panel for arc welding

9.8.4 Executing the Arc Welding Program

Execute the arc welding program in the following steps.

- 1. Confirm Step Execution and Test Execution are disabled.
- 2. Set welding enabled.
- 3. Set the speed override 100%.
- 4. Execute the program.

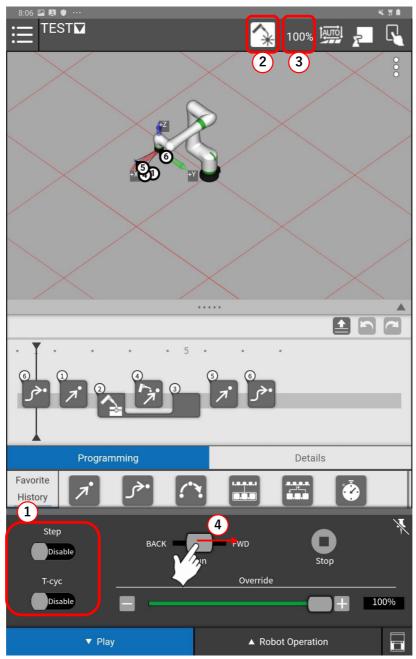


Fig. 9.8.4(a) The checklist when the arc welding program is verified

5. Arc welding is performed when various arc welding icons are executed.

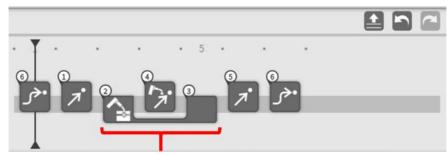


Fig. 9.8.4(b) The arc welding section

↑ CAUTION

If the "Basic Arc" instruction or the "Basic Weave" instruction is executed while the speed override is not 100%, "ARC-033 Override must be 100%" alarm occurs and the program pauses.

∴ CAUTION

If an arc is not generated at the beginning of arc welding, "ARC-013 Arc Start failed " alarm occurs and the program pauses.

9.9 MANUAL GUIDED TEACHING HANDLE

9.9.1 **Overview**

To enable the Manual Guided Teaching function, user has to grip the enabling divide (deadaman switch). For the detail.

Manual Guided Teaching Handle is a device to operate robot two-handed by the Manual Guided Teaching function. It has an additional enabling device to enable the function.



Fig. 9.9.1 Manual Guided Teaching Handle system

To use this device S530 software option has to be ordered, In case of this option is ordered safety input SFDI1 is used for the enabling device on the Handle. And RI[1] and RI[2] is used for operation buttons They cannot be used for other pourpuse.

. WARNING

This device enables to move the robot by the Manual Guided Teaching function. Extreme caution must be exercised when using this function. When you operate the robot by the device, you must strictly adhere to the following precautions.

- The Tablet TP or an external emergency stop button must be prepared near the operator to use the emergency stop button any time.
- Two or more persons must not operate robot by the Manual Guided Teaching.
 You must check the person does not stay in the operation area.
- The contact stop is disabled while High Speed mode of Collaborative robot. If the High Speed mode is used, adequate risk assessment for the whole robot system is necessary to verify that the contact stop can be disabled. Please refer 7.2 High Speed Mode" section in OPERATOR'S MANUAL (Collaborative Robot Function) (B-83744EN).

9.9.2 Manual guided teaching handle

Manual Guided Teaching Handle consists of Operation Handles, a Enabling device and two Operation Buttons. Operation Handle 1 equips the enabling. The user grips these handles with both hands and moves the robot arm.

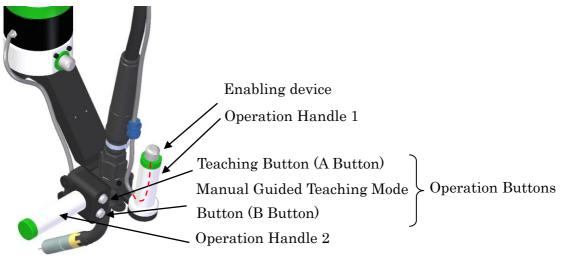


Fig. 9.9.2(a) Manual Guided Teaching Handle

Operation Handle 1 and Operation Handle 2 are removable easily without using any tool.

When removing Operation Handle 1, the Enabling device is needed to be removed and mounted on Adapter.

The Enabling device can be separated at the Relay connector.

The procedure how to moving the Enabling device is below.

- 1. Separate Relay connector.
- 2. Remove the enabling device from Operation Handle1.
- 3. Attach the enabling device to Adapter.
- 4. Connect Relay connector.

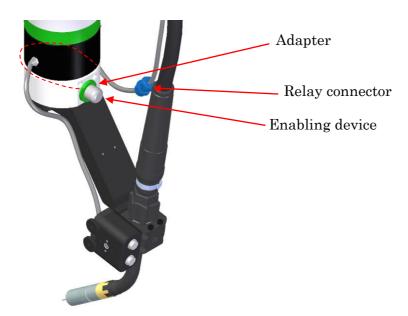


Fig. 9.9.2(b) Appearance after removing Manual Guided Teaching Handle

9.9.3 Connection

Fig 9.9.3(a), Fig 9.9.3(b) shows constructions of the Manual Guided Teaching Handle. Torch block and torch bracket specification in the diagram is DAIHEN torch BT350RD(A14L-0193-0351).

Please arrange the torch block and torch bracket according to torch specification.

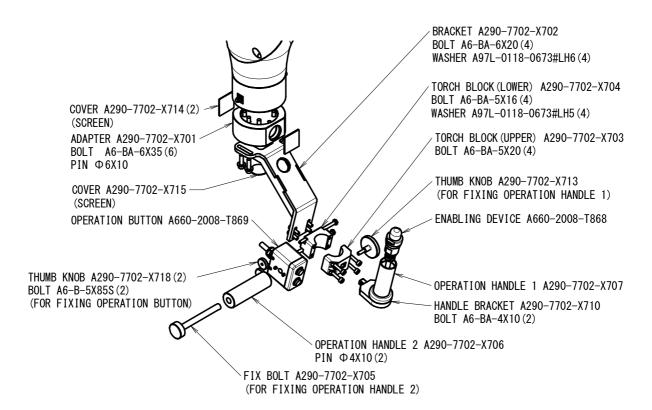


Fig. 9.9.3(a) Manual guided teaching handle constructions.

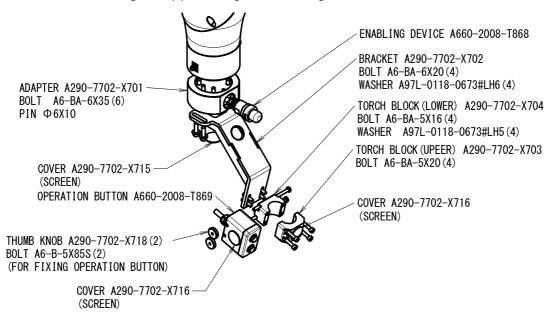


Fig.9.9.3(b) Manual guided teaching handle constructions (after removing Manual Guided Teaching Handle).

Fig 9.9.3(c) shows the Cable connection instruction.

The enabling device Switch is connected with the controller (CMRC15) via enabling device Cable. Teaching Button and Manual Guided Teaching Mode Button are connected with CRX EE interface via Operation Handle Button Cable.

The enabling device cable and Device cable (User arranged device) should be suspended by cable hanger. Please decide the optimal suspending position in consideration of Device cable weight and robot operation range.

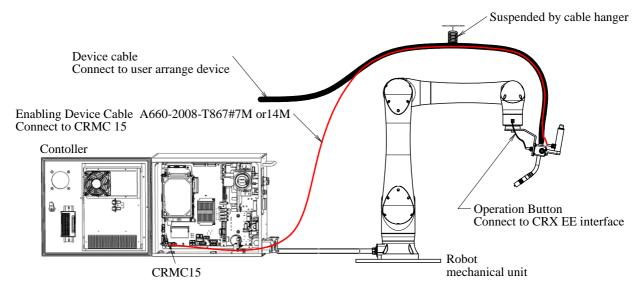


Fig. 9.9.3(c) Cable connection.

⚠ WARNING

Please power off both the controller and the welding power source when connecting the cable connectors.

After connecting the operation switch, set the EE interface screen while referring to below figure, reboot the robot controller and activate the operation switch.

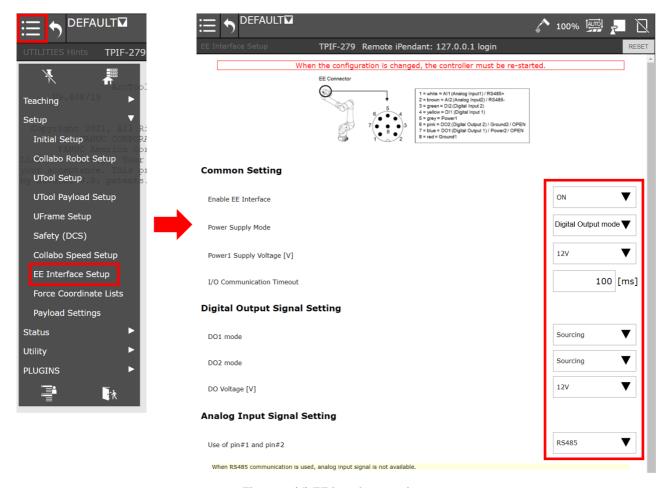


Fig. 9.9.3(d) EE interface setting.

9.9.4 Robot Operation

Enabling device of the Manual Guided Teaching Handle

The Enabling device is located on the Manual Guided Teaching Handle. Manual Guided Teaching is enabled when the enabling device (the deadman switch) of the Teach Pendant or The Enabling device of the Manual Guided Teaching Handle is pressed.

The robot must not operate by two persons. If both the enabling switch of the Teach Pendant and the Manual Guided Teaching Handle are gripped, Manual Guided Teaching will not be enabled.

Manual Guided Teaching can be used in AUTO mode. This function does not perform in T1/T2 mode.

⚠ WARNING

- Two or more persons must not operate robot by Manual Guided Teaching.
 Otherwise, serious personal injury could result.
- Don't execute the welding process during Manual Guided Teaching.

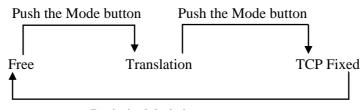
Teaching Button (A button)

A Teaching Button is located on the Switch Box of the Manual Guided Teaching Handle and it is labeled "A". When the Teaching Button is pushed, robot motion instruction is added to the selected program and current robot position is recorded. This button is enabled only while at a teaching instruction is displayed on a program line. Please refer "1.2.5 Teaching" in this manual.

Manual Guided Teaching Mode button (B button)

A Manual Guided Teaching Mode button is located on the Switch Box of the Manual Guided Teaching Handle and it is labeled "B". When the Manual Guided Teaching Mode button is pushed, Manual Guided Teaching Mode is changed. The Manual Guided Teaching function has three modes, "Free", "Translation" and "TCP Fixed".

The Mode is changed as following sequence.



Push the Mode button

Fig. 9.9.4(a) Manual Guided Teaching Mode

When the button is pushed, Robot Operation Panel in the Tablet TP is opened automatically. You can check witch the mode is selected in the Panel.

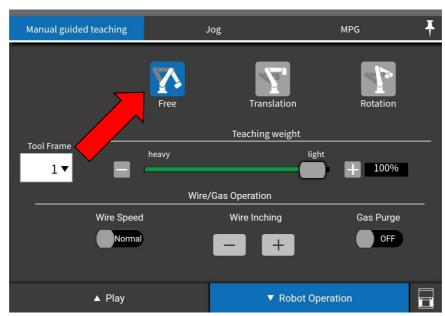


Fig. 9.9.4(b) Display Robot Operation Panel

9.9.5 Teaching

When user drag & drop "Handle Teach" instructions from the icon pallet to the program line, teaching by the handle device starts.

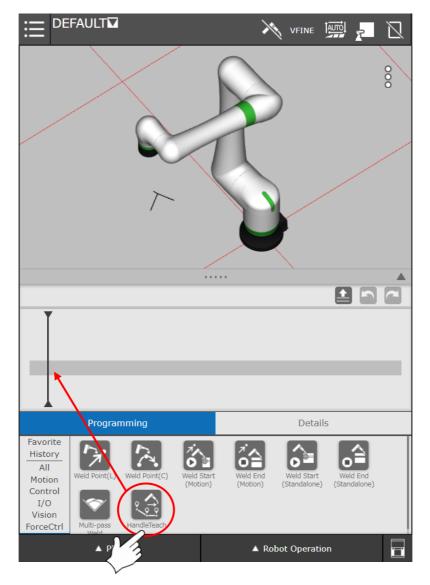


Fig. 9.9.5(a) Drag & Drop Handle Teaching icon

Following screen is displayed when the icon is dropped to the program line.

- The Teaching button is enabled.
- Program line is move to top of the screen. And "Handle Teach" icon with "!" mark is displayed in the program line
- A detail screen of "Handle Teaching" instruction is displayed.
- Manuel Guided Teaching Panel appears automatically.

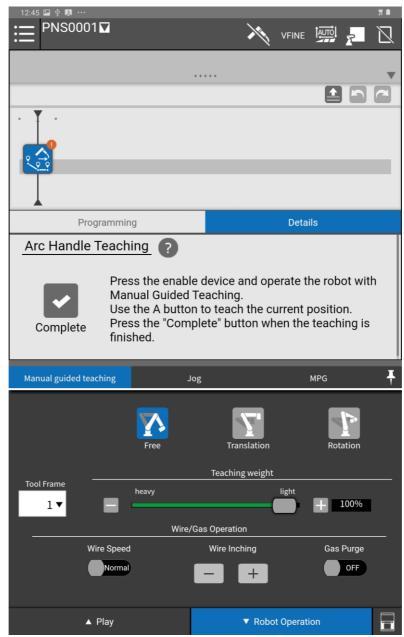


Fig. 9.9.5(b) Handle Teaching Mode

The Teaching Button is enabled while the "Handle Teach" instruction icon exists on the program line.

Instructions are added by pushing the teaching button. There are two operations, SHORT-press and LONG-press. If user pushes the button for longer than 1 second, it performs as LONG-press. If the user releases the button within 1 second, it performs as SHORT-press.

The instructions are inserted to the position of "Handle Teach" icon on the program line by pushing teaching button.

If the "Handle Teach" icon is NOT in "Basic Arc" instruction when the teaching button is pushed by SHORT-press, "Line Move" instruction is taught to the selected programs and current position is recorded. When the button is pushed by LONG-press, the "Basic Arc" instruction is taught to the selected programs and current position is recorded as the start position of the instruction. When the LONG-press is completed, LED of the teaching button will be turned on.



Fig. 9.9.5(c) Teach Line instruction



Fig. 9.9.5(d) Teach Basic Arc instruction

While handle teaching, other teaching operation such as teaching, delete and copy & paste of instruction can be also performed.

However, instruction including "Handle Teach" cannot be operated, neither moving an icon on the program line, copy & paste nor undo/redo.

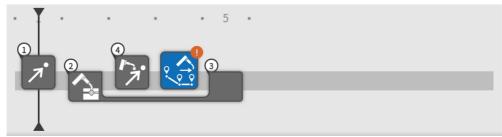


Fig. 9.9.5(e) Teach Weld Point (L) instruction



Fig. 9.9.5(f) Teach End point of Basic Arc instruction

While handle teaching, other teaching operation can be also performed, teaching, delete and copy & paste instruction.

User cannot operate "Handle Teach" instruction, move on the program line, copy & paste and undo/redo operation.

When a complete button in the detail screen of the instruction is touched, teaching by the handle is finished "Handle Teach" instruction disappear and the teaching bottom is disabled.

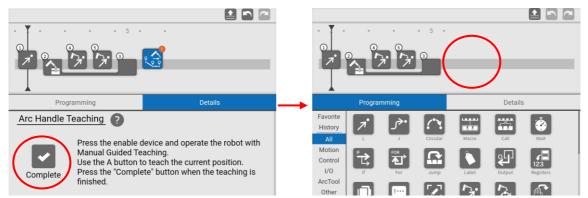


Fig. 9.9.5(g) Complete Handle Teaching

To execute the arc welding program, please refer to Chapter 9.8 "EXECUTING THE ARC WELDING PROGRAM".

MEMO

When the Multi-pass Weld (option: J532 or R794) is installed, "Weld Start(Motion)" and "Weld End(Motion)" is taught instead of "Basic Arc" in manual guided teaching handle. For example, the program with same construction in Fig 9.9.5(f) will be taught as shown in Fig 9.9.5(h).



Fig. 9.9.5(h) Arc Handle Teaching with the Multi-pass Weld option

9.9.6 Teaching Manual Guided Teaching Handle by User

The FANUC Manual Guided Teaching Handle is certificated by the certification body. It consists following components.

Manual Guided Teaching Handle device

The device mount to wrist flange of CRX series robot. Fig. 9.6.6 (a) shows the CRX wrist flange interface.

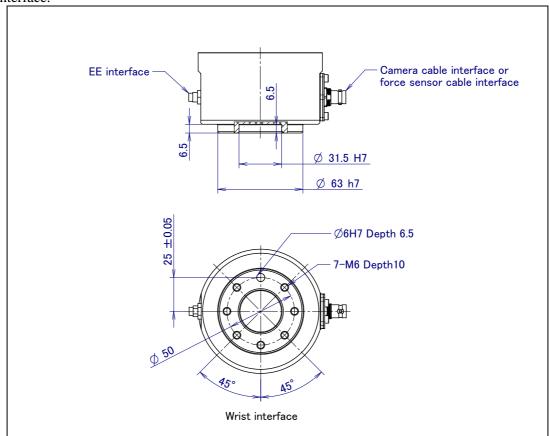


Fig. 9.9.6 (a) CEX wrist flange interface

Enabling device

- The switch is a certificated three position switch and it has dual channel safety signal,
- The switch is wired to safety input SFDI1 in CMRC15 of R-30iB Mini Plus controller. Table 9.9.6(a) shows the connector specification. Fig. 9.9.6(b) shows the circuit diagram of controller main board and pin layout of Safety inputs (CRMC15)
- While the switch is middle position, SFDI1 is ON, and in other situation it is OFF.
- The switch and peripheral circuit is protected as IP-56
- When the enabling device is ON, it performs to enable Manual Guided Teaching function. The contact stop function is disabled during the Manual Guided Teaching operation.
- The safety function meets EN ISO 13849-1:2015 (PL d, Cat. 3) and IEC 61508 2nd Ed SIL3. It is certificated by the certification body.

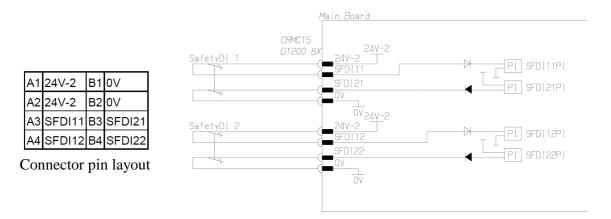


Fig. 9.9.6(b) Safety DI connection diagram

Table 9.9.6(a) Connector specification

Parts name	Manufacturer	Manufacturer specification	Fanuc specification
Connector	TYCO ELECTRONICS AMP CO LTD.	1-1827864-4	A63L-0002-0066#R08DX

Teaching button

- The "Teaching" button is connected Digital input 1 in CRX EE interface. Fig. 9.9.6 (c) shows the Pin layout for CRX EE interface. Table 9.9.6(b) shows the EE connector specification
- When the button is changed OFF to ON while the Handle Teach instruction is displayed on the program line, an instruction is taught to selected robot program and current position is recorded. Please refer "1.2.5 Teaching" in this manual.

"Manual Guided Teaching Mode" button

- The "Manual Guided Teaching Mode" button is connected Digital input 2 in CRX EE interface. Fig. 9.9.6(c) shows the Pin layout for CRX EE interface. Table 9.9.6(b) shows the EE connector specification
- When the button is changed to ON, selected Manual Guided Teaching mode is change. Please refer "1.2.4 Robot Operation" in this manual.

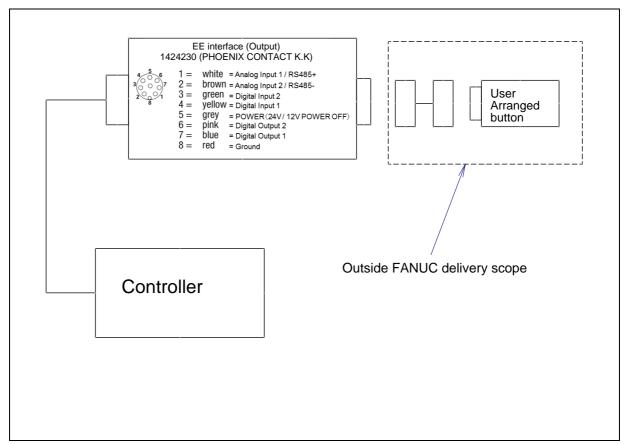


Fig. 9.9.6(c) Pin layout for CRX EE interface

Table 9.9.6(b) Connector specifications (User side)

Manufacturer	Manufacturer specification
PHOENIX CONTACT K.K	1404190 Straight plug 1404194 Angle plug
P	

Software

- 7DF5/10 or later software version supports this function.
- S530 software option must be ordered to use the Manual Guided Teaching Handle. When S530 is ordered safety input SFDI1 is used for the enabling device. RI[1] is used for "Teaching" button. RI[2] is used for "Manual Guided Teaching Mode" buttons. These signals cannot be used for other purpose.

User must follow the same approach and implementation as above description to develop the Manual Guided Teaching Handle for FANUC CRX series robot.



⚠ WARNING

The robot system including the manual guided teaching device must comply with ISO 10218-1 and ISO 10218-2. It is recommended to get a certificate from a certification body.

10 TOOL INTERFACE

This chapter describes the tool interface specification which is available on the EE connector mounted on the wrist of FANUC Robot CRX series.

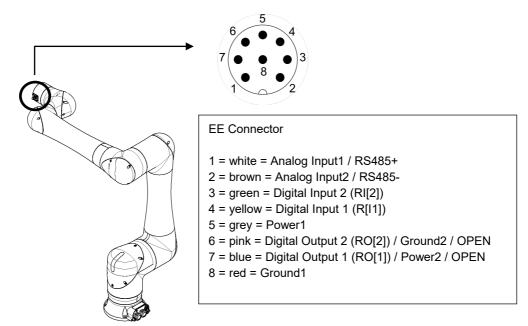


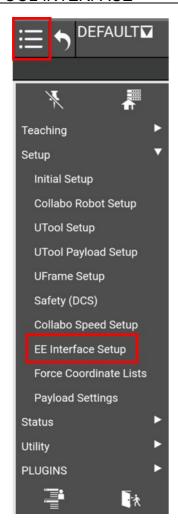
Fig. 10 (a) EE connector

10.1 EE INTERFACE SETUP SCREEN

EE Interface setup screen allows to configure the tool interface (EE Interface) according to the electrical specification of the peripheral device. This screen is available as a standard feature of FANUC Robot CRX series with Tablet TP. Tap the menu icon on the Tablet TP, and then select "Setup" -> "EE Interface Setup" to show EE Interface Setup screen similar to the following.

⚠ CAUTION

- 1 When EE Interface configuration is changed, the robot controller must be re-started to take effect.
- 2 Be sure to complete the EE Interface configuration and turn off the robot controller before connecting the device to EE connector. If you connect the device before configuration is complete, the device may be damaged, for example, due to incorrect power supply voltage.
- 3 The EE Interface Setup screen is available only on V9.40P/05 or later software version. If V9.40P/04 or older software version is used, please update the robot software to the latest version (V9.40P/05 or later).



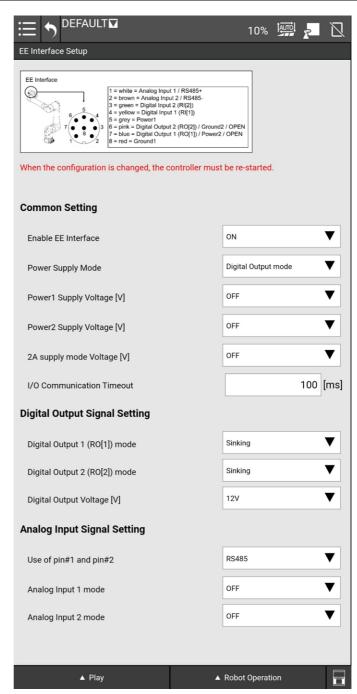


Fig. 10.1 (a) EE Interface Setup screen

Table 10.1 (a) EE Interface Setup Items

Item	Description
	Enable/disable EE Interface.
Enable EE Interface	• OFF
	ON (default)
	Set power supply mode of EE Interface.
Dower Supply Mode	Digital output mode (default)
Power Supply Mode	2A supply mode
	2 pin supply mode
	Set power supply voltage for Power1 (pin #5).
Dowert Supply Voltage IVI	OFF (No power supply) (default)
Power1 Supply Voltage [V]	• 12V
	• 24V

ltem	Description
Power2 Supply Voltage [V]	Set power supply voltage for Power2 (pin #7). OFF (No power supply) (default) 12V 24V
2A supply mode Voltage [V]	Set voltage when "2A supply mode" is selected for "Power Supply Mode". OFF (No power supply) (default) 12V 24V
I/O Communication Timeout	Specify the I/O time-out value [ms]. The system posts an alarm "HOST-424 IO is not updated during \$TLIF.\$IO_TIMEOUT[ms] for Tool I/F function" with STOP severity if I/O was not updated for the specified time. The default value is 100 [ms].
Digital Output 1 (RO[1]) mode	 Specify the digital output mode for Digital Output 1 (RO[1]) (pin #7). Digital Output is not used Sinking (default) Sourcing Push-Pull
Digital Output 2 (RO[2]) mode	Specify the digital output mode for Digital Output 2 (RO[2]) (pin #6). • Digital Output is not used • Sinking (default) • Sourcing • Push-Pull
Digital Output Voltage [V]	Set the voltage of Digital Output 1 (RO[1]) (pin #7) and Digital Output 2 (RO[2]) (pin #6). Either "12V" or "24V" must be selected if "Sourcing" or "Push / Pull" is specified for the item "Digital Output 1 mode" or "Digital Output 2 mode". OFF 12V (default) 24V
Use of pin #1 and pin #2	Select the use of the pin #1 and #2 on the EE Interface. OFF RS485 (default) Analog Input
Analog Input 1 mode	Specify the analog input mode for Analog Input1 (pin #1). OFF (default) O-10V (Voltage) 4-20mA (Current)
Analog Input 2 mode	 Specify the analog input mode for Analog Input2 (pin #2). OFF (default) 0-10V (Voltage) 4-20mA (Current)

⚠ CAUTION

- 1 When 2A supply mode or 2 pin power supply mode is used, Digital Output 1 (RO[1]) (Power2) and Digital Output 2 (RO[2]) (Ground2) are not available.
- 2 When RS485 serial communication is used, analog input signal is not available.
- 3 When using the analog input, the item "Use of pin #1 and pin #2" must be set "Analog Input", and the AI mode of corresponding analog input pin must be set "0-10V (Voltage)" or "4-20mA (Current)".
- 4 When "Sinking" or "Push-Pull" is set as Digital Output mode, "Digital Output Voltage [V]" cannot be set 12V.

When opening the EE Interface Setup screen after the installation of the plugin software which configures the EE interface communication settings, the confirmation screen is displayed as below. Press the "Confirm" button on the screen to change the EE Interface configuration manually.

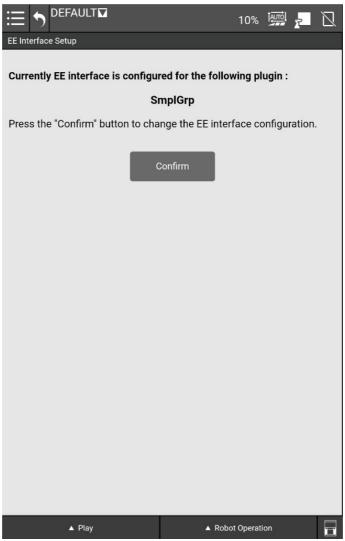
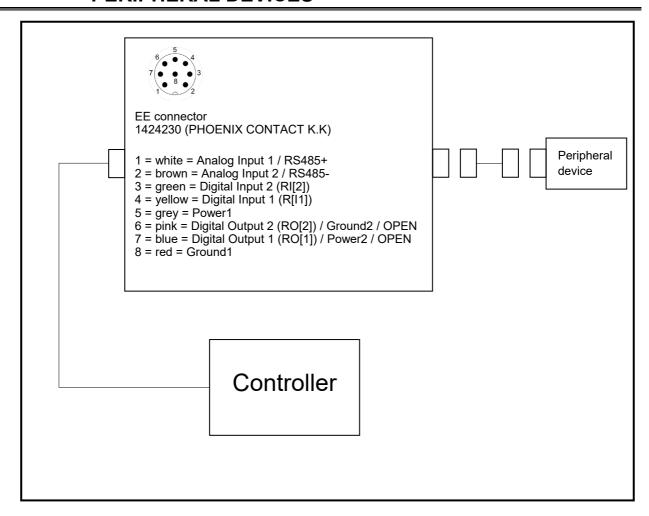


Fig. 10.1 (b) Confirmation screen

↑ CAUTION

The confirmation screen is available on the robot software version V9.40P/20 or after.

10.2 CONNECTION BETWEEN THE TOOL INTERFACE AND PERIPHERAL DEVICES



! CAUTION

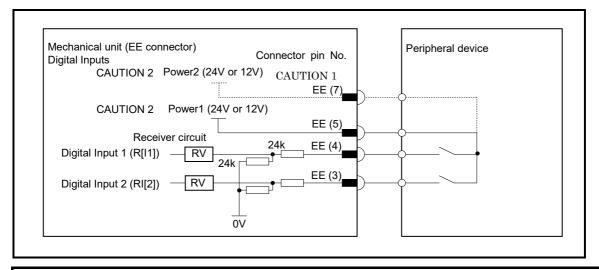
For setup of each pin, refer to the Section 10.1 EE Interface Setup screen.

Table 10.2 (a) Connector specifications (User side)

Cable name	Input side (J1 base)	Output side (Wrist flange)		Maker/dealer
EE		1404190	Straight plug (Attached)	PHOENIX
ᄄ		1404194	Angle plug	CONTACT K.K

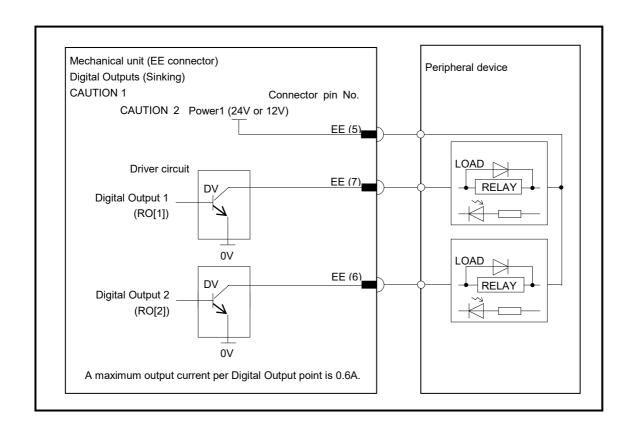
Table 10.2 (b) Connector specifications (Mechanical unit side • reference)

Cable name	Input side (J1 base)	Output side (Wrist flange)	Maker/dealer
		4.40.4000	PHOENIX
EE		1424230	CONTACT K.K



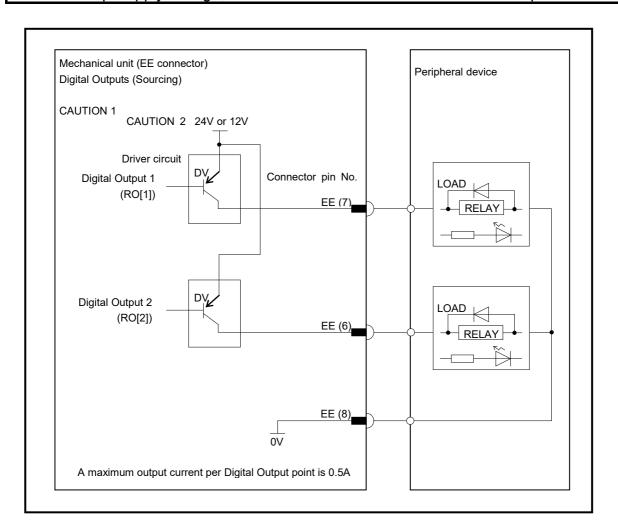
⚠ CAUTION

- 1 Power can be supplied by pin #5 or pin #7.
 - For setup power supply, refer to the Section 10.1 EE Interface Setup screen. When pin #7 as power supply is used, Digital Output 1 (RO[1]) and Digital Output 2 (RO[2]) are not available.
 - Pin #5 and pin #7 are independent power supply. Pin #5 and pin #7 must not be connected.
- 2 Supply voltage can be selected from 24V and 12V.
 For setup Supply voltage, refer to the Section 10.1 EE Interface Setup screen.



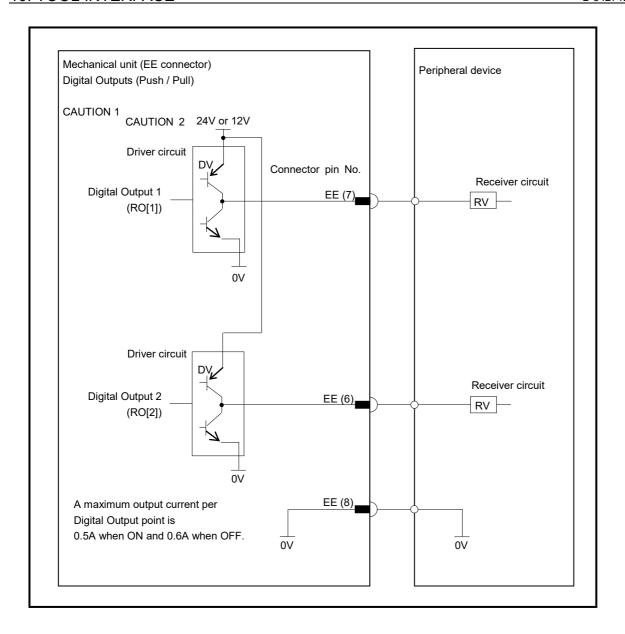
⚠ CAUTION

- 1 Digital output mode can be selected from Sinking, Sourcing and Push / Pull. Digital Output 1 (RO[1]) and Digital Output 2 (RO[2]) can be set independently. For setup digital output mode, refer to the Section 10.1 EE Interface Setup screen.
- 2 Supply voltage can be selected from 24V and 12V. For setup Supply voltage, refer to the Section 10.1 EE Interface Setup screen.



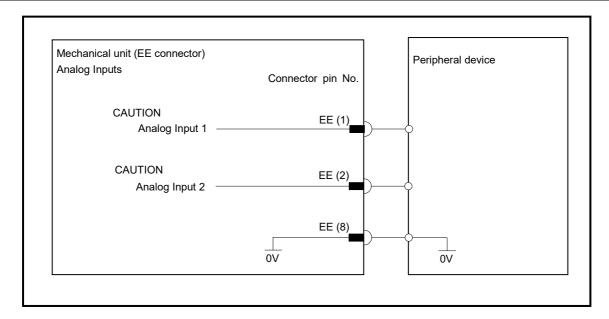
! CAUTION

- 1 Digital output mode can be selected from Sinking, Sourcing and Push / Pull. Digital Output 1 (RO[1]) and Digital Output 2 (RO[2]) can be set independently. For setup digital output mode, refer to the Section 10.1 EE Interface Setup screen.
- Voltage of digital output (Sourcing) can be selected from 24V and 12V. For setup voltage of digital output, refer to the Section 10.1 EE Interface Setup screen.



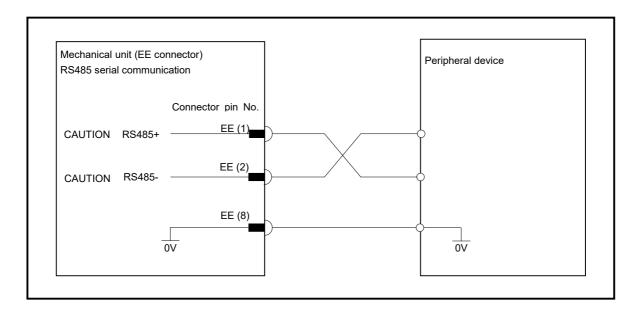
A CAUTION

- 1 Digital output mode can be selected from Sinking, Sourcing and Push / Pull. Digital Output 1 (RO[1]) and Digital Output 2 (RO[2]) can be set independently. For setup digital output mode, refer to the Section 10.1 EE Interface Setup screen.
- Voltage of digital output (Push / Pull) can be selected from 24V and 12V. For setup voltage of digital output, refer to the Section 10.1 EE Interface Setup screen.



⚠ CAUTION

When analog input signal is used, RS485 communication is not available. Analog Input 1 and Analog Input 2 can be set independently. For setup analog input mode, refer to the Section 10.1 EE Interface Setup screen.



⚠ CAUTION

When RS485 serial communication is used, analog input signal is not available.

10.3 INTERNAL POWER SUPPLY AND INPUT/OUTPUT SIGNAL SPECIFICATIONS

Following are the specifications of internal power supply and input/output signal from Tool Interface to peripheral devices.

10.3.1 INTERNAL POWER SUPPLY SPECIFICATIONS

Following are the specifications of internal power supply from Tool Interface to peripheral devices.

Set the internal power supply (Power1, Power2) to OFF (No power supply), 12V or 24V.

Power1 and Power2 are independent power supply and can be set different power supply voltage respectively.

The electrical specifications are shown below.

Table 10.3.1 (a): Electrical specifications of internal power supply

Parameter	Min	Тур	Max	Unit
Supply voltage in 24V	21.6	24	26.4	V
Supply voltage in 12V	10.8	12	13.2	V
Supply current in both modes (*2)	-	1000	2000 (*1)	mA
Supply current in 2A supply mode (*2)		2000	2000	mA

^(*1) When 2A supply mode is not used, 2000 mA is for max 1 second. Duty cycle max: 10%. Average current must not exceed 1000 mA. When Power2 is used, total current of Power1 and Power2 must not exceed 2000 mA.

⚠ CAUTION

When 2A supply mode is used, Digital Output 1 (RO[1]) (Power2) and Digital Output 2 (RO[2]) (Ground2) are not available.

Power1 and Power2 are independent power supply. Power1 and Power2 must not be connected.

10.3.2 DIGITAL OUTPUT SIGNAL SPECIFICATIONS

Following are the specifications of digital output signals from Tool Interface to peripheral devices.

Digital output signals support three different modes.

Table 10.3.2 (a): Digital output signal modes

Mode	Active	Inactive
Sinking	Low	Open
Sourcing	High	Open
Push / Pull	High	Low

The electrical specifications are shown below.

^(*2) When connecting inductive loads, please use a protective diode.

Table 10.3.2 (b): Electrical specifications of digital output signals

Parameter	Min	Тур	Max	Unit
Voltage when open	-0.5	-	26	V
Current when sinking / pin	0	600	3000 (*1)	mA
Current when sourcing / pin	-	-	500 (*2)	mA

- (*1) 3000 mA for max 1 second. Duty cycle max: 10%. Average current must not exceed 1000 mA.
- (*2) Total current of power1 and source current of digital output signals must not exceed 2000 mA.

↑ CAUTION

When 2A supply mode is used, Digital Output 1 (RO[1]) (Power2) and Digital Output 2 (RO[2]) (Ground2) are not available.

10.3.3 DIGITAL INPUT SIGNAL SPECIFICATIONS

Following are the specifications of digital input signals from peripheral devices to Tool Interface.

Table 10.3.3 (a): Electrical specifications of digital input signals

Parameter	Min	Тур	Max	Unit
Input voltage	-0.5	-	26	V
Logical low voltage	-	-	2.0	V
logical high voltage	5.5	-	-	V
Input resistance	-	48k		Ω

10.3.4 ANALOG INPUT SIGNAL SPECIFICATIONS

Following are the specifications of analog input signals from peripheral devices to Tool Interface.

Analog input signals are nondifferential and can be set to either voltage (0-10V) or current (4-20mA) The electrical specifications are shown below.

Table 10.3.4 (a): Electrical specifications of analog input signals

Parameter	Min	Тур	Max	Unit
Input voltage in voltage mode	-0.5	-	12.5	V
Input resistance range 0V to 10V	-	10.6k		Ω
Resolution	-	12	-	bit
Input voltage in current mode	-0.45	-	4.5	V
Input current in current mode	-2.5	-	24	mA
Input resistance range 4mA to 20mA	-	183	187	Ω
Resolution	-	12	-	bit

⚠ CAUTION

When analog input signal is used, RS485 communication is not available.

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11.1 USB MEMORY OPERATION (TABLET TP APP V1.12 OR LATER)

11.1.1 Overview

In Tablet TP app V1.12 or later, the internal memory unique to the Tablet TP app can be used as UT1 device. Files saved in the internal memory can be copied from USB port on Tablet TP base. This section describes how to operate UT1 with Tablet TP.

NOTE

For the UT1 with Tablet TP app V1.11 or earlier, the data is read and written directly on USB memory as before.

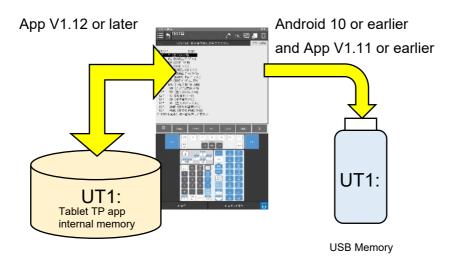


Fig. 11.1.1 USB memory operation overview

The internal memory (UT1) operation of Tablet TP app V1.12 or later can be done in the "USB memory operation" drawer menu that is added by inserting USB memory device to the Tablet TP.

In this menu, the following operations related to the Tablet TP app internal memory (UT1) can be performed.

Table 11.1.1 USB memory operation items

	Items	Description
	items	Description
1	Export files to the USB memory	Copies the files that is stored in Tablet TP app internal memory (UT1) to
		the specified folder in the USB memory.
		Copies all files including those in subfolders.
		If the same file exists in the USB memory, the file will be overwritten.
2	Import files from the USB memory	Copies the files in USB memory to the Tablet TP internal memory
		(UT1).
3	Delete files in the Tablet TP	Deletes the robot backup files in Tablet TP app internal memory (UT1).
		Deleted files cannot be restored.
4	Remove the USB Memory	Removes the USB memory device connected to the Tablet TP Base
		safely.

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NOTE

- USB is recognized at the timing below.
 - At the launch of the Tablet TP app.
 - When the USB memory device is connected while the Tablet TP app is opened.
- The drawer menu "Enable USB port / Disable USB port" is not displayed in Android 11 or later.

11.1.2 **Exporting files to the USB memory**

Copy the files in Tablet TP app internal memory (UT1) to the USB memory in the following procedure.

⚠ CAUTION

Make sure to have enough free space in the USB memory. File export fails if the space is insufficient during copy operation.

- 1 Launch the Tablet TP app.
- 2 Insert the USB memory device into the USB memory port on the Tablet TP Base.

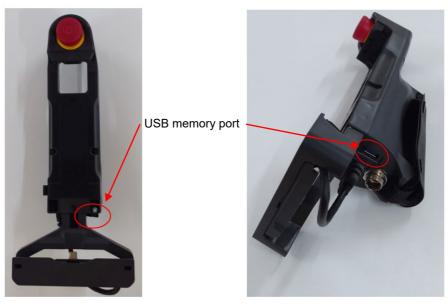


Fig. 11.1.2(a) USB memory port

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3 Slide the left end of the screen towards the right to display the menu and select "USB memory operation".

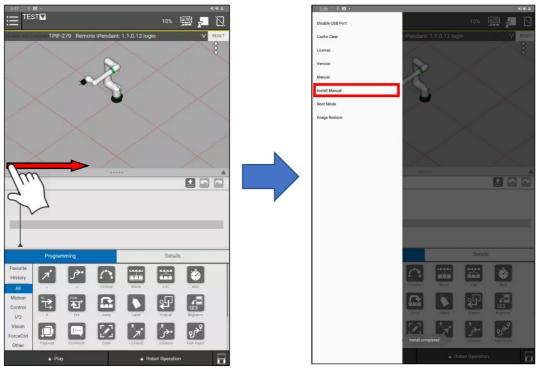


Fig. 11.1.2(b) Tablet TP app drawer menu

4 On the displayed pop-up related to the Tablet TP app internal memory, tap "(1) Export files to the USB memory".

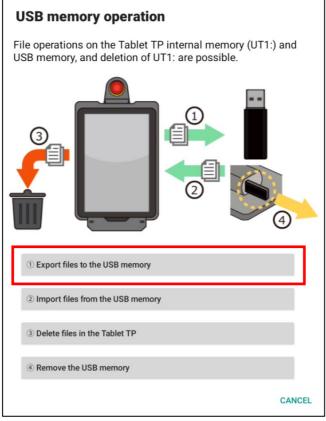


Fig. 11.1.2(c) USB memory operation menu

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The pop-up will be closed when the USB memory device is removed during the pop-up is displayed. In this case, insert the USB memory device again into the USB memory port of the Tablet TP Base.

5 The following pop-up will be displayed. Tap "Select Folder".

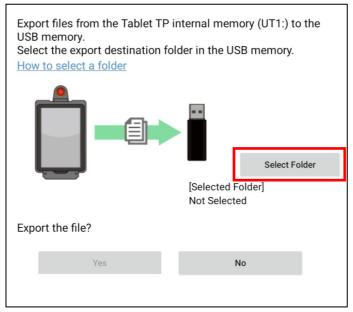


Fig. 11.1.2(d) File export

6 On the displayed directory selection screen, tap the hamburger button (≡) at the top left of the screen, and tap the USB memory device inserted into the USB memory port.

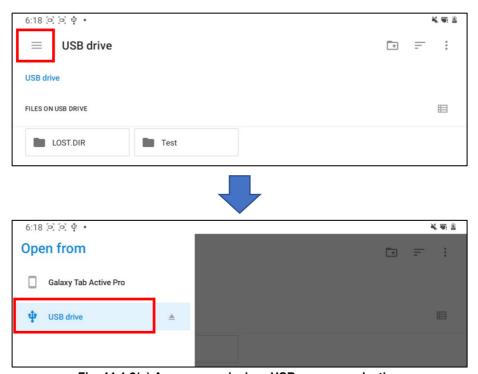


Fig. 11.1.2(e) Access permission: USB memory selection

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7 On the folder selection screen, select the export destination folder, and tap "USE THIS FOLDER" at the bottom of the screen.



Fig. 11.1.2(f) Access permission: Folder selection

8 The following pop-up will be displayed. Tap "ALLOW".



Fig. 11.1.2(g) Access permission



The folder other than USB memory cannot be specified.

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9 Confirm that the specified folder has been changed from "Not selected" to the folder specified in step 7, and tap "Yes".

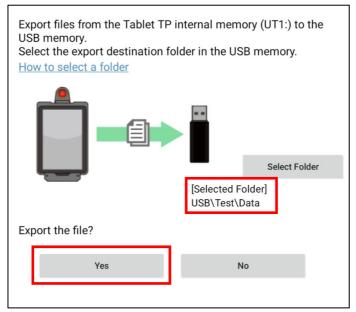


Fig.11.1.2(h) File export

Files in the internal memory (UT1) are copied to the specified folder in the USB memory.

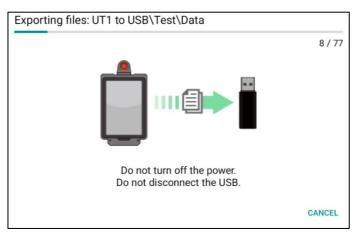


Fig. 11.1.2(i) Display during the file export

⚠ CAUTION

If the same file exists in the USB memory, it will be overwritten with the file in the internal memory (UT1).

When the "Cancel" button is tapped during copy operation, the files that has already been copied will be remain in the USB memory. The files overwritten before tapping "Cancel" cannot not be restored.

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When the copy is completed, the following screen will be displayed. Tap "OK" to close the pop-up. Refer to "11.1.5 Removeing the USB memory" and remove the USB memory device safely.



Fig. 11.1.2(j) File export completion screen

11.1.3 Importing files from the USB memory

Import files in the USB memory to the Tablet TP app internal memory (UT1) in the following procedure.

\triangle

CAUTION

Make sure to have enough free space in the Tablet TP app internal memory (UT1). File import fails if the space is insufficient during copy operation.

- 1 Launch the Tablet TP app.
- 2 Insert the USB memory device into the USB memory port on the Tablet TP Base.

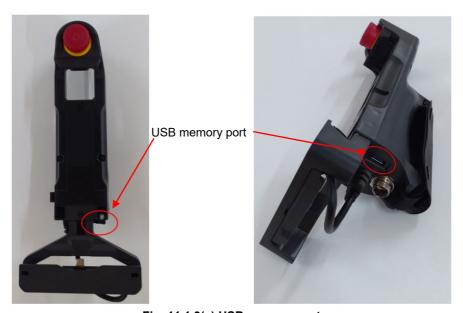


Fig. 11.1.3(a) USB memory port

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3 Slide the left end of the screen towards the right to display the menu and select "USB memory operation".

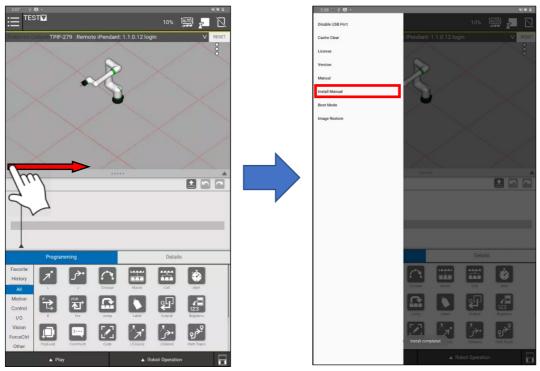


Fig. 11.1.3 (b) Tablet TP app drawer menu

4 On the displayed pop-up related to the Tablet TP app internal memory, tap "(2) Import files from the USB memory".

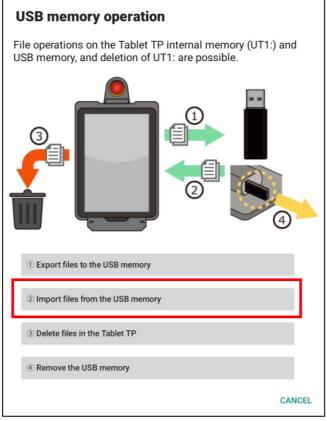


Fig. 11.1.3(c) USB memory operation menu

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MEMO

The pop-up will be closed when the USB memory device is removed during the pop-up is displayed. In this case, insert the USB memory device again into the USB memory port of the Tablet TP Base.

5 The following pop-up will be displayed. Tap "Select Folder".

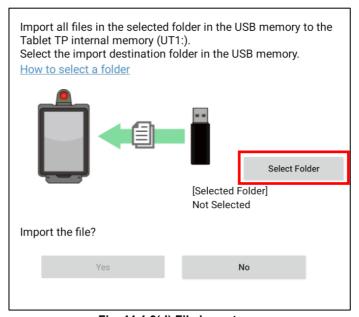


Fig. 11.1.3(d) File import

6 On the displayed directory selection screen, tap the hamburger button (≡) at the top left of the screen, and tap the USB memory device inserted into the USB memory port.

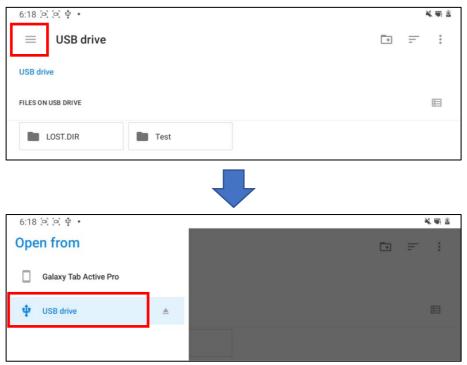


Fig. 11.1.3(e) Access permission: USB memory selection

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On the folder selection screen, specify the folder where the files have saved, and tap "USE THIS FOLDER" at the bottom of the screen.



Fig. 11.1.3(f) Access permission: Folder selection

8 The following pop-up will be displayed. Tap "ALLOW".



Fig. 11.1.3(g) Access permission



The folder other than USB memory cannot be specified.

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9 Confirm that the specified folder has been changed from "Not selected" to the folder specified in step 7, and tap "Yes".

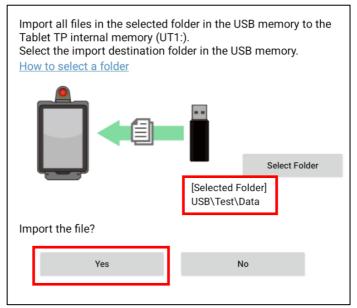


Fig.11.1.3(h) File import

Files in the USB memory are copied to the internal memory (UT1).

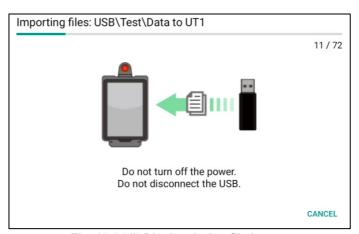


Fig. 11.1.3(i) Display during file import

⚠ CAUTION

If the same file exists in the USB memory, it will be overwritten with the file in the internal memory (UT1).

When the "Cancel" button is tapped during copy operation, the files that has already been copied will remain in the Tablet TP internal memory (UT1). The files overwritten before tapping "Cancel" cannot not be restored.

When the copy is completed, the following screen will be displayed. Tap "OK" to close the pop-up. Refer to "11.1.5 Removeing the USB memory" and remove the USB memory device safely.



Fig. 11.1.3(j) File import completion screen

11.1.4 Deleting files in the Tablet TP app

Delete the robot backup files saved in the Tablet TP app in the following procedure.

↑ CAUTION

Files deleted with this procedure cannot be restored.

- 1 Launch the Tablet TP app.
- 2 Insert the USB memory device into the USB memory port on the Tablet TP Base.

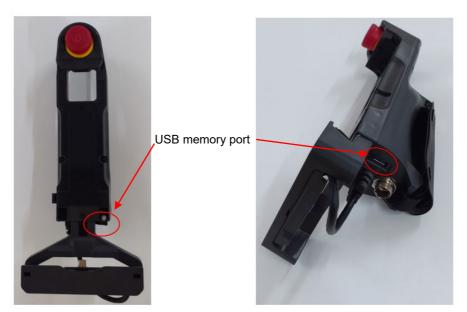


Fig. 11.1.4(a) USB memory port

3 Slide the left end of the screen towards the right to display the menu and select "USB memory operation".

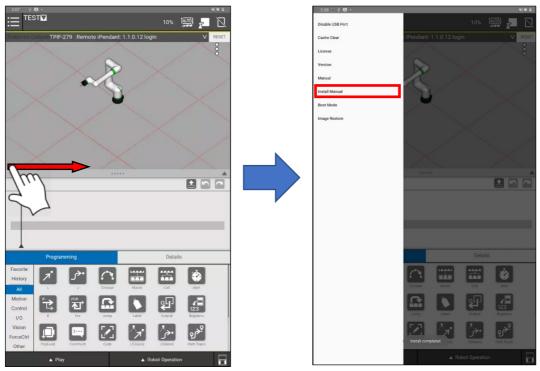


Fig. 11.1.4(b) Tablet TP app drawer menu

4 On the displayed pop-up related to the Tablet TP app internal memory, tap "(3) Delete files in the Tablet TP".

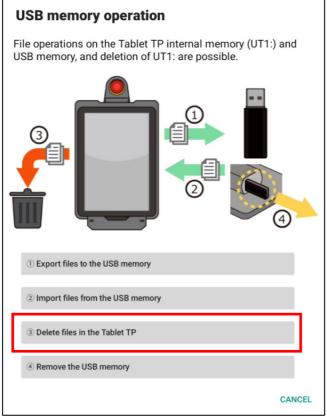


Fig. 11.1.4(c) USB memory operation menu



MEMO

The pop-up will be closed when the USB memory device is removed during the pop-up is displayed. In this case, insert the USB memory device again into the USB memory port of the Tablet TP Base.

5 The following pop-up will be displayed. Tap "Yes".

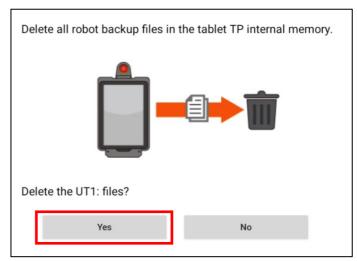


Fig. 11.1.4(d) File deletion

File deletion is executed.

The pop-up "UT1: file deleting" is displayed during file deletion. Please wait for a while.

6 After completed the file deletion, tap "OK" and close the pop-up.



Fig. 11.1.4(e) File deletion completion screen

11.1.5 Removing the USB Memory Device

Remove the USB memory device connected to the Tablet TP Base safely in the in the following procedure.

- Slide the left end of the screen towards the right to display the menu and select "USB memory operation".
- 2 On the displayed pop-up related to the Tablet TP app internal memory, tap "(4) Remove the USB memory".

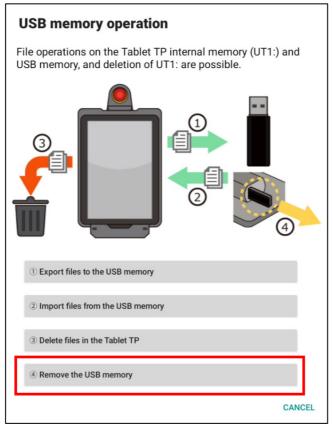


Fig. 11.1.5(a) USB memory operation menu

3 The following pop-up will be displayed. Tap "Yes".

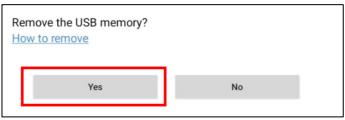


Fig. 11.1.5(b) USB memory removal

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4 The storage screen will be displayed. Tap "USB drive".



Fig. 11.1.5(c) Storage

5 The USB drive screen will be displayed. Tap "Unmount".

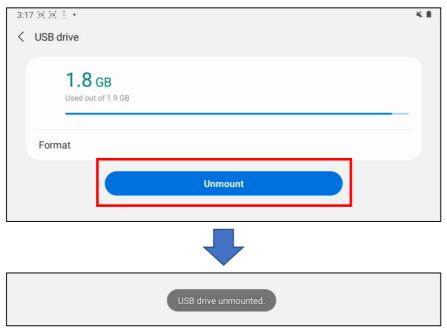


Fig. 11.1.5(d) Unmount

6 Confirm that the USB memory is unmounted, and then remove the USB memory device from the Tablet TP Base.

11.2 INSTALLING MANUALS INTO THE TABLET TP

Some FANUC manuals can be viewed from the Tablet TP app. In order to view the FANUC manuals from the Tablet TP app, users must install them onto the Tablet TP. This section describes the procedures used to install manuals onto the Tablet TP.

⚠ CAUTION

- Some FANUC manuals can be viewed from the Tablet TP. If the manual does not support the display on the Tablet TP, view it with the conventional method.
- Some USB memory devices might not be supported. Please use the USB memory devices FANUC recommends or have been used with Tablet TP.
- Use the latest version of the Tablet TP app unless you have a specific reason. If the Android OS of the Tablet TP is OS 11, the Tablet TP app must be V1.11 or later.
- Only Tablet TP apps with versions above V1.03 are supported for viewing FANUC manuals.
- The Tablet TP app is only for Android OS.
- Tablet TP app can only be used for the CRX robot series or robot controllers with the Tablet TP option (S527) ordered.

11.2.1 **Preparation (Common to All Versions)**

The installation procedure of the manual for Tablet TP varies depending on the version of the Tablet TP app, but the following preparations are required regardless of the version.

/ CAUTION

Use the latest version of the Tablet TP app unless you have a specific reason. The installation procedure of the manual is different between V1.10 or earlier and V1.11 or later. If you need to use it with the Tablet TP app of V1.10 or earlier installed, refer to "11.2.3 Installation Procedure (Tablet TP App V1.10 or Earlier)".

If the version of the Tablet TP app is older than V1.03, the manual cannot be viewed with the Tablet TP.

Obtain the installer

Download the latest Tablet TP manual installer zip file (fanuc manual.zip) from your regional FANUC customer service website that provides software downloads.

In Japan, the website is https://store.member.fanuc.co.jp/fanuc/store/.

The website in your region will vary. Please visit www.fanuc.com to select your region.

Format the USB memory device

Prepare a USB device containing no files or folders. Format the USB memory device as FAT32. For more information about formatting as FAT32, read "Format" in "8.1 FILE INPUT/OUTPUT UNITS" of "R-30iB/R-30iB Mate/R-30iB Compact Plus/R-30iB Mini Plus CONTROLLER OPERATOR'S MANUAL (Basic Function) (B-83284)".

11.2.2 Installation Procedure (Tablet TP App V1.11 or Later)

If the version of the Tablet TP app is V1.11 or later, install the manual with the following procedure.

Prepare the installer

- 1 Copy the downloaded Tablet TP manual installer zip file (fanuc_manual.zip) to the USB memory device prepared in "Format the USB memory device" of "11.2.1 Preparation (Common to All Versions)".
- 2 Make sure that the Tablet TP app V1.11 or later is installed on the tablet.

Check the Tablet TP app version

Slide the left end of the screen towards the right to display the menu and select "Version".

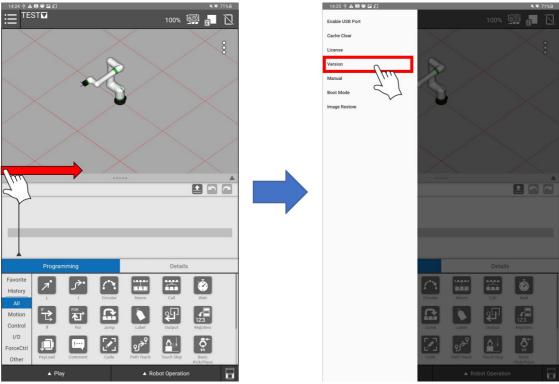


Fig. 11.2.2(a) Tablet TP app drawer menu

2 A pop-up will be displayed. Confirm the Tablet TP app version.



Fig. 11.2.2(b) Tablet TP app version

Connect the USB memory device

- 1 Turn on the controller.
- Insert the USB memory device prepared in Step 1 of "Prepare the installer" into the USB memory port on the Tablet Base.

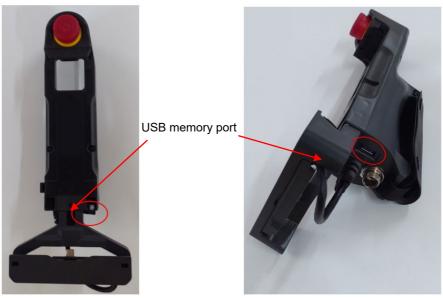


Fig. 11.2.2(c) USB memory port

3 Launch the Tablet TP app.



MEMO

The USB memory device can be inserted into the USB memory port while the Tablet TP app is running.

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Install the manual

1 Slide the left end of the screen towards the right to display the menu and select "Install Manual".

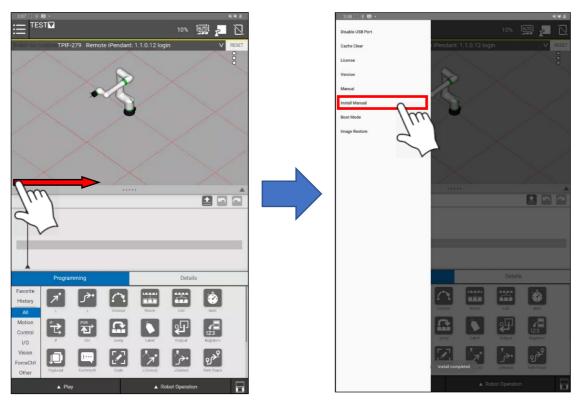


Fig. 11.2.2(d) Tablet TP app drawer menu

2 The following pop-up will be displayed. Tap "OK". The directory selection screen opens.

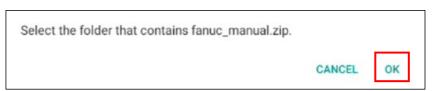


Fig. 11.2.2(e) Manual selection

3 On the displayed directory selection screen, tap the hamburger button (≡) at the top left of the screen, and tap the USB memory device inserted into the USB memory port.

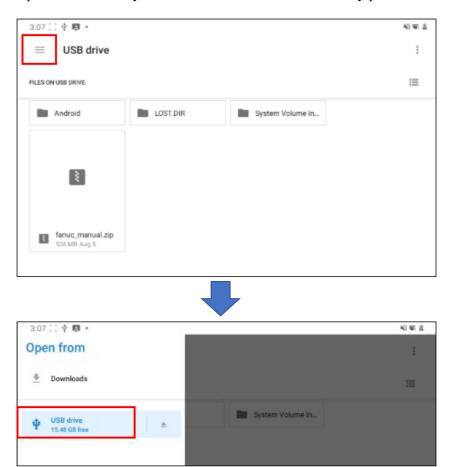


Fig. 11.2.2(f) Access permission: USB memory selection

On the directory selection screen, move to the directory where the Tablet TP manual installer zip file (fanuc_manual.zip) is saved, and tap "USE THIS FOLDER" at the bottom of the screen.

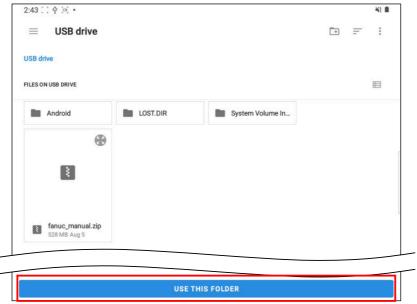


Fig. 11.2.2(g) Access permission: Folder selection



MEMO

The text of the button at the bottom of the screen varies depending on the Android OS you are using.

- For the Android OS 10: ALLOW ACCESS TO "USB DRIVE"
- For the Android OS 9: SELECT (displayed at the bottom right of the screen)
- 5 Tap "ALLOW" in the displayed pop-up screen. The installation process will begin.



Fig. 11.2.2(h) Access permission



If the Android OS you are using is OS 10, the message displayed in the pop-up will be different, but perform the same operation.

If your Android OS is OS 9, this operation is not necessary because the pop-up will not be displayed.

6 The "Installing manual" pop-up should appear during installation process. Wait for about 5 minutes for the install process to complete.



Fig. 11.2.2(i) Manual installation screen

The "Installing manual" pop-up will clear when the manuals are installed.

After the installation is completed, confirm that the manuals can be viewed by following the procedure described in "Viewing the manual".

Viewing the manual

1 Slide the left end of the screen towards the right to display the menu and select "Manual".

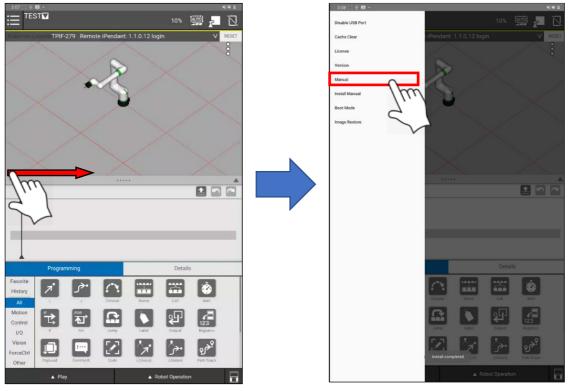


Fig. 11.2.2(j) Tablet TP app drawer menu

2 The following Manual List screen should appear. Tap the manual you want to view.

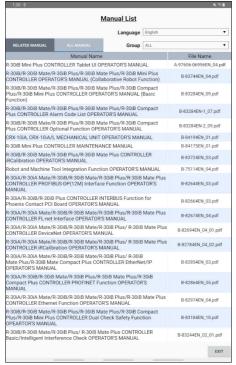


Fig. 11.2.2(k) Manual list

11.2.3 Installation Procedure (Tablet TP App V1.10 or Earlier)

Install with the following procedure when the Tablet TP app version is V1.03 to V1.10. Unlike V1.11 or later, it is necessary to unzip the zip file of the Tablet TP manual installer, copy it to the USB memory device, and connect it to the Tablet TP.

↑ CAUTION

If the Android OS version of Tablet TP is OS 11, tablet TP app V1.10 or earlier cannot be used. Update the version to V1.11 or later, and then install Tablet TP manual by following the procedure in "11.2.2 Installation Procedure (Tablet TP App V1.11 or Later)".

Prepare the installer

- Unzip the Tablet TP manual installer zip file (fanuc manual.zip) and copy "fanuc manual" directory to the root directory of the USB memory device prepared in "Format the USB memory device" of "11.2.1 Preparation (Common to All Versions)".
- Make sure that the Tablet TP app V1.03 to V1.10 is installed on the tablet. Tablet TP manual cannot be installed on versions older than V1.03.

Check the Tablet TP app version

Slide the left end of the screen towards the right to display the menu and select "Version".

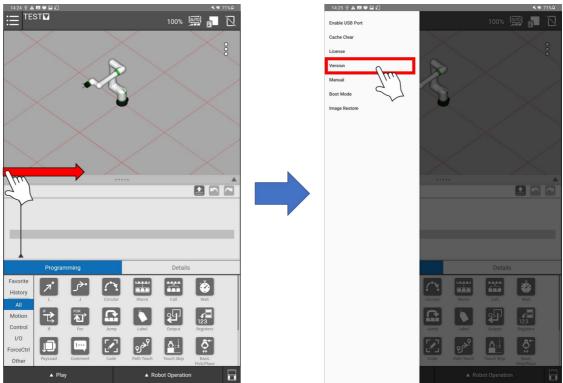


Fig. 11.2.3 (a) Tablet TP app drawer menu

2 A pop-up will be displayed. Confirm the Tablet TP app version.

Tablet TP version1.10

Fig. 11.2.3(b) Tablet TP app version

Connect the USB memory device

- 1 Turn on the controller.
- 2 Insert the USB memory device prepared in Step 1 of "Prepare the installer" into the USB memory port on the Tablet Base.

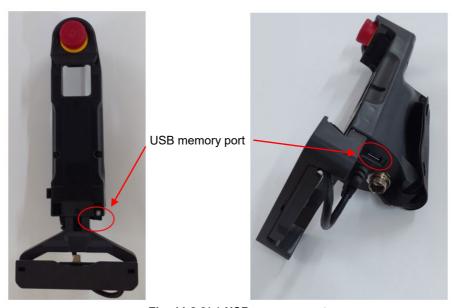


Fig. 11.2.3(c) USB memory port

Install the manual

Activate the Tablet TP app and slide the left end of the screen towards the right. A menu like the following should be displayed on the left side of the screen.

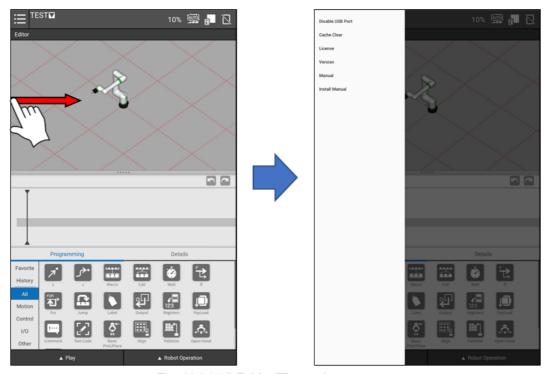


Fig. 11.2.3 (d) Tablet TP app drawer menu

2 Touch "Install Manual" and the "Installing manual" message should appear. Wait for about 5 minutes for the install process to complete. The "Installing Manual" message will clear when the manuals are installed.

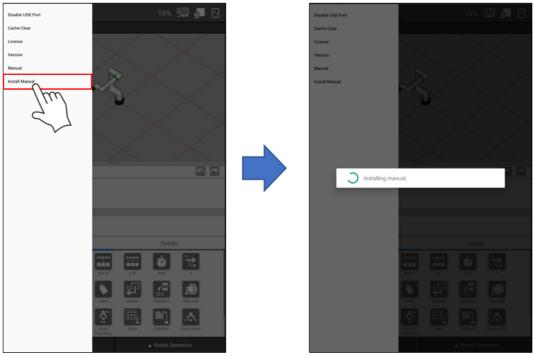


Fig. 11.2.3 (e) Manual installation screen (V1.10 or earlier)

Viewing the manual

1 Slide the left end of the screen towards the right to display the menu and select "Manual".

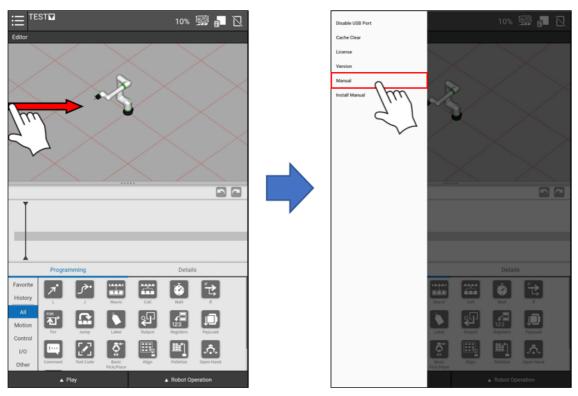


Fig. 11.2.3 (f) Tablet TP app drawer menu

2 The following Manual List screen should appear. Tap the manual you want to view.



Fig. 11.2.3(g) Manual list

11.2.4 Troubleshooting

"Install Manual" does not show in the menu at "Install the manual".

• "Install Manual" will not show with a USB memory device without the Tablet TP manual installer. Check whether the USB memory device is inserted into the USB memory port on the Tablet Base.

- If the Tablet TP app is V1.11 or later, check if the USB memory device has fanuc_manual.zip. If the Tablet TP app is V1.10 or earlier, check to make sure "fanuc_manual" is in the root directory of the USB memory device.
- If the USB memory device was inserted after activating the Tablet TP app, "Install Manual" might not show immediately. In this case, wait for a few seconds until the USB memory device is enabled.

Neither of "Manual" and "Install Manual" show in the column at "Install the manual".

• Check the version of the Tablet TP app. To check the version of the Tablet TP app, press "Version" in the menu. The manual can be viewed for versions above V1.03. Users can find the newest version of the Tablet TP app from your regional FANUC customer service website that provides software downloads.

In Japan, the website is https://store.member.fanuc.co.jp/fanuc/store/.

The website in your region will vary. Please visit www.fanuc.com to select your region.

Other issues

- Installing manuals will not be completed if the controller's power is turned OFF or the USB memory device is removed during the installation process. In this case, try again from the procedure in "Install the manual".
- If the Tablet TP app is V1.10 or earlier, and the Tablet TP manual installer zip file is not properly unzipped onto your USB memory device, some manuals may not show on the Tablet TP. If the Tablet TP app is V1.11 or later, the same symptoms may occur as if the zip file of the manual installer for Tablet TP is damaged.
- In this case, try again from "Prepare the installer" of "Preparation (Common to All Versions)".
- Unmount the USB memory device before removing it from the USB memory port.

 If the Android OS of the Tablet TP is 11 or later, refer to "11.1.5 Removing the USB memory device".

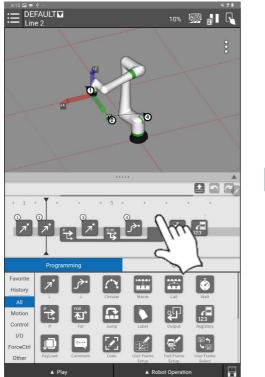
If the Android OS of the Tablet TP is 10 or earlier, the USB memory device can be unmounted by the following procedure.

- Open the "Settings" app, and select "Device care"
- Select "Storage Settings" from a menu.
- Press the unmount button next to the USB memory storage

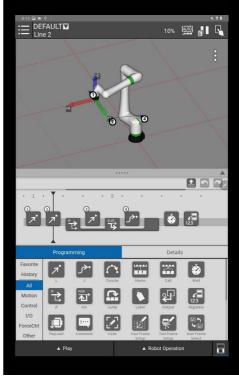
The procedure may varies depending on the Android OS version. If you cannot operate with the procedure as described above, refer to the tablet manual or help.

11.3 Diagnostic Log

Diagnostic Log for Tablet TP app is a function to save the operation history of the tablet TP screen as a video (mp4 format). Recording the operation history as a video may help identify the cause of the trouble.







Record the screen operation history

Play the recorded operation

Note

To use this function, tablet TP app V1.15 or later is required.

The recorded operation is about 5 minutes. It keeps recording the most recent operation, and the operation record before 6 minutes is automatically deleted.

⚠ CAUTION

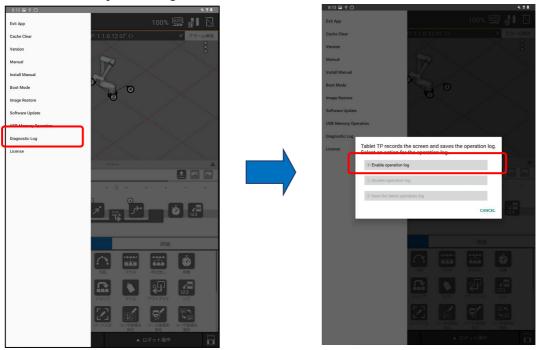
The screen video is recorded only when the tablet TP app screen is displayed on the front screen of the tablet. It is not recorded while another application or another screen is displayed.

The values and passwords entered on the tablet TP screen are also recorded as videos.

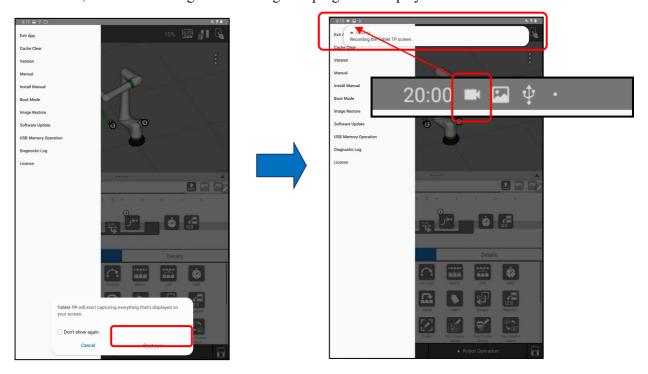
11.3.1 Procedure of the operations

Enable Diagnostic Log (Start recording)

- 1 Slide from the left edge of the screen to the right to display the drawer menu.
- 2 Select "Diagnostic Log" from the menu.
- 3 Select "Enable operation log".

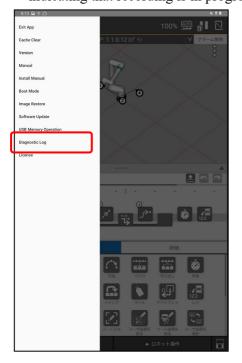


In the pop-up that appears at the bottom of the screen, select "Start Now" to start recording the screen video. When you start recording, you will see a message in the notification area of your tablet. In addition, an icon indicating that recording is in progress is displayed.

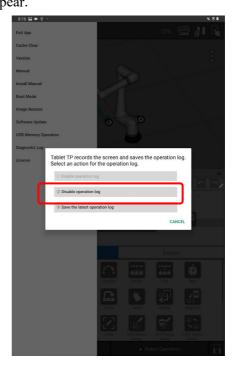


Disable Diagnostic Log (Stop recording)

- 1 Slide from the left edge of the screen to the right to display the drawer menu.
- 2 Select "Diagnostic Log" from the menu.
- 3 Select "Disable operation log". Recording will stop, and the message displayed in the notification area on the tablet and the icon indicating that recording is in progress will disappear.

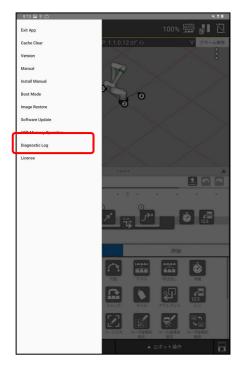






Save the operation log

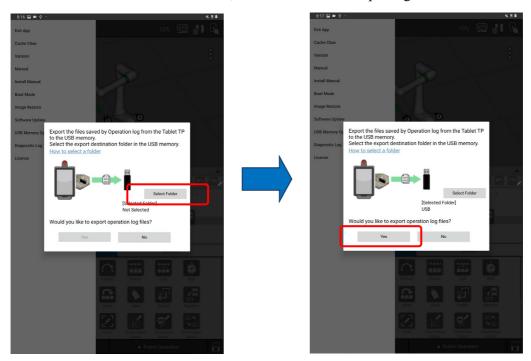
- 1 Insert the USB into the tablet TP-based USB port.
- 2 Slide from the left edge of the screen to the right to display the drawer menu.
- 3 Select "Diagnostic Log" from the menu.
- 4 Select "Save the latest operation log".





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5 Select the save destination from "Select Folder".
For details on how to select a folder, refer to the "11.1.2 Exporting files to a USB memory".



Diagnostic log file is saved as an MP4 format file. You can play it on a device that can play MP4 format files.

12 SOFTWARE UPDATE

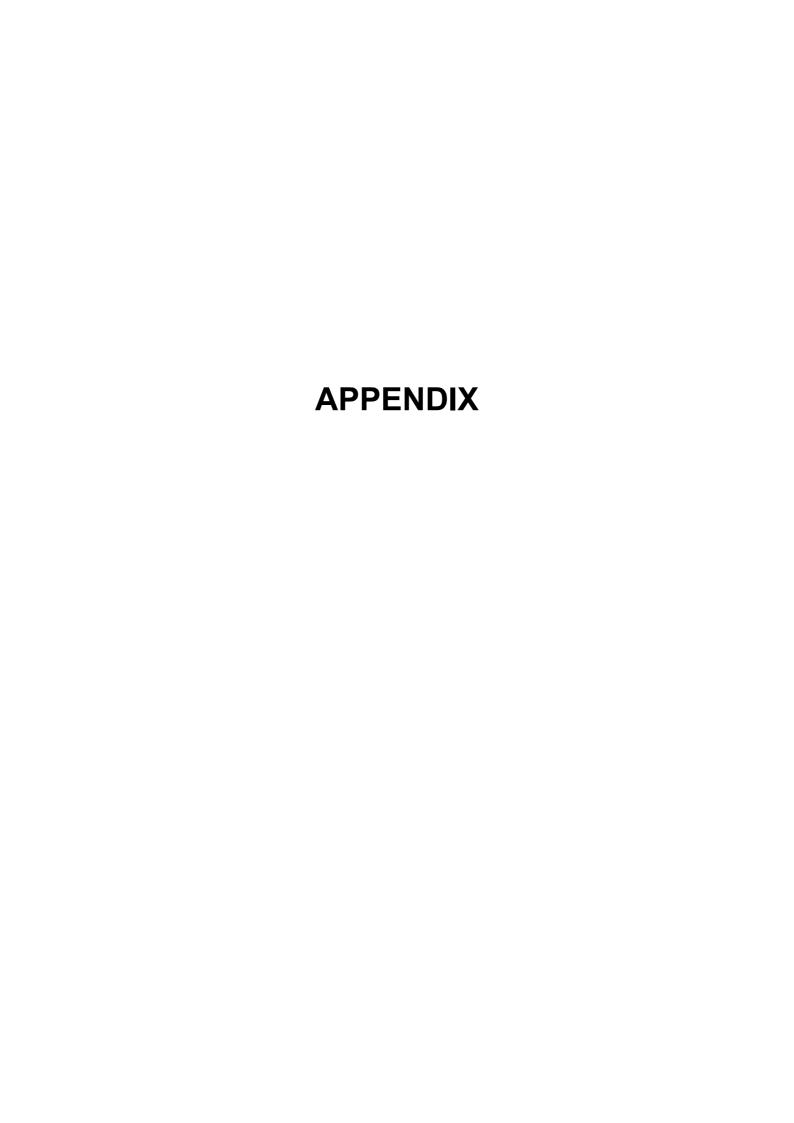
In the CRX series, you can download the latest software and update the software of your CRX series robot.

You can confirm whether the latest software exists in the FANUC membership site.

Fanuc membership site Japan https://store.member.fanuc.co.jp/fanuc/store/

In the case of regions other than the above, please contact the service base of the neighborhood.

For more information about the installation method of the software, please confirm the attached software update procedure for the CRX series robot.





VERSION INFORMATION

This appendix describes how to check the version information of the device and application used to operate the robot with the Tablet TP.

Contents of this appendix

- A.1 OS VERSION OF ANDROID TABLET DEVICE
- A.2 VERSION OF THE TABLET TP APP
- A.3 SOFTWARE EDITION OF ROBOT CONTROLLER

A.1 OS VERSION OF ANDROID TABLET DEVICE

Follow the procedure below to check the OS version of the Android tablet device.

NOTE

The procedure may vary depending on the tablet device and Android OS version.

Press the Settings icon on the home screen of your tablet device to display the Settings screen.



Fig. A.1 (a) Home Screen

2 Scroll to the bottom of the Settings screen and press "About tablet" to display the About tablet screen.

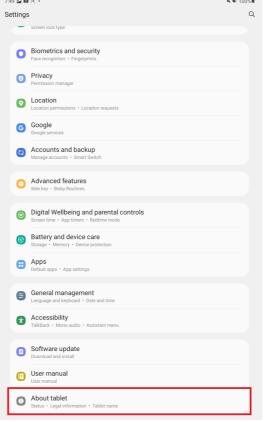


Fig. A.1 (b) Settings Screen

Press "Software information" on the About tablet screen to check the version of the tablet device.

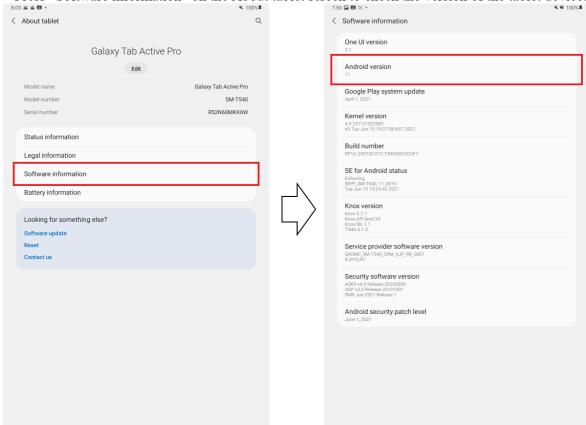


Fig. A.1 (c) Version Information

A.2 VERSION OF THE TABLET TP APP

Follow the procedure below to check the version of the Tablet TP app.

1 Launch the Tablet TP app.

2 Slide the left end of the screen towards the right to display the menu and select "Version".

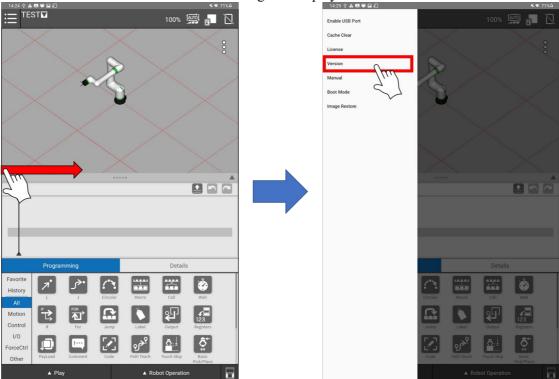


Fig. A.2 (a) Motion (option) instruction

A pop-up will be displayed. Confirm the Tablet TP app version.

Tablet TP version1.11

OK

Fig. A.2 (b) Program instruction menu

A.3 SOFTWARE EDITION OF ROBOT CONTROLLER

Follow the procedure below to check the version of the Tablet TP app.

- 1 Press [MENU] key to display the screen menu.
- 2 Select " 0 NEXT —" and then select " 4 STATUS" on the next page.
- 3 Press F1, [TYPE] to display the screen change menu.
- 4 Select "Version ID". Software version screen is displayed.

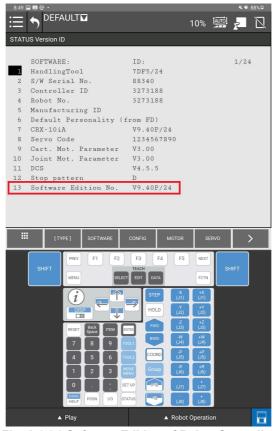


Fig. A.3 (a) Software Edition of Robot Controller

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REVISION RECORD

REVISION RECORD

Edition	Date	Contents
04	Jul.,2022	For 7DF5/16~32
03	Jul.,2021	For 7DF5/06~15
		Applied to R-30iB Plus/R-30iB Mate Plus controller
02	Dec.,2020	For 7DF5/05
01	Sep., 2020	

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