

EPSON

Epson RC+ 8.0 Simulator

Original instructions

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1. Introduction

1.1 Introduction

Thank you for purchasing this Epson robot system.

This manual provides the information necessary for correctly using the software.

Before using the system, please read this manual and related manuals to ensure correct use.

After reading this manual, store it in an easily accessible location for future reference.

Epson conducts rigorous testing and inspection to ensure that the performance of our robot systems meets our standards. Please note that if the Epson robot system is used outside the operating conditions described in the manual, the product will not perform up to its basic performance.

This manual describes potential hazards and problems that are foreseen. To use the Epson robot system safely and correctly, be sure to follow the safety information contained in this manual.

1.2 Trademarks

Microsoft, Windows, the Windows logo, Visual Basic, and Visual C++ are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries.

Intel Core is a trademark of Intel Corporation.

XVL is a registered trademark of Lattice Technology, Co., Ltd.

All other company names, brand names, and product names are registered trademarks or trademarks of their respective companies.

1.3 Notation

Microsoft® Windows® 10 operating system

Microsoft® Windows® 11 operating system

In this manual, the above operating systems are referred to as Windows 10 and Windows 11, respectively. Windows 10 and Windows 11 are sometimes collectively referred to as Windows.

1.4 Terms of Use

No part of this instruction manual may be reproduced or reprinted in any form without express written permission.

The information in this document is subject to change without notice.

Please contact us if you find any errors in this document or if you have any questions about the information in this document.

1.5 Manufacturer

SEIKO EPSON CORPORATION

1.6 Contact Information

Contact information details are listed in the "Supplier" section in the following manual.

Note that the contact information may vary depending on your region.

"Safety Manual - Contact Information"

The Safety Manual is also available at the following site.

URL: <https://download.epson.biz/robots/>



1.7 Before Use

Before using this manual, be sure that you understand the following information.

The Installation Folder for Epson RC+ 8.0

You can change the path for the installation folder for Epson RC+ 8.0 anywhere. This manual assumes that Epson RC+ 8.0 is installed in `C:\EpsonRC80`.

2. Safety

Please read "Safety Manual" before installing the robot system or before connecting cables and check the safety requirements.

For the safety of the Controller with Safety Board, refer to the safety manual for the product you use.

2.1 Conventions

The following symbols are used in this manual to indicate important safety information. Be sure to read the descriptions shown with each symbol.

WARNING

This symbol indicates an imminently hazardous situation which, if operation is not performed properly, will result in death or serious injury.

WARNING

This symbol indicates a potentially hazardous situation which, if operation is not performed properly, could result in an injury due to electric shock.

CAUTION

This symbol indicates a potentially hazardous situation which, if operation is not performed properly, may result in a minor or moderate injury or in property damage only.

2.2 Definitions

2.2.1 Robot Power

The status of robot power is explained below in terms of restriction to operation:

Operation-prohibited status:

Robot cannot be operated.

Restricted (low power) status:

Robot can operate at low speed and low torque.

Unrestricted (high power) status:

Robot can operate without restriction.

The robot will not operate regardless of the control actions taken by the operator when in the operation-prohibited state. During operation, when the safeguard circuit opens, the system will switch to operation-prohibited state.

The robot will operate at low speed and torque in the restricted state (low power). In the unrestricted state (high power), the robot will operate at the programmed speed and torque.

In the event that the robot should make an unexpected movement, the restricted state (low power) decreases operating speed allowing the operator to avoid danger. The torque is also decreased to minimize serious injury to the operator should one be struck by the robot. The maximum values of the decreased speed and torque are set according to the robot used and cannot be changed by the user.

As a safety precaution the initial power state of the robot will be set to either the restricted (low power) state or the operation-prohibited state. The system will not change to the unrestricted (high power) state if the appropriate procedures are not followed.

Due to the multi-protect circuit and mutual monitoring circuit in the controller, when the system is in a restricted state (low power state) or operation-prohibited state, even a single failure will not cause runaway operation exceeding the specified reduced speed and reduced torque.

2.2.2 Safeguard (Safeguard Interlock)

Safety barriers for safety must be installed around the Manipulator, and safeguards must be installed at the entrance and exit of the safety barriers.

The term "safeguard" mentioned in this manual is a safety device with an interlock that allows entry into the safety barriers. Safeguards include safety door switch, safety barriers, light curtains, safety gates, safety floor mats, and so on. The safeguard is an input that informs the Robot Controller that an operator may be inside the safeguard area.

For RC700-E, RC800 series:

You need to assign at least one Safeguard (SG) in Safety Function Manager. For more details, refer to the following manual.

"Safety I/O Connector" in "Robot Controller Manual"

For models other than RC700-E, RC800 series:

Connect the safeguard interlock switch to the safeguard input of the controller's EMERGENCY connector. For more details, refer to the following manual.

"EMERGENCY" in "Robot Controller Manual"

When the safeguard is opened, Protective Stop operates to change the safeguard state to open (displayed: SO).

Safeguard open

Operations are prohibited. Further robot operation is not possible until either the safeguard is closed and the latch is released, or TEACH or TEST mode is turned on and the enable circuit is activated.

Safeguard closed

The robot can operate automatically in an unrestricted (high power) state. To ensure safe operation, install a safety system using safety doors, light curtains, safety floor mats, etc.

WARNING

- If a third person accidentally releases the safeguard while an operator is working inside the Safety barriers, this may result in a hazardous situation. To protect the operator working inside the safeguard, provide means to lock out or tag out the latch release switch.
- To protect operators working near the robot, be sure to connect a safeguard switch and make sure that it works properly.

2.2.3 Operation Mode

The operation mode is defined as the single control point for the controller, therefore you cannot use more than one operation mode at the same time.

There are four operation modes for the controller: AUTO, PROGRAM, TEACH, and TEST. AUTO operation modes allow you to execute programs in the controller when the safeguard is closed. PROGRAM operation mode allows you to execute and

debug programs when the safeguard is closed. TEACH operation mode allows you to jog and teach the robot at slow speed while inside the safeguarded area.

TEST operation mode allows you to execute a program at slow speed while the safeguard is opened.

KEY POINTS

Teaching operation described in this manual is the operation of AUTO operation mode or PROGRAM operation mode. This intended for jogging the robot or teaching operation outside the safeguard.

2.2.4 Start Mode

The Start mode specifies the operation mode for Epson RC+ 8.0 when it starts. You can set the Epson RC+ 8.0 to start in AUTO or PROGRAM mode.

For information on how to change the start mode, see below.

"Epson RC+ 8.0 User's Guide - Operation"

2.2.5 Changing Operation Mode

You can change from AUTO operation mode or PROGRAM operation mode to TEACH mode by setting the mode selector key switch on the Teach Pendant to the TEACH position as described below.

- TP1, TP2: Teach
- TP3, TP4: TEACH/T1, TEACH/T2

When the mode selector key switch is changed as described below to send a release latch input signal, the operation mode is returned to the previous operation mode.

- TP1, TP2: Auto
- TP3, TP4: AUTO

The AUTO operation mode can be changed to PROGRAM mode during the Epson RC+ 8.0 startup sequence. A password can be used to allow only certain personnel to change the startup operation mode.

When Epson RC+ 8.0 starts in AUTO operation mode, the AUTO operation mode cannot be changed to PROGRAM operation mode after the system has started. To change the operation mode, restart the system and log into PROGRAM mode, then set the start mode again and restart Epson RC+ 8.0.

For details on the Start Mode, see below.

"Epson RC+ 8.0 User's Guide - Operation - Starting Epson RC+ 8.0 - Start Mode"

To change to TEST operation mode:

- TP1: Switch the mode selector key switch on the Teaching Pendant to Teach, and then select Function key F1: Test Mode.
- TP3, TP4: Switch the mode selector key switch on the Teaching Pendant to TEACH/T1 or TEACH/T2, and then tap the [Test] tab.

For more details, refer to the following manual.

- "Functions Operation Mode (TEACH/AUTO/TEST) in Robot Controller option Teaching Pendant TP1 manual"
- "Functions Operation Mode (TEACH/AUTO) in Robot Controller option Teaching Pendant TP2 manual"

- "Functions Operation Mode (TEACH/AUTO/TEST) in Robot Controller option Teaching Pendant TP3 manual"
- "Operation Mode (TEACH/AUTO/TEST) in Robot Controller option Teaching Pendant TP4 manual"

KEY POINTS

- T2 mode cannot be used on RC700-A and RC700-D Controllers complying with the UL standards.
- T2 mode can be used on RC700-E and RC800 series.

2.2.6 Emergency Stop

The controller is equipped with an emergency stop input terminal. If the normally closed emergency stop circuit is broken, the power supplied to all motors will be shut off (and enter servo-free status) and the robot will be stopped by dynamic braking.

For more details on wiring, refer to the following manual:

"EMERGENCY" in "Robot Controller Manual"

2.2.7 Teach Pendant

Operators can use the teach pendant to operate the robot in the TEACH or TEST operation mode.

For operation instructions, refer to the following manuals.

- "Robot Controller option Teaching Pendant TP1 manual"
- "Robot Controller option Teaching Pendant TP2 manual"
- "Robot Controller option Teaching Pendant TP3 manual"
- "Robot Controller option Teaching Pendant TP4 manual"

2.3 Installation and Design Precautions

For installation and design precautions, refer to the following manuals.

- "Safety Manual"
- "Robot Controller Manual"
- "Manipulator Manual"

2.4 Precautions regarding Robot Operation

For precautions regarding robot operation, refer to the following manuals.

- "Safety Manual"
- "Robot Controller Manual"
- "Manipulator Manual"

2.5 Backup of Projects and Controller

After a project has been created or edited, or after system data including robot parameters has been edited, the project and controller files should be copied and stored in media other than the hard disk on the PC (e.g. USB memory key). Keep the backup media in a safe place in case of damaged data on the hard disk.

To backup, select [Controller Tools] from the Epson RC+ 8.0 [Tools] menu and execute [Controller Backup]. See details below.

"Epson RC+ 8.0 User's Guide - Epson RC+ 8.0 GUI - [Tools] Menu - [Controller] Command (Tools Menu)"

Controller Backup is a function to backup both the project and the controller.

To backup only the project data, select [Copy] from the [Project] menu. See details below.

"Epson RC+ 8.0 User's Guide - Epson RC+ 8.0 GUI - [Project] Menu - [Copy] Command (Project Menu)"

CAUTION

If your system cannot be restored by Restore Controller, you must restore robot calibration parameters (Hofs, CalPIs) before operating the robot. If you fail to do so, the robot will move to incorrect positions.

3. Simulator Functions

Simulator functions enable easy robot motion checking on your PC, which gives you flexibility to consider the system layout, measure the operation time, and create robot programs.

They are useful from the introduction stage to the launch of robot system.



KEY POINTS

In order to use this function, a license that is higher than the Epson RC+ Basic Edition is required.

3.1 Overview

The following are the major simulator functions: Robot motion 3D display

Shows robot orientation and motion in a 3D display from various viewpoints. Offers accurate display data based on design data.

This function is not available for the manipulator series (models) as described below. If a simplified layout consideration or measurement of motion time is needed, set an alternative model. However, external dimensions and motion range may differ. Be careful when you set the alternative models.

For details on unsupported models, see below.

Appendix A: Simulator Functions List of Unsupported Manipulator Models

Series	Model	Alternative model (When using a Virtual Controller)	
X5	All models	No alternative model	-
G6-II	Protected-model G6-***D*-II, G6-***P*-II	Standard model, Cleanroom model G6-***S*-II, G6-***C*-II	*
G10-II	Protected-model G10-***D*-II, G10-***P*-II	Standard model, Cleanroom model G10-***S*-II, G10-***C*-II	*
G20-II	Protected-model G20-***D*-II, G20-***P*-II	Standard model, Cleanroom model G20-***S*-II, G20-***C*-II	*

*: External dimensions and motion range differ.

Interference check

Checks whether the robot (including the hand and devices installed on the robot) interferes with itself or its peripherals. (This function is not available for the robots that do not support 3D display.)

Robot operation time prediction

Predicts the robot operation time for a program.

Considers the speed setting (Speed, etc.) and acceleration / deceleration setting (Accel, etc.) when predicting the robot motion time.

SPEL+ program execution

Allows you to create, execute, and debug SPEL+ programs.

For restrictions on the simulator functions, see below.

Simulator Specifications and Restrictions

4. Using the Simulator

You can try the simulation functions using the provided sample virtual controllers and projects.

4.1 Working with the Samples

You can operate a robot easily using the samples provided.

Follow the steps below:

- Connect to a virtual controller (robot)
- Open a project
- Display the [Robot Simulator] window
- Operate the robot by executing the program
- Next step

1. Connect with the virtual controller

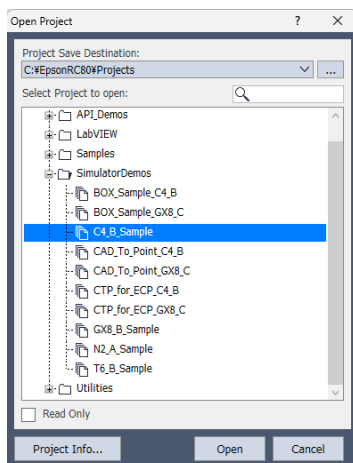
Connection: C4-B Sample ▾

Select "C4-B Sample" from the Epson RC+ 8.0 toolbar [Connection] list box. When the connection is complete, the [Connection] list box shows "C4-B Sample".

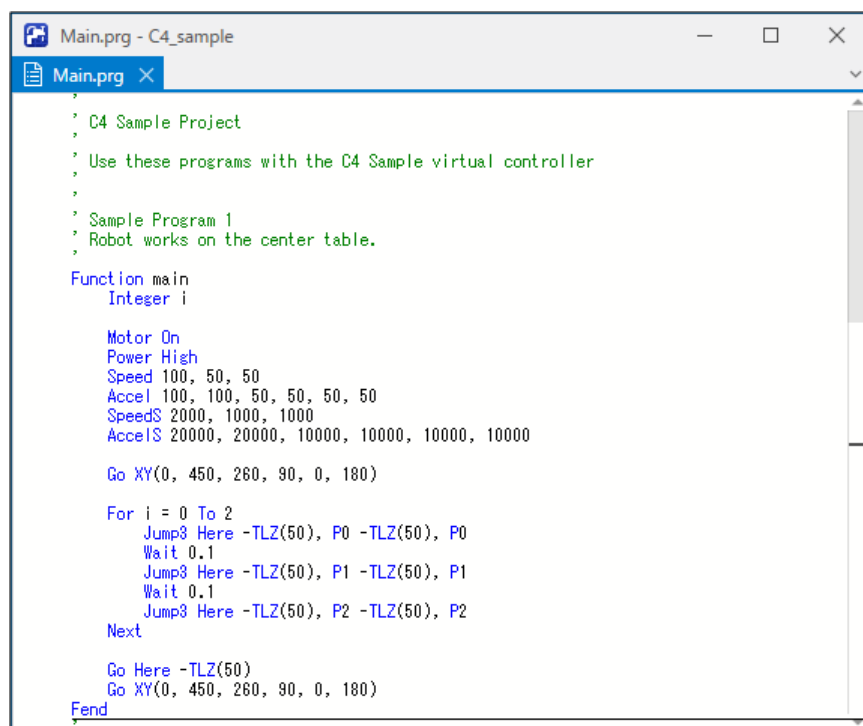
2. Open a project

i. Click [Open...] from [Project] on Epson RC+ 8.0 menu.

ii. Select [Projects]-[SimulatorDemos]-[C4_B_Sample].



iii. Click the [Open] button. The [Robot Simulator] window appears.



```

Main.prg - C4_sample
Main.prg X
' C4 Sample Project
' Use these programs with the C4 Sample virtual controller
'
' Sample Program 1
' Robot works on the center table.
Function main
  Integer i

  Motor On
  Power High
  Speed 100, 50, 50
  Accel 100, 100, 50, 50, 50, 50
  SpeedS 2000, 1000, 1000
  AccelS 20000, 20000, 10000, 10000, 10000, 10000

  Go XY(0, 450, 260, 90, 0, 180)

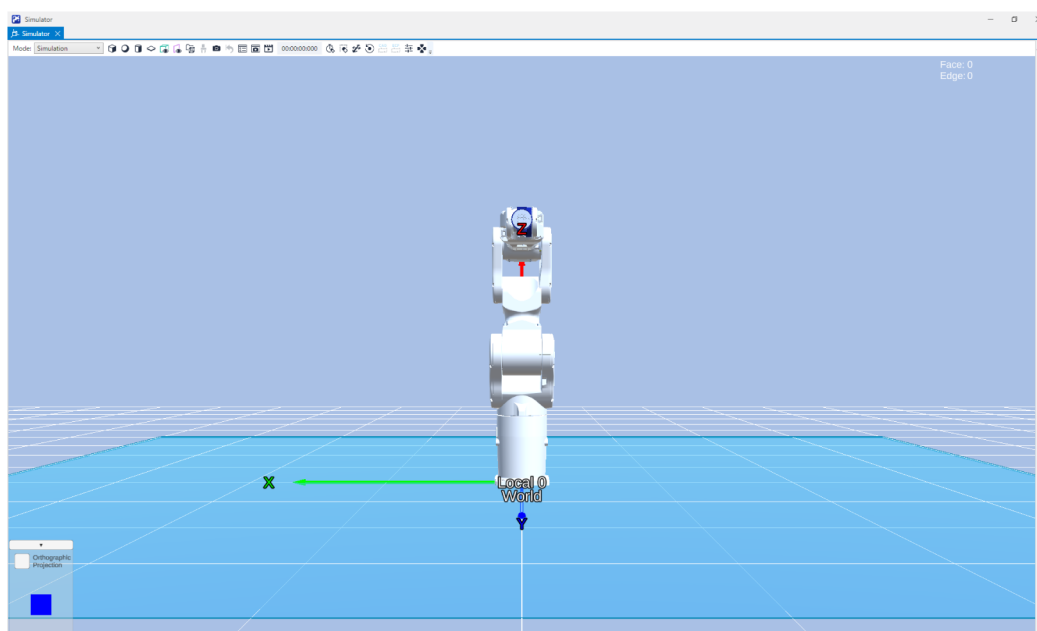
  For i = 0 To 2
    Jump3 Here -TLZ(50), P0 -TLZ(50), P0
    Wait 0.1
    Jump3 Here -TLZ(50), P1 -TLZ(50), P1
    Wait 0.1
    Jump3 Here -TLZ(50), P2 -TLZ(50), P2
  Next

  Go Here -TLZ(50)
  Go XY(0, 450, 260, 90, 0, 180)
End

```

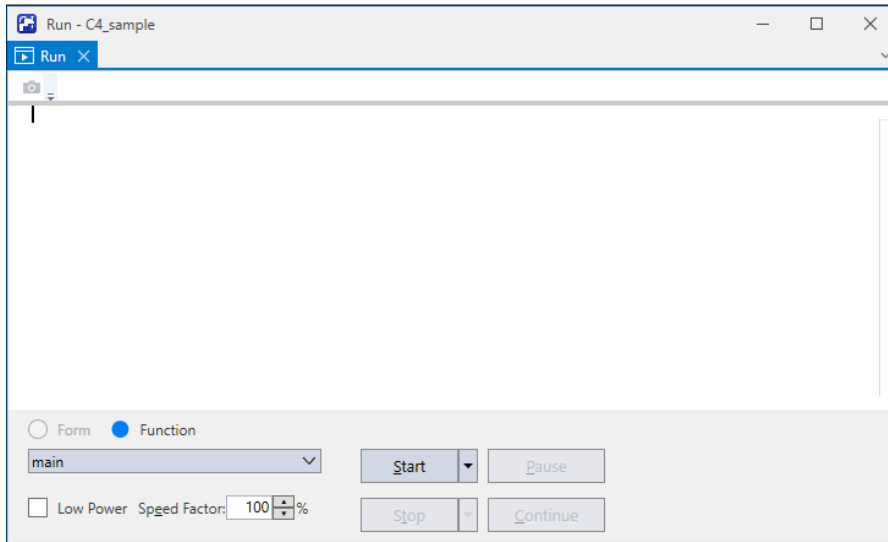
3. Display the [Robot Simulator] window

Click the  [Simulator] button on the toolbar. The [Robot Simulator] window appears.



4. Operate the robot by executing the program

- i. From the tool bar, click the  [Run Window] button. The project will be built and the [Run] window will appear.



- ii. Click the [Start] button. When the message "Are you ready to start?" appears, click [Yes]. The program starts and the robot moves in the 3D display.

5. Next step

If you want to change the sample, follow the Steps 5 to 7 below. If you want to create your own system, start from Step 1.

Working with the User Created System

If you want to change the sample virtual controller, see below and change the copied sample.

Virtual Controller - "Copy the sample or configured virtual controller"

4.2 Working with the User Created System

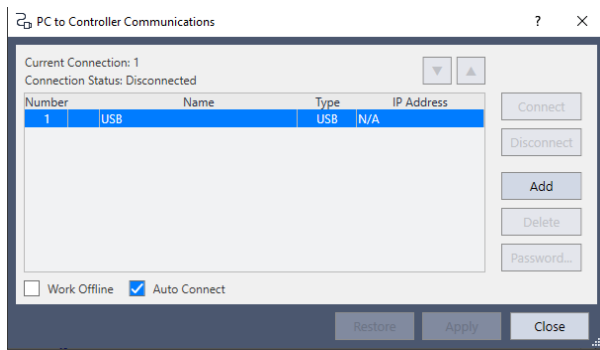
You can create your own system and simulate the robot operation on your PC.

Follow the steps below:

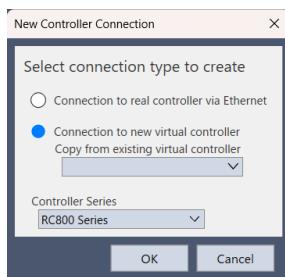
- Register a virtual controller (connection settings)
- Connect with the virtual controller
- Configure a robot
- Display the [Robot Simulator] window
- Place the objects
- Create a program
- Operate the robot by executing the program
- Measure the robot operation time
- Test the collision detection

1. Register a virtual controller (connection settings)

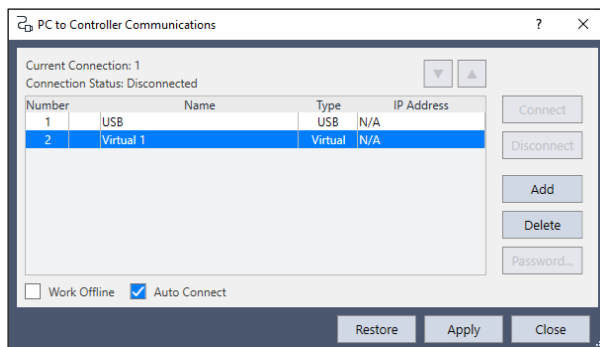
- i. Click the  [PC to Controller Communications] button on the Epson RC+ 8.0 toolbar. The [PC to Controller Communications] dialog box is displayed.



- ii. Click the [Add] button. The [New Controller Connection] dialog appears.
- iii. Select the [Connection to new virtual controller], and then select [RC800 Series] as the [Controller series].



- iv. Click the [OK] button.
- v. A new virtual controller named "Virtual 1" is created. Click the [Apply] button.



KEY POINTS

Program total execution time

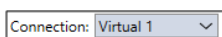
With licenses up to Epson RC+ Basic Edition, the total execution time of programs in the virtual controller is limited to one hour.

If total execution is over one hour, a warning message appears.

You can execute the program again after the warning is displayed. The total execution timer will be reset.

- vi. Click the [Close] button to return to the Epson RC+ 8.0 main window.

2. Connect with the virtual controller

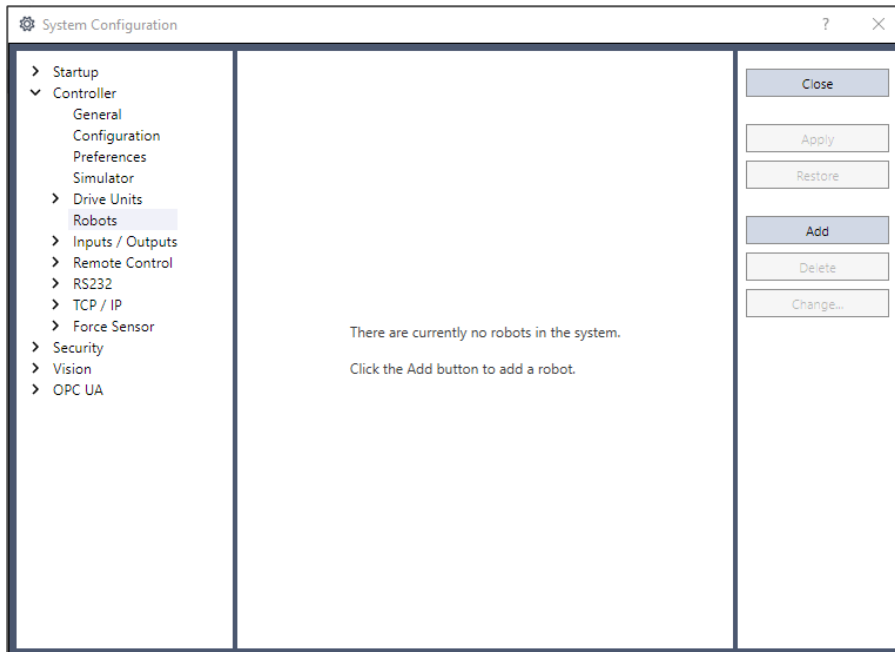


Select the created "Virtual 1" from the Epson RC+ 8.0 toolbar [Connection] list box. When the connection is complete, the [Connection] list box shows "Virtual 1".

3. Configure a robot

In this tutorial, a C8-C901S robot model is used.

- i. In the Epson RC+ 8.0 menu, select [Setup]-[System Configuration].
- ii. Select [Controller]-[Robots] from the dialog tree. The message "There are currently no robots in the system. Please register your robot" will appear.



- iii. Click the [Add] button to open the [Add New Robot] dialog box. Input the robot information as follows:

[Robot Name]: robot1

[Robot Serial #]: 1

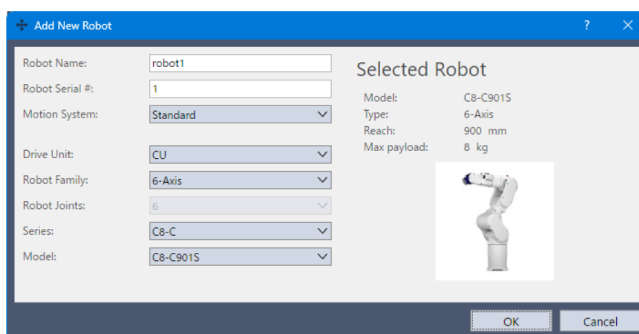
[Motion System]: Standard

[Drive Unit]: CU

[Robot Family]: Six Axis

[Series]: C8-C

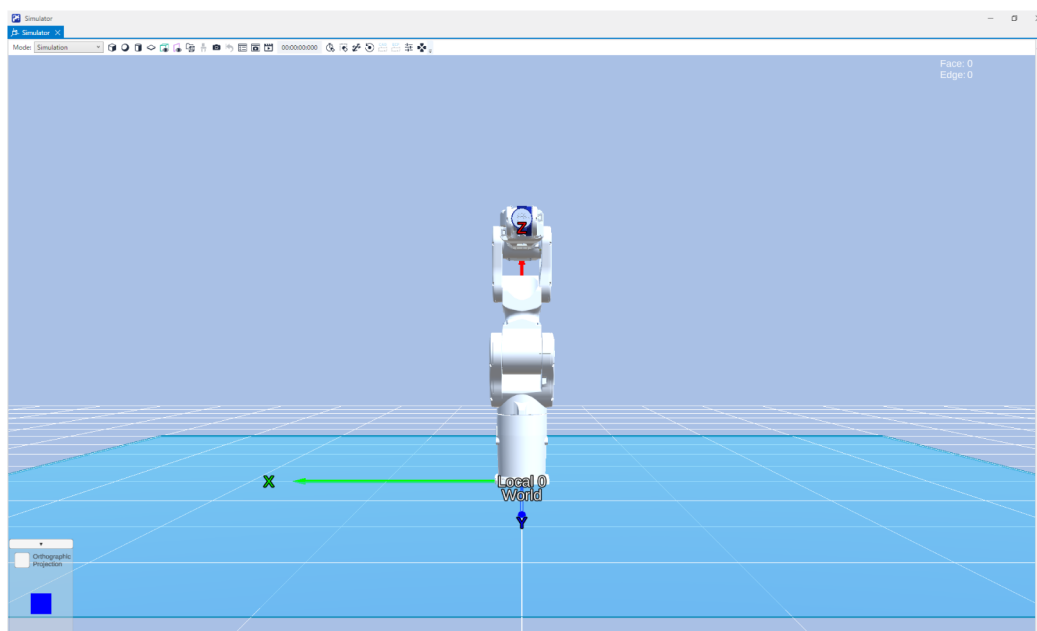
[Robot]: C8-C901S



- iv. Click the [OK] button. The message "Restarting Controller" appears.
- v. When the message disappears, click the [Close] button to return to the Epson RC+ 8.0 main window.

4. Display the [Robot Simulator] window

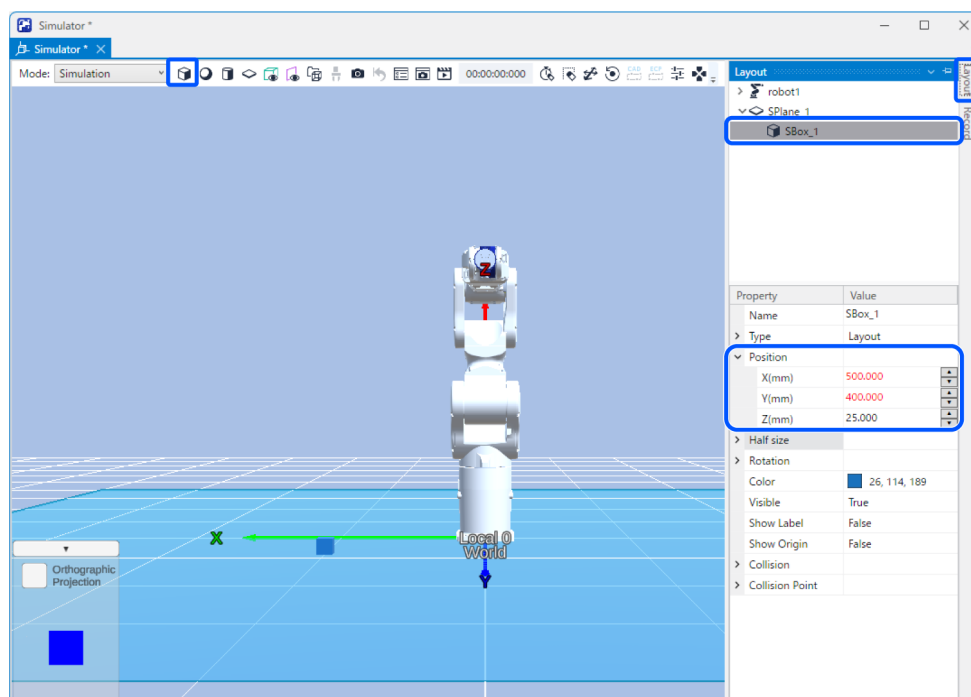
Click the toolbar- [Simulator] button. The following window appears.



5. Place the objects

For this tutorial, we will add a box to the layout.

- i. Click the  [Box] button on the toolbar.
- ii. Click the [Layout] tab and select "SBox_1" from the [Layout] tree. Change the [Position] of the property grid. For this tutorial, enter X = 500, Y = 400.



TIP

To save the layout change, execute the Epson RC+ 8.0 menu-[File]-[Save].

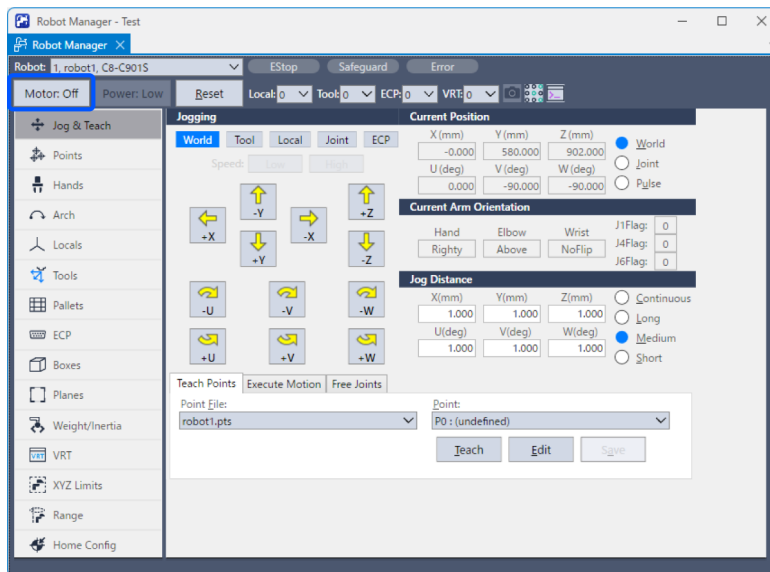
6. Create a program

i. Create a new project

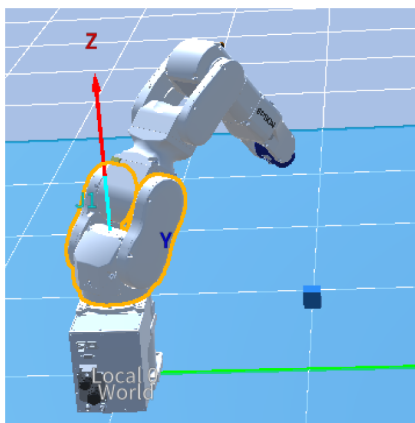
- Click the Epson RC+ 8.0 menu-[Project]-[New Project].
- Enter a new project name. For this tutorial, enter "Test".
- Click the [OK] button. Then, the project "Test" is created.

ii. Operate the robot and teach points.

- Click the Epson RC+ 8.0 toolbar-  [Robot Manager] button to display the [Robot Manager].
- Click the [Motor: Off] button. The message to confirm the operation appears. Click the [Yes] button.

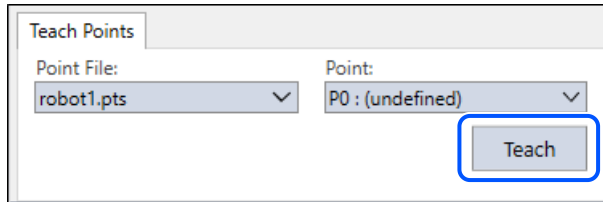


- In the [Robot Simulator] window, move the robot joint to a point where it does not interfere with the box. A robot joint can be moved by clicking the  [Rotate/Jog] button on the toolbar and dragging the joint.



- Click the [Teach] tab in the upper right corner of the simulator window to display the [Teach] panel.

Click the [Teach] button. The message to confirm the operation appears. Click the [Yes] button.



- e. The [New Point Information] dialog appears. Click the [OK] button.
- f. Select “P1 - (undefined)” from the [Point] list box on the lower right.
- g. Click the toolbar  [Rotate/Jog] button and drag the joint to a position where it does not collide with the box.
- h. Click the [Teach] button from the [Teach] tab. The message to confirm the operation appears. Click the [Yes] button.
- i. The [New Point Information] dialog appears. Click the [OK] button.
- j. Click the Epson RC+ 8.0 toolbar [Save all files] button to save the P0 and P1 data.

TIP

You can also use the [Jog & Teach] window to move the robot.

- iii. Create and execute a program with robot motion.

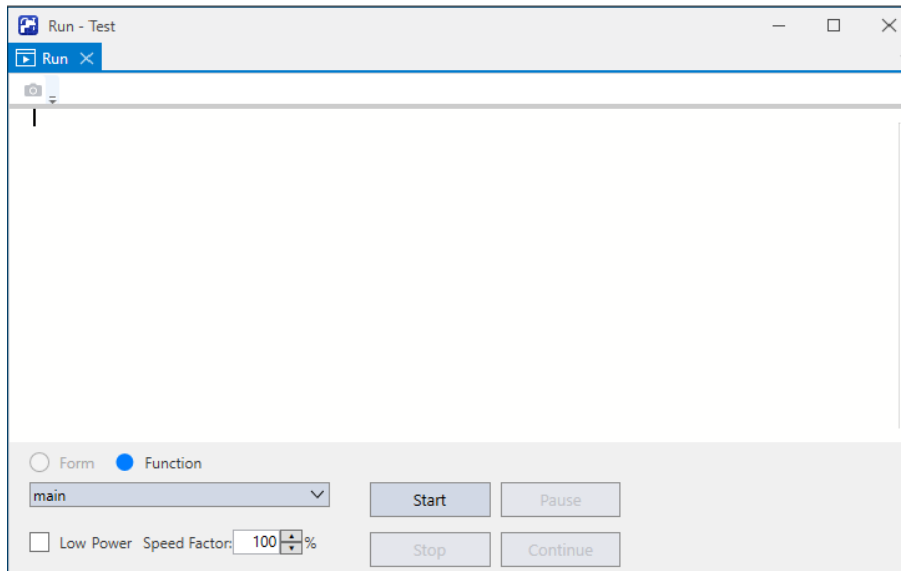
- a. Create the following program in Main.prg program.

```
Function main
  Go P0
  Go P1
Fend
```

- b. Click the Epson RC+ 8.0 toolbar [Build project] button. The program will be built. When the build is complete, the message "Build complete, no errors" appears in the status window.

7. Operate the robot by executing the program

- i. Click the Epson RC+ 8.0 toolbar  [Run Window] button. The following window appears.



- ii. Click the [Start] button. When the message "Are you ready to start?" appears, click [Yes]. The program starts and the robot moves in the 3D display.

8. Measure the robot operation time

The elapsed program run time (cycle time) is displayed in the Tool bar of the [Robot Simulator] window. The displayed time is an estimated time from when the program is executed using the [Start] button in the [Run] window until the program ends.



The following describes how to measure the operation time between two points (P0 → P1).

- i. Change the program in the "Main.prg" file to the following program.

```
Function main
  Motor On
  Power High
  Speed 100
  Accel 100,100
  Go P0
Fend

Function main2
  Go P1
Fend
```

- ii. Click the Epson RC+ 8.0 toolbar [Build project] button.

The program will be built. When the build is complete, the message "Build complete, no errors" appears in the status window.

- iii. Click the Epson RC+ 8.0 toolbar  [Run Window] button.

- iv. Confirm that "main" is selected in the [Function] drop-down list and click the [Start] button. When the message "Are you ready to start?" appears, click [Yes].

The program starts and the robot goes to P0, the point to start the time measurement, in the 3D display.

v. Select “main2” in the [Function] dropdown list.

vi. Click the [Start] button. When the message "Are you ready to start?" appears, click [Yes].

The program starts and the robot moves in the 3D display. At this time, the elapsed time displayed in the upper right of the [Simulator] window serves as a guide for the operation time from P0 to P1.

KEY POINTS

When you operate the real robot, the actual cycle time will be longer than the simulated cycle time according to the model, Fine, load settings. See details below.

Simulator Specifications and Restrictions

Also, when Speed, Accel values in the program are changed, the cycle time will reflect it.

TIP

Motion command includes Move and Jump as well as Go. For information on how to use these commands, refer to the following manuals:

- Help
- "SPEL+ Language Reference"

9. Test the collision detection

i. Go back to the [Robot Simulator] window.

ii. Click the toolbar  [Rotate/Jog] button and drag the joint to a position where it collides with the box.

When the robot joint hits the box, the display turns to red.

iii. Select “P2 - (undefined)” from the [Point] list box in the [Teach] tab, and click the [Teach] button.

The message to confirm the operation appears. Click the [Yes] button.

iv. The [New Point Information] dialog appears. Click the [OK] button.

v. Click the Epson RC+ 8.0 toolbar [Save all files] button to save the P2 data.

vi. Click the toolbar  [Rotate/Jog] button and drag the joint to a position where it does not collide with the box.

vii. Click the Tool bar-  [Reset Collision] button. Then, the red display returns to normal.

viii. Add the following function to the “Main.prg” program file.

```
Function main3
  Go P2
End
```

ix. Click the Epson RC+ 8.0 toolbar [Build project] button. The program will be built.

When the build is complete, the message "Build complete, no errors" appears in the status window.

- x. Click the Epson RC+ 8.0 toolbar  [Run Window] button.
- xi. Select “main3” in the [Function] dropdown list.
- xii. Click the [Start] button.

The message "Are you ready to start?" appears. Click the [Yes] button. The program starts and the robot moves in the 3D display. When the robot joint hits the box, the display turns to red.

TIP

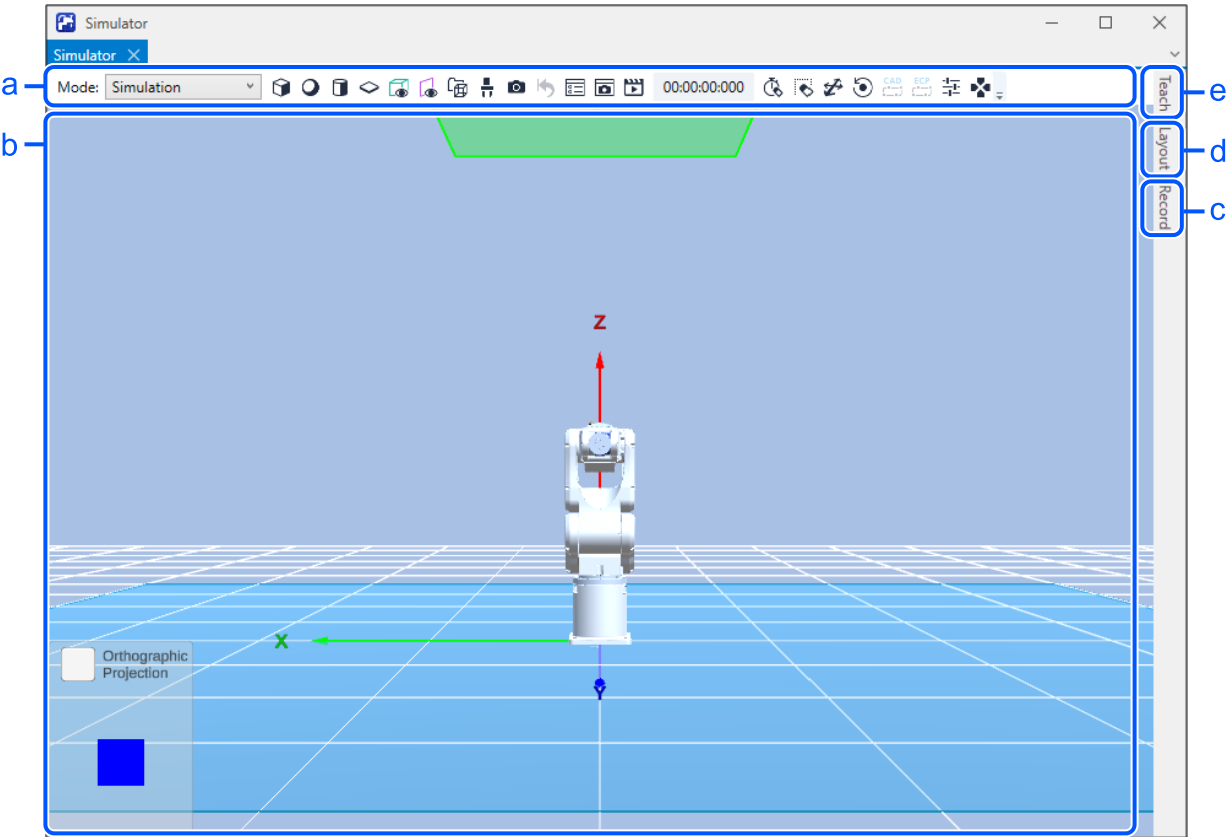
When a collision happens, the users can stop the controller program execution with an error. See below.

Collision detection

5. Description of Functions

This section describes how to use the [Robot Simulator] window and functions.

5.1 [Robot Simulator] window layout



Symbol	Item	Description
a	Tool Bar	Buttons for commands commonly used in the simulator are lined up.
b	3D Display	Allows you to check the robot orientation and motion from various points of view.
c	Record Tab	Allows you to record simulation results.
d	Layout Tab	Displays lists of robot and layout objects, and sets properties.
e	Teach Tab	Used to check current position and perform point teaching.

5.1.1 Tool Bar

The configuration of the toolbar will change according to the mode. There are two modes: simulation mode and playback mode. Simulation mode is described here.

For more information on the Playback mode toolbar, see below.

Record / Playback



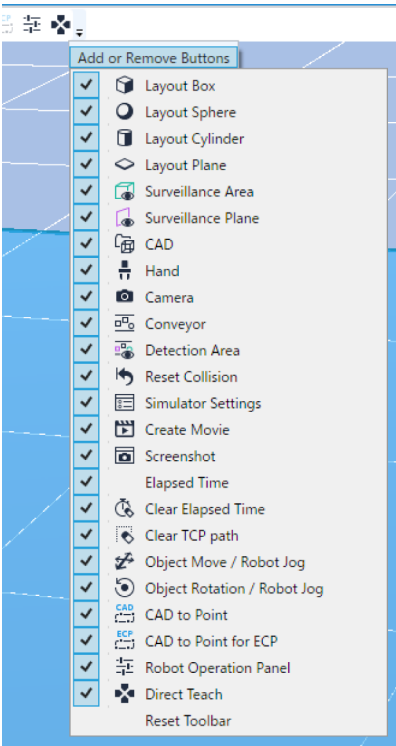
Button	Description
Mode: Simulation	Simulator operating mode. It switches between [Simulation Mode] and [Playback Mode].
Layout Box	Adds a box object.

Button	Description
 Layout Sphere	Adds a sphere object.
 Layout Cylinder	Adds a cylinder object.
 Layout Plane	Adds a floor / wall object.
 Surveillance Area	Adds a surveillance area object.
 Surveillance Plane	Adds a surveillance plane object.
 CAD	Adds a CAD object. When you click this button, the [Open CAD Data] dialog appears.
 Hand	Adds a hand object. When you click this button, the [Open Hand Data] dialog appears. Hand sample data is provided in the Epson RC+ 8.0 directory (C : \EpsonRC80\Simulator\Hand Samples).
 Camera	Add a virtual camera. When you click this button, the [System Configuration] dialog box opens and the Add Camera window appears. You can select a camera and lens.
 Conveyor	Adds a conveyor object. This can be added only with Epson RC+ Standard Edition or higher.
 Detection area	Adds a detection area object. This can be added only with Epson RC+ Standard Edition or higher.
 Reset Collision	Resets the collision detection status. When you click this button while the robot is not interfering with any layout objects, the red display turns to normal.
 Simulator Settings	Shows the [Simulator Settings] dialog. In this dialog, the 3D [Render Options] can be configured.
 Screenshot	Saves the current 3D display as an image file. The [Save As] dialog box appears, allowing you to specify a file name and file type (JPEG or PNG format).
 Create Movie	In Simulation mode, a project can be executed. In Playback mode, simulation results (log files) can be played back and movie files can be saved in MP4 format. A dialog for naming and saving a file appears.
 Elapsed Time	Shows the program execution time as if you ran the same program with a real controller. When a program starts, the elapsed time counter counts from "0:" and stops when the program finished. It pauses counting when the program is paused and resumes when the program continues execution.

Button	Description
 Clear Elapsed Time	Resets the elapsed time to "0".
 Clear TCP path	Clear the TCP path (including Render Singularity Avoiding path) which the robot displays.
 Move	Displays the guides. The objects can be moved by dragging the guides. For SCARA robots, the Joint #3 can be dragged to move up and down.
 Rotate/Jog	Displays the guides. The objects can be rotated by dragging the guides. The guides for the Manipulator are shown only at the Manipulator base. The joint angle can be changed by dragging the arm. For SCARA robots, the Joint #4 can be rotated.
 CAD to Point	Switches to the mode for outputting the point data from the CAD data.
 ECP CAD to Point for ECP	Switches to the mode for outputting the point data for external control point (ECP) motion from the CAD data.
 Robot Operation Panel	Displays the robot operation panel. Jog operation is available.
 Direct Teaching	By dragging the robot, you can operate jog operating with virtual direct teaching.

With Epson RC+ Standard Edition or higher, toolbar buttons can be added or removed.

Clicking the drop-down arrow button  on the right end of the toolbar displays the [Add or Remove Buttons] menu. Selecting this menu displays a list of buttons. Toolbar buttons can be added or removed by selecting or clearing the checkbox on the left side of the menu. Adding or removing toolbar buttons corresponds to showing or hiding the buttons. Note that buttons cannot be added to or removed from the playback mode toolbar.



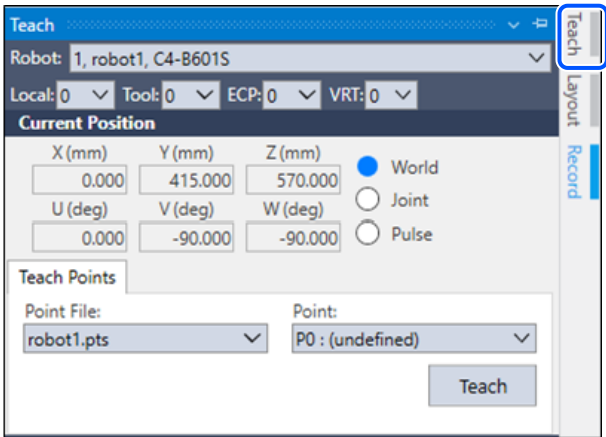
5.1.2 Teach

Select [Teach] from the right tab of the simulator window to display the Teach panel. You can teach the robot while checking the 3D display.

The Teach panel includes some functions of the [Jog & Teach] panel on Robot Manager.

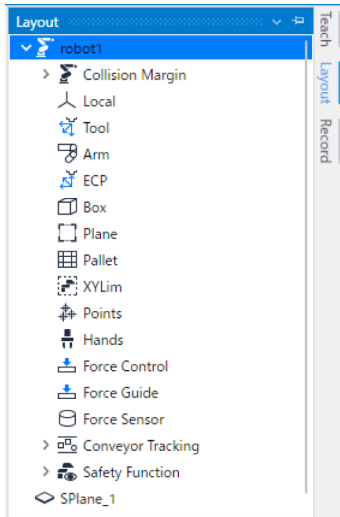
See details below.

"Epson RC+ 8.0 User's Guide - Epson RC+ 8.0 GUI - [Tools] Menu - [Robot Manager] Command (Tools Menu) - [Tools] - [Robot Manager] - [Jog & Teach] Panel"

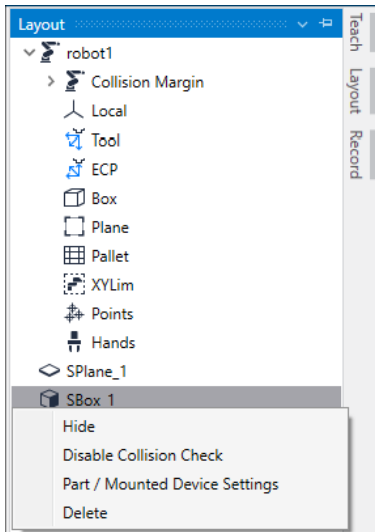


5.1.3 Layout Tree

Select [Layout] from the right tab of the simulator window to display a tree view of robot and layout objects.



The context menu appears by right-clicking the layout object. The frequently used functions can be used without operating by the property grid. The displayed items vary depending on objects.



[Cut], [Copy], and [Paste] commands in the [Edit] menu are available for layout objects other than CAD objects.

Also, the hierarchy of the layout objects can be changed by dragging and dropping.

What is an Object?

The objects in the simulator are either a "Robot Object" or a "Layout Object":

A "Robot Object" includes the robot itself, its hand, local coordinates, point information, etc. A "Layout Object" includes objects to be placed around the robot to simulate the robot peripheral environment in the 3D display.

Robot Object

- Robot: The robot itself. Display data is provided in advance.
- Hand: Reads and registers CAD data (XVL (.xv3), VRML2.0, STEP, IGES).
- Force Sensor: Set force sensor can be displayed.
- Safety Function: When using option of safety function, it displays robot monitored range and monitored areas.
- Object to reflect force control data: Force Control, Force Guide

- Object to reflect collision detection margin: Collision Margin
- Object to reflect a robot parameter: Local, Tool, Arm, ECP, Box, Plane, Pallet, XYLim
- Object to reflect robot point data: Point
- Object to reflect safety function parameter: Monitored Range, Monitored Areas, SLP_A, SLP_B, SLP_C, SLS, Soft Axis Limiting
- Object to reflect conveyor tracking data: Conveyor Tracking

Layout Objects

- Simple object: Box, Sphere, Cylinder, Floor / Wall
The display data for these objects is handled by the simulator. The object size can be changed as desired by editing properties.
- CAD object: These objects are created by loading CAD data (XVL(.xv3), VRML2.0, STEP, IGES, and DXF) from a file.
- Conveyor object: Conveyor display data is handled by the simulator. The object size can be changed as desired by editing properties.
- Detection Area Object: An object for detecting other objects. When combined with a conveyor object, it can be used as a sensor to detect workpieces (parts) moving on the conveyor. The display data is handled by the simulator. The object size can be changed as desired by editing properties.

Camera Objects

The following devices can be displayed. Devices that are supported in Epson RC+ 8.0 Option Vision Guide 8.0 Hardware & Setup can be selected.

- Camera: USB and GigE camera can be selected.
- Lens: Each model of standard camera lens, megapixel camera lens, mega-pixel camera lens (HF), 1-inch lens can be selected.
- Extension tube: Each length of tubes can be selected.

Surveillance Objects

These are layout objects that detect contact or collision with a robot. There are two types: Surveillance Area objects and Surveillance Planes. Similar to the layout objects, the display data is prepared in advance. The object size can be changed as desired by editing properties.

Part Feeder Object

The following devices can be displayed. You can select devices supported by "Epson RC+ 8.0 Option Part Feeding 8.0 Introduction & Software".

- Feeder unit: IF-80, IF-240, IF-380, IF-530, IF-A1520, or IF-A2330 can be selected in the system configuration.
- Hopper: First generation (Gen.1) and second generation (Gen.2) can be selected.
- Part: Simple objects and CAD objects, which are layout objects, can be used for parts handled by the feeder.

5.1.4 Property Grid Pane

In the Property Grid pane, you can view and change the settings of the robot objects and layout objects in the Layout Object pane.

5.1.4.1 Robot Object

Robot

Property	Value
Number	1
Name	robot1
Type	6-Axis
Series	C4-B
Model	C4-B601S
Change Robot	Click to change
> Position	
> Rotation	
Show Label	False
▼ Collision	
Check	True
Check Self	True
Color	 168, 0, 0
Transparent	False
Transparency(%)	50  

Property	Value
Number	Robot number
Name	Robot name. You can specify any name for a robot.
Type	Robot type The robot type (SCARA and 6-Axis) is shown. This property is read-only.
Series	Robot series The robot series is shown. This property is read-only.
Model	Robot model name The robot model is shown. This property is read-only.
Change Robot	If you want to change the robot model, click on  [Change Robot] button. When you click on this button, a dialog appears to change the robot. For details, see Changing the robot model described later in this chapter.
Position	Robot position Specifies the base center in the simulator World coordinates.
Rotation	Robot angle
Show Label	- Displays the label: True - Not display the label: False (default)
Show Singularity Area	Shows/hides elbow singularity areas for N series robots. - Show area: True - Not show area: False (Default) This can be set for N series only.

Collision Property	Value
Check	Enables / disables the collision detection for layout objects. - Enable: True (default) - Disable: False Even if this is enabled, it does not detect collision between the robot base and layout objects.
Check Self	Enables / disables the collision detection for a robot itself. - Enable: True (default) - Disable: False

Collision Property	Value
Color	Specify color to be used when collision of the arms is detected. Default: 168,0,0

Property	Value
Transparent	▪ Semi-transparent: True ▪ Not semi-transparent: False (default) The front-back relation of the objects may be incorrect depending on the viewing angle. See details below. Simulator Specifications and Restrictions
Transparency	Specifies the transparency in the range of 1 to 90%. Transparency increases as the setting value becomes larger.

Changing the robot model

When you want to change the displayed Robot click the  [Change Robot] button. The [System Configuration]-[Controller]-[Robots]-[Robot*]-[Change]-[Change Robot] dialog will appear.

 [Change Robot] button is not displayed, increase the property grid width and click the [Value] column of the grid once.



KEY POINTS

When you change the displayed robot model, all the settings for the robot (Local coordinates, Tool coordinates, etc.) will be initialized to the default values.

Collision Margin

Sets a collision detection margin for each robot arm collectively or separately.

When the robot type is changed from SCARA robot to 6-Axis robot or 6-Axis robot to SCARA robot, the Value will be reset. When changing to the same type robot, the value will be remained.

Property	Value
Visible	False
Size(mm)	0.100
Color	 255, 216, 0
Check	False
CollisionColor	 168, 0, 0

Property	Value
Visible	▪ Display: True ▪ Not display: False (Default)
Size	Margin size
Color	Margin color Default: 255,216,0
Check	Enables / disables the collision detection. ▪ Enable: True ▪ Disable: False (default)

Property	Value
CollisionColor	Specify the color to be used when collision of the arms is detected. Default: 168,0,0

Local, Arm, ECP, Box, Pallet

If a setting for the corresponding number has not been defined, the checkbox is grayed out.

You can set up from the [Tools]-[Robot Manager] items.

- Local : Local settings
- Arm: Arm settings
- ECP : External control point settings
- Box : Entry detection area
- Pallet : Pallet settings

No.	Visible
0	☒
1	☐
2	☐
3	☐
4	☐
5	☐

Item	Description
Visible	Shows / Not show corresponding settings. ▪ Not visible: Uncheck (default) ▪ Visible: Check

For Local 0 (Base), "Visible" is the default.



KEY POINTS

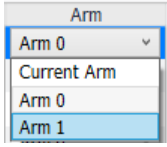
Arm can be displayed only with Epson RC+ Standard Edition or higher.

Tool

If the each setting of the corresponding number is not defined yet, the check box is grayed out. It can be set using [Tools] - [Robot Manager] - [Tools].

No.	Visible	Arm
0	☒	Arm 0 ▾
1	☐	Arm 0 ▾
2	☐	Arm 0 ▾
3	☐	Arm 0 ▾
4	☐	Arm 0 ▾
5	☐	Arm 0 ▾

Item	Description
Visible	Shows / Not show corresponding settings. ▪ Not visible: Uncheck (default) ▪ Visible: Check

Item	Description
Arm	Select the corresponding Arm number. You can choose Current Arm, Arm 0, or a predefined Arm.  The default is Arm 0. This setting is available only with Epson RC+ Standard Edition or higher. In the Basic Edition, the display always uses Arm 0 as the reference.

Plane

If a setting for the corresponding number has not been defined, the checkbox is grayed out. You can set up from [Tools]-[Robot Manager]-[Planes].

No.	Visible	Origin
1	☐	☐
2	☐	☐
3	☐	☐
4	☐	☐
5	☐	☐

Item	Description
Visible	Shows / Not show corresponding settings. - Not visible: Uncheck (default) - Visible: Check
Origin	Shows / Not show the origin of corresponding settings. When the checkmark is not placed in [Visible], the [Origin] checkbox is grayed. - Not visible: Uncheck (default) - Visible: Check

XYLim

If the XYLim is not defined yet, the check box is grayed.

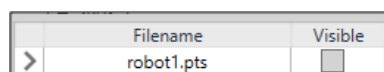
You can set up from [Tools]-[Robot Manager]-[XYZ Limits].

Pos.	Visible
All	☐
MinX	☐
MaxX	☐
MinY	☐
MaxY	☐
MinZ	☐
MaxZ	☐

Item	Description
Pos.	Shows the position of parameter that configures XYLim.
Visible	Shows / Not show the plane in corresponding position. - Not visible: Uncheck (default) - Visible: Check If Pos. All is checked, it displays all plane that configures XYLim. Not put in the check, they will be hidden. If it set to show some planes, the check box shows indeterminate state.

Points

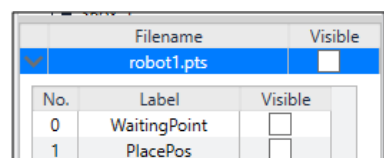
Display the point display setting status in the point file. Switch to show/non-show all points.



Item	Description
File Name	Show a point file name.
Visible	Shows / Not show all points - Not visible: Uncheck - Visible: Check If it is set to show some points, the check box shows indeterminate state.

Point

If the point of the corresponding number is not defined yet, the check box is grayed.



Item	Description
Label	Shows a point label In the dialog, point labels cannot be configured or edited.
Visible	Shows / Not show a point - Not visible: Uncheck (default) - Visible: Check

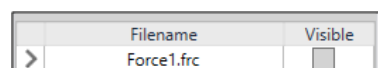


TIP

If you cannot see the [Visible] column, increase the property grid display width.

Force Control

Show the display method of the force objects in the force file. Switch visible and not visible of the all force objects.

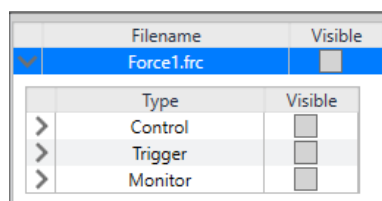


Item	Description
File Name	Show a force file name.
Visible	Shows / Not Show all force objects. - Not visible: Uncheck - Visible: Check If it is set to show some force objects, the check box shows indeterminate state.

Force Object

Show the display method of the force control objects, force trigger objects, and force monitor objects in the force file. Switch visible and not visible of the all force objects of the specified type.

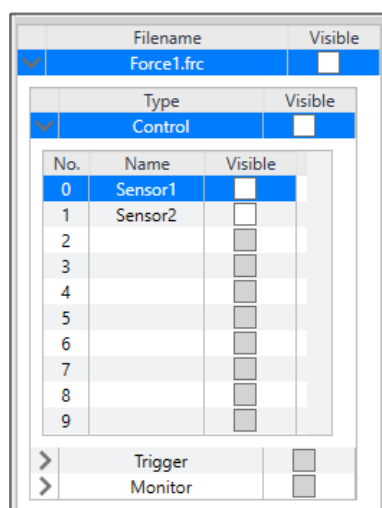
If there is no force object of the specified type, the checkbox is grayed.



Item	Description
Type	Control (force control), Trigger (force trigger), and Monitor (force monitor) are shown.
Visible	Shows / Not Show all force objects of the specified type. - Not visible: Uncheck - Visible: Check If it is set to show some force objects, the check box shows indeterminate state.

Force Control, Force Trigger, Force Monitor

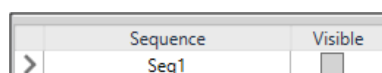
When the force object of the corresponding number is not defined yet, the checkbox is grayed.



Item	Description
Name	Show a force label. In the dialog, force label cannot be configured or edited.
Visible	Shows / Not Show the force object. - Not visible: Uncheck - Visible: Check

Force Guide

Show the display method of the force guide object in the sequence which is set by the force guide, and switch visible and not visible of the all force objects.



Item	Description
Sequence	Show a force guide sequence name.
Visible	Shows / Not Show the all force objects. - Not visible: Uncheck - Visible: Check If it is set to "Visible" for some force objects, the check box shows indeterminate state.

Force Guide Object

When the force guide object type of the corresponding number (a step number in the sequence) is "Decision" or "SPELFunc", the checkbox is grayed. When the [Enabled] property of the object is set to "False", the [Name] is also grayed.

Sequence		Visible
Seq1		☐
No.	Name	Visible
1	Contact01	☐
2	ContactProbe01	☐
3	Press01	☐

Item	Description
Name	Show a force guide object name.
Visible	Shows / Not Show the force guide object. - Not visible: Uncheck - Visible: Check

Force Sensor

By registering Force Sensor, "Force Sensor" is displayed in the layout object.

Property	Value
Number	FS1
Label	
Visible	True
Show Label	False
Model	S250N
Flange	S250NtoC4
Show Flange Offset	False
Show Sensor Tip	False
Collision	
Check	True
Color	168, 0, 0
Collision Margin	
Visible	False
Size(mm)	0.100
Color	255, 216, 0
Check	False
CollisionColor	168, 0, 0
Transparent	False
Transparency(%)	50

Property	Value
Number	Displays a sensor number registered in the controller.

Property	Value
Label	Displays a sensor name registered in the controller.
Visible	- Display: True (default) - Not display: False
Show Label	- Displays the label: True - Not display the label: False (default)
Model	Displays a model registered in the controller.
Flange	Displays a flange determined by combination of the robot and Force Sensor (default). Select "None" to hide.
Show Flange Offset	- Display: True - Not display: False (Default) Specifies whether to display the flange offset position in coordinate system.
Show Sensor Tip	- Display: True - Not display: False (Default) Specifies whether to display the tip position of Force Sensor in coordinate system.

For properties such as "Collision", "Collision Margin" or "Transparent", refer to the hand or layout objects properties.

Hands

Show a status of Visible and Collision of the configured hand.

Name	Visible	Collision
Hand_1	☒	☒
Hand_2	☒	☒

Item	Description
Name	Shows a hand name.
Visible	Shows / Not Show the hand. - Not visible: Uncheck - Visible: Check
Collision detection	Enable / Disable the collision detection. - Disable: Uncheck - Enable: Check

Hand

When a hand is registered with a robot, "Hand" is added in the Layout Objects tree.

Property	Value
Name	Hand_1
Mount Position	Force Sensor ▼
▼ Offset Position	
X(mm)	0.000 ▲▼
Y(mm)	0.000 ▲▼
Z(mm)	0.000 ▲▼
▼ Offset Rotation	
X(degree)	0.000 ▲▼
Y(degree)	0.000 ▲▼
Z(degree)	0.000 ▲▼
Filename	c3_gripper_1.wrl
Save as XVL...	Click_to_Save
Rendering Quality	Default ▼
Unit	Millimeter ▼
Scale	1.000 ▲▼
Visible	True ▼
Show Label	False ▼
Show Origin	False ▼
▼ Collision	
Check	True ▼
Color	 168, 0, 0 ▼
▼ Collision Margin	
Visible	False ▼
Size(mm)	0.100 ▲▼
Color	 255, 216, 0 ▼
Check	False ▼
CollisionColor	 168, 0, 0 ▼
Transparent	False ▼
Transparency(%)	50 ▲▼

Property	Value
Name	Hand name You can specify any name. (Default: Hand_1)
Mounted Position	Hand mounting position It can be attached to Force Sensor or Tool coordinate system.
Offset Position	Mounting offset from the robot end effector position.
Offset Rotation	Hand mounting direction
File name	CAD data file name of the hand. It cannot be changed.
Save as XVL...	The loaded hand object can be saved in the XVL format. Click [...] and specify the destination. When XVL-format hand data is loaded, this item is grayed out and cannot be used.
Rendering Quality	Specify the rendering quality. - Standard: Default - Quality-preferred: Fine - Speed-preferred: Fast
Unit	Set the unit of length for the CAD data.
Scale	Set the scale ratio of the CAD data.

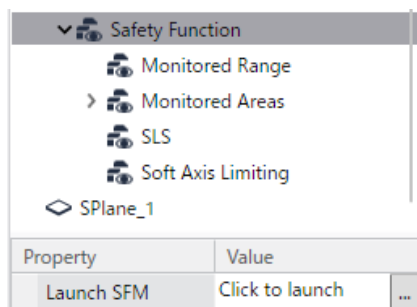
Property	Value
Visible	▪ Display: True (default) ▪ Not display: False
Show Label	▪ Displays the label: True ▪ Not display the label: False (default)
Show Origin	▪ Displays the origin coordinate system: True ▪ Not displays the origin coordinate system: False (default)

Collision Property	Value
Check	Enables / disables the collision detection. ▪ Enable: True (default) ▪ Disable: False Collision with the robot flange is not detected even when this property is set "True".
Color	Specify the color to be used when collision of the arms is detected. Default: 168,0,0

Collision Margin Property	Value
Visible	▪ Display: True ▪ Not display: False (Default)
Size	Margin size
Color	Margin color Default: 255,216,0
Check	Enables / disables the collision detection. ▪ Enable: True ▪ Disable: False (default)
CollisionColor	Specify the color to be used when collision of the arms is detected. Default: 168,0,0
Transparent	▪ Semi-transparent: True ▪ Not semi-transparent: False (default) The front-back relation of the objects may be incorrect depending on the viewing angle. See details below. Simulator Specifications and Restrictions
Transparency	Specifies the transparency in the range of 1 to 90%. Transparency increases as the setting value becomes larger.

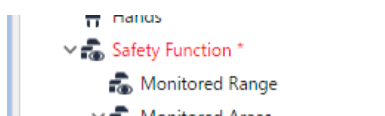
Safety Function

If option of safety function is enabled, "Safety Function" is displayed in the layout object. Moreover, from the property grid, you can call the Safety Function Manager.



Property	Value
Launch SFM	To call the Safety Function Manager, press the  [Click to launch] button. Safety Function Manager appears.

If there is a change in the safety function parameter, [Safety Function] is displayed in red in the object tree, as shown in the figure below. In such a case, you must start the Safety Function Manager to reflect the settings.



Monitored Range

Shows robot monitored range are displayed or hidden, and shows the enabled and disabled of collision detection.

Pos.	Radius (mm)	Visible
All		☐
J2	150	☐
J3	200	☐
J5	50	☐
J6	200	☐

Item	Description
Pos.	Displays "All" indicating all monitored ranges, or the joints for which individual monitored range can be set. If it is SCARA robot, displays J2 or J3. If it is 6-Axis robot, displays J2, J3, J5, and J6.
Radius	Radius of the robot monitored range Specifying a radius for "All" sets the radius of all configurable joints at once. When you change the radius of some joints, the value of the radius for "All" becomes blank. This setting is available only with Epson RC+ Standard Edition or higher. In the Basic Edition, make this setting from the Safety Function Manager.
Visible	Shows / Not Show the robot monitored range. - Not visible: Uncheck - Visible: Check Place a checkmark for All to display the monitored range of all configurable joints. Clear the checkmark to hide all monitored ranges. When you set the monitored range to display for some joints, the "All" checkbox shows an indeterminate state.

Monitored Areas

Shows monitored areas are displayed or hidden, and shows status of collision detection. Also, it switches visible and not visible of monitored areas, and switches enabled and disabled of collision detection.

Type	Visible	Collision
All	☐	☐
SLP_A	☐	☐
SLP_B	☐	☐
SLP_C	☐	☐

Item	Description
Type	Displays "All" indicating all monitored areas, or individual monitored areas SLP_A, SLP_B, and SLP_C.
Visible	Shows / Not Show the robot monitored range. - Not visible: Uncheck - Visible: Check Place a checkmark for All to display all monitored areas. Clear the checkmark to hide all monitored areas. When you set some monitored areas to display, the All checkbox shows an indeterminate state.
Collision detection	Enable/disable collision detection at the monitoring position. - Disable: Uncheck - Enable: Check Place a checkmark for All to enable the collision detection of all monitored areas. Clear the checkmark to disable the collision detection of all monitored areas. When you enable collision detection for some monitored areas, the All checkbox shows an indeterminate state.

SLP_A, SLP_B, SLP_C

Indicate whether each plane that configures the monitored areas is enabled or displayed, and also make the settings for the areas.

Property	Value
Type	Wall ▼
Visible	False
ShowLabel	False
SimCheckCollision	False
☒ Pos.	Value
☒ X1(mm)	-200 ▲▼
☐ X2(mm)	0 ▲▼
☒ Y1(mm)	300 ▲▼
☒ Y2(mm)	-100 ▲▼
☐ Z1(mm)	0 ▲▼
☐ Z2(mm)	0 ▲▼

Property	Value
Type	Setting of the range of monitored areas - Wall - Restricted Area This setting is available only with Epson RC+ Standard Edition or higher. In the Basic Edition, make this setting from the Safety Function Manager.

Visible	Shows/Hides the planes that configure the monitored areas ▪ True: Shows ▪ False: Hides Displays only the enabled planes in the case of True. Hides all planes in the case of False, regardless of whether the planes are enabled or disabled.
ShowLabel	Shows / Hides "SLP_A(X1), SLP_A(X2), ..." as the object name ▪ True: Shows ▪ False: Hides In the case of True, displays the object name only for the enabled planes. This setting is available only with Epson RC+ Standard Edition or higher. In the Basic Edition, the object name cannot be displayed.
SimCheckCollision	Enables/Disables collision detection in the simulator ▪ True: Enables ▪ False: Disables

Item	Description
Pos.	Display X1, X2, Y1, Y2, Z1 and Z2 as a plane that configures monitored areas. Also displays a checkbox for switching between enabling or disabling each plane. ▪ Disable: Uncheck ▪ Enable: Check Select the header checkbox to enable all monitored areas. When the Visible property is True, displays the monitored areas. Clear the header checkbox to disable and hide all monitored areas. When some monitored areas are enabled, the header checkbox shows an indeterminate state. Enabling or disabling each plane is available only with Epson RC+ Standard Edition or higher. In the Basic Edition, make this setting from the Safety Function Manager.
Value	Position of planes that configure the monitored areas This setting is available only with Epson RC+ Standard Edition or higher. In the Basic Edition, make this setting from the Safety Function Manager.

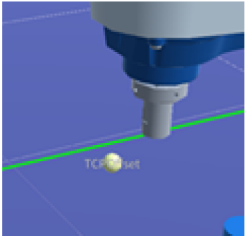
SLS

Sets the TCP Offset value, a parameter of Safety Limited Speed, and specifies whether to show or hide it.

Setting and display are available only with Epson RC+ Standard Edition or higher. In the Basic Edition, only the TCP Offset position can be set from the Safety Function Manager.

Property	Value
▼ TCP Offset	
X(mm)	0 
Y(mm)	0 
Z(mm)	0 
Visible	False
ShowLabel	False
ShowOrigin	False

Property	Value
X, Y, Z	Offset from the position of Tool 0

Property	Value
Visible	Shows/Hides the dots at the offset position - True: Shows - False: Hides 
ShowLabel	Shows/Hides "TCPOffset" as the object name - True: Shows - False: Hides
ShowOrigin	Shows/Hides the coordinate system at the offset position - True: Shows - False: Hides

Soft Axis Limiting

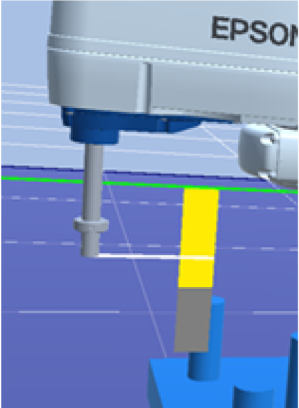
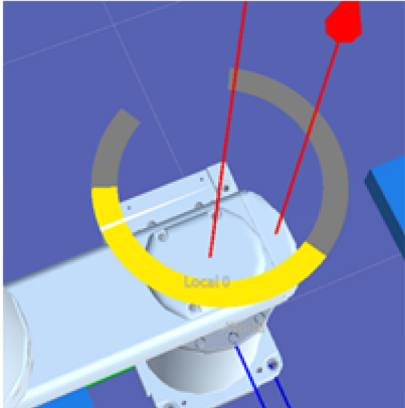
Shows/Hides the setting range of Soft Axis Limiting, and configures the setting.

Setting and display are available only with Epson RC+ Standard Edition or higher. In the Basic Edition, only the Soft Axis Limiting value can be set from the Safety Function Manager, but the setting range cannot be displayed.

Property		Value	
Fit to Range		Click to change	...
Fit to Min/Max		Click to change	
Pos.	Minimum	Maximum	Visible
All			☐
J1(deg)	10.000	100.000	☐
J2(deg)	20.000	200.000	☐
J3(deg)	30.000	300.000	☐
J4(deg)	40.000	400.000	☐
J5(deg)	50.000	500.000	☐
J6(deg)	60.000	600.000	☐

Property	Value
Fit to Range	To set the limiting value of each axis to the same value as the setting of the Range, press the  [Click to change] button.
Fit to Min/Max	To set the limiting value of each axis to the same value as the minimum value and maximum value of the range that can be set, press the  [Click to change] button.

Item	Description
Pos.	Displays All indicating all joints, or the joints for which individual motion monitoring range can be set. Displays only J1 to J4 for a SCARA robot. For a 6-axis robot, J5 and J6 are also displayed.

Item	Description
Lower-limit value Upper-limit value	Motion range monitoring value of each joint When you specify the setting value for All, the motion range monitoring value of all joints is specified as a batch. When you change the setting value of some joints, the setting value of All becomes blank.
Visible	Shows/Hides the monitored range based on the motion range monitoring value ■ Hides: Uncheck ■ Shows: Check Place a checkmark for All to display the monitored range of all joints. Clear the checkmark to hide all monitored ranges. When you set to display some monitored ranges, the All checkbox shows an indeterminate state. As for the motion range, the monitored range of each axis is displayed in yellow and the range is displayed in gray. A white indicator is displayed at the current angle position.  ① ② 1. Display example of rotation axis 2. Display example of linear axis

Conveyor Tracking

Changes the display status of the configured conveyor tracking settings. This setting is available only with Epson RC+ Standard Edition or higher.

Property	Value
Show Conveyor Origin	False
Show Upstream Limit	False
Show Downstream Limit	False
Show TrackAbortLine	False
Show Queue	False

Property	Value
Show Conveyor Origin	Shows/Hides the origin of the conveyor coordinate system. ■ True: Shows ■ False: Hides (default)
Show Upstream Limit	Shows/Hides the upstream limit of conveyor tracking. ■ True: Shows ■ False: Hides (default)

Property	Value
Show Downstream Limit	Shows/Hides the downstream limit of conveyor tracking. ▪ True: Shows ▪ False: Hides (default)
Show TrackAbortLine	Shows/Hides the tracking abort line of conveyor tracking. ▪ True: Shows ▪ False: Hides (default)
Show Queue	Shows/Hides the queue information of conveyor tracking. ▪ True: Shows ▪ False: Hides (default)

KEY POINTS

Conveyor tracking simulation is available only with Epson RC+ Standard Edition or higher. Refer to the following video manual for an overview and detailed instructions.



Sample connections and projects are provided for conveyor tracking simulation. It is also used in the video manual mentioned above.

From the Epson RC+ 8.0 menu, select [Project]-[Open], then select [Projects]-[SimulatorDemos]-[ConvTrack_GX8_C], and then select [RC800 Series]-[CnvTrack GX8-C] from the Epson RC+ 8.0 toolbar-[Connection:] list box. You can actually check the operations and behaviors described in the video manual.

Conveyor

Once you add the conveyor tracking settings, "Conveyor" appears under "Conveyor Tracking" in the object tree. This operation is available only with Epson RC+ Standard Edition or higher.

Property	Value
Name	Conveyor 1
Conveyor ID	1
Type	Sensor
Motion	Straight
Orientation	Level
Resolution (mm/...	0.000
▼ Conveyor Origin	
Visible	False
X (mm)	-821.000
Y (mm)	300.000
Z (mm)	100.000
U (deg)	0.000
V (deg)	0.000
W (deg)	0.000
▼ Upstream Limit	
Visible	False
Diagonal	True
X1 (mm)	300.000
Y1 (mm)	-140.000
X2 (mm)	440.000
Y2 (mm)	100.000
▼ Downstream Limit	
Visible	False
Diagonal	True
X1 (mm)	1000.000
Y1 (mm)	-140.000
X2 (mm)	1200.000
Y2 (mm)	100.000
▼ TrackAbortLine	
Enable	True
Visible	False
Diagonal	True
X1 (mm)	1300.000
Y1 (mm)	-140.000
X2 (mm)	1500.000
Y2 (mm)	100.000
Show Queue	False

Property	Value
Name	Conveyor name Displays the "Name" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid.
Conveyor ID	Conveyor ID
Type	Tracking type Displays the "Type" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid. ■ Vision: Vision conveyor tracking ■ Sensor: Sensor conveyor tracking
Motion	Tracking direction Displays the "Tracking Direction" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid. ■ Straight: Straight ■ Circular: Circular
Orientation	Conveyor orientation Displays the "Conveyor Orientation" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid. ■ Level: Installed level ■ Tilted: Installed tilted

Property	Value
Resolution	Encoder resolution Displays the currently set encoder resolution. It cannot be changed from the property grid.
Show Queue	Shows/Hides the queue information of conveyor tracking. - Display: True - Not display: False (Default)

■ Conveyor Origin

When associated with a conveyor object, the origin of the conveyor coordinate system can be displayed on the conveyor object. You can also see the current setting values.

Property	Value
Visible	Shows/Hides the origin of the conveyor coordinate system. - Display: True - Not display: False (Default)
X, Y, Z, U, V, W	Origin coordinates in conveyor coordinate system. Displayed as coordinate values in the simulator World coordinates. It cannot be changed from the property grid.

■ Upstream Limit

When associated with a conveyor object, the upstream limit for conveyor tracking can be displayed on the conveyor object. You can also see the current upstream limit setting values.

Property	Value
Visible	Shows/Hides the upstream limit - Display: True - Not display: False (Default)
Diagonal	Diagonal upstream limit enabled/disabled Displays the "Upstream Limit" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid. - Enable: True - Disable: False
Limit	Coordinates when diagonal upstream limit is disabled Displays the "X1" set value, which is the "Upstream Limit" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid.
X1, Y1, X2, Y2	Coordinates when diagonal upstream limit is enabled Displays the "Upstream Limit" set using [Tools]-[Conveyor Tracking]. This is the relative position from the conveyor origin. It cannot be changed from the property grid.

■ Downstream Limit

When associated with a conveyor object, the downstream limit for conveyor tracking can be displayed on the conveyor object. You can also see the current downstream limit setting values.

Property	Value
Visible	Shows/Hides the downstream limit ▪ Display: True ▪ Not display: False (Default)
Diagonal	Diagonal downstream limit enabled/disabled Displays the "Downstream Limit" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid. ▪ Enable: True ▪ Disable: False
Limit	Coordinates when diagonal downstream limit is disabled Displays the "X1" set value, which is the "Downstream Limit" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid.
X1, Y1, X2, Y2	Coordinates when diagonal downstream limit is enabled Displays the "Downstream Limit" set using [Tools]-[Conveyor Tracking]. This is the relative position from the conveyor origin. It cannot be changed from the property grid.

▪ TrackAbortLine

When associated with a conveyor object, the tracking abort line for conveyor tracking can be displayed on the conveyor object. You can also see the current tracking abort line setting values.

Property	Value
Enable	Tracking abort line enabled/disabled Displays the "Tracking Abort Line" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid. ▪ Enable: True ▪ Disable: False
Visible	Shows/Hides the tracking abort line ▪ Display: True ▪ Not display: False (Default)
Diagonal	Diagonal tracking abort line enabled/disabled Displays the "Tracking Abort Line" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid. ▪ Enable: True ▪ Disable: False
Limit	Coordinates when diagonal tracking abort line is disabled Displays the "X1" set value, which is the "Tracking Abort Line" set using [Tools]-[Conveyor Tracking]. It cannot be changed from the property grid.
X1, Y1, X2, Y2	Coordinates when diagonal tracking abort line is enabled Displays the "Tracking Abort Line" set using [Tools]-[Conveyor Tracking]. This is the relative position from the conveyor origin. It cannot be changed from the property grid.

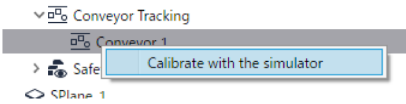
Conveyor calibration

A conveyor object set up in the simulator can be calibrated in the same way as a real conveyor. For details, see below.

- "Epson RC+ Option Conveyor Tracking - Vision Conveyor"
- "Epson RC+ Option Conveyor Tracking - Sensor Conveyor"

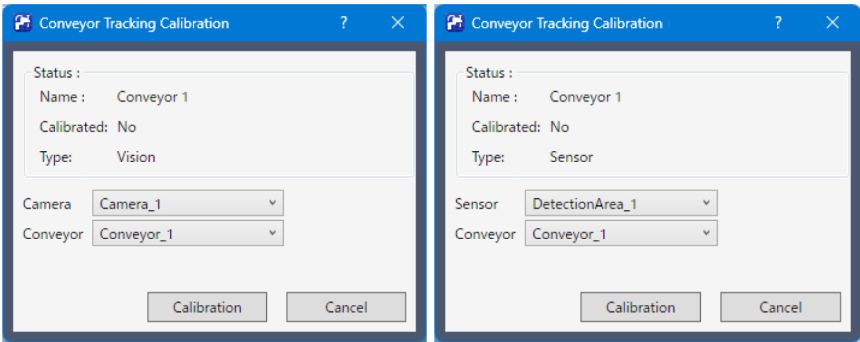
A conveyor object set up in the simulator can be simply calibrated based on the relative positions of the set conveyor object and robot object.

Select and right-click "Conveyor" in the layout tree to display the following context menu.



The following dialog box appears when "Calibrate with the simulator" is selected. Click the [Calibrate] button to automatically perform calibration based on the position and orientation information from the camera or sensor and the conveyor. Vision calibration must be performed before setting "Vision" as the conveyor tracking type. For details about vision calibration, refer to the following manual.

"Vision Calibration" in "Vision Guide 8.0 Software"



Status

Item	Description
Name	The name of the conveyor to be calibrated is displayed. This is the conveyor name selected in the layout tree.
Calibrate...	Displays whether calibration has been performed.
Type	Displays the conveyor tracking type. ▪ Vision: Vision conveyor tracking ▪ Sensor: Sensor conveyor tracking

Conveyor Origin

Item	Description
Camera	If the conveyor tracking type is "Vision", select the camera object to use for calibration.
Sensor	If the conveyor tracking type is "Sensor", select the detection area object to use for calibration.
Conveyor	Select the conveyor object to use for calibration.

KEY POINTS

Tips for simple calibration

- Whether or not a detection area object using a camera object is used depends on the conveyor tracking type set in the project conveyor tracking settings. For details on the conveyor tracking settings, see below.
"Epson RC+ Option Conveyor Tracking - Conveyor Settings"
- The +X direction of the conveyor object is forward. Place the conveyor object according to the transport direction in advance.
- If the conveyor tracking type is "Sensor", the center of the detection area object becomes the origin of the conveyor coordinate system. Setting the center of the detection area object at a height close to the gripping position of the workpiece (part) makes it easier to adjust the gripping position later.
- If the conveyor tracking type is "Vision", place the camera object to look down on the conveyor from above. Operation is not guaranteed when the camera object is placed to view from below.
- If you move the conveyor object, detection area object, or camera object used for simple calibration, the calibration results are not updated automatically. Perform the simple calibration again.
- When a simple calibration is performed, the conveyor tracking project file is updated and saved. If calibration was already performed using the actual device, confirm in advance whether it is okay to update the file.
- Although it is possible to apply the results of the simple calibration to the actual device, its precision and operation is not guaranteed. Therefore, it may cause unexpected operation of the robot and even damage workpieces (parts) and other peripherals. When using an actual device, make sure to always perform calibration in the environment of the actual device.

5.1.4.2 Layout Objects

Layout Box, Layout Sphere, Layout Cylinder, Layout Plane, CAD

There are common attributes for all objects and others are for particular objects.

SBox_1	
Property	Value
Name	SBox_1
▼ Type	Layout ▼
Offset Position	
X(mm)	400.000
Y(mm)	300.000
Z(mm)	25.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
▼ Position	
X(mm)	400.000
Y(mm)	300.000
Z(mm)	25.000
▼ Half size	
X(mm)	25.000
Y(mm)	25.000
Z(mm)	25.000
▼ Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Color	26, 114, 189
Visible	True
Show Label	False
Show Origin	False
▼ Collision	
Check	True
Show Result	Whole
Color	168, 0, 0
▼ Collision Point	
Radius(mm)	5
Color	168, 0, 0

Sphere_1	
Property	Value
Name	Sphere_1
▼ Type	Layout ▼
Offset Position	
X(mm)	600.000
Y(mm)	600.000
Z(mm)	50.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
▼ Position	
X(mm)	600.000
Y(mm)	600.000
Z(mm)	50.000
Radius(mm)	50.000
▼ Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Color	26, 114, 189
Visible	True
Show Label	False
Show Origin	False
▼ Collision	
Check	True
Show Result	Whole
Color	168, 0, 0
▼ Collision Point	
Radius(mm)	5
Color	168, 0, 0

Cylinder_1	
Property	Value
Name	Cylinder_1
▼ Type	Layout ▼
Offset Position	
X(mm)	750.000
Y(mm)	750.000
Z(mm)	50.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
▼ Position	
X(mm)	750.000
Y(mm)	750.000
Z(mm)	50.000
Radius(mm)	50.000
Height(mm)	100.000
▼ Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Color	26, 114, 189
Visible	True
Show Label	False
Show Origin	False
▼ Collision	
Check	True
Show Result	Whole
Color	168, 0, 0
▼ Collision Point	
Radius(mm)	5
Color	168, 0, 0

SPlane_1

Property	Value
Name	SPlane_1
Type	Layout
Offset Position	
X(mm)	0.000
Y(mm)	0.000
Z(mm)	0.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Plane Type	Horizontal
Position	
X(mm)	0.000
Y(mm)	0.000
Z(mm)	0.000
Half size	
Height(mm)	2000.000
Width(mm)	2000.000
Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Color	26, 144, 189
Visible	True
Show Label	False
Show Origin	False
Collision	
Check	True
Show Result	Whole
Color	168, 0, 0
Collision Point	
Radius(mm)	5
Color	168, 0, 0

CAD_1

Property	Value
Name	CAD_1
Type	Layout
Offset Position	
X(mm)	550.000
Y(mm)	550.000
Z(mm)	0.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Position	
X(mm)	550.000
Y(mm)	550.000
Z(mm)	0.000
Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Filename	c3_gripper_2.wrl
Save as XVL...	Click to Save
Rendering Quality	Default
Unit	Millimeter
Scale	1.000
Visible	True
Show Edge	True
Show Label	False
Show Origin	False
Collision	
Check	True
Show Result	Whole
Color	168, 0, 0
Collision Point	
Radius(mm)	5
Color	168, 0, 0
Collision Margin	
Visible	False
Size(mm)	0.100
Color	255, 216, 0
Check	False
CollisionColor	168, 0, 0
Transparent	False
Transparency(%)	50

Property	Object	Value
Name	All	You can specify any name.
Plane Type	Plane	■ Floor: Horizontal (default) ■ Wall: Vertical

Property	Object	Value
Type	All	Sets the object type. - Layout: Layout object (default) - Part: Part object - Mounted Device: Mounted device When Part or Mounted Device is selected, the [Part/Mounting Device Settings] dialog box appears. See details below. Part/Mounted Device Settings
Offset Position	All	You can view/set the position of an object as an offset from its parent object. If the parent object does not exist, it will display/set the same as the Position property.
Offset Rotation	All	You can view/set the object's placement angle as an offset from the parent object. If the parent object does not exist, it will display/set the same as the Rotation property.
Position	All	Specifies a center point in simulator World coordinates. Layout Cylinder: Bottom surface center
Half size	Box, Plane	Box is specified by length from the center. Specified by X, Y, Z. The length is double this length. Plane is specified by height (length of floor, height of wall) and width (width of floor and wall). The length, height, and width are double the specified size.
Radius	Sphere, Cylinder	Sphere radius, cylinder radius
Height	Cylinder	Cylinder height
Rotation	All	Object angle (Z-axis centering)
Filename	CAD	CAD data file name. It cannot be changed.
Save as XVL...	CAD	The loaded hand object can be saved in the XVL format. Click [...] and specify the destination. When XVL-format hand data is loaded, this item is grayed out and cannot be used.
Rendering Quality	CAD	Specify the rendering quality. - Standard: Default - Quality-preferred: Fine - Speed-preferred: Fast
Unit	CAD	Set the unit of length for the CAD data.
Scale	CAD	Set the scale ratio of the CAD data.
Color	Box, Sphere, Cylinder, Plane	Display color Refer to Change layout object color for the details.
Visible	All	- Display: True (default) - Not display: False
Show Edge	CAD	Displays Edge (edge line) of the CAD data. - Display: True (default) - Not display: False When loading a CAD file, you can specify whether to show or hide the Edge.

Property	Object	Value
Show Label	All	- Displays the label: True - Not display the label: False (default)
Show Origin	All	- Displays the origin coordinate system: True - Not displays the origin coordinate system: False (default)
Transparent	CAD	- Semi-transparent: True - Not semi-transparent: False (default) The front-back relation of the objects may be incorrect depending on the viewing angle. See details below. Simulator Specifications and Restrictions
Transparency	CAD	Specifies the transparency in the range of 1 to 90%. Transparency increases as the setting value becomes larger.

Collision

Property	Object	Value
Check	All	Enables / disables the collision detection. - Enable: True (default) - Disable: False Collision with the robot flange is not detected even when this property is set "True".
Show result	All	Specify how to display the color configured in Color property when the a collision is detected. - Entirely: Whole (default) - Collision point: Point - Entire object and collision point: WholeAndPoint
Color	All	Specify the color to be used when collision of the arms is detected. Default: 168,0,0

Collision Point

Property	Object	Value
Radius(mm)	All	Specify the radius of collision point displayed when the collision is detected.
Color	All	Specify the color to be used when collision of the arms is detected. Default: 168,0,0

Change layout object color

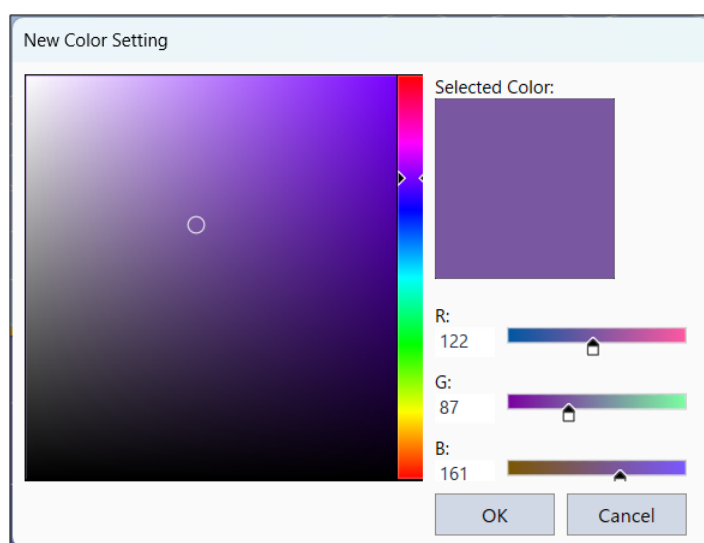
When you want to change layout object color, click on the drop-down  in the Color property and the dialog shown below will be displayed. If you cannot see the drop-down , increase the property grid width.



Click color you want to display. Layout object color will be changed.

If you do not want to change color, click anywhere other than the display color setting dialog. The dialog will be closed.

If you create a custom color, right-click any color in the bottom two rows (16 colors) in the [Custom] tab, and the color setting dialog will be displayed.



Create a custom color and click the [OK] button.

Created color will be displayed in the display color setting dialog.

5.1.4.3 Camera Objects

Some properties are common for the both fixed camera and mobile camera, and other properties are only enabled for either one of them.

Camera_1		Camera_2(robot1: J6)	
Property	Value	Property	Value
Name	Camera_1	Name	Camera_2
Camera Number	1	Camera Number	2
Type	PC Vision	Type	PC Vision
Connection Type	GigE	Connection Type	GigE
Model	acA640-120gm	Model	acA640-120gm
Resolution	640 x 480	Resolution	640 x 480
Extension Tube	0.0 mm	Extension Tube	0.0 mm
Lens Type	Mega Pixel	Lens Type	Mega Pixel
Focal Length	8 mm	Focal Length	8 mm
Camera Tip		Camera Tip	
X(mm)	614.500	X(mm)	0.000
Y(mm)	600.000	Y(mm)	499.400
Z(mm)	66.900	Z(mm)	684.500
Visible	False	Visible	False
Show View Ray	True	Show View Ray	True
Show View Center	True	Show View Center	True
Near Plane		Near Plane	
Width(mm)	46	Width(mm)	46
Height(mm)	34	Height(mm)	34
Distance(mm)	100	Distance(mm)	100
Visible	True	Visible	True
Color	 Yellow	Color	 Yellow
Fill	False	Fill	False
Far Plane		Far Plane	
Width(mm)	650	Width(mm)	650
Height(mm)	486	Height(mm)	486
Distance(mm)	1500	Distance(mm)	1500
Visible	True	Visible	True
Color	 Lime	Color	 Lime
Fill	True	Fill	True
Pixel Resolution		Pixel Resolution	
Near X(mm)	0.072	Near X(mm)	0.072
Near Y(mm)	0.071	Near Y(mm)	0.071
Far X(mm)	1.016	Far X(mm)	1.016
Far Y(mm)	1.013	Far Y(mm)	1.013
Trigger IO	None	Trigger IO	None
Mount Type	Fixed	Mount Type	Mobile
Position		Robot	1
X(mm)	600.000	Joint	6
Y(mm)	600.000	Offset Position	
Z(mm)	0.000	X(mm)	0.000
Rotation		Y(mm)	20.000
X(degree)	0.000	Z(mm)	60.000
Y(degree)	0.000	Offset Rotation	
Z(degree)	0.000	X(degree)	0.000
Visible	True	Y(degree)	-90.000
Show Label	False	Z(degree)	-90.000
Show Origin	False	Position	
Collision		X(mm)	0.000
Check	True	Y(mm)	432.500
Show Result	Whole	Z(mm)	670.000
Color	 168, 0, 0	Rotation	
Collision Point		X(degree)	0.000
Radius(mm)	5	Y(degree)	-90.000
Color	 168, 0, 0	Z(degree)	-90.000
Collision Margin		Visible	True
Visible	False	Show Label	False
Size(mm)	0.100	Show Origin	False
Color	 255, 216, 0	Collision	
Check	False	Collision Point	
CollisionColor	 168, 0, 0	Collision Margin	
Transparent	False	Transparent	False
Transparency(%)	50	Transparency(%)	50

Property	Object	Value
Name	All	Displays the camera name.

Property	Object	Value
Camera Number	All	Displays the system camera number.
Type	All	The camera type (Compact Vision, PC Vision) is displayed.
Connection Type	All	Displays camera connection type (GigE, USB).
Model	All	Displays a camera model.
Resolution	All	Displays a camera resolution.
Extension Tube	All	Displays a length of extension tube.
Lens Type	All	Displays a lens type.
Focal Length	All	Displays focal length of lens.
Show View Ray	All	Show / not show the view ray. ▪ Display: True (default) ▪ Not display: False
Show View Center	All	Show / not show the view center. ▪ Display: True (default) ▪ Not display: False
Trigger IO	All	Sets the output number used for the virtual hardware trigger.

Camera Tip

Property	Object	Value
X, Y, Z	All	Displays the world coordinates on the edge of the camera lens. Change the value to change the camera position.
Visible	All	▪ Display: True (default) ▪ Not display: False

Near Plane/ Far Plane

Property	Object	Value
Width	All	Displays the camera view width.
Height	All	Displays the camera view height.
Distance	All	Displays distance of Camera Tip and Near Plane/ Far Plane.
Visible	All	Visible / not visible the depth of field. ▪ Display: True (default) ▪ Not display: False
Color	All	Sets the camera view color.

Property	Object	Value
Fill	All	Sets a fill of the camera view. In case of Near Plane: ■ Display: True ■ Not display: False (Default) In case of Far Plane: ■ Display: True (default) ■ Not display: False

Pixel Resolution

Property	Object	Value
Near X, Y	All	Displays the size of Near Plane in pixel.
Far X, Y	All	Displays the size of Far Plane in pixel.

Mount type

Property	Object	Value
Mount type	All	Displays the mount type of camera. The mount type (fixed camera, mobile camera) can be changed from [Setup]-[System Configuration]-[Vision]-[Camera] mounting settings.
Robot	Mobile	Displays the mounted robot number. The robot can be changed from the [Setup]-[System Configuration]-[Vision]-[Camera] mounting settings.
Joint	Mobile	Displays the mounted joint number. Joints (5, 6) can be changed from the [Setup]-[System Configuration]-[Vision]-[Camera] mounting settings.
Offset Position	Mobile	Display the relative position from the mounted joint. It is linked to the setting value of the camera's Position property or Joint property. Therefore, changes to these properties may cause the values to be updated automatically. Even in such cases, the values are correct as settings and do not affect the position of the camera in 3D.
Offset Rotation	Mobile	Display the relative orientation from the mounted joint. It is linked to the setting value of the camera's Rotation property or Joint property. Therefore, changes to these properties may cause the setting values to be updated automatically as follows: When Y is set at +90 degrees or -90 degrees, the X and Z settings are swapped. Even in such cases, the values are correct as settings and do not affect the orientation of the camera in 3D.

For properties such as "Collision", "Collision Margin", or "Transparent", refer to the layout objects properties.

5.1.4.4 Surveillance Objects

SurveillanceArea, SurveillancePlane

There are attributes that are enabled SurveillanceArea or SurveillancePlane or both.

Property	Value
Name	SurveillanceArea_1
Type	Layout
Offset Position	
X(mm)	0.000
Y(mm)	0.000
Z(mm)	500.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Position	
X(mm)	0.000
Y(mm)	0.000
Z(mm)	500.000
Half size	
X(mm)	1000.000
Y(mm)	1000.000
Z(mm)	500.000
Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Color	255, 216, 0
Visible	True
Show Label	False
Show Origin	False
Collision	
Check	True
Show Result	Point
Color	168, 0, 0
Collision Point	
Radius(mm)	5
Color	168, 0, 0
I/O Control	Click to Show Detail

Property	Value
Name	SurveillancePlane_1
Type	Layout
Offset Position	
X(mm)	850.000
Y(mm)	850.000
Z(mm)	500.000
Offset Rotation	
X(degree)	90.000
Y(degree)	0.000
Z(degree)	0.000
Position	
X(mm)	850.000
Y(mm)	850.000
Z(mm)	500.000
Half size	
Height(mm)	500.000
Width(mm)	500.000
Rotation	
X(degree)	90.000
Y(degree)	0.000
Z(degree)	0.000
Color	255, 216, 0
Visible	True
Show Label	False
Show Origin	False
Collision	
Check	True
Show Result	Whole
Color	168, 0, 0
Collision Point	
Radius(mm)	5
Color	168, 0, 0
I/O Control	Click to Show Detail

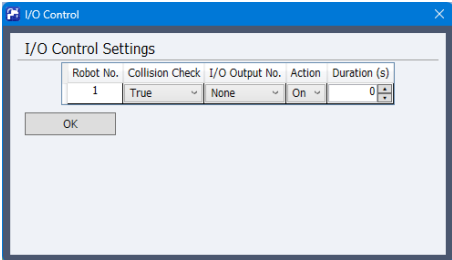
Property	Value
Name	You can specify any name.
Type	Set to Layout. Cannot change the setting.
Offset Position	You can view/set the position of an object as an offset from its parent object. If the parent object does not exist, it will display/set the same as the Position property.
Offset Rotation	You can view/set the object's placement angle as an offset from the parent object. If the parent object does not exist, it will display/set the same as the Rotation property.
Position	Specifies a center point in simulator World coordinates.
Half size	Specifies a length from the center. The length is double this length.
Rotation	Specify the placement angle.
Color	You can change the display color. Click the drop-down to change it. The display color setting dialog will be displayed. Refer to Change layout object color for the details.

Property	Value
Visible	▪ Display: True (default) ▪ Not display: False
Show Label	▪ Displays the label: True ▪ Not display the label: False (default)
Show Origin	▪ Displays the origin coordinate system: True ▪ Not displays the origin coordinate system: False (default)

Collision

Property	Value
Check	Enables/disables the collision detection and I/O control setting. ▪ Enable: True (default) ▪ Disable: False
Show result	Specify how to display the color configured in Color property when the a collision is detected. ▪ Entirely: Whole (default) ▪ Collision point: Point ▪ Entire object and collision point: WholeAndPoint
Color	Specify the color to be used when collision of the arms is detected. Default: 168,0,0

Collision Point

Property	Value
Radius(mm)	Specify the radius of collision point displayed when the collision is detected.
Color	Specify the color to be used when collision of the arms is detected. Default: 168,0,0
I/O Control	Click [...].to display the [I/O Control Setting] dialog. You can select the following settings for each configured robot. ▪ Enables / disables the collision detection: Enabled (True), Disabled (False) ▪ I/O Output # ▪ On/Off Setting ▪ Duration (Time to continue On/Off)  When a robot collides or contacts with an object, Output No. of the specified I/O is turned On or Off. I/O output bit numbers already used in remote output signals cannot be used (are not displayed.) If a bit that has already been set is assigned to a remote output setting, the setting value is reset to None.

Property	Value
	When setting the duration (On/Off duration), disable the setting that causes an error stop if a collision is detected during program execution (*). If set to Enable, it will not function even if a collision is detected, because it will be in Emergency Stop status.

* See details below.

Collision detection

5.1.4.5 Conveyor Object

KEY POINTS

Conveyor tracking simulation is available only with Epson RC+ Standard Edition or higher. Refer to the following video manual for an overview and detailed instructions.



Sample connections and projects are provided for conveyor tracking simulation. It is also used in the video manual mentioned above.

From the Epson RC+ 8.0 menu, select [Project]-[Open], then select [Projects]-[SimulatorDemos]-[ConvTrack_GX8_C], and then select [RC800 Series]-[CnvTrack GX8-C] from the Epson RC+ 8.0 toolbar-[Connection:] list box. You can actually check the operations and behaviors described in the video manual.

Conveyor objects can be operated only with Epson RC+ Standard Edition or higher.

Conveyor

Most of the attributes are the same as for Layout objects, but some attributes are only valid for Conveyor objects.

Property	Value
Name	Conveyor_1
Type	Layout
Offset Position	
X(mm)	0.000
Y(mm)	300.000
Z(mm)	100.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Position	
X(mm)	0.000
Y(mm)	300.000
Z(mm)	100.000
Half size	
Height(mm)	1000.000
Width(mm)	100.000
Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Operation	Independent
Speed(mm/s)	100.000
Accel(mm/s ²)	100.000
Decel(mm/s ²)	100.000
Forward	True
Supply	Click to Show Detail
Color	 0, 102, 0
Visible	True
Show Label	False
Show Origin	False
Collision	
Check	True
Show Result	Whole
Color	 168, 0, 0
Collision Point	
Radius(mm)	5
Color	 168, 0, 0

Property	Value
Name	Conveyor_1
Type	Layout
Offset Position	
X(mm)	0.000
Y(mm)	300.000
Z(mm)	100.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Position	
X(mm)	0.000
Y(mm)	300.000
Z(mm)	100.000
Half size	
Height(mm)	1000.000
Width(mm)	100.000
Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Operation	LinkTracking
Conveyor ID	1
Trigger IO	-1
Speed(mm/s)	100.000
Accel(mm/s ²)	100.000
Decel(mm/s ²)	100.000
Forward	True
Supply	Click to Show Detail
Color	 0, 102, 0
Visible	True
Show Label	False
Show Origin	False
Collision	
Check	True
Show Result	Whole
Color	 168, 0, 0
Collision Point	
Radius(mm)	5
Color	 168, 0, 0

Property	Value
Name	You can specify any name.
Type	Setting fixed to "Layout".
Offset Position	You can show/set the position of an object as an offset from its parent object. If no parent object exists, it is shown/set the same as the Position property.
Offset Rotation	You can show/set the placement angle of an object as an offset from its parent object. If the parent object does not exist, it will display/set the same as the Rotation property.
Position	Specifies the center point in simulator World coordinates.
Half size	Specify a length from the center. The length is double the specified length. Specified by height (Conveyor length) and width (Conveyor width).
Rotation	Specify the placement angle.

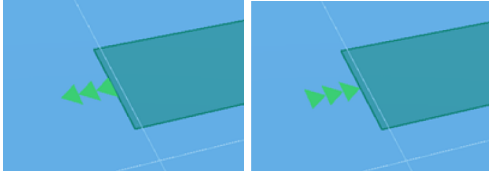
Property	Value
Operation	Specifies the motion type of the Conveyor object (whether or not it is linked to the Conveyor Tracking setting). " In the case of "LinkTracking", it is linked to the conveyor tracking settings. This robot can perform conveyor tracking to follow workpieces (parts) moving along a conveyor object. " In the case of "Independent", the motion is independent and not linked to the conveyor tracking settings. Also, the value obtained by the Cnv_QueueGet function differs according to the operation type. The value will fluctuate if "LinkTracking" is selected to link to the conveyor tracking setting. However, the value does not fluctuate if "Independent" is selected. ▪ Linked to conveyor tracking settings: LinkTracking ▪ Not linked to conveyor tracking settings: Independent (default)
Color	You can change the display color. Click the drop-down v to change it. The display color setting dialog box is displayed. For details, refer to "Change layout object color" below. Layout Objects
Visible	▪ Display: True (default) ▪ Not display: False
Show Label	▪ Displays the label: True ▪ Not display the label: False (default)
Show Origin	▪ Show center point: True ▪ Hide center point: False (Default)

For details about the Collision and Collision Point properties, see the properties below.

Layout Objects

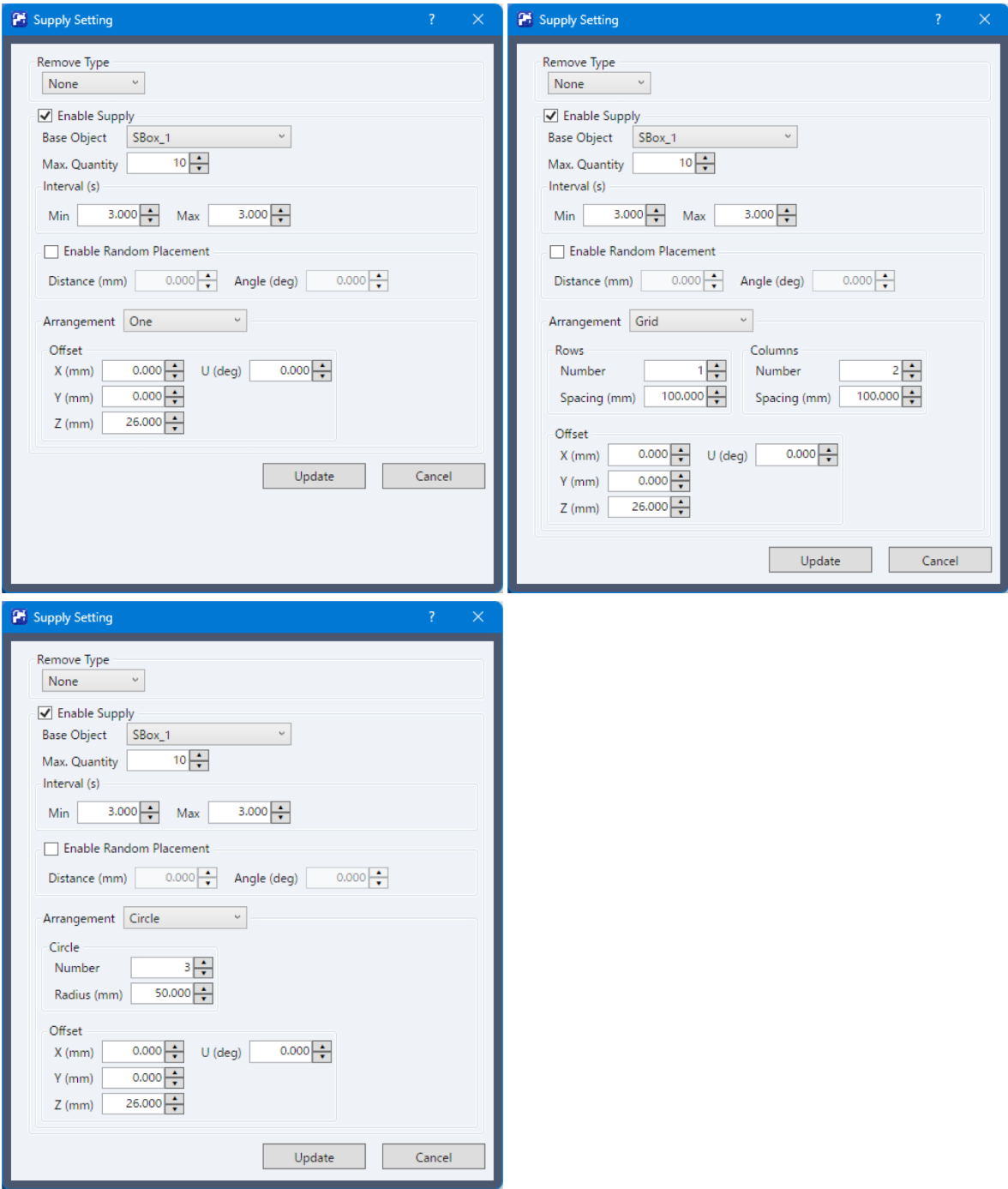
Operation

Property	Value
Conveyor ID	If the conveyor object motion type is "LinkTracking", specify the conveyor number for which conveyor tracking is set.
Trigger IO	If the conveyor object motion type is "LinkTracking", specify the I/O output number for the encoder count to latch.
Speed	Specify the motion speed of the conveyor object.
Accel	Specify the acceleration of the conveyor object.
Decel	Specify the deceleration of the conveyor object.

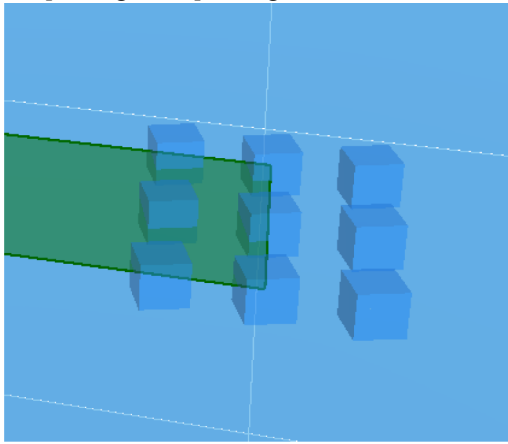
Property	Value
Forward	Enable/Disable the forward direction as the conveyor object motion direction. ▪ Forward: True (default) ▪ Reverse: False Depending on the setting value, an arrow indicating the motion direction of the conveyor object is displayed. This arrow blinks while the conveyor object is running.  Normally, use this with the setting set to True. Set this to False when you want to return the workpiece (part) toward the reverse direction side (upstream side). When set to False, automatic supply and automatic removal of workpieces (parts) cannot be used (this operates the same as when "Remove Type" is set to "None" in the Supply Setting dialog). In addition, conveyor tracking simulation cannot be used.
Supply	This sets the supply of workpieces (parts) that move on the conveyor object.

Set the supply of workpieces (parts) that move on the conveyor object.

To set or change the workpiece (parts) that flow on the conveyor object, click the  [Click to Show Detail] button for the setting value of the Supply property. A supply setup dialog box appears.

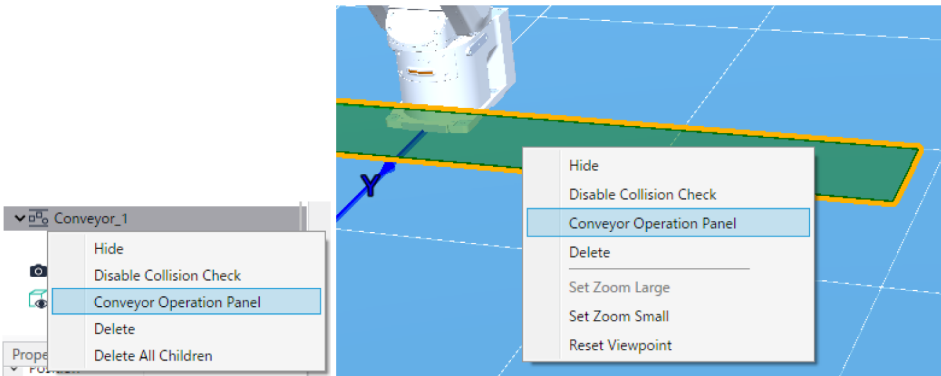


Item	Description
Remove Type	Workpiece (part) deletion method Specifies how to handle workpieces (parts) that reach the end of the conveyor object. - None: Do not delete (default) Workpieces (parts) accumulate at the end of the conveyor object. - Reach End: Delete Workpieces (parts) are deleted (no longer displayed) when they reach the end of the conveyor object.
Enable Supply	Enable/Disable supply of workpieces (parts) to the conveyor object When enabled, various settings are available. - Enable: Check - Disable: Uncheck (default)

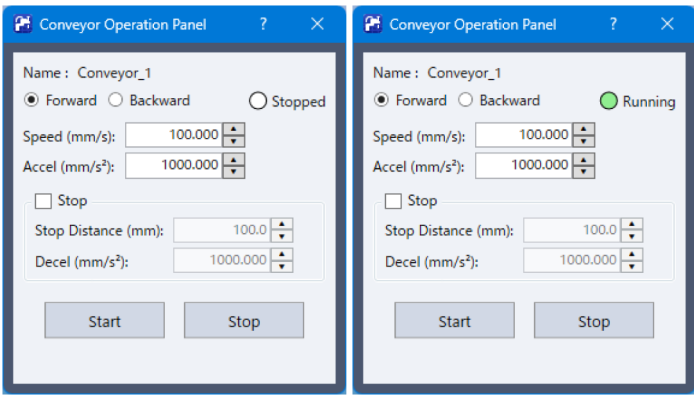
Item	Description
Base Object	The object used as the workpiece (part) You can select layout objects that are already placed in 3D. When a base object is set, a preview is displayed near the starting point of the conveyor object according to the [Arrangement] setting described later. 
Max. Quantity	Maximum quantity of supplied workpieces (parts)
Interval	Time interval (seconds) between workpieces (parts) being fed - Minimum value: The minimum time until the next workpiece (part) is supplied - Maximum value: The maximum time until the next workpiece (part) is supplied If the minimum and maximum values are the same, the workpieces (parts) are fed at equal intervals. If the values are different, the workpieces (parts) are fed at random time intervals between the minimum and maximum values.
Enable Random Placement	Enable/Disable random placement of workpieces (parts) - Enable: Check - Disable: Uncheck (default) When enabled, the workpieces (parts) are randomly placed/supplied based on the settings below. - Distance: Distance interval between workpieces (parts) being fed The workpieces (parts) are supplied at random distance intervals, with the specified distance in the X-axis direction in the origin coordinate system of the conveyor object as the maximum value. - Angle: Orientation of supplied workpieces (parts) The workpieces (parts) are supplied at random orientations, with the rotation angle in the Z-axis direction in the origin coordinate system of the conveyor object as the maximum value.
Arrangement	Workpiece (part) placement method Select one of the following methods. - One: Place workpieces (parts) individually (default) - Grid: Place workpieces (parts) on a grid - Circle: Place workpieces (parts) in a circle
Rows Columns	When workpiece (part) placement method is set to "Grid" Define the grid with [Quantity] and [Interval], and place the workpieces (parts).
Radius	When workpiece (part) placement method is set to "Circle" The workpieces (parts) specified in [Quantity] are placed on an arc with the radius specified here.
Offset	Offset value from the origin of the conveyor object Sets the [Grid] or [Circle] placement with the offset value specified here as the center.

Manipulating conveyor objects

Select and right-click a conveyor object in the layout tree or 3D display to display the following context menu.



When you select "Conveyor Operation Panel", the following dialog box appears.



Item	Description
Forward Backward	Specify the motion direction of the conveyor object. - Forward: +X-axis direction in conveyor coordinate system - Backward: -X-axis direction in conveyor coordinate system
Speed Accel	Motion speed and acceleration of the conveyor object. These correspond to the Speed and Accel property values of the conveyor object, respectively.
Abort	Enable/Disable the stopping operation for the conveyor object When selected, the stopping operation for the conveyor object is enabled, causing the conveyor object to stop with the specified stopping distance and deceleration. The deceleration corresponds to the Decel property value of the conveyor object. If disabled, the conveyor object does not stop until the [Stop] button is clicked. - Enable: Check - Disable: Uncheck (default)
Start Abort	Start/Stop the conveyor object movement Click the [Start] button to start the conveyor object. Click the [Stop] button to stop the conveyor object.

Running Stopped	Indicator showing the operating status of the conveyor object When you click the [Start] button or use the SimSet command to start the conveyor object operation (by specifying the Start property), this indicator switches from "Stopped" to "Running". When you click the [Stop] button or use the SimSet command to stop the conveyor object operation (by specifying the Stop property), this indicator switches from "Running" to "Stopped". ☐ Stopped ☒ Running
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5.1.4.6 Detection area object

Detection area objects can be operated only with Epson RC+ Standard Edition or higher.

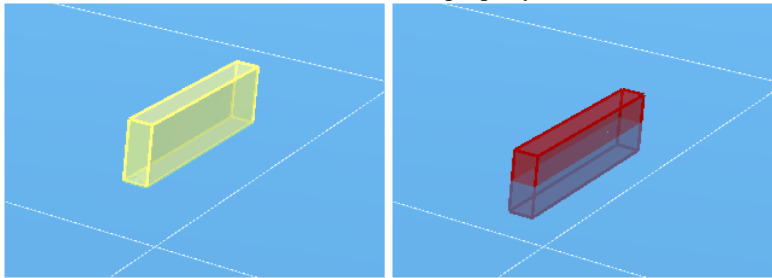
DetectionArea

This object detects contact with other objects. When placed on a conveyor object, it can be used as a sensor to detect workpieces (parts) moving on the conveyor.

Most of the attributes are the same as for Layout objects, but some attributes are only valid for detection area objects.

Property	Value
Name	DetectionArea_1
Type	Layout
Robot	
Tool	
Joint	
Offset Position	
X(mm)	600.000
Y(mm)	600.000
Z(mm)	25.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Position	
X(mm)	600.000
Y(mm)	600.000
Z(mm)	25.000
Half size	
X(mm)	10.000
Y(mm)	100.000
Z(mm)	25.000
Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Color	255, 255, 128
Visible	True
Show Label	False
Show Origin	False
Collision	
Check	True
Color	168, 0, 0
Sensor	
IO Type	Output
IO Number	None
Action	True
Trigger	LeadingEdge
Duration(s)	0.00
Delay(s)	0.00
Enable Virtual Only	True

Property	Value
Name	You can specify any name.

Property	Value
Type	Setting fixed to "Layout". Cannot change the setting.
Offset Position	You can show/set the position of an object as an offset from its parent object. If no parent object exists, it is shown/set the same as the Position property.
Offset Rotation	You can show/set the placement angle of an object as an offset from its parent object. If the parent object does not exist, it will display/set the same as the Rotation property.
Position	Specifies the center point in simulator World coordinates.
Half size	Specify a length from the center. Specified by X, Y, Z. The length is double the specified length.
Rotation	Specify the placement angle.
Color	You can change the display color. Click the drop-down v to change it. The display color setting dialog box is displayed. For details, refer to "Change layout object color" below. Layout Objects
Visible	■ Display: True (default) ■ Not display: False
Show Label	■ Displays the label: True ■ Not display the label: False (default)
Show Origin	■ Show center point: True ■ Hide center point: False (Default)
Collision Check	Enable/Disable detection operation ■ Enable: True (default) ■ Disable: False If the detection area object is already in contact with another object, it cannot detect contact with a new object. If contact cannot be detected correctly, follow the steps below. 1. Ensure that it is positioned so that it does not come into contact with objects for which contact detection is not required. 2. If contact is unavoidable, consider setting the Collision Check property of the object for which contact detection is not required to False.
Collision Color	Specifies the color used when contact occurs with another object (excluding conveyor objects), including workpieces (parts). When the Collision Check property is True, the color changes to the color specified by this property when contact occurs with another object, including workpieces (parts). When the objects are no longer in contact, the color returns to the color set in the Color property. 

Sensor

Property	Value
IO Type	I/O output destination when an object is detected - Memory: Memory I/O (default) - Input: All input ports - Output: All output ports
I/O Number	I/O number specified in [IO Type]
Action	I/O Output value Sets the output value for the output destination and I/O number specified in [IO Type] and [I/O Number]. - True: Turns I/O on (default) - False: Turns I/O off
Trigger	I/O output timing setting Sets the I/O output timing when an object is detected. - LeadingEdge: When the object comes into contact with the detection area (default) - TrailingEdge: When the object comes out of contact with the detection area
Duration	I/O output duration The I/O output is maintained for the specified period of time.
Delay	I/O output delay time I/O output after the specified time elapses.
Enable Virtual Only	Enabled/Disabled when a virtual controller is connected - True: I/O output only when a virtual controller is connected (default) - False: I/O output not restricted to when a virtual controller is connected

5.1.4.7 Part Feeder Object

KEY POINTS

Part feeding simulation is available only with Epson RC+ Standard Edition or higher. Refer to the following video manual for an overview and detailed instructions.



Sample connections and projects are provided for part feeding simulation. It is also used in the video manual mentioned above.

From the Epson RC+ 8.0 menu, select [Project]-[Open Project], then select [Projects]-[SimulatorDemos]-[PF_Sample_GX8_C], and then select [RC800 Series]-[PF Sample GX8-C] from the Epson RC+ 8.0 toolbar-[Connection:] list box. You can actually check the operations and behaviors described in the video manual.

When the parts feeder setting is enabled in [Setup]-[System Configuration]-[Controller]-[Part Feeder], the part feeder object is automatically displayed in the layout tree and 3D display.
This operation is available only with Epson RC+ Standard Edition or higher.

Feeder Object

This object represents the part feeder unit. Most of the attributes are the same as for Layout objects, but some attributes are only valid for part feeder objects.

Feeder_1

Feeder1_Hopper1

Feeder1_Hopper2

Property	Value
Name	Feeder_1
Feeder Number	1
Model	IF-240
Type	Layout
Offset Position	
X(mm)	-116.000
Y(mm)	537.000
Z(mm)	0.000
Offset Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Position	
X(mm)	-116.000
Y(mm)	537.000
Z(mm)	0.000
Rotation	
X(degree)	0.000
Y(degree)	0.000
Z(degree)	0.000
Show Pick Area	1
Vibration Scale	10.000
Supply Type	FromFile
Filename	Feeder_1.pfs
Visible	True
Show Label	False
Show Origin	False
Collision	
Check	True
Show Result	Whole
Color	168, 0, 0
Collision Point	
Radius(mm)	5
Color	168, 0, 0
Collision Margin	
Visible	False
Size(mm)	0.100
Color	255, 216, 0
Check	False
CollisionColor	168, 0, 0
Transparent	False
Transparency(%)	50

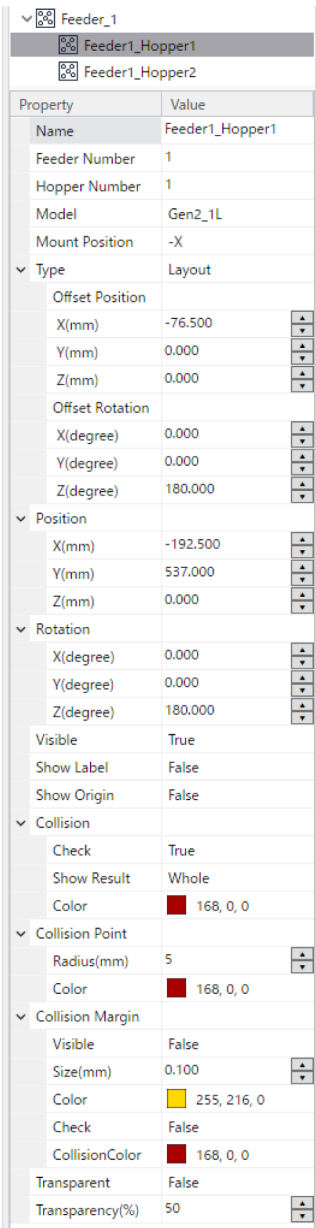
Property	Value
Name	Displays the feeder name. You can specify any name.
Feeder Number	Displays the feeder number. This is the feeder number set in [Setup]-[System Configuration]-[Controller]-[Part Feeder]. It cannot be changed from the property grid.

Property	Value
Model	Displays the feeder model name. This is the feeder model name set in [Setup]-[System Configuration]-[Controller]-[Part Feeder]. For IF-380 and IF-530, a model can be selected according to the height of the frame surrounding the platform. For IF-A1520 and IF-A2330, when Purge gate installed is enabled, a model can be selected according to the purge gate mounting position (left or right). The 3D display changes according to the selected model.
Type	Setting fixed to "Layout". Cannot change the setting.
Offset Position	You can show/set the position of an object as an offset from its parent object. If no parent object exists, it is shown/set the same as the Position property.
Offset Rotation	You can show/set the placement angle of an object as an offset from its parent object. If the parent object does not exist, it will display/set the same as the Rotation property.
Position	Specifies the center point in simulator World coordinates.
Rotation	Specify the placement angle.
Show Pick Area	Specifies the part number for which the pick area is displayed.
Vibration Scale	Sets the vibration ratio in the simulation. The vibration intensity (magnitude of the external force applied to parts) changes in proportion to this value. Use this setting to further adjust the vibration after calibrating part feeding. Normally, this does not need to be changed.
SupplyType	Displays/Sets the parts supply method. ▪ Hopper: Supplies parts randomly based on the parts supply settings in [Tools]-[Part Feeding]. ▪ FromFile: Supplies parts from a saved parts supply file.
Filename	When the SupplyType property is set to FromFile, specifies the file (parts supply file) in which the parts supply information is recorded. Clicking the  button displays the file open dialog. Specifies a parts supply file (extension: ".pfs"). Parts are supplied from this part supply file when part supply is required. Alternatively, parts can be supplied at any time by specifying the SimSet command as shown below. SimSet Feeder_1.SupplyType, 1 SimSet Feeder_1.Filnname, CurDir\$ + "Feeder_1.pfs" PF_OutoutOnOff 1, On, 1, 5000
Visible	▪ Display: True (Default) ▪ Not display: False
Show Label	▪ Displays the label: True ▪ Not display the label: False (Default)
Show Origin	▪ Show center point: True ▪ Hide center point: False (Default)

For properties such as "Collision", "Collision Margin", or "Transparent", refer to the layout objects properties.

Hopper object

This object represents the hopper. When [Hopper installed] is enabled in [Setup]-[System Configuration]-[Controller]-[Part Feeder], it is automatically added as a child object of the feeder object. It cannot be used as a standalone object or as a child object of another object. Most of the attributes are the same as for Layout objects, but some attributes are only valid for hopper objects.



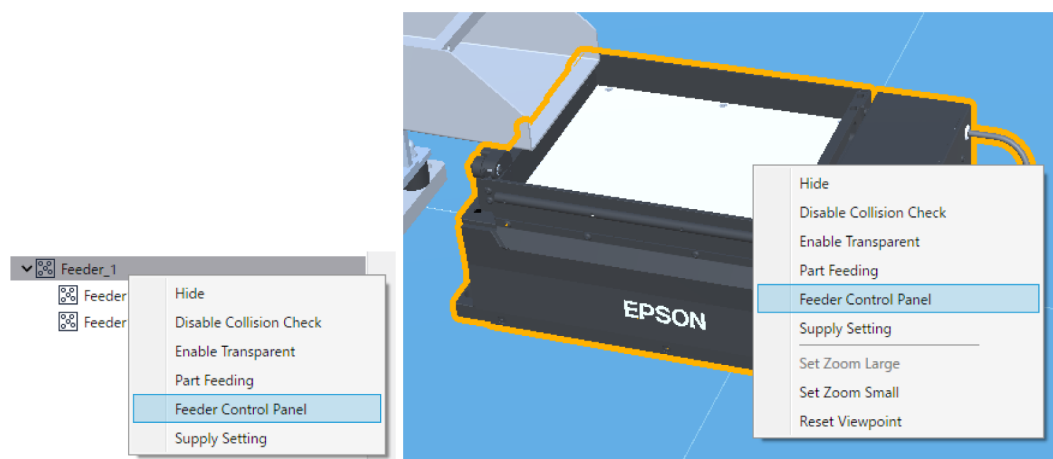
Property	Value
Name	Displays the hopper name. You can specify any name.
Feeder Number	Displays the number of the feeder that is the parent object. It cannot be changed from the property grid.
Hopper Number	Displays the hopper number. Cannot change the setting.
Model	Displays the hopper model name. You can also select a model according to the hopper type selected in [Setup]-[System Configuration]-[Controller]-[Part Feeder]-[Hopper installed]. The 3D display changes according to the selected model.

Property	Value
Mount Position	Sets the hopper mounting position. Specifies the direction of the hopper supply port with respect to the origin coordinate system of the feeder unit. The hopper display in the 3D display changes according to the specified direction. ■ +X: +X-axis direction (Default) ■ -X: -X-axis direction ■ +Y: +Y-axis direction ■ -Y: -Y-axis direction
Type	Setting fixed to "Layout". Cannot change the setting.
Offset Position	You can show/set the position of an object as an offset from the feeder unit, which is the parent object.
Offset Rotation	You can show/set the installation angle of an object as an offset from the feeder unit, which is the parent object.
Position	Specifies the center point in simulator World coordinates.
Rotation	Specify the placement angle.
Visible	■ Display: True (Default) ■ Not display: False
Show Label	■ Displays the label: True ■ Not display the label: False (Default)
Show Origin	■ Show center point: True ■ Hide center point: False (Default)

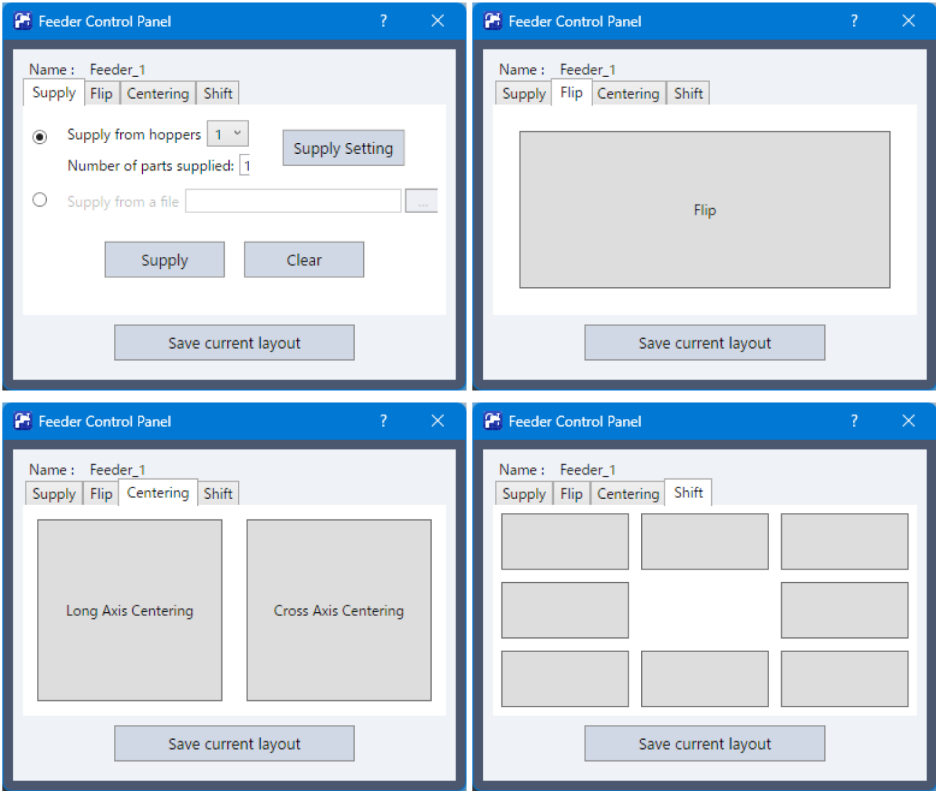
For properties such as "Collision", "Collision Margin", or "Transparent", refer to the layout objects properties.

Feeder Control Panel

Select and right-click a feeder object or hopper object in the layout tree or 3D display to display the following context menu.



When you select "Feeder Control Panel", the following dialog box appears.



 KEY POINTS

This function can be used to simulate feeder operation.

This simulation is intended to check the supply or placement state of parts on the feeder, and it reproduces the positions and orientations of parts in a simulated manner. This is a simulation based on a simplified model and does not perform strict physical simulation including feeder vibration, collision, or friction. Therefore, the behavior of the actual device is not completely reproduced. Use this function for preliminary verification purposes such as layout study and general operation checking.

Also, when using CAD data as a part in this function, the shape for simulation is automatically generated based on each element of the CAD data. If the CAD data consists of a single element, the generated shape may differ significantly from the actual part shape, resulting in an inaccurate representation of the part's pose and contact state.

In particular, the differences between the generated shape and the actual shape may be significant with the following types of parts or CAD data:

- Parts with large recesses
- Parts with large protrusions and indentations, such as L-shaped or U-shaped parts
- CAD data created by treating multiple part shapes or complex shapes as a single element

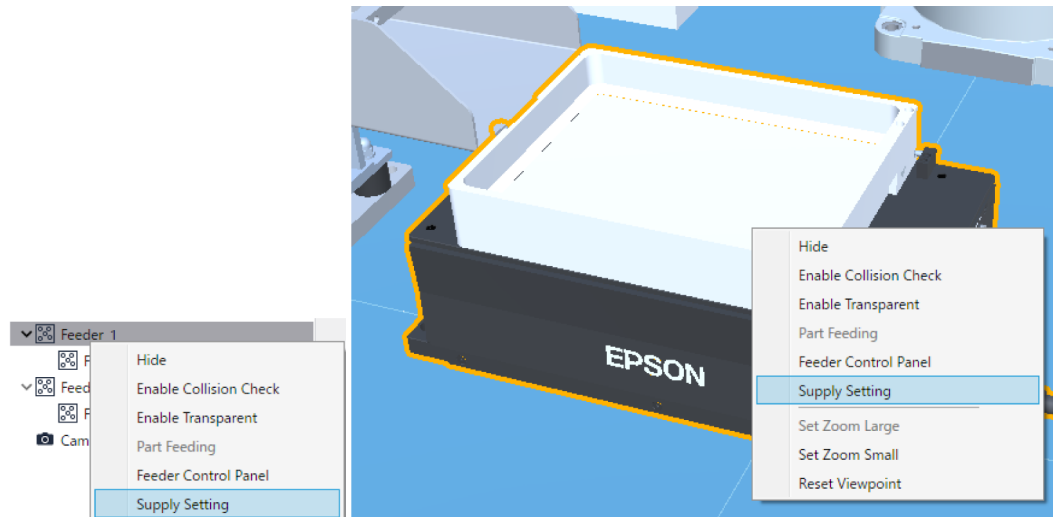
In this case, dividing the CAD data into multiple elements can make shapes for simulation closer to the actual part shape, allowing for a more realistic reproduction of the part's pose and contact state. On the other hand, increasing the number of elements increases the number of shapes to be handled during simulation, which may increase the processing time.

Item	Description
Name	Displays the name of the feeder object for which the operation is set.

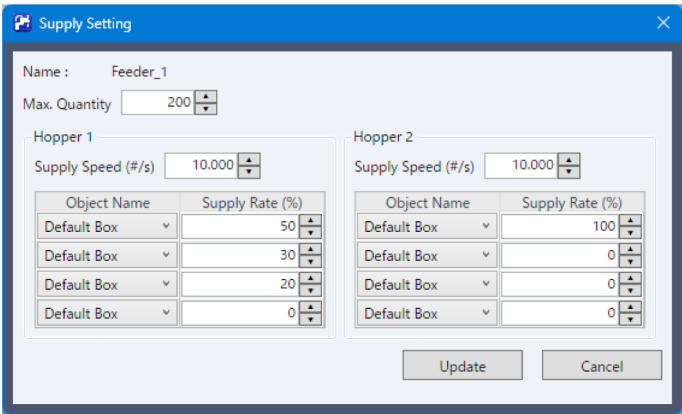
Item	Description
Supply Flip Centering Shift	Specifies the feeder operation. - Supply: Supplies parts onto the platform. Parts can also be removed from the platform. - Flip: Executes a flip operation. You can specify the ratio of parts to be flipped. - Centering: Executes a centering operation. You can specify the long axis or short axis direction as the part movement direction. - Shift: Executes a shift operation. You can specify one of eight directions as the part movement direction.
Save current layout	The part placement state after executing the feeder operation can be saved as a part placement file.
Supply from hoppers	Supplies the number of parts set in [Number of parts supplied] from the hopper with the specified number. Clicking the [Supply Setting] button allows you to specify the object used as the part. For details on [Supply Setting], see "Supply Setting" described later.
Supply from a file	Uses a part placement file for parts supply. Clicking the  button displays the file open dialog. Specifies a part placement file.
Supply	Supplies parts onto the feeder platform.
Clear	Removes parts from the feeder platform.

Supply Setting

As with the Feeder Control Panel, select and right-click a feeder object or hopper object in the layout tree or 3D display to display the following context menu.



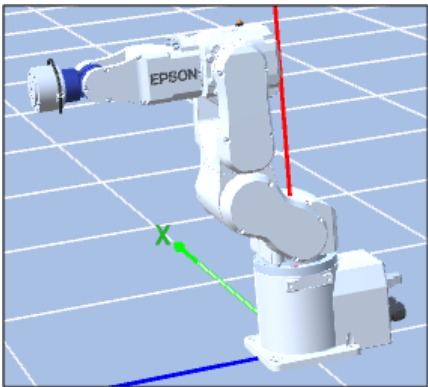
Selecting [Supply Setting] from the context menu or clicking the [Supply Setting] button on the Feeder Control Panel displays the following dialog box.



Item	Description
Name	Displays the name of the feeder object for which part supply is configured.
Max. Quantity	Sets the maximum number of parts that can be supplied to the feeder at one time. This is also the maximum number of parts that the feeder can hold. Parts cannot be supplied or held beyond the number set here.
Supply Speed	Specifies the supply speed (parts/sec) for Hopper 1 and Hopper 2.
Object Name	Specifies the object to use as a part. You can select layout objects that are already placed in the 3D display. Up to four types of parts can be specified per hopper.
Supply Rate	Specifies the supply rate for parts. The sum of the supply rates for the four types of parts must be 100%.

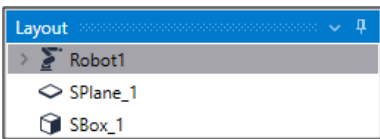
5.1.5 3D Display

In the 3D display, you can check the robot orientation and motion from various points of view.

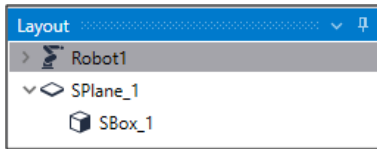


Adding a layout object

When a layout object is added while the robot object is selected in [Layout Objects], it will be added as independent object.



When a layout object is added while the layout object is selected in [Layout Objects], it will be added as a grouped object of the selected object.



Grouped objects move together when the parent object moves. RightTable/CenterTable/LeftTable of the sample virtual controller "C4 Sample" is an example of grouping.

Editing a layout object

[Cut], [Copy], and [Paste] commands in the [Edit] menu are available for layout objects other than CAD objects.

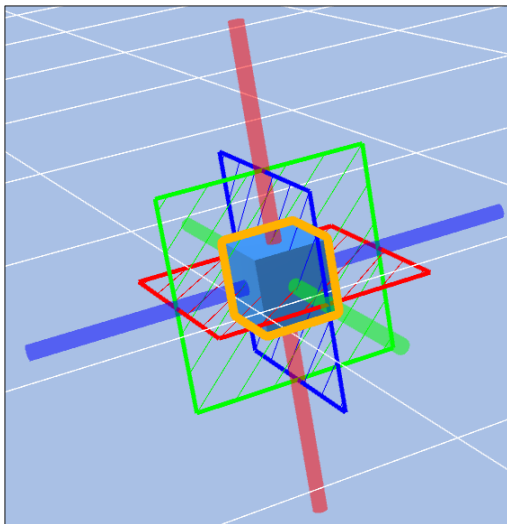
Changing a hierarchy of layout objects

To change a hierarchy of layout objects, drag and drop a layout object in the layout object.

Change the robot / layout object position

Guides that show the direction of movement can be displayed by clicking the  [Move] button on the toolbar and clicking an object such as a robot or box.

To move the object, drag the grid corresponding to the axis.



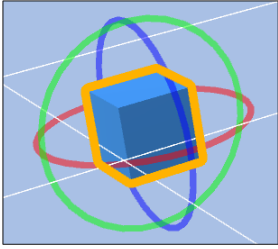
Snap function

The snap function is enabled when moving an object. If there is another object at the destination and there is a surface perpendicular to the direction of movement, the objects automatically snap together when they come within a certain distance. This snap function can be disabled by holding down the [Alt] key while dragging. Available only with Epson RC+ Standard Edition or higher.

Rotate the robot / layout object

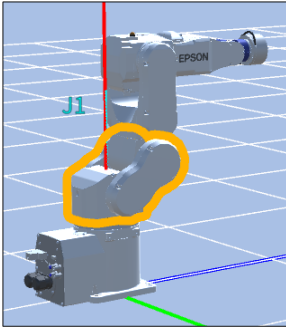
Guides that show the direction of rotation can be displayed by clicking the  [Rotate/Jog] button on the toolbar and clicking an object such as a robot base or box.

To rotate the object, drag the guide corresponding to the direction you want to rotate the object.



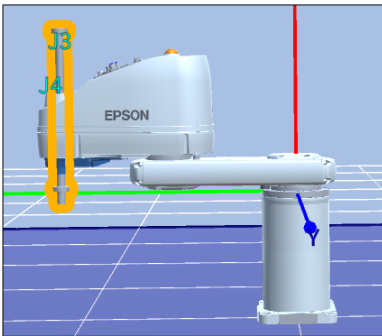
Move the robot joint

A robot joint can be moved by clicking the -  [Rotate/Jog] button on the toolbar and dragging the joint. The selected joint is displayed in yellow.



For SCARA robot:

- To move the shaft (J3): Click the toolbar  [Move] button and drag the robot shaft up or down.
- To rotate the shaft (J4): Click the toolbar  [Rotate/Jog] button and drag the robot shaft left or right.



Undo/Redo

You can use the Undo/Redo functions to undo or redo operations on the simulator, including moving and rotating objects. However, you cannot undo or redo robot joint movements. Available only with Epson RC+ Standard Edition or higher.

To undo, press the [Ctrl]+[Z] keys or select [Undo] from the [Edit] menu. To redo, press the [Ctrl]+[Y] keys or select [Redo] from the [Edit] menu.

Change the view point

To rotate the view point, press the mouse left button and drag the 3D display. To move the view point left, right, down, or up, press the right mouse button and drag the 3D display. You can also use the [W], [A], [S], [D], and cursor keys to move the view point. You can reset the view point from the menu opened by right click.

Zoom the layout

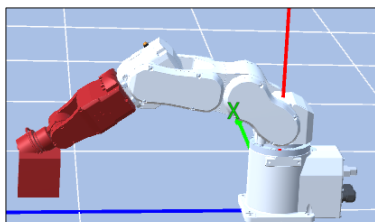
To zoom the 3D display, use the mouse wheel to scroll. You can change the zoom level from the menu opened by right clicking with the mouse.

Check for collisions

When a collision between a robot and layout object is detected, the collided robot joint and layout object are displayed in red.

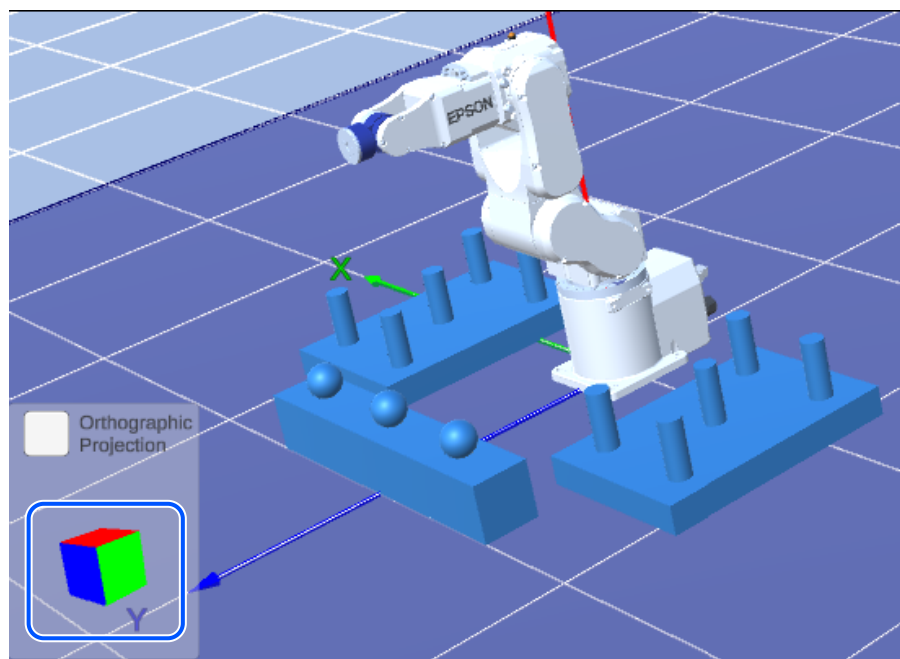
For details on collision detection, see below.

Collision detection

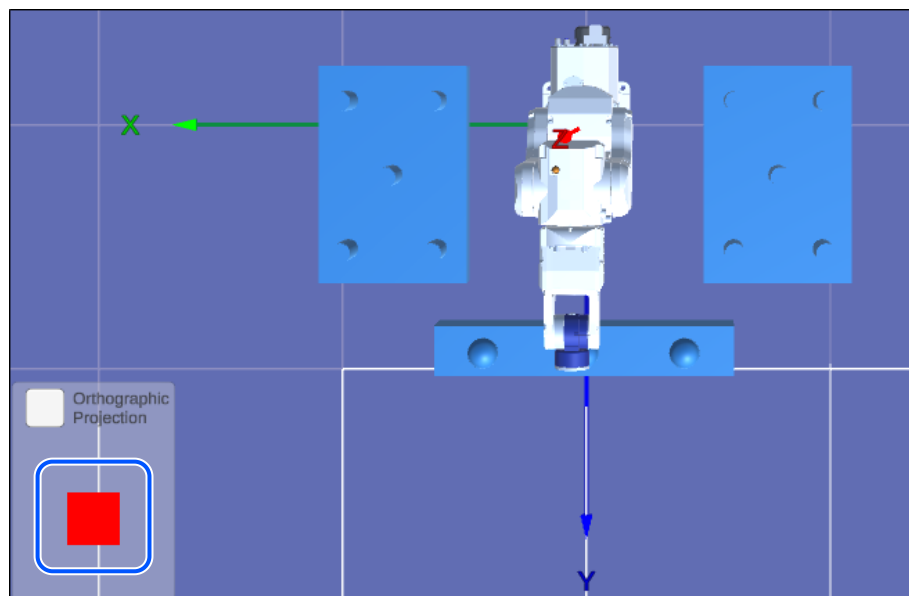


3D view control

The cube is located in the lower left corner of the 3D display. Dragging the cube with the mouse rotates the cube, which in turn rotates the viewpoint.

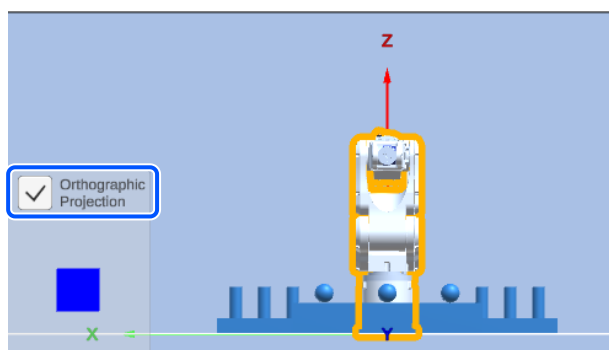


You can also click on a plane on the cube to reset the viewpoint to that plane.



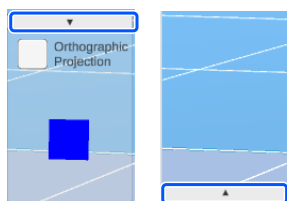
Orthographic projection

Check [Orthographic Projection] in the lower left corner of the 3D display to switch the 3D view to an orthographic projection (object size does not depend on perspective).



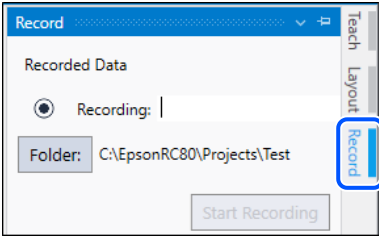
Minimization

You can minimize the display area of the 3D view operation cube and [Orthographic Projection] checkbox.

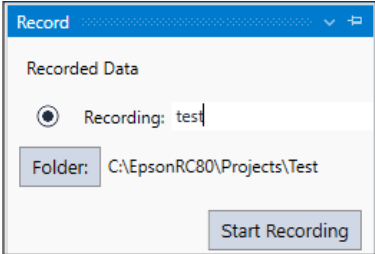


5.1.6 Record / Playback

Select [Record] from the right tab of the simulator window to display the Record panel. In Playback mode, you can record and produce simulation results.



Record (simulation mode)



Selecting the [Record] tab in the upper right corner of the simulator window allows you to set up simulation results for recording.

Item	Description
Log	Specifies a log file for recording.
Folder	Specifies a folder to save the log file.
Start Recording/Stop Recording	Starts and stops recording. Once the log file is specified and the [Start Recording] button is pressed, recording is ready.

Playback (playback mode)



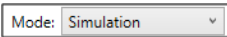
Item	Description
 Reset Collision	Resets the collision detection status. When you click this button while the robot is not interfering with any layout objects, the red display turns to normal.
 Simulator Settings	Shows the [Simulator Settings] dialog. In this dialog, the 3D [Render Options] can be configured.
 Screenshot	Saves the current 3D display as an image file. The [Save As] dialog box appears, allowing you to specify a file name and file type (JPEG or PNG format).
 Create Movie	Plays a simulation result (log file) and saves into a movie file in MP4 format. The [Save As] dialog box appears, allowing you to specify a file name.
 Elapsed Time	Displays the run time of the log file being played.
 Clear TCP path	Clear the TCP path (including Render Singularity Avoiding path) which the robot displays.
 PLAY	Plays a simulation result of a specified log file.

Item	Description
 STOP	Stops the simulation playback.

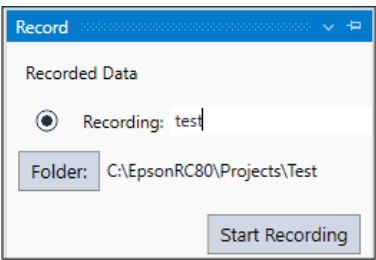
Outputting robot motion to log file

To reproduce the results of a simulation later, the robot's motion (action) must be output to a log file.

- 1. Confirm that the mode is “Simulation” mode on the Simulator toolbar.



- 2. Select the [Record] tab in the upper right corner of the simulator window to display the [Record] window.



- 3. Enter a name for [Log].
- 4. Click [Folder] to set the folder where the log will be saved.
- 5. Click [Start Recording].

The icon next to the log file name changes from  to , and recording is ready. A message prompting program execution appears.

- 6. Run the program.

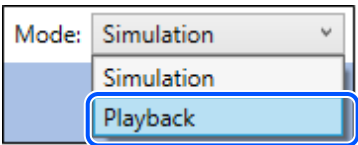
When program execution is complete, recording will automatically end. When recording has ended, the icon next to the log file name changes from  to  and a log file with the specified name is generated in the specified folder.

 **KEY POINTS**

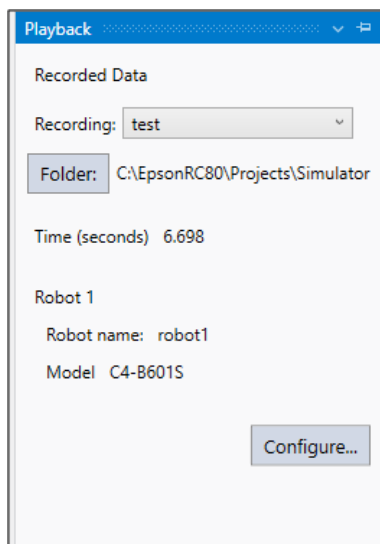
During recording, the [Start Recording] button changes to the [Stop Recording] button. To stop recording, press the [Stop Recording] button.

Reproducing robot motion from log file

- 1. From the simulator toolbar, change the mode from “Simulation” to “Playback”.

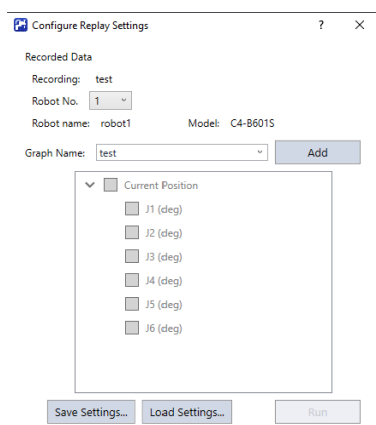


- 2. Select the [Playback] tab in the upper right corner of the simulator window to display the [Playback] window.



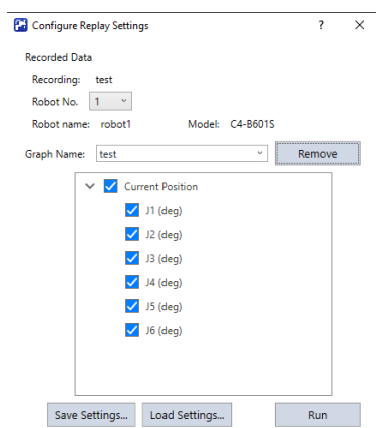
3. From the [Log] drop-down list, select the log you want to reproduce.

4. Click the [Configure] button. The configuration window will appear.

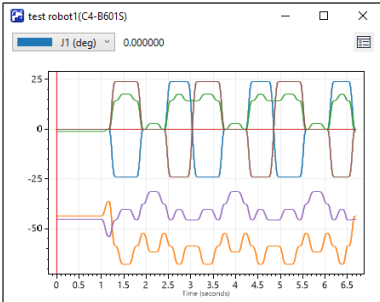


5. Select the target robot from [Robot No.].

6. The playback function graphically displays joint movements. Enter the [Graph Name] and click the [Add] button.

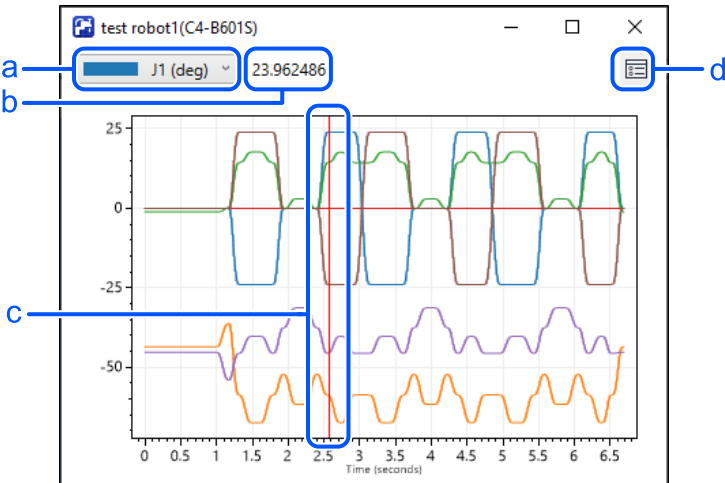


7. Select a joint to graph, and then click the [Run] button. A graph window appears.



8. Click the toolbar  [Playback] button to replay the logged operation.

Graph window functions



Symbol	Description
a	Select the joint whose value will be checked.
b	The selected joint's value is displayed.
c	Drag the vertical indicator with the mouse to adjust the playback position.
d	You can reset the window to its initial display or export data to a CSV file.

5.1.7 Create Movie

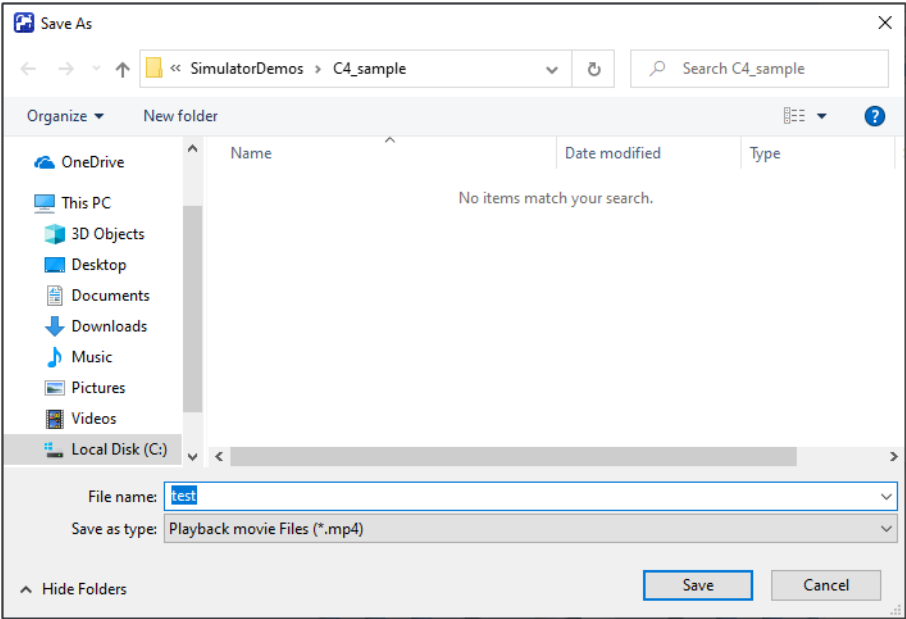
You can store the simulation results in movie files.

In simulation mode, you can execute projects and save movie files in MP4 format.

In playback mode, you can replay simulation results (log files) and save movie files in MP4 format.

Saving movie files

1. Click  [Create Movie] in the simulator toolbar.
2. The [Save As] dialog box appears. Specify the folder and file name where the movie will be saved.



- 3. Click the [Save] button.
- 4. In simulation mode, run the project. When project has finished executing, a movie file is created.

In playback mode, the logged operation will be replayed. When playback ends or is stopped midway, a movie file is created.

 **KEY POINTS**

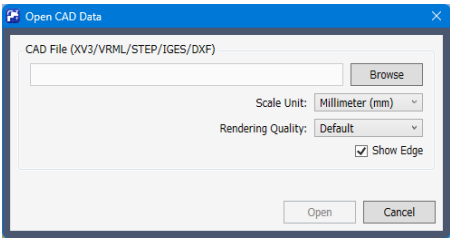
A movie file is created each time a project is executed or a logged action is played back. To exit movie creation, click [Create Movie] again.

5.1.8 Loading the CAD file

The CAD file can be loaded to lay out the hand or CAD object data in the 3D display. For details of available CAD data, see below.

Specifications and precautions for the 3D display - "Available CAD data for 3D display"

Pressing the  [CAD] button on the toolbar opens the [Open CAD Data] dialog box.



Item	Description
[Browse] button	Displays the dialog box for selecting the file. Select a CAD file to load.

Item	Description
Scale Unit	Select a unit of length used in the CAD data in order to match the unit with the simulator. This can be changed in the property grid after loading the data.
Rendering Quality	Specify the rendering quality. ▪ If "Fine" is selected, the data is displayed in details but it takes time. ▪ If "Fast" is selected, the details are not displayed (e.g. the screw holes are shown as a square), but the data can be displayed faster.
Show Edge	Selects whether to show edges (edge lines) in the display after opening (importing) CAD data. When checked, the ShowEdge property is True and the Edge is shown in the CAD data display.
[Open] button	Starts loading the data.

5.1.9 Saving the CAD file

The loaded CAD file can be converted to the XVL format to save. Converting the file to the XVL format can reduce the file size, resulting in a shorter loading time.

Saving CAD files

1. Select the CAD object to save in the layout object.
2. Click the  [Click to Save] setting for the [Save as XVL...] property in the property grid.
3. The [Save As] dialog box appears. Click [Save].
4. If the file is saved successfully, the confirmation message appears. Click [Yes].

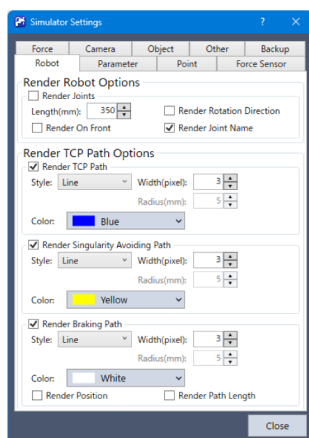
5.2 Simulator Settings

Pressing the  [Simulator Settings] button displays the [Simulator Settings] dialog box.

The settings will be kept after restarting the Epson RC+ 8.0.

5.2.1 [Robot]

Settings related to 3D display of the robot.



Render Robot Options

Item	Description
Render Joints	Displays an arrow that shows a supporting point and a rotation axis of the robot.
- Length	Set a length for rendering the joints.
- Render Rotation Direction	Display a rotation direction when rendering the joints.
- Render Joint Name	Display the joint names (J1, J2, J3, J4, J5, J6) when rendering the joints.
- Render On Front	Display the arrow of "Render Joints" in front of the robot.

Render TCP Path Options

Item	Description
Render TCP Path	Displays the path of the origin point on active Tool coordinate system for a fixed time.
Render Singularity Avoiding path	Only displays the path of operation to avoid render singularity for the path of the origin point on active Tool coordinate system.
Render Braking Path	Displays only the motion trajectory when an error occurs in the path of the origin point of an active tool coordinate system. This can be displayed only with Epson RC+ Standard Edition or higher. The accuracy and precision of the trajectory displayed by this function are not guaranteed. Depending on the error, the trajectory may not be displayed or may be distorted. When applying this to an actual system, be sure to check its operation in combination with an actual robot. Also, add a margin if necessary.
Style	Select line or dot to indicate the paths. For render braking path, the setting is available only with Epson RC+ Standard Edition or higher.
Width	Specify the line width of paths. For render braking path, the setting is available only with Epson RC+ Standard Edition or higher.
Radius	Specify the diameter of dots indicating paths. For render braking path, the setting is available only with Epson RC+ Standard Edition or higher.
Color	Specify the color of paths. For render braking path, the setting is available only with Epson RC+ Standard Edition or higher.
Render Position	When displaying the render braking path, the start and end points of the trajectory can be displayed as X, Y, and Z values in simulator World coordinates. This can be displayed only with Epson RC+ Standard Edition or higher.
Render Path Length	Displays the length of the path in render braking path. This can be displayed only with Epson RC+ Standard Edition or higher.

5.2.2 [Parameter]

Settings related to 3D display of robot parameters.

You can set the coordinate system and displayed name for each parameter.

Simulator Settings

Force

Camera

Object

Other

Backup

Robot

Parameter

Point

Force Sensor

Render Robot Parameter Options

Locals

Length(mm): 850

☐ Render Rotation Direction

☒ Render Axis Name

☐ Render On Front

☐ Display object name

Style: Number

Tools

Length(mm): 350

☐ Render Rotation Direction

☒ Render Axis Name

☐ Render On Front

☒ Display object name

Style: Number

Arms

Link Radius(mm): 5

☒ Render On Front

Joint Radius(mm): 10

☒ Display object name

Style: Number

ECP

Length(mm): 350

☐ Render Rotation Direction

☒ Render Axis Name

☐ Render On Front

☒ Display object name

Style: Number

Boxes

☒ Display object name

Style: Number

Planes

☒ Display object name

Style: Number

Plane Origin

Length(mm): 350

☐ Render Rotation Direction

☒ Render Axis Name

☐ Render On Front

Pallets

☒ Display object name

Style: Number

XYZ Limits

☒ Display object name

Style: Position

Conveyor

Width(pixel): 2

Conveyor Origin

Length(mm): 350

☐ Render Rotation Direction

☒ Render Axis Name

☐ Render On Front

Render Queue

Radius(mm): 10

☐ Render On Front

☒ Display object name

☒ Conveyor Number

☒ Queue Index

☐ User Data

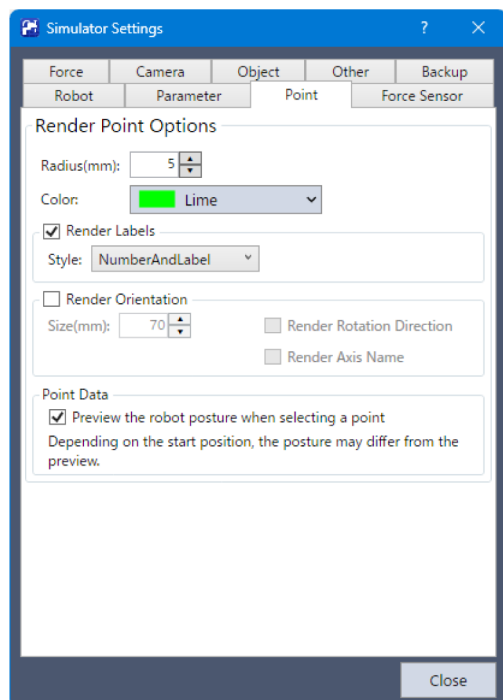
Close

Render Robot Parameter Options

Item	Description
Length	Set a length of the coordinate axis.
Render Rotation Direction	Display the rotational direction of the coordinate axis.
Render Axis Name	Displays the coordinate axis names (X, Y, Z, U, V, W).
Render On Front	Display the arrow of "Render Robot Parameter" in front of the robot or the object.
Show object names	Displays the object name (parameter name) of the robot parameters. This setting is available only with Epson RC+ Standard Edition or higher. The label display is not available in the Basic Edition.
Style	You can set the display style when the object name (parameter name) of the robot parameters is displayed. - Number: Robot parameter name and number - Number and robot ID: Robot parameter name and number, robot number - Number and robot name: Robot parameter name and number, robot name The display styles for the XYZ Limits are as follows. - Position: X, Y, Z coordinate position - Position and robot ID: X, Y, Z coordinate position and robot number - Position and robot name: X, Y, Z coordinate position and robot name
Link radius	You can set the radius of the cylinder that shows each link (arm) when displaying an additional arm.
Joint radius	You can set the radius of the sphere that shows each joint in the display of the additional arm.
Width	You can set the conveyor tracking upstream and downstream limits, and the width of the tracking abort line. This setting is available only with Epson RC+ Standard Edition or higher.
Show Queue	You can configure the display of queue information for conveyor tracking. This setting is available only with Epson RC+ Standard Edition or higher. The queue information can be displayed as a sphere. The radius allows you to set the size of the sphere. In addition, by enabling the object name display, you can also display the conveyor number, queue index, and user data.

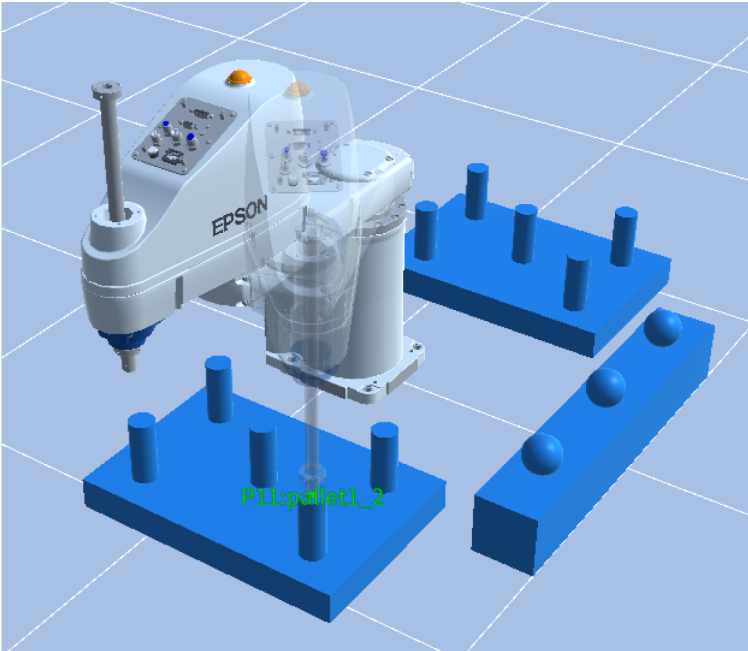
5.2.3 [Point]

Settings related to 3D display of the point data of the robot.



Render Point Options

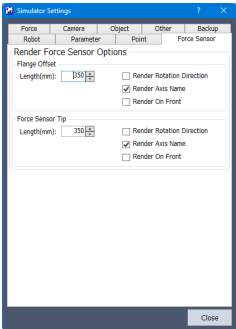
Item	Description
Radius	Specify the diameter of dots indicating points.
Color	Specify the color of dots indicating points.
Render Labels	Display a point label.
Style	Set a display style when rendering the point label. - Label: Label registered in point file. - Number: Point number - NumberAndLabel: Point number and label
Render Orientation	Display an orientation at the point as a coordinate axis.
Size	Set a size of coordinate axis that shows the orientation at the point.
Render Rotation Direction	Display the rotational direction on the coordinate axis that shows the orientation at the point.
Render Axis Name	Displays the coordinate axis name (X, Y, Z, U, V, W) of the coordinate axis that shows the orientation at the point.

Item	Description
Preview the robot posture when selecting a point	When a defined point is selected in the point editor, the robot pose at that point is displayed semi-transparently. 

5.2.4 [Force Sensor]

Settings related to 3D display of the force sensor.

You can set the coordinate system that shows a flange offset and tip of the force sensor.



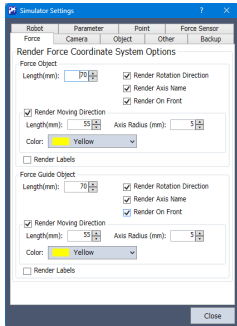
Render Force Sensor Options

Item	Description
Length	Set a length of the coordinate axis.
Render Rotation Direction	Display the rotational direction of the coordinate axis.
Render Axis Name	Displays the coordinate axis names (X, Y, Z, U, V, W).
Render On Front	Display the arrow of "Render Force Sensor" in front of the robot or the object.

5.2.5 [Force]

Settings related to 3D display of the force control data.

You can set the force coordinate system and moving direction for force object or force guide object.



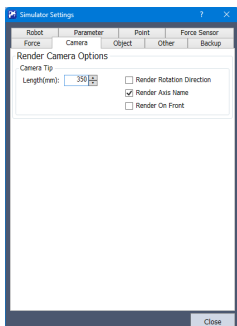
Render Force Coordinate System Options

Item	Description
Length	Set a length of the coordinate axis of the force coordinate system.
Render Rotation Direction	Display the rotational direction of the coordinate axis.
Render Axis Name	Displays the coordinate axis names (Fx, Fy, Fz, Tx, Ty, Tz).
Render On Front	Display the arrow of "Render Force Coordinate System" in front of the robot or the force sensor.
Render Moving Direction	Show the moving direction of the robot by the force control.
Length	Set a length of an arrow that shows the moving direction of the robot.
Shaft radius	Set shaft radius of the arrow that shows the moving direction of the robot.
Color	Set a color of an arrow that shows the moving direction of the robot.
Render Labels	Show a label of the force object and force guide object name.

5.2.6 [Camera]

Settings related to 3D display of the camera object.

You can set the display of the coordinate system that shows the camera tip.



Render Camera Options

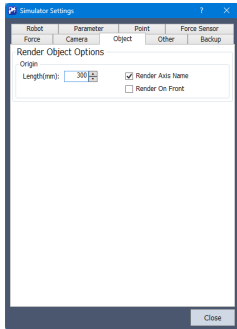
Item	Description
Length	Set a length of the coordinate axis.
Render Rotation Direction	Display the rotational direction of the coordinate axis.

Item	Description
Render Axis Name	Displays the coordinate axis names (X, Y, Z, U, V, W).
Render On Front	Display the arrow of "Render Camera" in front of the object.

5.2.7 [Object]

Settings related to 3D display of the general objects including robot, CAD object, and simple object.

You can set up the display of the coordinate system to show the origin of objects.

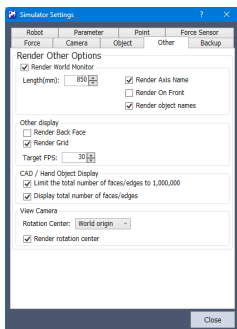


Render Object Options

Item	Description
Length	Set a length of the coordinate axis which shows an origin of the object.
Render Axis Name	Displays the coordinate axis names (X, Y, Z).
Render On Front	Display the arrow of "Render Object" in front of the object.

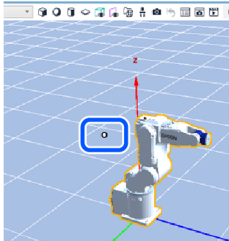
5.2.8 [Other]

Other settings related to 3D display.



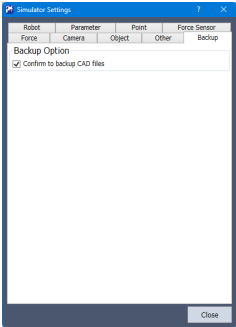
Render Other Options

Item	Description
Render World Monitor	Displays the World coordinates.
Length	Set a length of the coordinate axis which shows a world coordinate.
Render Axis Name	Displays the coordinate axis names (X, Y, Z).
Render On Front	Display the arrow of "Render Other" in front of the object.

Item	Description
Show object names	Displays the object name of the world coordinates. This setting is available only with Epson RC+ Standard Edition or higher. The label display is not available in the Basic Edition.
Render Back Face	Displays the surface of polygons.
Render Grid	Displays the grids on the simulator.
Target FPS	Sets 3D drawing performance. This is a target time of how long you want to take time to execute one 3D drawing (one frame). Depending on the model of computer you are using, the CPU may be overloaded and 3D drawing and RC+ operation may become slow. In these cases, setting a lower target FPS may improve the problem.
Limit the total surface/edge information data points to one million	The total number of polygons and polylines in the CAD data loaded is limited to a million each. Uncheck the box to remove this restriction. This will enable loading/displaying large-scale CAD data, but may cause the application to become unstable. To cancel the setting: Check your PC's performance and make sure you fully understand this limitation before deactivating it.
Display the current total of surface/edge information data points	This displays the total number of face and edge information data points loaded as CAD objects and Hand objects.
Rotation Center	This sets the center point for rotating the viewpoint. - World origin: World coordinate origin position - Clicked point: The position where the left mouse is clicked This setting is available only with Epson RC+ Standard Edition or higher. In the Basic Edition, the viewpoint always rotates around the origin of the world coordinate system.
Display Rotation Center	This displays a marker at the center point for rotating the view camera (viewpoint). A marker is displayed when the rotation of the viewpoint begins (when dragging starts), and the marker is hidden when the rotation ends (when dragging ends).  This setting is available only with Epson RC+ Standard Edition or higher. The marker is not displayed in the Basic Edition.

5.2.9 [Backup]

You can configure settings related to backing up simulator data.



Backup options

Item	Description
Confirm CAD file backup	When performing a controller backup, display a confirmation message asking whether to back up the CAD files.

5.3 Part/Mounted Device Settings

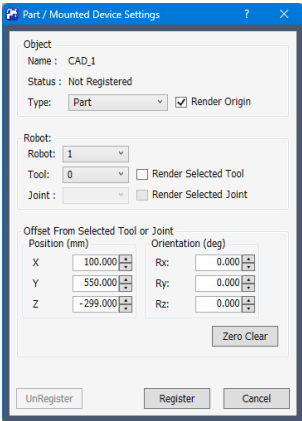
You can move the layout objects along with the robot like part such as workpieces grasped by the robot or devices mounted on the robot arm.

Set the layout objects for part/mounted device settings in the [Part/Mounted Device Settings] dialog. In the dialog, there are two methods to display

- Right-click the target object in the [Layout] panel. Select [Part/Mounted Device Settings] from the displayed context menu.
- If you click the  [Down arrow] button shown in [Type] on the Property Grid and change it to Part or Mounted Device, the [Part/Mounted Device Settings] dialog will appear.

There are two methods to reset the Part/Mounted Device Settings and return the [Type] to "Layout".

- Click the [UnRegister] button on the [Part/Mounted Device Settings] dialog.
- Select the "Layout" on the [Type] property of property grid.



Item	Description
Type	Select from the following. ▪ Layout: Layout object (default) ▪ Part: Part object ▪ Mounted Device: Mounted device
Render Object Origin	Display the object origin.

Item	Description
Robot #	Specify the robot to associate with the selected object.
Tool	When the [Type] is "Part", set the tool coordinate system to place an object.
Render Selected Tool	Display the tool coordinate system.
Joint	When the [Type] is "Mounted Device", set joint number to place an object.
Render Selected Joint	Display joints.
Offset From Selected Tool or Joint	Set a relative position from the selected tool or joint.
Zero Clear	Set the offset value to "0.000".
Register	Register an object to the selected type.
UnRegister	Return the registered [Type] of the object to "Layout".
Cancel	Cancel the settings.

The Part/Mounted Device Settings can also be configured from the property grid.

From the property grid, you can configure the following settings.

Property	Value
Type	Sets the object type being set. Click ▼ and select the type from the dropdown list. - Layout: Layout object (default) - Part: Part object - Mounted Device: Mounted device
Robot	Display the robot number to which the selected object is associated. If multiple robots are set, you can also change robots.
Tool	If the Type is "Part", the number of the tool coordinate system in which the object is placed is displayed. If multiple tool coordinate systems are set, the tool coordinate system can also be changed.
Joint	If the Type is "Mounted Device", the number of the joint where the object is placed is displayed. This can also be changed.
Offset Position	Display the position relative to the tool or joint being set. This can also be changed. It is linked to the setting value of the selected object's Position property, Tool property, or Joint property. Therefore, changes to these properties may cause the values to be updated automatically. Even in such cases, the values are correct as settings and do not affect the position of the object in 3D.
Offset Rotation	Display the orientation relative to the tool or joint being set. This can also be changed. It is linked to the setting value of the selected object's Rotation property, Tool property, or Joint property. Therefore, changes to these properties may cause the setting values to be updated automatically as follows: When Y is set at +90 degrees or -90 degrees, the X and Z settings are swapped. Even in such cases, the values are correct as settings and do not affect the orientation of the object in 3D.

5.4 Collision detection

In the simulation, collisions can be detected between the robots including its hand and the layout objects.

Here we describe the settings and details of collision detection.

5.4.1 Basic settings for collision detection

In the [Property Grid] of the robot, the following can be configured.

Collision Property	Value
Check	Enables / disables the collision detection for layout objects. ▪ Enable: True (default) ▪ Disable: False Even if this is enabled, it does not detect collision between the robot base and layout objects.
Check Self	Enables / disables the collision detection for a robot itself. ▪ Enable: True (default) ▪ Disable: False
Color	Specify color to be used when collision of the arms is detected. Default: 168,0,0

5.4.2 Target of collision detection

In the Property Grid of the layout objects, the following can be configured.

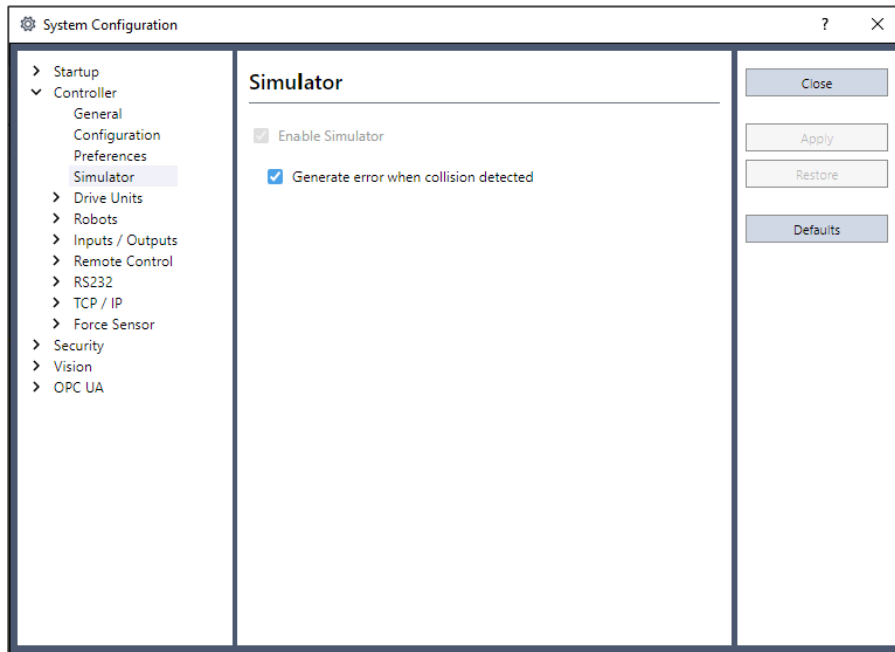
Collision

Property	Object	Value
Check	All	Enables / disables the collision detection. ▪ Enable: True (default) ▪ Disable: False Collision with the robot flange is not detected even when this property is set "True".
Show result	All	Specify how to display the color configured in Color property when the a collision is detected. ▪ Entirely: Whole (default) ▪ Collision point: Point ▪ Entire object and collision point: WholeAndPoint
Color	All	Specify the color to be used when collision of the arms is detected. Default: 168,0,0

5.4.3 Generate error when collision is detected

When you open the [Setup]-[System Configuration]-[Controller]-[Simulator] and check the [Generate error when collision detected] checkbox, if a collision is detected during SPEL+ program execution, an error occurs in the controller and the program stops.

After changing the checkbox and clicking the [Apply] button, click the [Close] button.



KEY POINTS

- The purpose of this function is to find where the program has a problem. It is not to prevent the collision of robots.
- It cannot guarantee that it has enough time for robots to stop when the simulator detects the collision.

5.4.4 Caution about the collision detection of Floor / Wall

A collision is detected when a floor or wall is in contact with the robot.

If the robot or plane positions are changed so that the robot passes completely through the plane, then no collision is detected.

5.4.5 Collision Detection Precision

The collision detection in the simulator cannot guarantee accuracy. Make sure to have a margin when you apply the simulation result for a real robot system.

5.4.6 Caution about the CAD data

Collision cannot be detected when the CAD data has only the wire frame models. To use the collision detection function, add surface to the CAD data.

For restrictions on the simulator, see below.

[Simulator Specifications and Restrictions](#)

5.5 CAD To Point (6-axis Robot)

CAD To Point outputs the edge (edge line) information included in the CAD data as a point data. This function enables the user to generate a point data according to the path by sequentially selecting the edges of the CAD data shown in the 3D display.

Since this function automatically registers points of manipulator motion based on the CAD data of the workpiece, it can save time to develop a program.

Follow the simple CAD data sample below to use CAD To Point. In this example, a motion in which the tip of a syringe traces a periphery of the CAD object (tray) will be created.

Follow the steps below:

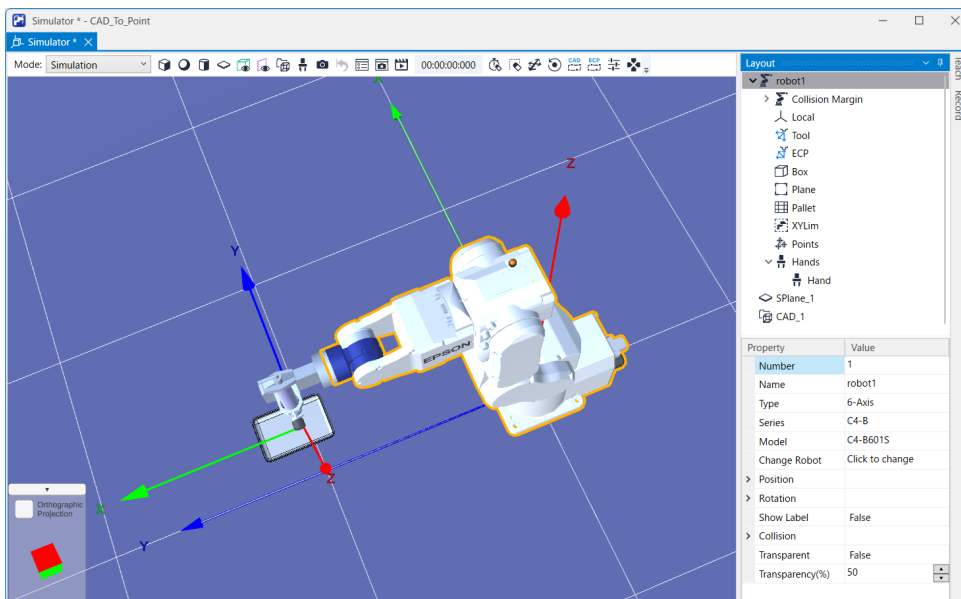
- Connect to the virtual controller (CADtoPoint C4-B)
- Open a project
- Select an edge of a CAD object and create a robot motion path
- Export the edges as point data
- Create a program
- Operate the robot by executing the program

1. Connect to the virtual controller (CADtoPoint C4-B)

Connection: CADtoPoint C4-B

Select "CADtoPoint C4-B" from the Epson RC+ 8.0 toolbar [Current controller connection] list box. When the connection is completed, "CADtoPoint C4-B" will be displayed in [Current controller connection] list box.

Click the  [Simulator] button on the toolbar to display the Simulator window. CADtoPoint C4-B contains CAD objects: "Work" and the Hand are placed.

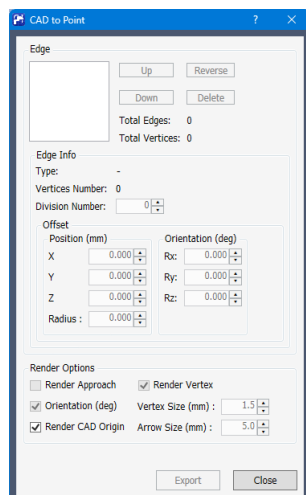


2. Open a project

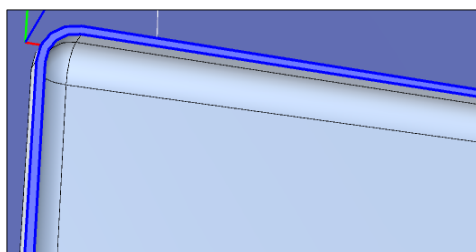
- i. Click [Open...] from [Project] on Epson RC+ 8.0 menu.
- ii. Select [Projects]-[SimulatorDemos]-[CAD_To_Point_C4_B].
- iii. Click the [Open] button.

3. Select an edge of a CAD object and create a robot motion path

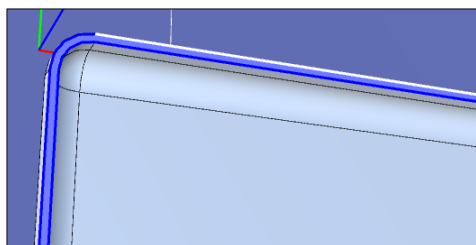
- i. Click the  [CAD to Point] button on the toolbar to display the [CAD to Point] dialog box.



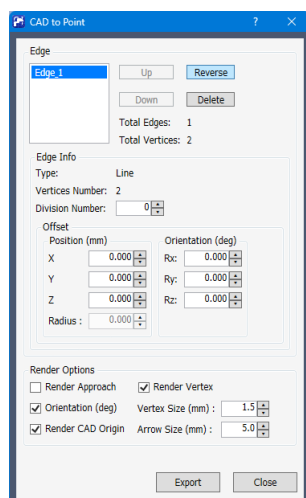
- ii. Hover the mouse over the CAD object and select a part having the edges. The selected part turns to be light blue and the edges are shown in blue.



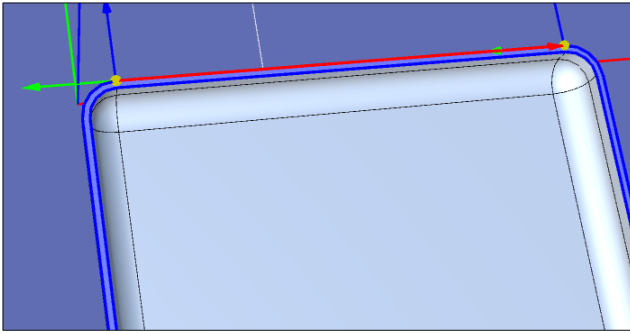
- iii. Hover the mouse over a desired blue edge. The selected edge turns to be white. Select the line first. This sample program will not operate properly when selecting the curve first since this is designed to select the line first.



- iv. Click the white edge. The selected edge will be shown in the [Edge] box of the [CAD to Point] dialog box.

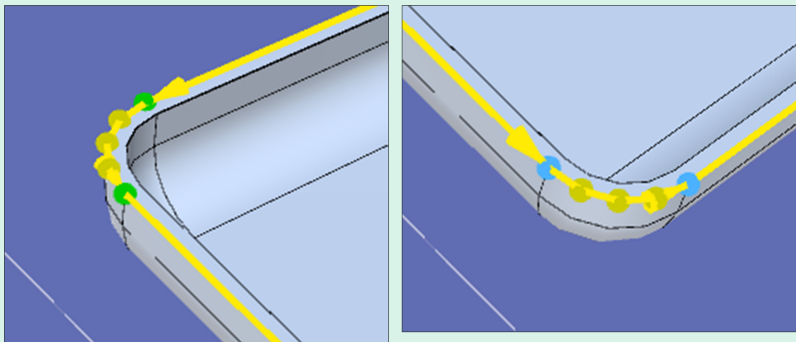


- v. In the 3D View, the selected edge is indicated with a red arrow.

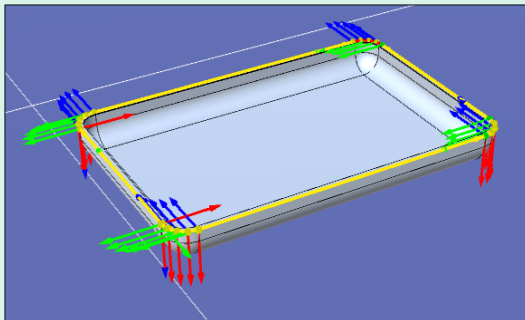


TIP

- The arrow indicates the direction from the starting point to the end point. The direction of the arrow can be reversed by clicking the [Reverse] button.
- If the start and end points of a consecutive edge with the same moving direction are piled up, the vertex color changes. When the both position (X,Y,Z) and orientation (U,V,W) match, the vertex is displayed in green. When only the position (X,Y,Z) matches, the vertex is displayed in light blue

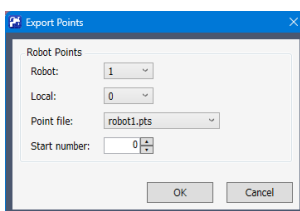


- The image will be shown as below after you select the edges one by one in counterclockwise to trace the periphery.

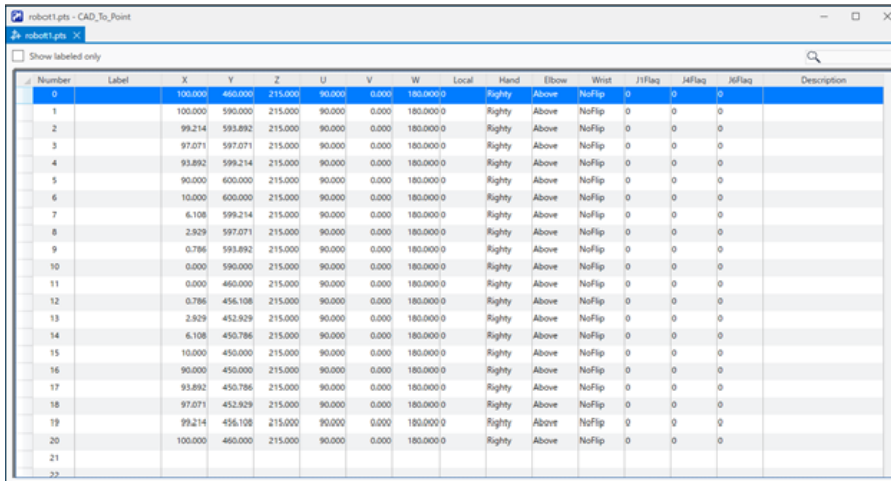


4. Export the edges as point data

Click the [Export] button on the [CAD to Point] dialog to display the [Export Points] dialog.



Click the [OK] button to output the point data to rows No. 0-20 in point file "robot1.pts".

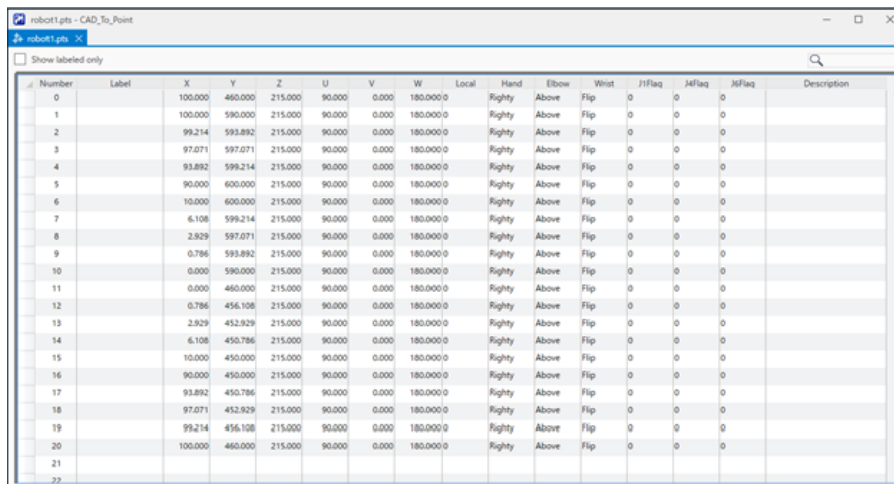


Number	Label	X	Y	Z	U	V	W	Local	Hand	Elbow	Wrist	J1Flag	J4Flag	J6Flag	Description
0		100.000	460.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
1		100.000	590.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
2		99.214	593.892	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
3		97.071	597.071	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
4		93.892	599.214	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
5		90.000	600.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
6		10.000	600.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
7		6.108	599.214	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
8		2.929	597.071	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
9		0.786	593.892	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
10		0.000	590.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
11		0.000	460.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
12		0.786	456.108	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
13		2.929	452.929	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
14		6.108	450.786	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
15		10.000	450.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
16		90.000	450.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
17		93.892	450.786	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
18		97.071	452.929	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
19		99.214	456.108	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
20		100.000	460.000	215.000	90.000	0.000	180.000/0		Righty	Above	NoFlip	0	0	0	
21															

5. Create a program

- i. Set the proper robot orientation for the point data.

Open the point file "robot1.pts" from the layout object, and change the wrist orientation (Wrist) of the exported No. 0-20 from "NoFlip" to "Flip".



Number	Label	X	Y	Z	U	V	W	Local	Hand	Elbow	Wrist	J1Flag	J4Flag	J6Flag	Description
0		100.000	460.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
1		100.000	590.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
2		99.214	593.892	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
3		97.071	597.071	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
4		93.892	599.214	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
5		90.000	600.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
6		10.000	600.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
7		6.108	599.214	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
8		2.929	597.071	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
9		0.786	593.892	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
10		0.000	590.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
11		0.000	460.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
12		0.786	456.108	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
13		2.929	452.929	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
14		6.108	450.786	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
15		10.000	450.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
16		90.000	450.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
17		93.892	450.786	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
18		97.071	452.929	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
19		99.214	456.108	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
20		100.000	460.000	215.000	90.000	0.000	180.000/0		Righty	Above	Flip	0	0	0	
21															

- ii. Create the following program in Main.prg program.

Function main

```
Motor On
TLSet 1, XY(-112, -41, 80, 0, -90, 0)
Tool 1
```

```
Go P0
Move P1 CP
Arc P3, P5 CP
Move P6 CP
Arc P8, P10 CP
Move P11 CP
Arc P13, P15 CP
Move P16 CP
Arc P18, P20 CP
```

```
Pulse 0, 0, 0, 0, 0, 0, 0
Motor Off
Fend
```

TIP

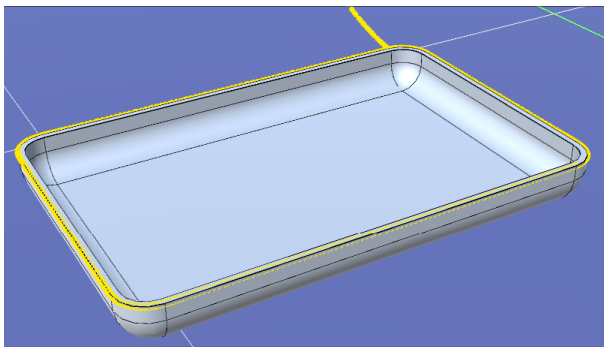
By using Tool coordinate system 1, the tip of the syringe can trace outlines of workpiece.

iii. Click the [Build] button on the toolbar. The program will be built.

When the build is complete, the message "Build complete, no errors" appears in the status window.

6. Operate the robot by executing the program

- i. Click the [Run Window] button on the toolbar  to display the Run window.
- ii. Click the [Start] button. When the message "Are you ready to start?" appears, click [Yes].
- iii. The program will be executed. Check that the manipulator moves from P0 to P20 sequentially and the tip of the syringe traces the edge of Work in counterclockwise direction.



5.6 CAD To Point (SCARA Robot)

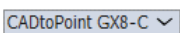
This section describes CAD to Point for a SCARA robot.

In this example, a motion in which the tip of a syringe traces a periphery of the CAD object (tray) will be created in the same way as a 6-axis robot.

Follow the steps below:

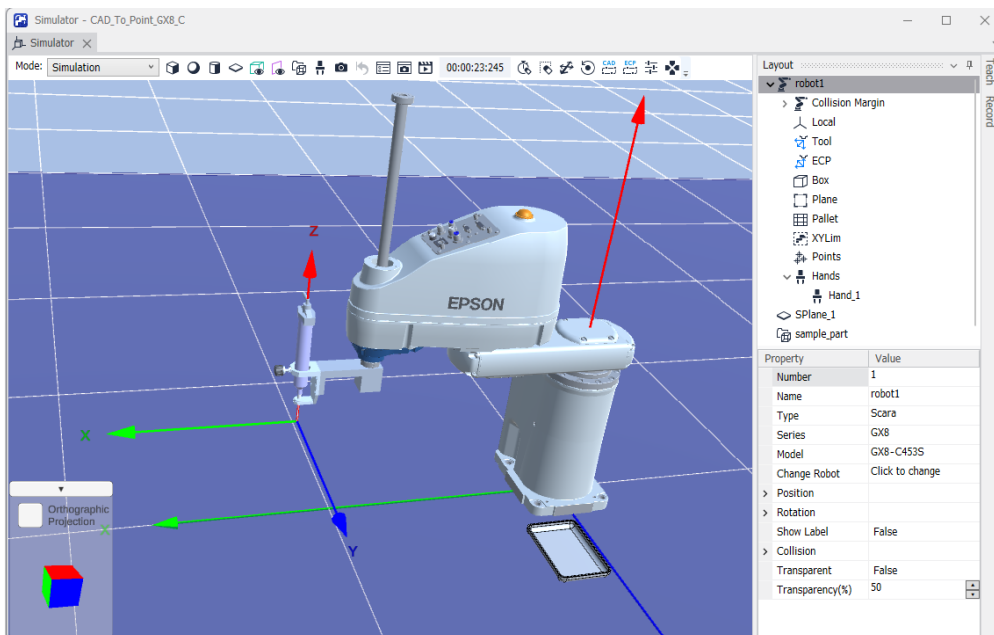
- Connect to the virtual controller (CADtoPoint GX8-C)
- Open a project
- Select an edge of a CAD object and create a robot motion path
- Export the edges as point data
- Create a program
- Operate the robot by executing the program

1. Connect to the virtual controller (CADtoPoint GX8-C)

Connection: 

Select "CADtoPoint GX8-C" from the Epson RC+ 8.0 toolbar [Current controller connection] list box. When the connection is completed, "CADtoPoint GX8-C" will be displayed in [Current controller connection] list box.

Click the  [Simulator] button on the toolbar to display the Simulator window. "CADtoPoint GX8-C" contains CAD objects: "sample_part" and Hand objects are placed.



2. Open a project

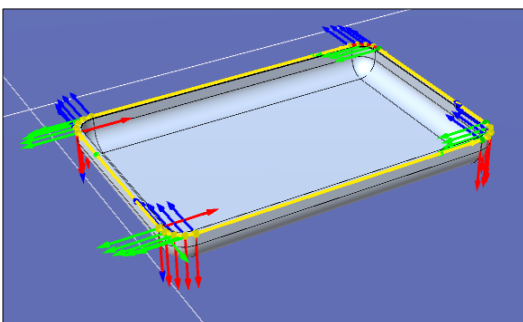
- i. Click [Open...] from [Project] on Epson RC+ 8.0 menu.
- ii. Select [Projects]-[SimulatorDemos]-[CAD_To_Point_GX8_C].
- iii. Click the [Open] button.

3. Select an edge of a CAD object and create a robot motion path

For selection of surface including edges and edges, see below.

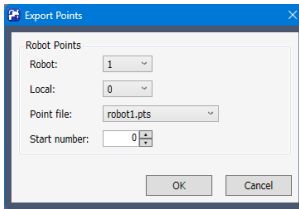
CAD To Point (6-axis Robot)

The image will be shown as below after you select the edges one by one in counterclockwise to trace the periphery.



4. Export the edges as point data

Click the [Export] button on the [CAD to Point] dialog to display the [Export Points] dialog.



Click the [OK] button to output the point data to rows No. 0-21 in point file "robot1.pts".

 A screenshot of the 'robot1.pts - CAD_To_Point_GX8_C' window. It shows a table with 24 rows and 8 columns: Number, Label, X, Y, Z, U, Local, and Hand. The 'Description' column is empty. The data is as follows:

Number	Label	X	Y	Z	U	Local	Hand
0		200.000	260.000	-184.000	90.000 0		Righty
1		200.000	390.000	-184.000	90.000 0		Righty
2		199.214	393.892	-184.000	90.000 0		Righty
3		197.071	397.071	-184.000	90.000 0		Righty
4		193.892	399.214	-184.000	90.000 0		Righty
5		190.000	400.000	-184.000	90.000 0		Righty
6		110.000	400.000	-184.000	90.000 0		Righty
7		106.108	399.214	-184.000	90.000 0		Righty
8		102.929	397.071	-184.000	90.000 0		Righty
9		100.786	393.892	-184.000	90.000 0		Righty
10		100.000	390.000	-184.000	90.000 0		Righty
11		100.000	260.000	-184.000	90.000 0		Righty
12		100.786	256.108	-184.000	90.000 0		Righty
13		102.929	252.929	-184.000	90.000 0		Righty
14		106.108	250.786	-184.000	90.000 0		Righty
15		110.000	250.000	-184.000	90.000 0		Righty
16		190.000	250.000	-184.000	90.000 0		Righty
17		193.892	250.786	-184.000	90.000 0		Righty
18		197.071	252.929	-184.000	90.000 0		Righty
19		199.214	256.108	-184.000	90.000 0		Righty
20		200.000	260.000	-184.000	90.000 0		Righty
21		200.000	260.000	-184.000	90.000 0		Righty
22							
23							
24							

5. Create a program

i. Create the following program in Main.prg program.

```
Function main

Speed 50, 50, 50
Accel 100,100,100,100,100,100
SpeedS 100
AccelS 400

TLSet 1, XY(-131, 0, -87, 0, 0, 0)
Tool 1
Go P0 :Z(-100)
SpeedS 50

Go P0
Move P1 CP
Arc P3, P5 CP
Move P6 CP
Arc P8, P10 CP
Move P11 CP
Arc P13, P15 CP
Move P16 CP
Arc P18, P20 CP

Go P0 :Z(-100)
```

```
Pulse 0, 0, 0, 0, 0, 0
Motor Off
```

Fend

TIP

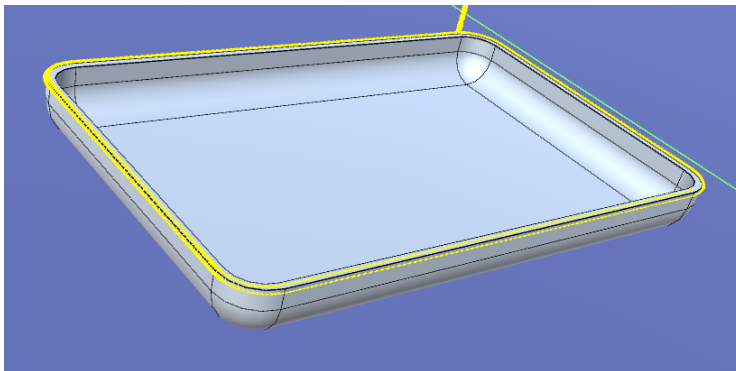
By using Tool coordinate system 1, the tip of the syringe can trace outlines of workpiece.

- ii. Click the [Build] button on the toolbar. The program will be built.

When the build is complete, the message "Build complete, no errors" appears in the status window.

6. Operate the robot by executing the program

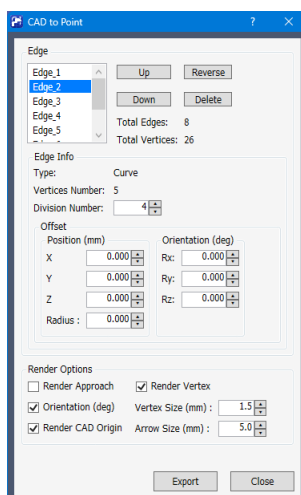
- i. Click the [Run Window] button on the toolbar  to display the Run window.
- ii. Click the [Start] button. When the message "Are you ready to start?" appears, click [Yes].
- iii. The program will be executed. Check that the manipulator moves from P0 to P21 sequentially and the tip of the syringe traces the edge of sample_work in counterclockwise direction.



5.7 Function of CAD to Point

CAD

Press the  [CAD to Point] button on the toolbar to display the [CAD to Point] dialog box.



Edge

Item	Description
[Up] button	Move the order of the selected edge to up.
[Down] button	Move the order of the selected edge to down.
[Reverse] button	Switch the start point and end point of the selected edge. Red arrow on the edge indicates the direction from start point to end point.
[Delete] button	Delete the selected edge.

Edge Information

Item	Description
Type	Display the type of the selected edge. Types are Line, Curve, and Composite Curve.
Vertex Number	Display the number of vertex of selected edge. Increase or decrease division number to increase or decrease the number of vertex.
Division number	Set the division number of the selected edge.

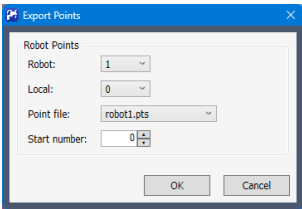
Offset

Item	Description
Pos.	Enable to move the vertex position to X, Y, and Z direction. Refer to the coordinate system of CAD object for the directions. Also, enable to expand or decrease from the center of the arc to radius direction if the edge is curve or composite curve which can approximate to the arc.
Orientation	Enable to rotate tool orientation to Rx, Ry, and Rz direction. Refer to the coordinate system of CAD object for the directions.

Render Option

Item	Description
Render Approach	Display the Z-axis (red arrow) of the render orientation to the vertex. It is useful when Z-axis of the render orientation cannot be seen due to workpieces.
Render Orientation	Display the orientation on the vertex. Only displays when the vertex is displayed.
Render CAD Origin	Display the origin of CAD object in coordinate system.
Render Vertex	Display the vertex of the selected edge.
Vertex Size	Set the vertex size.
Arrow Size	Change an arrow size that is directed to start point to end point of the selected edge.

Click the [Export Points] button on the [CAD to Point] dialog to display the [Export Points] dialog.



Point output

Item	Description
Robot #	Set the robot to output the points.
Local	Set the local coordinate to output the points.
Point File	Set the point file to output the points.
Start Number	Set the start number of outputting points.

5.8 CAD to Point for ECP (6-axis Robot)

CAD To Point for ECP is a function to output edge line information which is included in CAD data as point data to operate external control point (ECP) motion. You can use the ECP function with the virtual controller. If you want to use it with the actual controller, you will need to purchase ECP license. By the robot grasps workpiece and selecting edges of CAD objects on the 3D view sequentially, you can generate point data along with the motion path. The robot motion points can be registered automatically based on CAD data such as part. Therefore, development time of programs can be shortened.

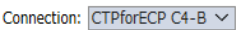
Use a sample using easy CAD data to execute CAD To Point for ECP.

In the example, create a motion to follow an outer circumference of grasped CAD object (tray) by the robot on the edge of fixed syringe.

Follow the steps below:

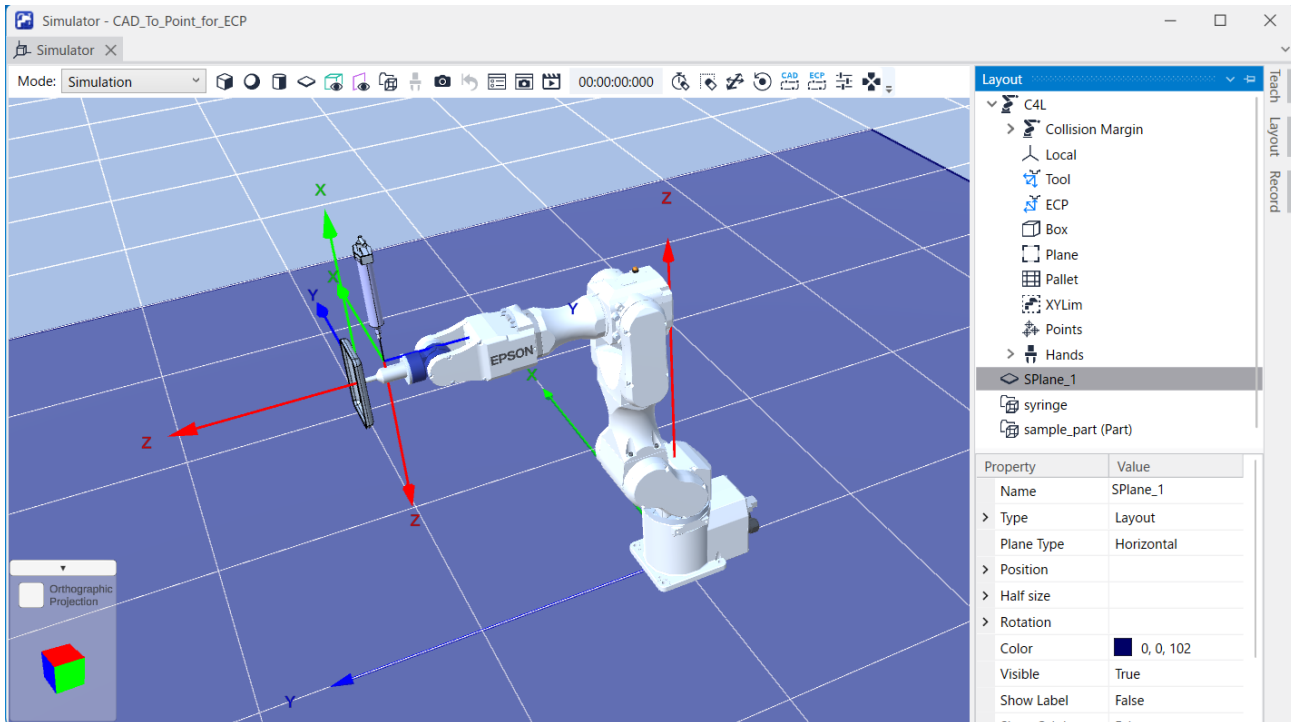
- Connect to virtual controller "CTPforECP C4-B"
- Open a project
- Select CAD Object and ECP
- Select an edge of a CAD object and create a robot motion path
- Export the edges as point data
- Create a program
- Operate the robot by executing the program

1. Connect to virtual controller "CTPforECP C4-B"



Select "CTPforECP C4-B" of [Connection:] on Epson RC+ 8.0 toolbar. When the connection is complete, "CTPforECP C4-B" is displayed in the [Connection:] box.

Click the  [Simulator] button on the toolbar to display the Simulator window. CAD objects: "sample_part" and "syringe", and Hand objects are placed.

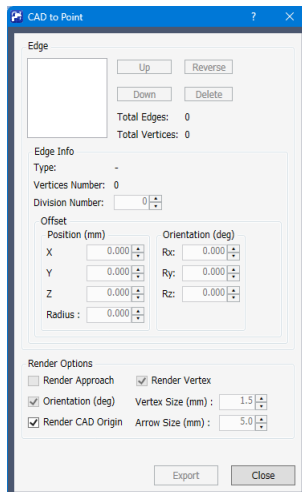


2. Open a project

- i. Click [Open...] from [Project] on Epson RC+ 8.0 menu.
- ii. Select [Projects]-[SimulatorDemos]-[CTP_for_ECP_C4_B].
- iii. Click the [Open] button.

3. Select CAD Object and ECP

- i. Click the  [CAD to Point for ECP button on the toolbar to display the [Select CAD Object and ECP] dialog.

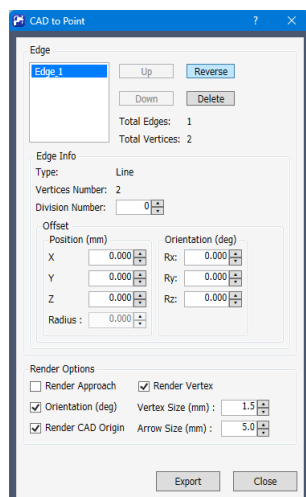


ii. Set as follows.

- CAD: sample_part
- Robot: 1
- Tool: 1
- Offset settings (X, Y, Z, Rx, Ry, Rz): 0.000
- ECP: 1

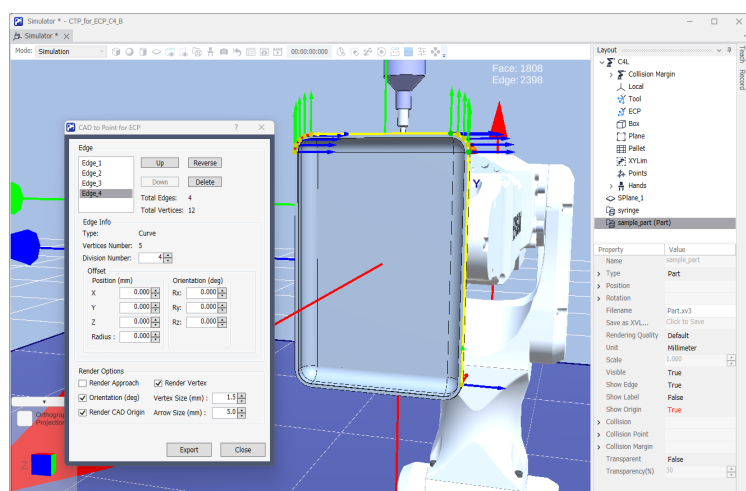
4. Select an edge of a CAD object and create a robot motion path

- i. Click the [Select Edge] button to display the [CAD to Point (ECP Support)] dialog.

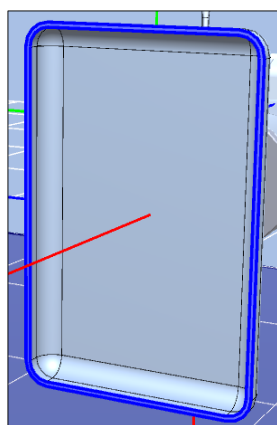


- ii. To operate the sample program properly, select edges in counter clockwise rotation sequentially from edge of straight part of right tray. For selection of surface including edges and edges, see below.

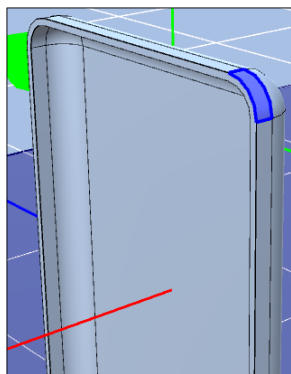
CAD To Point (6-axis Robot)



The straight part indicates edges on flat surface on the outer circumference.



The curve part indicates edges on side of the tray.



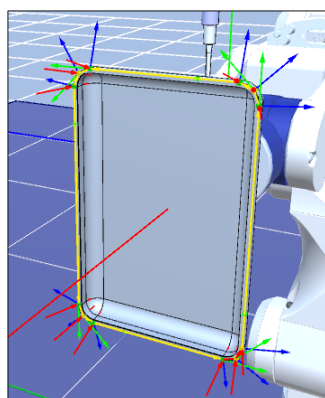
For division number and offset for each edge, refer to the following values.

Edge number			1	2	3	4	5	6	7	8
Type			Straight	Curve	Straight	Curve	Straight	Curve	Straight	Curve
Division number			0	2	0	2	0	2	0	2
Offset	Position (mm)	X	0	0	0	0	0	0	0	0
		Y	0	0	0	0	0	0	0	0
		Z	0	0	0	0	0	0	0	0
	Orientation (deg)	Rx	20	-70	20	-70	20	-70	20	-70
		Ry	0	0	0	0	0	0	0	0
		Rz	0	0	-90	0	180	90	90	180

TIP

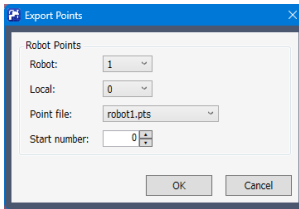
The arrow direction of edges indicates direction of start and end point of generating point. By clicking the [Reverse] button, you can reverse the arrow direction. Make sure to set the arrow direction will be counterclockwise rotation.

When all edges are set properly, it will be as follows.



5. Export the edges as point data

Click the [Export Points] button of the [CAD to Point (ECP Support)] dialog to display the [Export Points] dialog.



Click the [OK] button to output the point data to rows No. 0-12 in point file "robot1.pts".

6. Create a program

i. Set the proper robot orientation for the point data.

Open the point file "robot1.pts" from the layout objects and perform the following.

- Wrist orientation (Wrist) of output point No.0-12: NoFlip → Flip
- J6Flag of point No. 10-12: 0 → 1

robot1.pts - CAD_To_Point_for_ECP																
robot1.pts																
Show labeled only																
Number	Label	X	Y	Z	U	V	W	Local	Hand	Elbow	Wrist	J1Flag	J4Flag	J6Flag	Description	
0		65.000	641.854	718.804	0.000	0.000	-20.000	0	Righty	Above	Flip	0	0	0		
1		-65.000	641.854	718.804	0.000	0.000	-20.000	0	Righty	Above	Flip	0	0	0		
2		-17.678	674.035	707.091	-43.219	-13.995	-14.433	0	Righty	Above	Flip	0	0	0		
3		40.000	665.347	710.253	-90.000	-20.000	-0.000	0	Righty	Above	Flip	0	0	0		
4		-40.000	665.347	710.253	-90.000	-20.000	-0.000	0	Righty	Above	Flip	0	0	0		
5		17.678	674.035	707.091	-136.781	-13.995	14.433	0	Righty	Above	Flip	0	0	0		
6		65.000	641.854	718.804	-180.000	0.000	20.000	0	Righty	Above	Flip	0	0	0		
7		-65.000	641.854	718.804	180.000	0.000	20.000	0	Righty	Above	Flip	0	0	0		
8		-17.678	674.035	707.091	136.781	13.995	14.443	0	Righty	Above	Flip	0	0	0		
9		40.000	665.347	710.253	90.000	20.000	0.000	0	Righty	Above	Flip	0	0	0		
10		-40.000	665.347	710.253	90.000	20.000	0.000	0	Righty	Above	Flip	0	0	1		
11		17.678	674.035	707.091	43.219	13.995	-14.443	0	Righty	Above	Flip	0	0	1		
12		65.000	641.854	718.804	0.000	0.000	-20.000	0	Righty	Above	Flip	0	0	1		
13																
14																
15																

ii. Create the following program in Main.prg program.

```
Function main
```

```
Motor On
Power High
```

```
Tool 1
ECP 1
```

```
Go P0
```

```
Move P1 ECP CP
Arc3 P2, P3 ECP CP
```

```
Move P4 CP
Arc3 P5, P6 ECP CP
```

```
Move P7 CP
Arc3 P8, P9 ECP CP
```

```

Move P10 CP
Arc3 P11, P12 ECP CP

Pulse 0, 0, 0, 0, 0, 0
Motor Off

Fend

```

iii. Click the [Build] button on the toolbar. The program will be built.

When the build is complete, the message "Build complete, no errors" appears in the status window.

7. Operate the robot by executing the program

- i. Click the [Run Window] button on the toolbar  to display the Run window.
- ii. Click the [Start] button. When the message "Are you ready to start?" appears, click [Yes].
- iii. Confirm that the program is executed and follow an outer circumference of grasped CAD object (tray) by the robot on the edge of fixed syringe to operate ECP motion.

Functions of CAD to Point for ECP

Click the  [CAD to Point for ECP button on the toolbar to display the [CAD to Point (ECP Support)] dialog. For functions, see below.

CAD To Point (6-axis Robot) - "Function of CAD to Point"

5.9 CAD to Point for ECP (SCARA Robot)

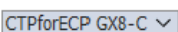
This section describes CAD to Point for ECP for a SCARA robot.

In the example, create a motion to follow an outer circumference of grasped CAD object (tray) by the robot on the edge of fixed syringe.

Follow the steps below:

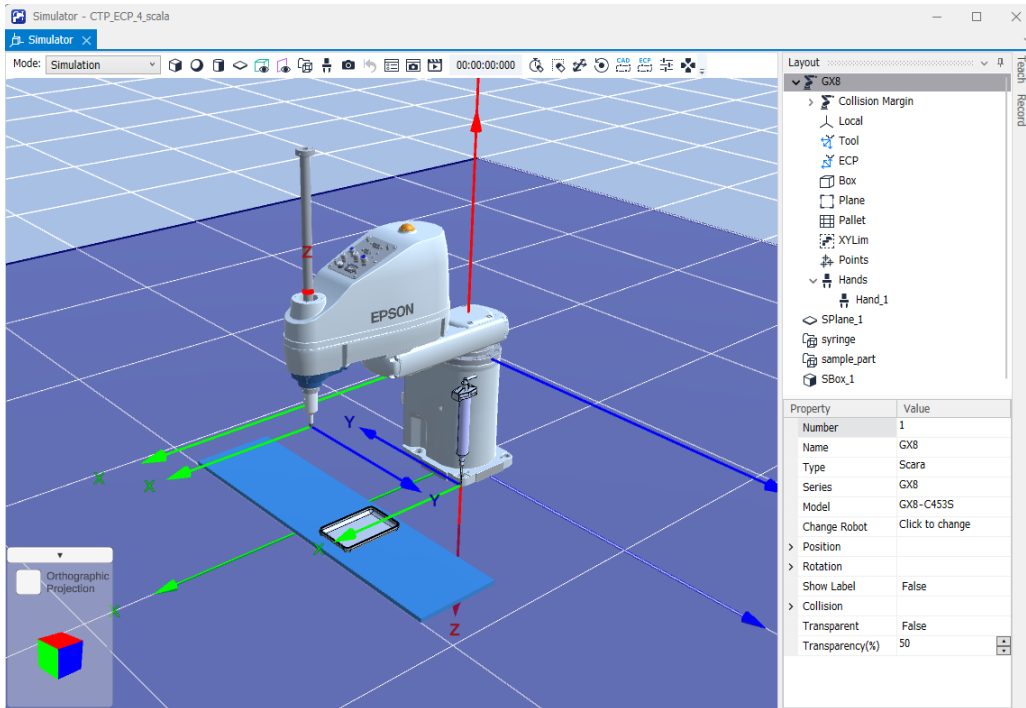
- Connect to virtual controller "CTPforECP GX8-C"
- Open a project
- Select CAD Object and ECP
- Select an edge of a CAD object and create a robot motion path
- Export the edges as point data
- Create a program
- Operate the robot by executing the program

1. Connect to virtual controller "CTPforECP GX8-C"

Connection: 

Select "CTP for ECP" of [Connection:] on Epson RC+ 8.0 toolbar. When the connection is complete, "CTP for ECP" is displayed in the [Connection:] box.

Click the  [Simulator] button on the toolbar to display the Simulator window. CAD objects: "sample_part" and "syringe", and Hand objects are placed.

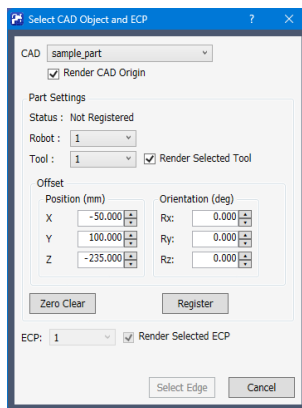


2. Open a project

- i. Click [Open...] from [Project] on Epson RC+ 8.0 menu.
- ii. Select [Projects]-[SimulatorDemos]-[CTP_for_ECP_GX8_C].
- iii. Click the [Open] button.

3. Select CAD Object and ECP

- i. Click the  [CAD to Point for ECP] button on the toolbar to display the [Select CAD Object and ECP] dialog.

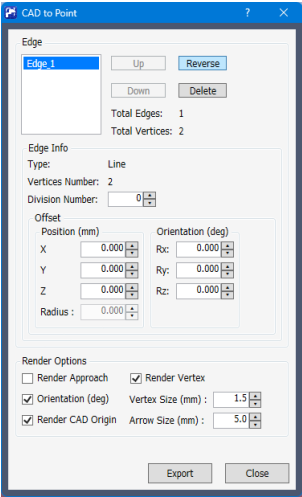


ii. Set as follows.

- CAD: sample_part
- Robot: 1
- Tool: 1
- Offset settings (X, Y, Z, Rx, Ry, Rz): 0, 0, -2, 0, 0, 0
- ECP: 1

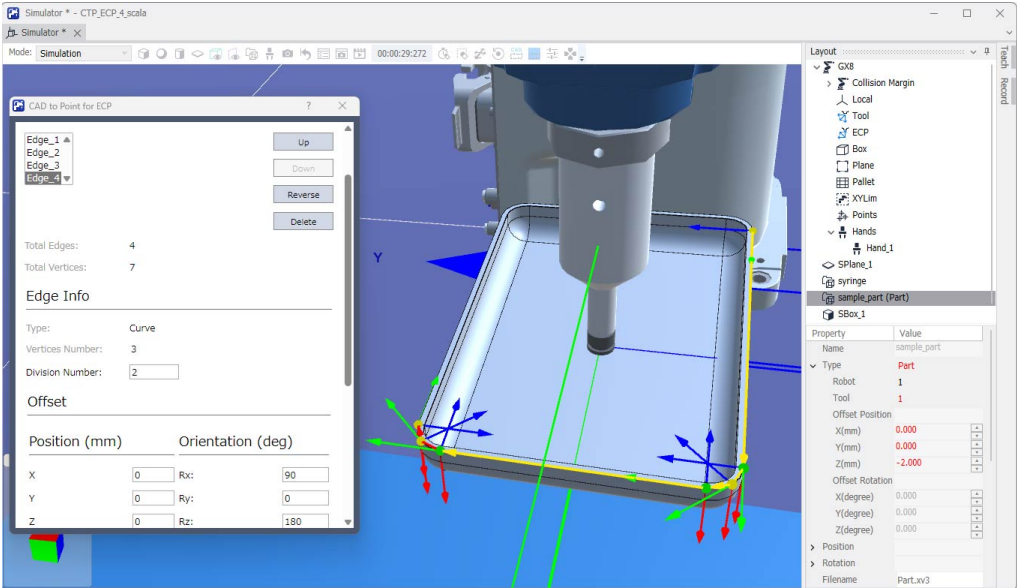
4. Select an edge of a CAD object and create a robot motion path

- i. Click the [Select Edge] button to display the [CAD to Point (ECP Support)] dialog.

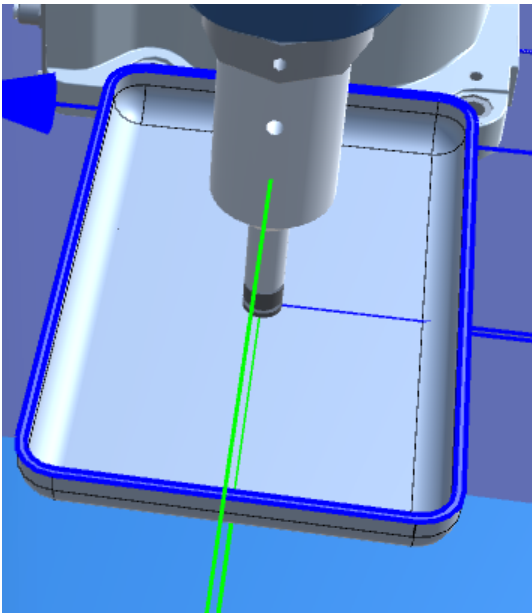


ii. To operate the sample program properly, select edges in clockwise rotation sequentially from edge of straight part of right tray. For selection of surface including edges and edges, see below.

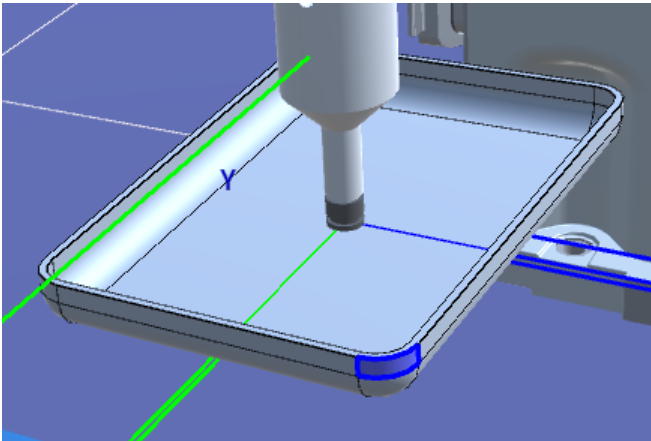
CAD To Point (6-axis Robot)



The straight part indicates edges on flat surface on the outer circumference.



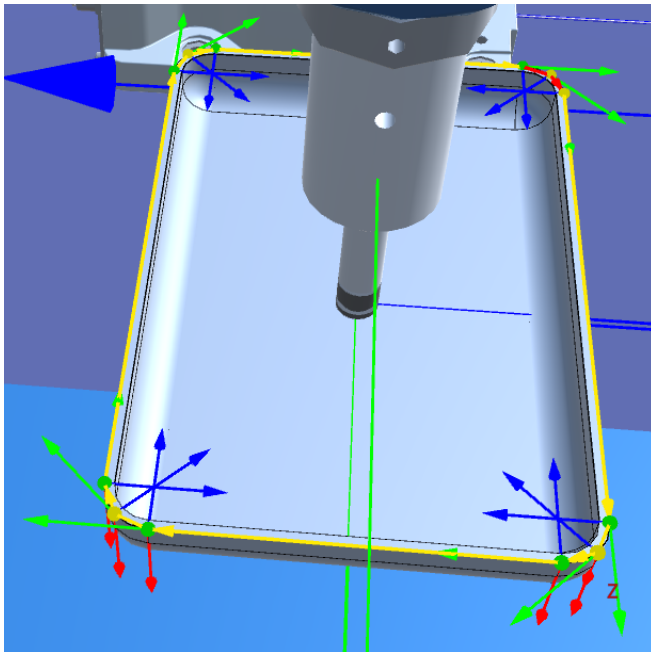
The curve part indicates edges on side of the tray.



For division number and offset for each edge, refer to the following values.

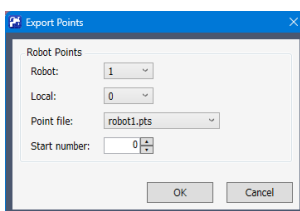
Edge number			1	2	3	4	5	6	7	8
Type			Straight	Curve	Straight	Curve	Straight	Curve	Straight	Curve
Division number			0	2	0	2	0	2	0	2
Offset	Position (mm)	X	0	0	0	0	0	0	0	0
		Y	0	0	0	0	0	0	0	0
		Z	0	0	0	0	0	0	0	0
	Orientation (deg)	Rx	0	90	0	90	0	90	0	90
		Ry	0	0	0	0	0	0	0	0
		Rz	0	180	90	180	180	0	-90	-90

When all edges are set properly, it will be as follows.



5. Export the edges as point data

Click the [Export Points] button of the [CAD to Point (ECP Support)] dialog to display the [Export Points] dialog.



Click the [OK] button to output the point data to rows No. 0-12 in point file "robot1.pts".

6. Create a program

i. Set the proper robot orientation for the point data.

Open the point file "robot1.pts" from the layout objects and perform the following.

- Output U value of point No. 6: -180.000 → 180.000
- Output U value of point No. 8: -135.000 → 225.000
- Output U value of point No. 9-10: -90.000 → 270.000
- Output U value of point No. 11: -45.000 → 315.000
- Output U value of point No. 12: 0.000 → 360.000

robot1.pts - CTP_ECP_4_scale									
robot1.pts									
☐ Show defined only									
Number	Label	X	Y	Z	U	Local	Hand	Description	
0		265.000	150.000	-213.000	0.000	0	Righty		
1		135.000	150.000	-213.000	45.000	0	Righty		
2		182.322	115.754	-213.000	90.000	0	Righty		
3		240.000	125.000	-213.000	135.000	0	Righty		
4		160.000	125.000	-213.000	180.000	0	Righty		
5		217.678	115.754	-213.000	225.000	0	Righty		
6		265.000	150.000	-213.000	270.000	0	Righty		
7		135.000	150.000	-213.000	315.000	0	Righty		
8		182.322	115.754	-213.000	360.000	0	Righty		
9		240.000	125.000	-213.000			Righty		
10		160.000	125.000	-213.000			Righty		
11		217.678	115.754	-213.000			Righty		
12		265.000	150.000	-213.000			Righty		
13									

ii. Create the following program in Main.prg program.

```
Function main2

Motor On
Power High

Tool 1
ECP 1

Go P0 +Z(-10)

Go P0

Move P1 ECP CP
Arc3 P2, P3 ECP CP

Move P4 CP
Arc3 P5, P6 ECP CP

Move P7 CP
Arc3 P8, P9 ECP CP

Move P10 CP
Arc3 P11, P12 ECP CP

Move P12 +Z(-50)

Pulse 0, 0, 0, 0
Motor Off

Fend
```

iii. Click the [Build] button on the toolbar. The program will be built.

When the build is complete, the message "Build complete, no errors" appears in the status window.

7. Operate the robot by executing the program

- i. Click the [Run Window] button on the toolbar  to display the Run window.
- ii. Select a function "main2" created in step 6, and then click the [Start] button." When the message "Are you ready to start?" appears, click [Yes].
- iii. Confirm that the program is executed and follow an outer circumference of grasped CAD object (tray) by the robot on the edge of fixed syringe to operate ECP motion.

Functions of CAD to Point for ECP

Click the  [CAD to Point for ECP button on the toolbar to display the [CAD to Point (ECP Support)] dialog. For functions, see below.

CAD To Point (6-axis Robot) - "Function of CAD to Point"

Combination with Pick & Place operation

This sample project contains a program that combines the Pick & Place operation of "sample_part" and the ECP operation created up to this point as a "main" function. Confirm the operation by following the steps.

1. Click the [Run Window] button on the toolbar to display the Run window.
2. Select the function "SetDefaultSetting" and then click the [Start] button.

When the message "Are you ready to start?" appears, click [Yes]. The robot and "sample_part" will be reset to their default positions and postures.

3. Select the function "main", and then click the [Start] button.

As in (2), When the message "Are you ready to start?" appears, click [Yes]. You will see the robot grasp the "sample_part" on the moving conveyor, trace its perimeter with ECP motion, and then reposition the "sample_part" on the conveyor.

The Pick & Place operation can be performed with the SimSet command. For more details, refer to the following manual.

"SPEL+ Language Reference"

5.10 Virtual Controller

To execute programs in the simulator, you need to create a virtual controller with defined robot and layout.

Robot settings and layout settings for the 3D display are saved for each virtual controller. If you want to transfer the robot or layout data, you can copy and transfer the data.

The virtual controller connection created by the Epson RC+ 8.0 cannot be used in lower versions of Epson RC+.

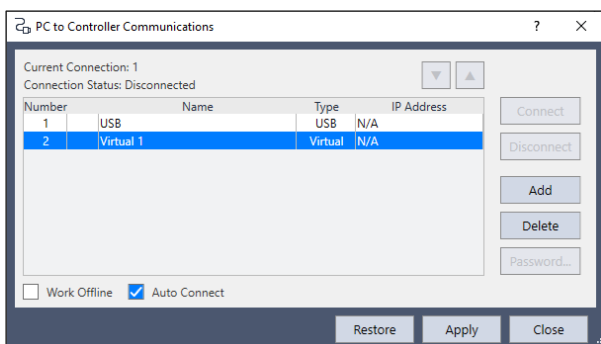
Create a new virtual controller

See details below.

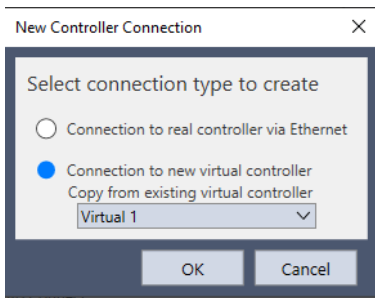
Working with the User Created System

Copy the sample or configured virtual controller

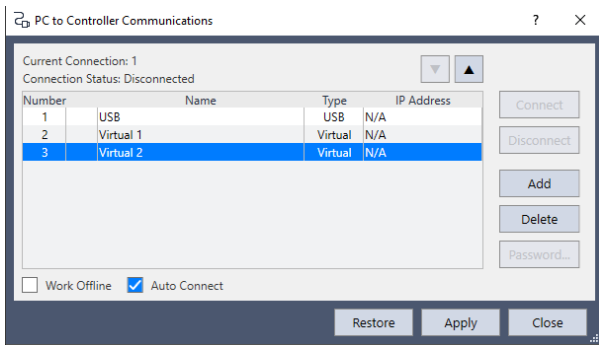
1. Click the  [Connection] button on the Epson RC+ 8.0 toolbar. The [PC to Controller Communications] dialog box is displayed.



2. Click the [Add] button. The [New Controller Connection] dialog appears.
3. Select [Connection to new virtual controller] and specify a virtual controller from the list box. Click the [OK] button.



4. A new virtual controller named "Virtual 2" is created. Click the [Apply] button.



5. Click the [Close] button to return to the Epson RC+ 8.0 main window.

6. Connect to "Virtual 2" and display the [Robot Simulator] window. The robot setting and layout setting of 3D display has been taken over from "Virtual 1".

7. When you want to change the robot type, use the [Change Robot] in the robot object property. See details below.

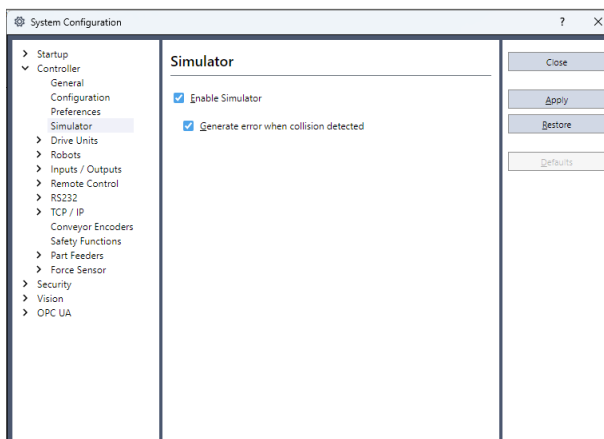
Property Grid Pane

5.11 Connection with controller

Enable the Simulator in controller

From the Epson RC+ 8.0 menu-[Setup]-[System Configuration]-[Controller]-[Simulator], check the [Enable Simulator] checkbox to enable the simulator function.

After checking the checkbox, click the [Apply] button and then click the [Close] button.



If collision with the simulator object is detected during a Jog motion or a robot motion command execution when the Simulator is enabled, the Manipulator stops operation and a Warning occurs.

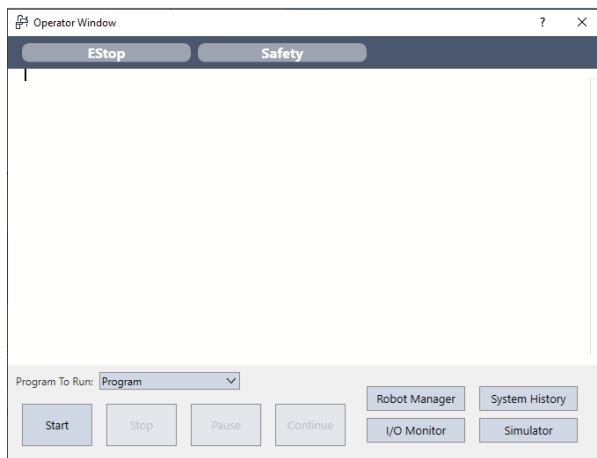
To avoid collision with peripherals by using the Simulator, set 15 mm or greater margins to the simulator object.

Function restrictions when connected with controller

- You cannot change the manipulator from the [Robot Simulator] window.
- You cannot select and move a robot arm in the Simulator window. However, this is possible when the controller is set to Dry Run.
- When a robot connected to the controller is not supported by the simulator, the robot will not appear in the layout tree and 3D window.
- The [Record/Playback] functions are not available.

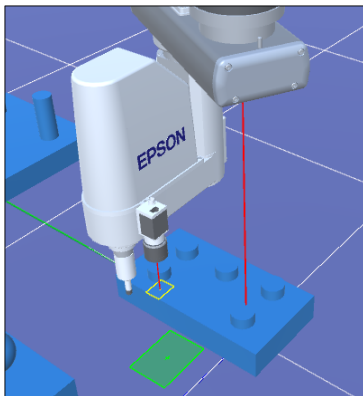
Operator Window

When you enable the simulator, the [Simulator] button is added to the Operator Window. When you click on the [Simulator] button, the 3D display window appears.



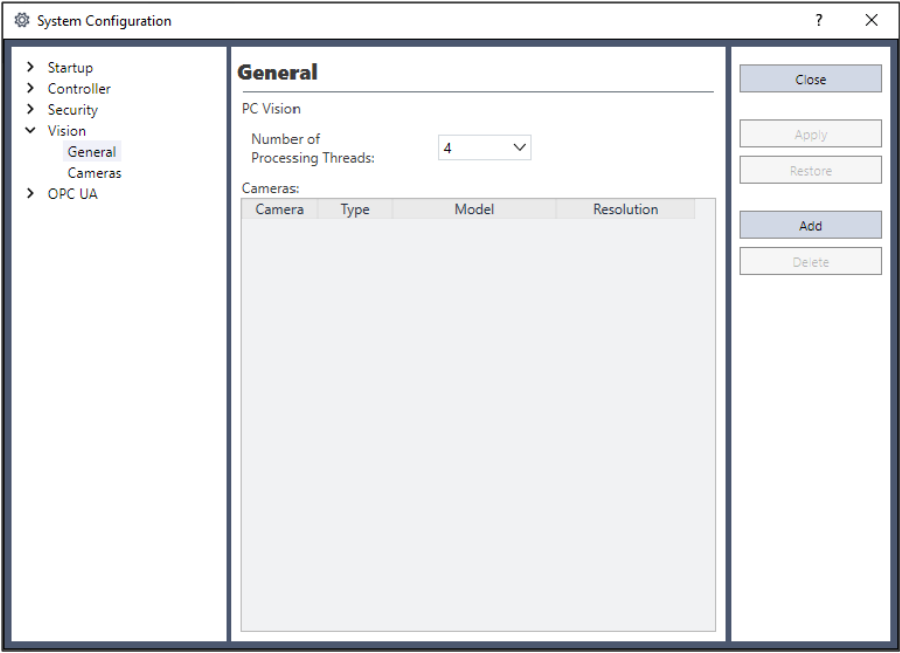
5.12 Virtual Camera Settings

Virtual camera settings are function to select camera or lens, and install as the fixed camera or mount as the mobile camera to the robot.

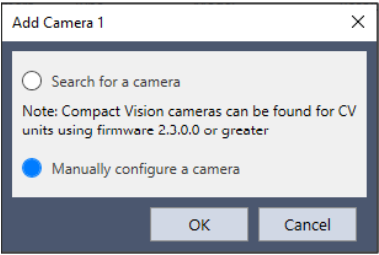


Add virtual cameras

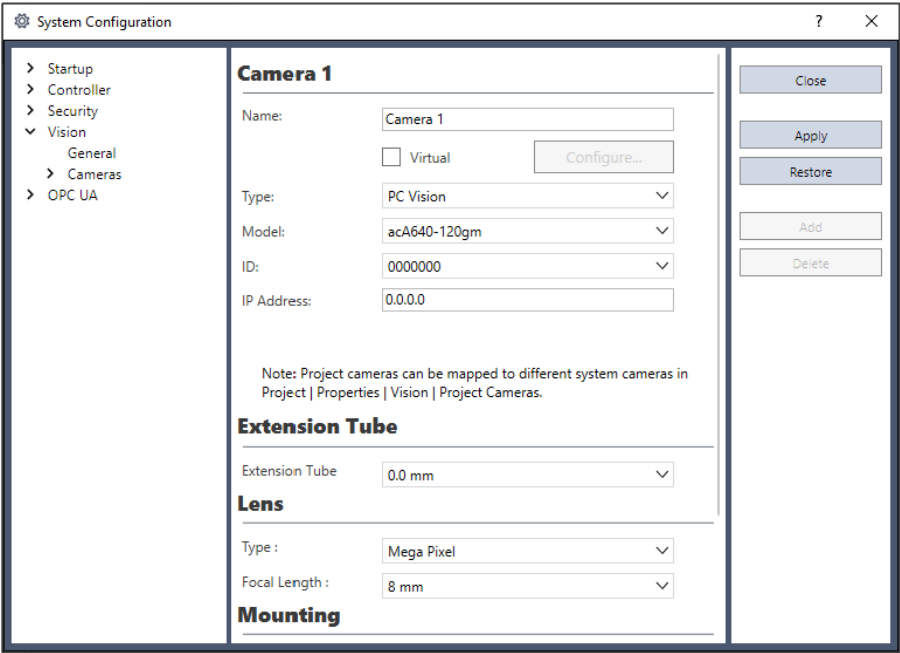
1. When you click the toolbar  [Camera] button, the camera settings window of the [System Configuration] dialog appears. Click the [Add] button.



2. Select [Manually Configure a Camera] and click the [OK] button.



3. The Configure Camera window is displayed. Set the camera type, mount type, etc.



4. Check the [Virtual] checkbox and click the [Apply] button. The camera is added to the 3D view.

In addition to manually selecting extension tubes, lenses, and such as described above, another method for adding a virtual camera is to use the [Camera Lens Tool].

When parameters such as the width and height of the field of view are entered, the optimum combination of camera, lens, and extension tube can be automatically calculated and selected.

For details on Camera Lens Tool, refer to the following manual.

“Vision Guide 8.0 Hardware & Setup - Setup - Software Configuration - Camera Lens Tool”

Camera Lens Tool

ParametersResults

Width: 250.00 mm

Height: 200.00 mm

Working Distance: 1846.54 mm

Focal Length: 50.00 mm

Camera: acA1300-60gm
acA1300-60gm

Lens: 50 mm (M5018-MP2)

Extension Tube:

Resolution: 0.195 mm/pixel

DOF: 25.9 mm (F1.8)
231.2 mm (F16.0)

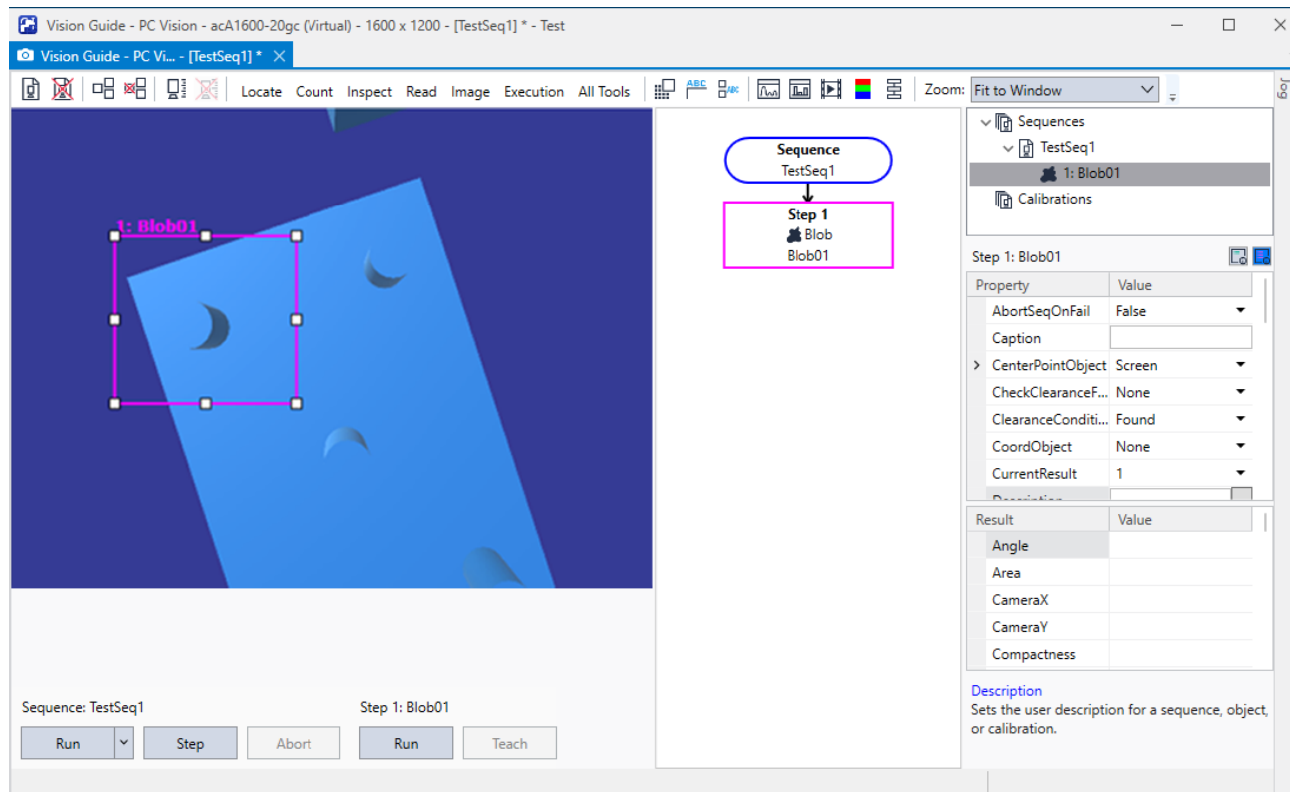
Save

	Camera	Lens	Extension Tube	Width	Height	Resolution	Working Dist
☒	acA1300-60gm	50 mm (M5018-MP2)		250.00 mm	200.00 mm	0.195 mm/pixel	1846.54 mm
☐	acA1300-60gm	50 mm (V5028-MPY)		250.00 mm	200.00 mm	0.195 mm/pixel	1913.94 mm
☐	NS4133BU/CU	50 mm (M5018-MP2)		250.00 mm	200.00 mm	0.195 mm/pixel	1846.54 mm
☐	NS4133BU/CU	50 mm (V5028-MPY)		250.00 mm	200.00 mm	0.195 mm/pixel	1913.94 mm
☐	acA1300-60gm	35 mm (V3528-MPY)		250.00 mm	200.00 mm	0.195 mm/pixel	1304.97 mm
☐	acA1300-60gm	35 mm (HF3520-12M)		250.00 mm	200.00 mm	0.195 mm/pixel	1266.87 mm
☐	NS4133BU/CU	35 mm (V3528-MPY)		250.00 mm	200.00 mm	0.195 mm/pixel	1304.97 mm

Vision Guide synchronization

A virtual camera can be configured as a camera in Vision Guide.

The image on the 3D display, as seen from the virtual camera, allows for the use of Vision Guide's image processing capabilities.



KEY POINTS

Depending on the combinations of the actual cameras and lens, mechanical vignetting occurs and the area around the image is captured black. The combinations that cause mechanical vignetting are shown below. Please be noted when using an actual camera.

Camera model	Lens type	Focal length
acA1300-60gm	Standard	12 mm
acA2500-20gm/gc	Standard	8mm, 12mm, 16mm, 50mm
	mega-pixel	8mm, 12mm, 16mm, 25mm, 50mm
	mega-pixel (HF)	8mm, 12mm, 16mm, 25mm
acA5472-5gm/gc	Standard	8mm, 12mm, 16mm, 50mm
	mega-pixel	8mm, 12mm, 16mm, 25mm, 50mm
	mega-pixel (HF)	8mm, 12mm, 16mm, 25mm

5.13 Motion restriction by BOX

By using the BOX command together with the GetRobotInsideBox function or the OnErr command, robot power and motion can be restricted when the tool center point (TCP) enters the approach check area (BOX).

Sample project using BOX

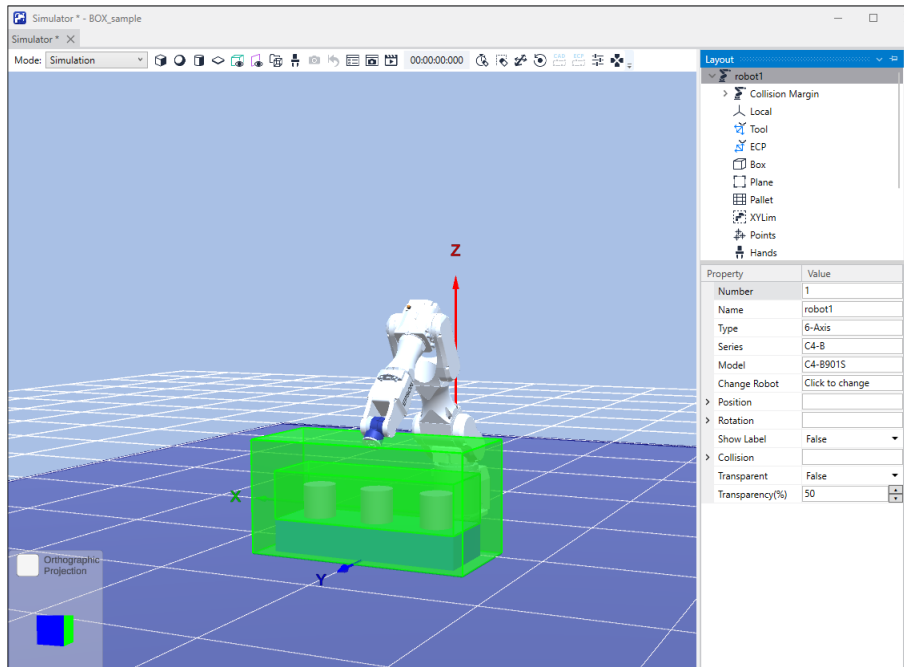
In the sample project, BOX2 is set outside BOX1. When the tool center point calculated based on the currently selected tool enters BOX2, the robot will stop temporarily. If the program execution is continued, the robot will resume operation in the restricted status (low speed, low power). Then, when the robot enters BOX1 inside BOX2, the robot will abort operation.

Use the sample project to execute the motion restriction using BOX. The projects is located in the following folders:

- For 6-axis robot: \EpsonRC80\projects\SimulatorDemos\BOX_sample_C4_B
- For SCARA robot: \EpsonRC80\projects\SimulatorDemos\BOX_sample_CX8_C

For details of the usage of the project, see below.

Working with the Samples

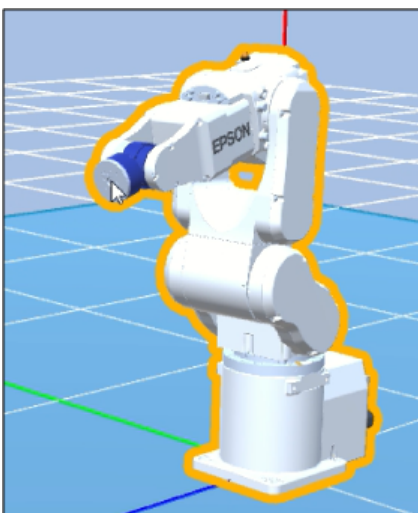


5.14 Virtual Direct Teaching

Virtual direct teaching is a function to perform a jog operation by dragging the robot. The operation simulates direct teaching.

How to use virtual direct teaching

1. Click the  [Direct Teach] button on the Epson RC+ 8.0 toolbar. When you mouse over the robot, the selected joint will appear in yellow.
2. Click the robot. The mouse cursor matches TCP.



3. Operate the robot by dragging.

The robot operates so that the mouse cursor matches TCP. The robot operates with the arm orientation reflects the robot operation panel.

Virtual direct teaching restriction

- When the mouse cursor is outside the robot operating range: Mouse cursor does not match TCP. The robot will be elbow singularity.

 **TIP**

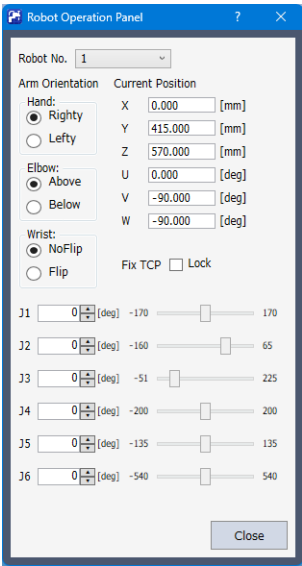
 You can also rotate objects when the [Direct Teach] button is clicked. See details below.

3D Display - "Rotate the robot / layout object"

5.15 Jog Operation on the Robot Operation Panel

Robot operation panel supports jog operation.

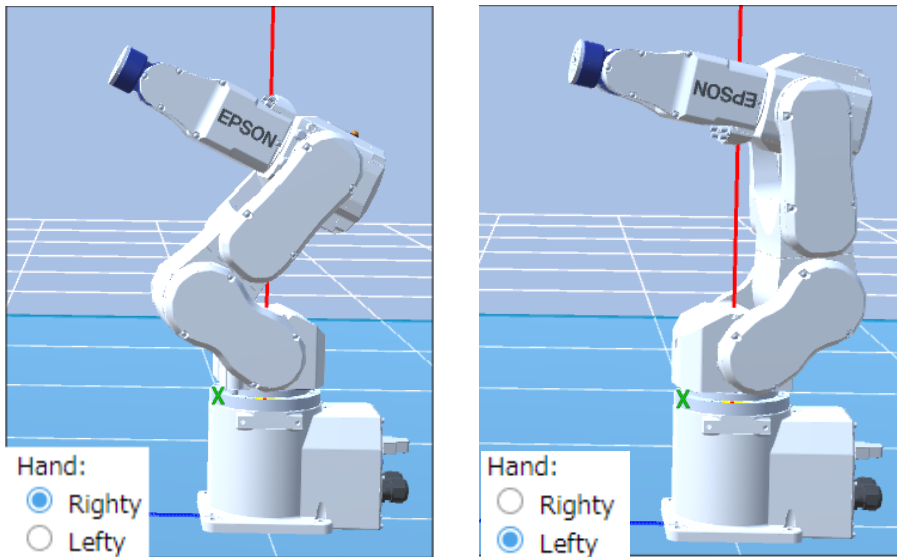
Click Epson RC+ 8.0 toolbar  [Robot Operation Panel] button to display the [Robot Operation Panel] dialog.



Item	Description
Robot number	Displays the number of the robot to be operated. You can select the robot to be operated from the pull-down menu.
Arm Orientation	Displays the orientation flag of the robot to be operated. Select the button to change the orientation flag.
Current Position	Displays the coordinates (XYZ) and orientation (UVW) of the tool coordinate system selected in Robot Manager.
Fix TCP	Specify TCP to fix. You can use the TCP with the fixed orientation change.
Track bar for each axis	Displays the current value, maximum value, and minimum value of each axis. When you operate the track bar, the corresponding joint move.

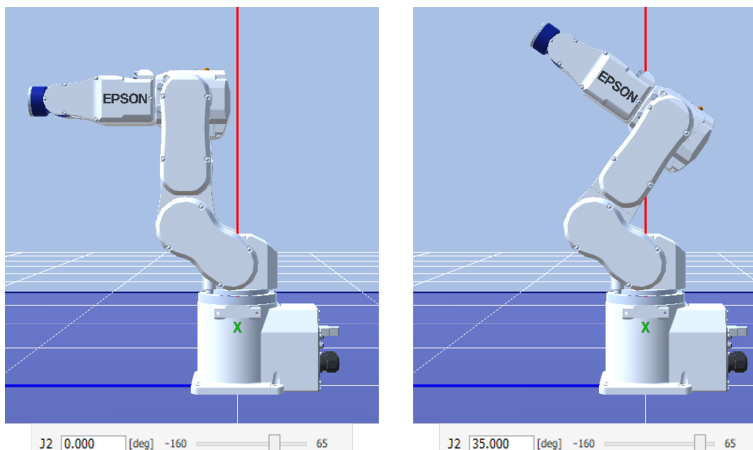
Changing point flag with radio button

By selecting the radio button, you can change the point flag of the robot to be operated.



Joint operation by track bar

Drag the movable part of the track bar to move the corresponding joint.



You can also operate the track bar in the following two ways:

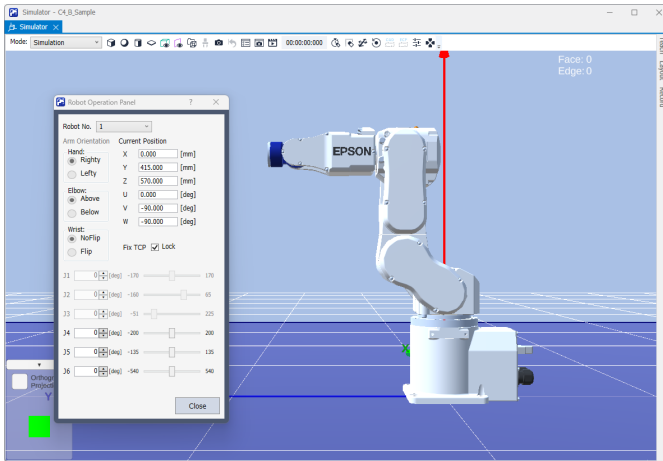
- Click the track bar.
 - Click the right side of the movable part of the track bar to change the value by +10.
 - Click the left side of the movable part of the track bar to change the value by -10.
- Press the arrow keys.
 - After selecting the track bar, press the [→] key to change the value by +1.
 - After selecting the track bar, press the [←] key to change the value by -1.

Changing orientation with fixed TCP

You can change the orientation of the robot with TCP fixed. However, this function fixes the origin position of the tool coordinate system 0. Follow the steps below.

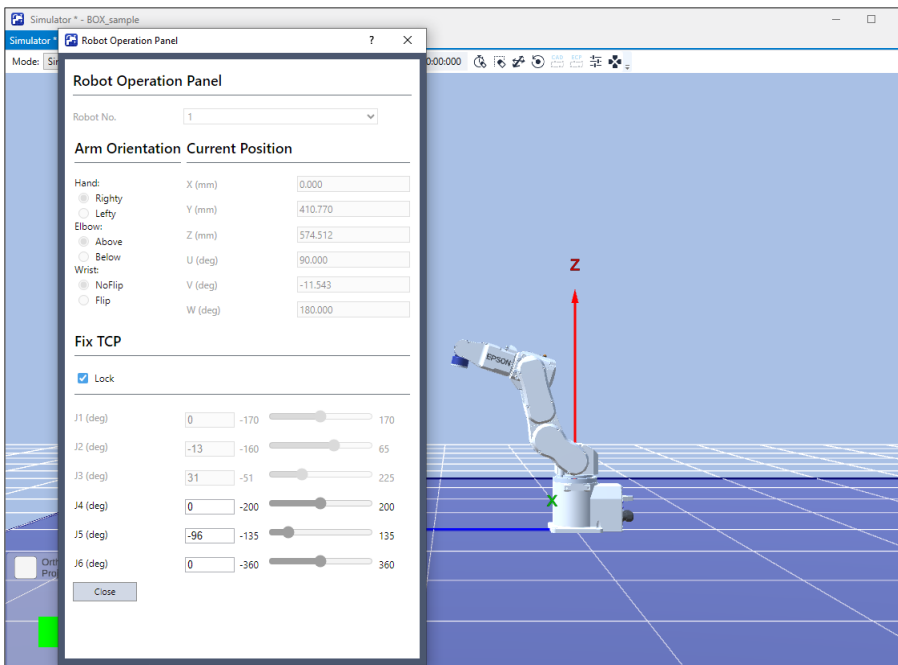
1. Check the [Robot Operation Panel] – [Lock] check box.

The TCP to be fixed is specified. The track bars and point flags from J1 to J3 are disabled.



2. Move the enabled track bar on [Robot Operation Panel].

The axis operated by the track bar moves with TCP and point flags held.



3. Uncheck the [Robot Operation Panel] – [Lock] check box.

The [Lock] display becomes default and the function to fix TCP is completed. The track bars for J1 to J3 are enabled.

In the following three cases, TCP cannot be used for changing the fixed orientation. In these cases, the track bars for J1 to J3 are disabled.

- The robot is singularity.
- TCP is near the Z axis.
- The current value of whichever J1 to J3 is the maximum or minimum value.

5.16 Backing up and Restoring Simulator Data

It is possible to back up and restore the simulator data.

KEY POINTS

Restoring backup data is available only with Epson RC+ Standard Edition or higher.

5.16.1 Backing up Simulator Data

The simulator data can be backed up as part of the backup data when you perform a controller settings backup using [Tools] menu - [Controller] - [Backup Controller].

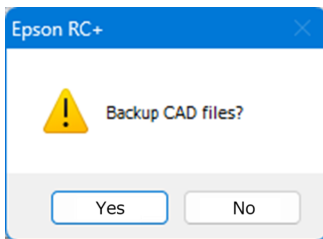
The following simulator data is backed up.

- Layout information
- CAD files (if CAD/hand objects are present)
- Screenshot image of the overall layout

However, simulator data is not backed up if the simulator function is disabled on the controller.

Backing up CAD files

A message prompts whether to back up the CAD files.



Click [Yes] to compile the CAD files used as CAD objects/hand objects into a single ZIP file and save it in the specified folder.

In Epson RC+ Standard Edition or higher, you can determine whether this confirmation message is displayed on the [Backup] tab of the [Simulator Settings] dialog box. If you choose not to display the message, the CAD files are backed up automatically.

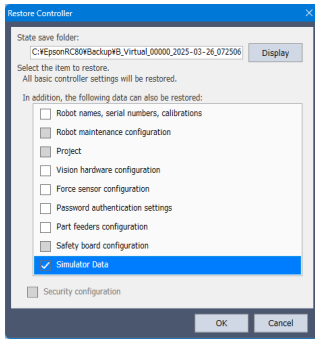
KEY POINTS

When a robot is added or removed, the CAD files are not backed up when the controller settings are automatically backed up.

5.16.2 Restoring Simulator Data

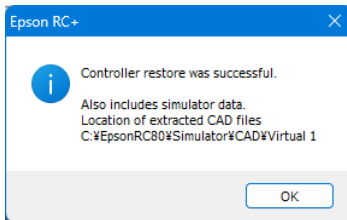
In Epson RC+ Standard Edition or higher, you can restore simulator data by selecting [Tools] menu - [Controller] - [Restore Controller].

If simulator data exists in the backup data, you can select the simulator data as an item to restore.



The following message appears if the restore is completed successfully.

If the simulator data contains a CAD file, the message indicates the location where the CAD file will be extracted.



Restoring CAD files

The CAD file will be extracted to the [Connection Name] folder in the `C:\EpsonRC80\Simulator\CAD` folder. The layout information is updated according to the CAD files in this folder.

KEY POINTS

If a CAD file with the same name already exists at the extraction destination, that file is overwritten.

5.17 Virtual Conveyor Function

In Epson RC+ Standard Edition or higher, you can check conveyor operation in the Simulator. This section describes the procedure for building an actual system using the virtual conveyor function.

5.17.1 Standalone Conveyor Operation

Let's create a conveyor system using a conveyor object and a detection area object corresponding to a sensor.

In this example, when the sensor detects a workpiece (part) moving on the conveyor, the conveyor stops, and the robot moves the workpiece (part) from the conveyor to the table using a Pick & Place operation.

Procedure overview

1. Create a virtual controller and configure a robot
2. Create a project
3. Add an object corresponding to the workpiece (part)
4. Add and configure an object corresponding to the table
5. Add and configure a conveyor object
6. Configure and verify the supply settings for the conveyor object
7. Add and configure a detection area object

8. Create and run a program

Procedure details

1. Preparation

- i. Create a new virtual controller connection.

In system configuration, set Robot 1 to "GX8-C652S" (name: robot1).

- ii. Create a new project named "Conv_Sensor".

- iii. Add a Box object (SBox_1) corresponding to the workpiece (part) transported by the conveyor, and configure it as follows.

- Change it to any color.
- Position setting (Position X, Y, Z): 550, 550, 25 (Move it to a location where it will not interfere with the work.)

- iv. Add a table (Box object) where the workpiece (part) will be placed, and configure it as follows.

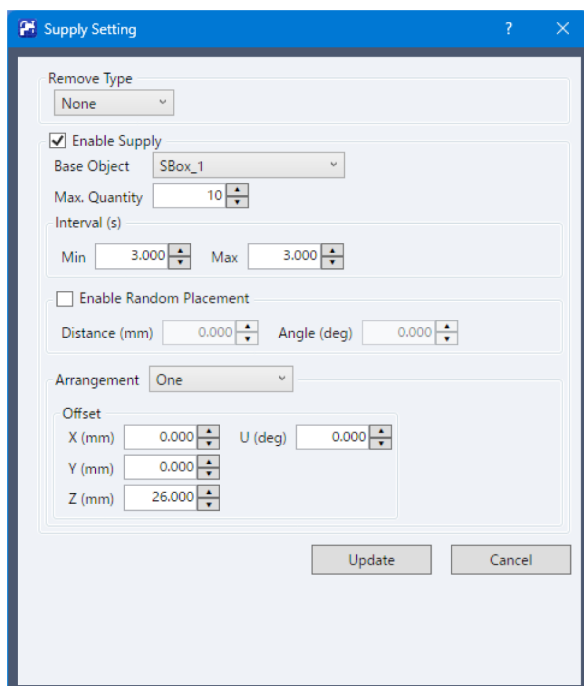
- Object name (Name): Table
- Size setting (Half size X, Y, Z): 40, 300, 50
- Position setting (Position X, Y, Z): 550, 0, 50

- v. Add a conveyor object and configure it as follows.

- Position setting (Position X, Y, Z): 400, 0, 100
- Orientation setting (Rotation Z): 90
- Size setting (Half size Height, Width): 500, 100

- vi. Configure the supply settings for the workpiece (part).

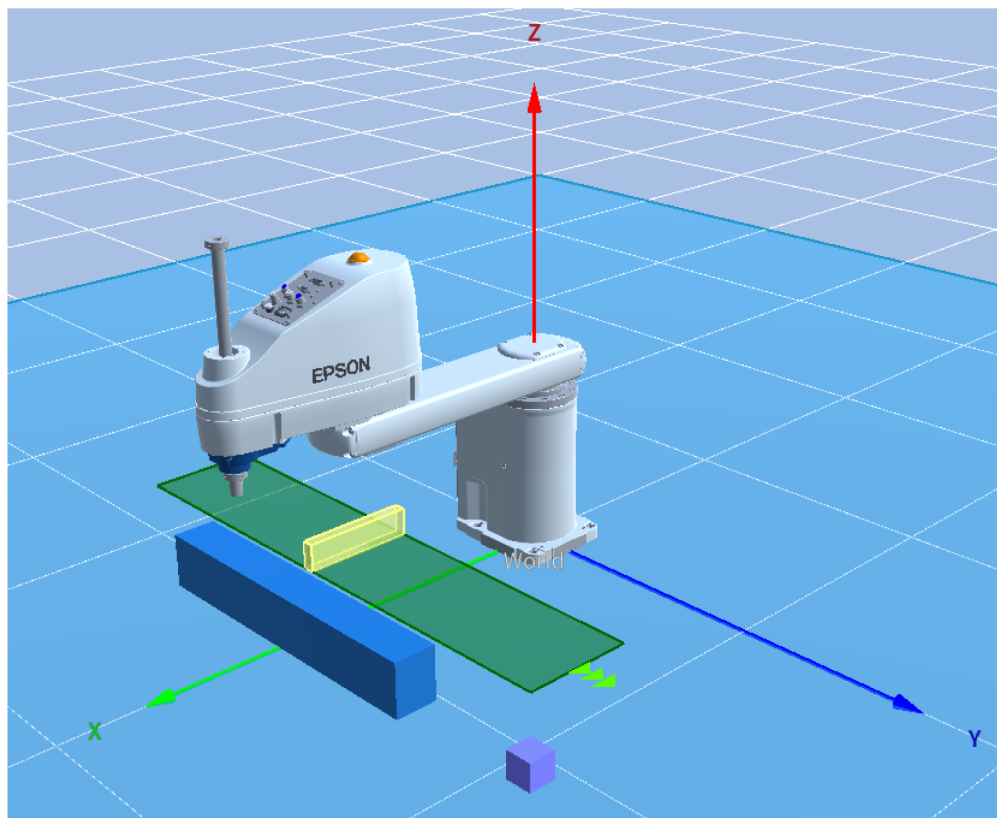
- a. Click the "Operation" - "Supply" property of the conveyor object added in the previous step.
- b. In the displayed Supply Setting dialog box, select [Enable Supply].
- c. Set [Base Object] to "SBox_1", which was added in the previous step.
- d. Set both [Min] and [Max] under [Interval] to "3.000".
- e. Set [Z] under [Offset] to "26.000".



vii. Add the detection area object "DetectionArea_1" corresponding to the sensor, and configure it as follows.

- Position setting (Position X, Y, Z): 400, -30, 125
- Orientation setting (Rotation Z): 90
- Sensor setting (Sensor - IO Type): Input
- Sensor setting (Sensor - IO Number): 10
- Sensor setting (Sensor - Duration): 1

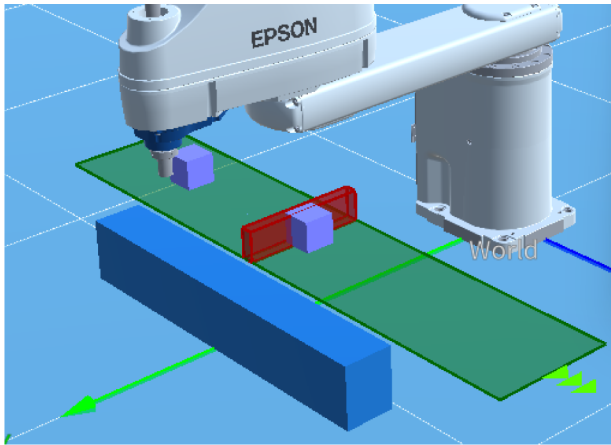
viii. Save the Simulator settings (Ctrl + S).



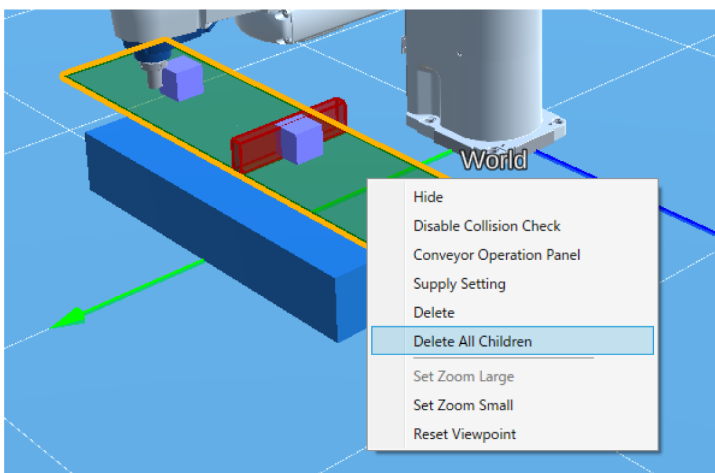
2. Check the motion

Follow the steps below to check whether the workpiece (part) is detected correctly.

- i. Open the Conveyor Operation Panel.
- ii. Start the conveyor object operation to transport the workpiece (part).
- iii. Confirm that the color of the detection area object changes when the workpiece contacts it.



- iv. After confirming that the workpiece (part) is detected correctly, delete the workpiece (part) from the conveyor.
- v. Right-click the conveyor object and select [Delete All Children].



3. Create a program

Create the following program as Main.prg.

```
Function main
  SimSet Conveyor_1.ClearSupply

  Motor On
  Power High
  Speed 100
  Accel 100, 100

  Integer i
  String name$

  TmReset 0

  For i = 1 To 10
    SimSet Conveyor_1.Start
    Wait Sw(10)
    SimSet Conveyor_1.Stop
    Wait 0.5
```

```

Jump XY(400, 0, -135, 0)

name$ = "Conveyor_1_" + Str$(i)
SimSet robot1.Pick, name$

Jump XY(550, i * 60 - 320, -135, 0)

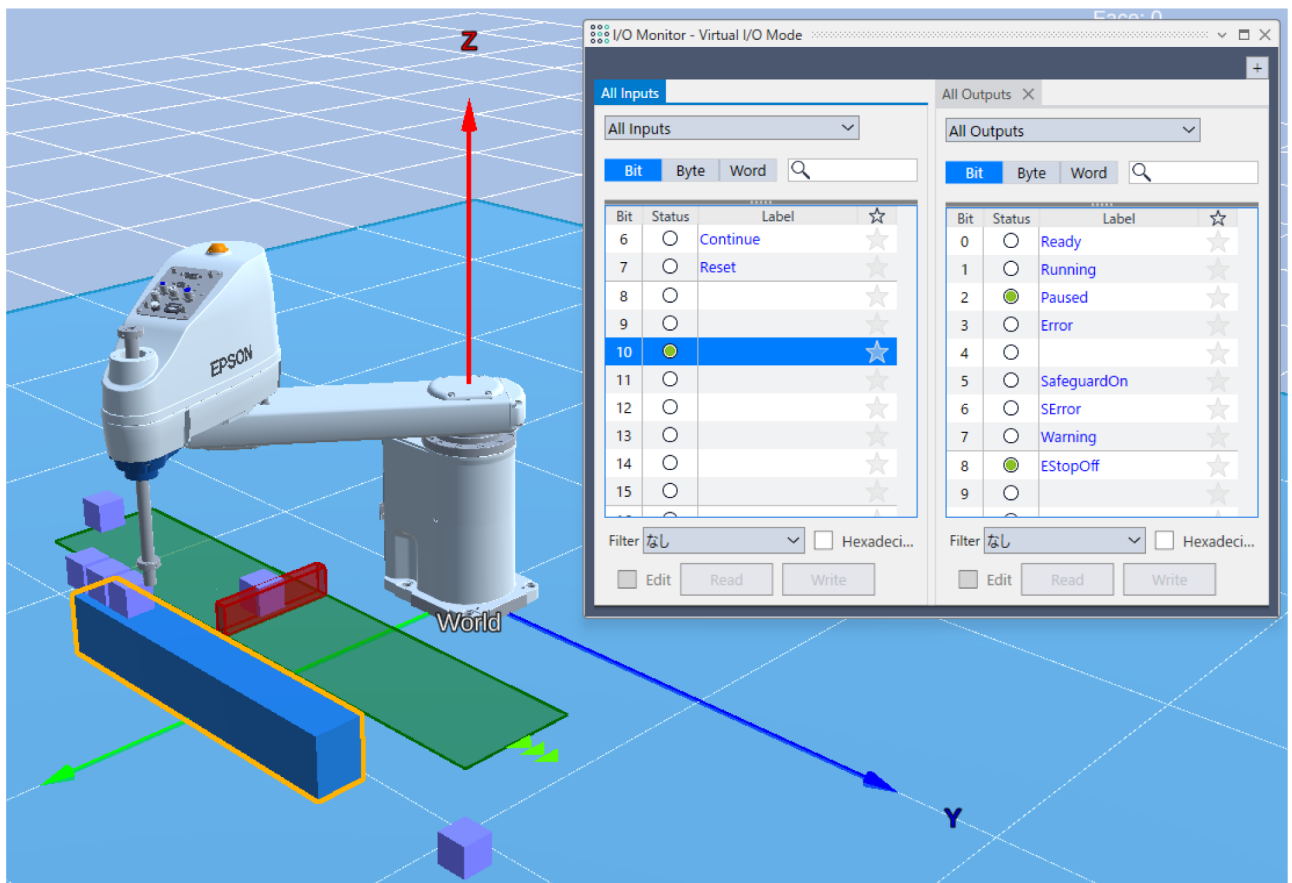
SimSet robot1.Place, name$, Table
Next

Print "Finished, ", Tmr(0), "[s]"
Fend

```

4. Run the program

- Click the [Run Window] button on the toolbar to display the Run window.
- Click the [I/O Monitor] button on the toolbar to display the I/O Monitor.
- In the Run Window, select the function "main", and then click the [Start] button.
- You can confirm changes in input bit 10 based on the properties set for the detection area object.



5.17.2 Conveyor Tracking Operation (Sensor Tracking)

Next, let's create a conveyor tracking operation using a sensor.

The robot uses Pick & Place to move a workpiece (part) that is moving on the object and has been detected by the sensor to the table.

Procedure overview

1. Create a virtual controller and configure a robot
2. Create a project
3. Add an object corresponding to the workpiece (part)
4. Add and configure an object corresponding to the table
5. Add and configure a conveyor object
6. Configure and verify the supply settings for the conveyor object
7. Add and configure a detection area object

The procedure up to this point is the same as described below.

Standalone Conveyor Operation

The following steps are for tracking operation.

8. Add conveyor tracking settings
9. Perform and configure conveyor calibration
10. Create and run a program

Procedure details

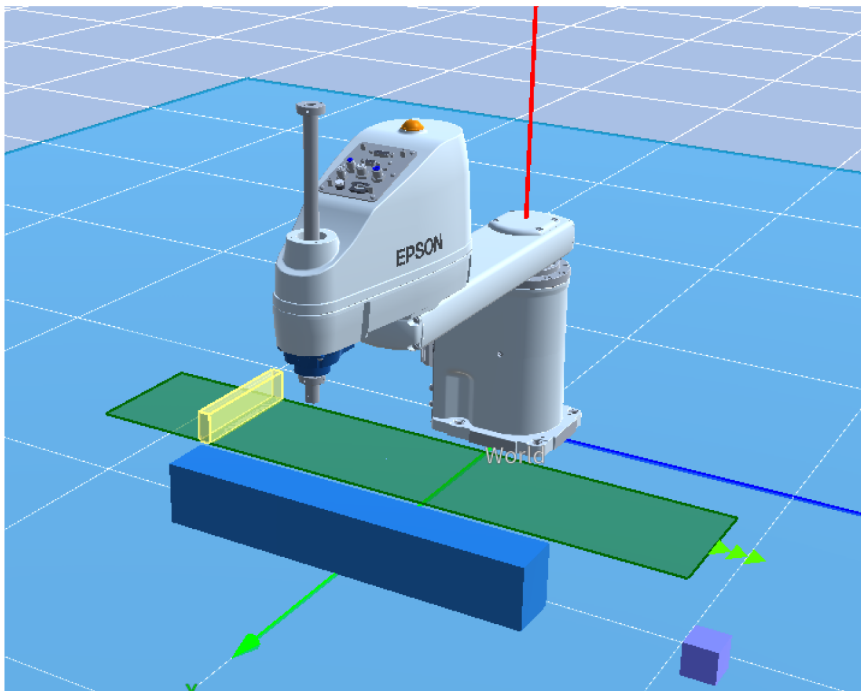
1. Preparation

The steps up to step 5 in Procedure overview are omitted because they are the same as the procedure described below.

Standalone Conveyor Operation

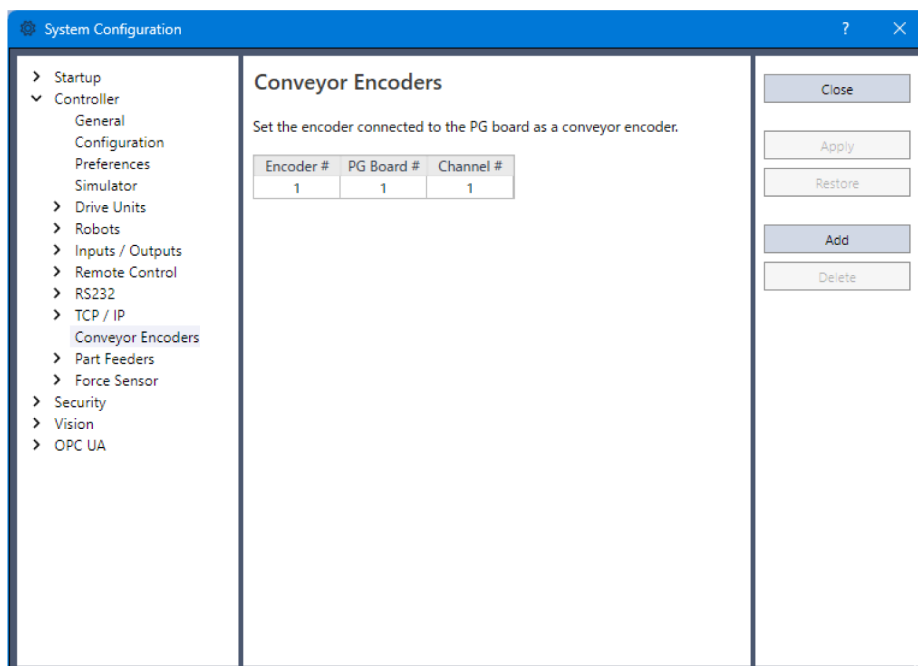
The differences are explained below.

- i. Add the detection area object "DetectionArea_1" corresponding to the sensor, and configure it as follows.
 - Position setting (Position X, Y, Z): 400, -300, 125
 - Orientation setting (Rotation Z): 90

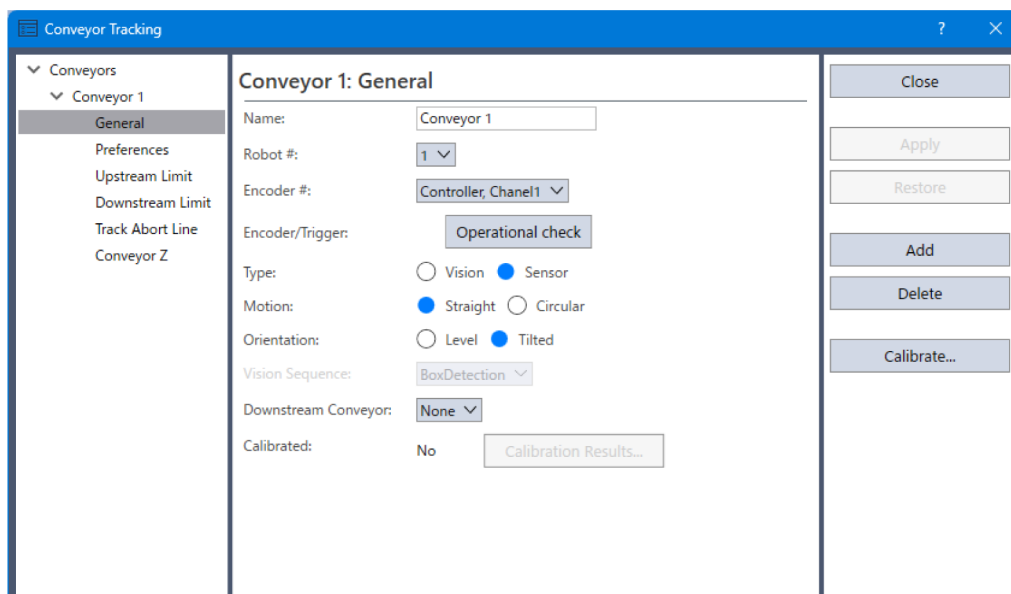


- ii. Configure conveyor tracking. Set as follows.

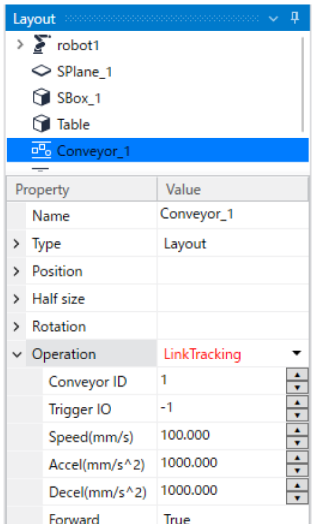
- a. In the Epson RC+ 8.0 menu - [Setup] - [System Configuration], confirm that an encoder has been added under [Controller] - [Conveyor Encoder].



- b. In the Epson RC+ 8.0 menu - [Tools] - [Conveyor Tracking], add a conveyor tracking configuration.
- c. Select [Sensor] for [Type].



- d. Configure the conveyor object as follows.
- Set the "Operation" property to "LinkTracking".
 - Set the "Conveyor ID" property to "1".



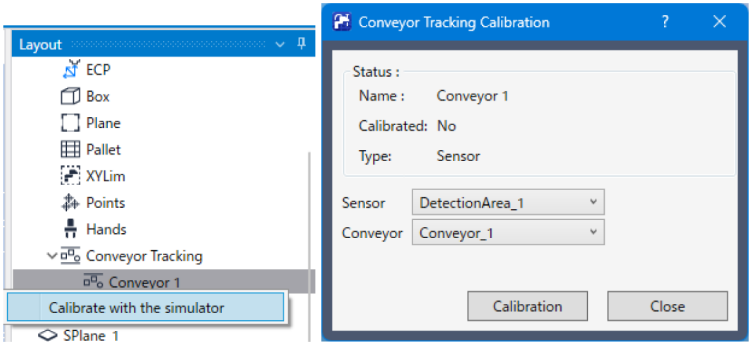
iii. Perform conveyor calibration.

For details on conveyor calibration in the Simulator, refer to the following.

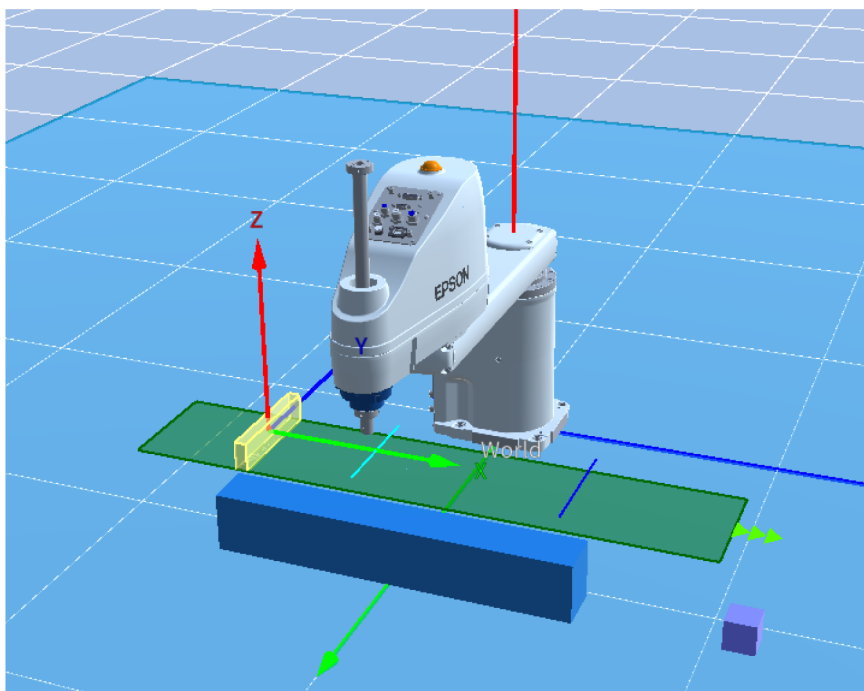
Robot Object - "Conveyor calibration"

Perform simple calibration by following the steps below.

- a. In the layout tree, expand the "Conveyor Tracking" node under the robot node.
- b. Right-click "Conveyor 1", and then click [Calibrate with the simulator].

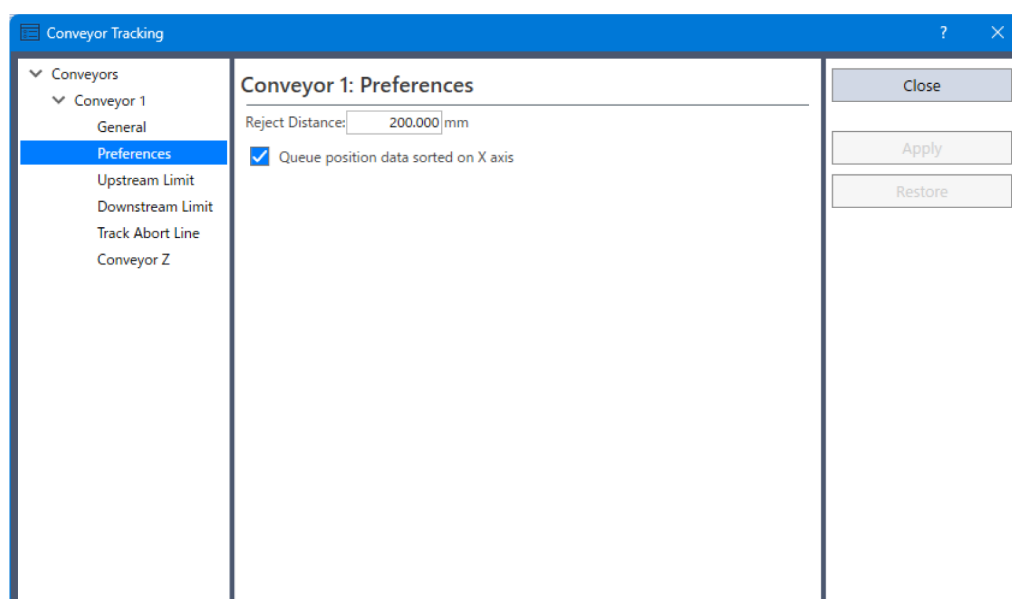


- c. Set the "Visible" property for each of the "Conveyor Origin", "Upstream Limit", and "Downstream Limit" properties to "True".
- d. Confirm the display of the conveyor origin, upstream limit, and downstream limit.



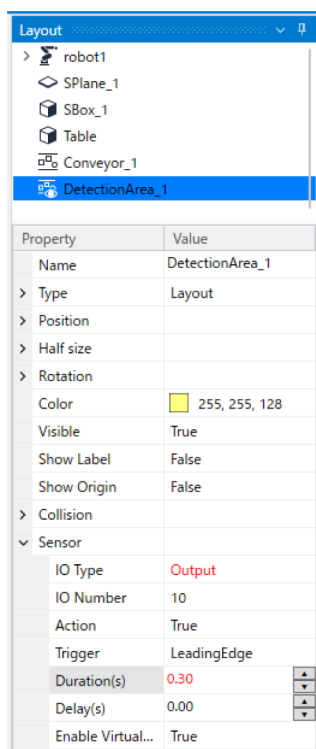
iv. Configure double registration prevention.

Open the Epson RC+ 8.0 menu - [Tools] - [Conveyor Tracking], and set the distance for preventing double registration of workpieces to "200mm".

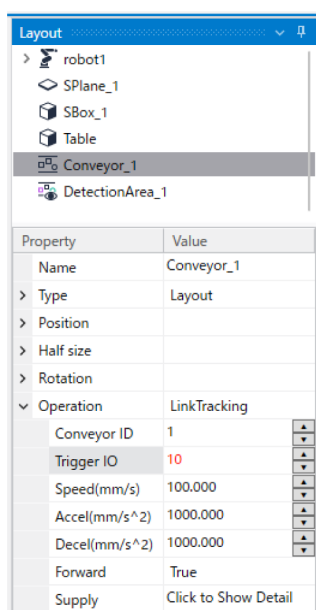


v. Configure the trigger settings.

- Configure the following for the detection area object.
 - Sensor setting (Sensor - IO Type): Output
 - Sensor setting (Sensor - IO Number): 10
 - Sensor setting (Sensor - Duration): 0.30



- Configure the following for the conveyor object.
 - Trigger IO setting (Operation - Trigger IO): 10
Set it to "10", the same value set for IO Number of the detection area object.



2. Create a program

Create the following program as Main.prg.

```
Function main
  SimSet Conveyor_1.ClearSupply

  Motor On
  Power High
  Speed 100
  Accel 100, 100
```

```

Cnv_Mode 1, 1
Cnv_Accel 1, 2000
Cnv_QueueRemove 1, All

Integer i
String name$

Xqt SensorDetection

TmrReset 0
SimSet Conveyor_1.Start

For i = 1 To 10
    Wait Cnv_QueueLen(1, CNV_QUELEN_PICKUPAREA) > 0

    Jump Cnv_QueueGet(1, 0) +Z(51)

    SimGet robot1.NearestObjToTool(0), name$
    SimSet robot1.Pick, name$

    Jump Here :X(550) :Y(i * 60 - 320)

    SimSet robot1.Place, name$, Table

    Cnv_QueueRemove 1, 0
Next

SimSet Conveyor_1.Stop
Quit SensorDetection

Print "Finished, ", Tmr(0), "[s]"
Fend

Function SensorDetection
    Double LPulse
    Cnv_QueueRemove 1, All
    LPulse = Cnv_LPulse(1)

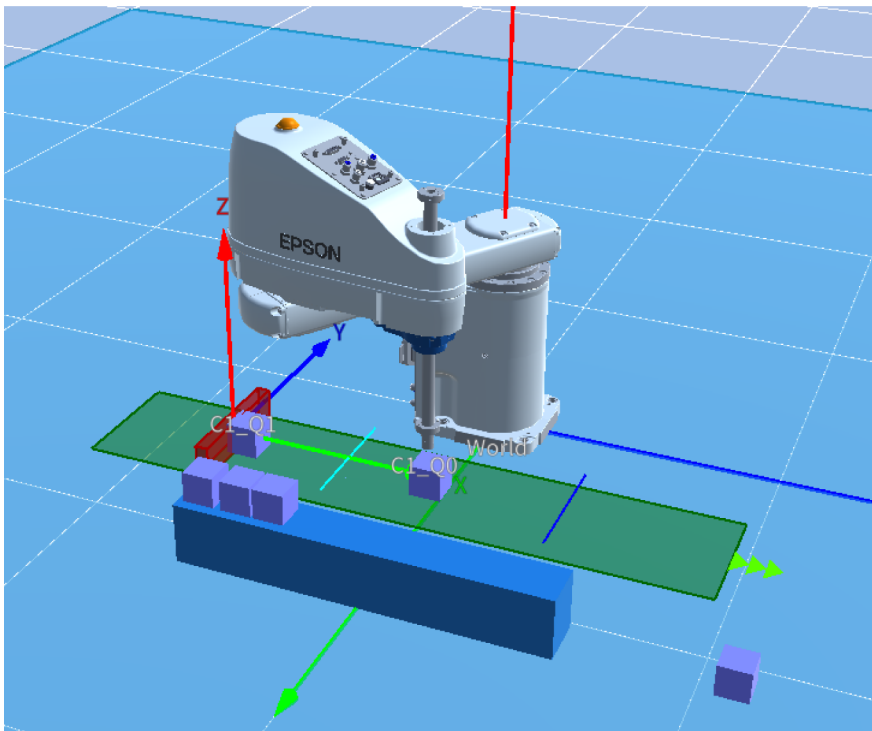
    Do
        If LPulse <> Cnv_LPulse(1) Then
            Cnv_QueueAdd 1, Cnv_Point(1, -20, 0)
            LPulse = Cnv_LPulse(1)
        EndIf
    Loop
Fend

```

3. Run the program

- i. Click the [Run Window] button on the toolbar to display the Run window.
- ii. In the Run Window, select the function "main", and then click the [Start] button.

- iii. Unlike standalone conveyor operation, confirm that the workpiece (part) is picked and placed by the robot without stopping the conveyor.



5.17.3 Conveyor Tracking Operation (Vision Tracking)

Next, let's create a conveyor tracking operation using vision.

The robot uses Pick & Place to move a workpiece (part) detected by vision from the conveyor to the table.

Procedure overview

1. Create a virtual controller and configure a robot
2. Create a project
3. Add an object corresponding to the workpiece (part)
4. Add and configure an object corresponding to the table
5. Add and configure a conveyor object
6. Configure and verify the supply settings for the conveyor object
7. Add and configure a virtual camera
8. Add conveyor tracking settings
9. Perform vision calibration
10. Create a vision sequence
11. Perform and configure conveyor calibration
12. Check workpiece (part) detection
13. Create and run a program

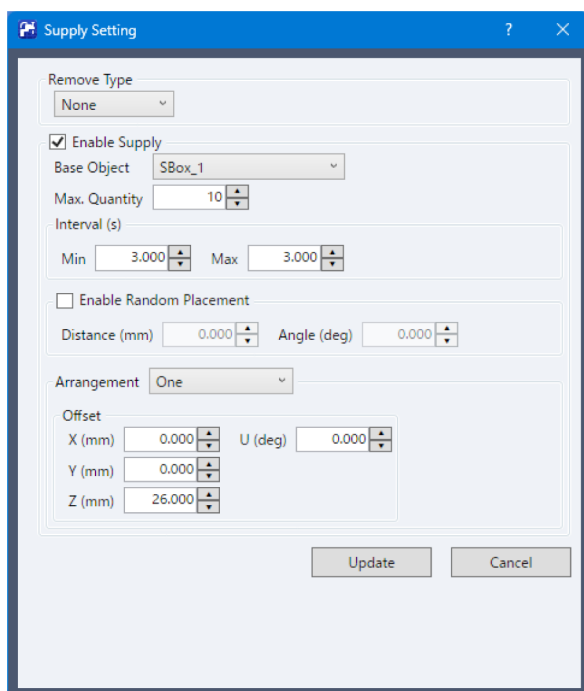
Procedure details

1. Preparation

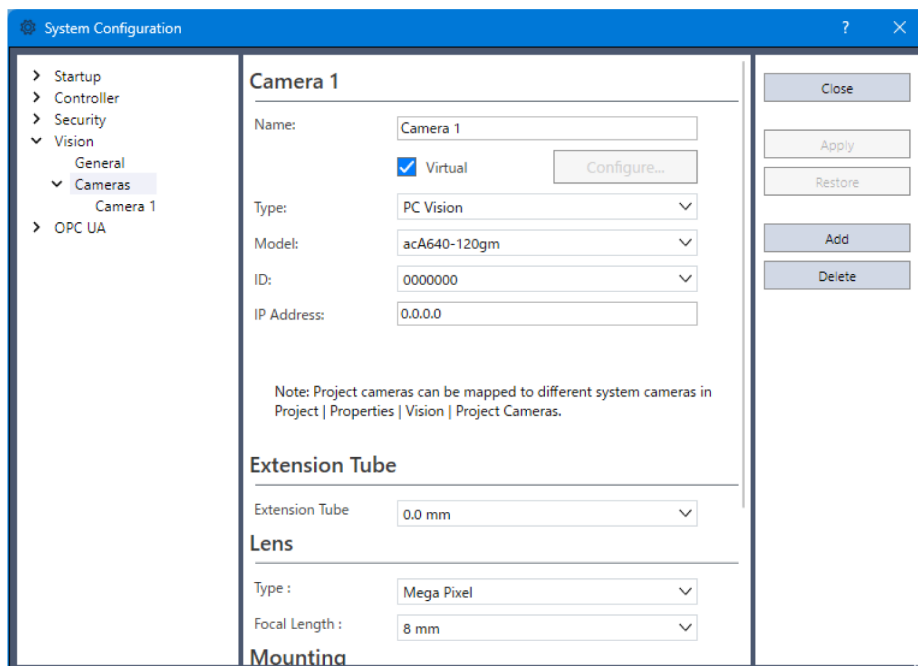
- i. Create a new virtual controller connection.

In system configuration, set Robot 1 to "GX8-C652S" (name: robot1).

- ii. Create a new project named "ConvTrack_Vision".
- iii. Add a Box object (SBox_1) corresponding to the workpiece (part) transported by the conveyor, and configure it as follows.
 - Change it to any color.
 - Position setting (Position X, Y, Z): 550, 550, 25 (Move it to a location where it will not interfere with the work.)
- iv. Add a table (Box object) where the workpiece (part) will be placed, and configure it as follows.
 - Object name (Name): Table
 - Size setting (Half size X, Y, Z): 40, 300, 50
 - Position setting (Position X, Y, Z): -550, 0, 50
- v. Add a conveyor object and configure it as follows.
 - Position setting (Position X, Y, Z): -400, 0, 100
 - Orientation setting (Rotation Z): 90
 - Size setting (Half size Height, Width): 500, 100
- vi. Configure the supply settings for the workpiece (part).
 - Click the "Operation" - "Supply" property of the conveyor object added in the previous step.
 - In the displayed Supply Setting dialog box, select [Enable Supply].
 - Set [Base Object] to "SBox_1", which was added in the previous step.
 - Set both [Min] and [Max] under [Interval] to "3.000".
 - Set [Z] under [Offset] to "26.000".

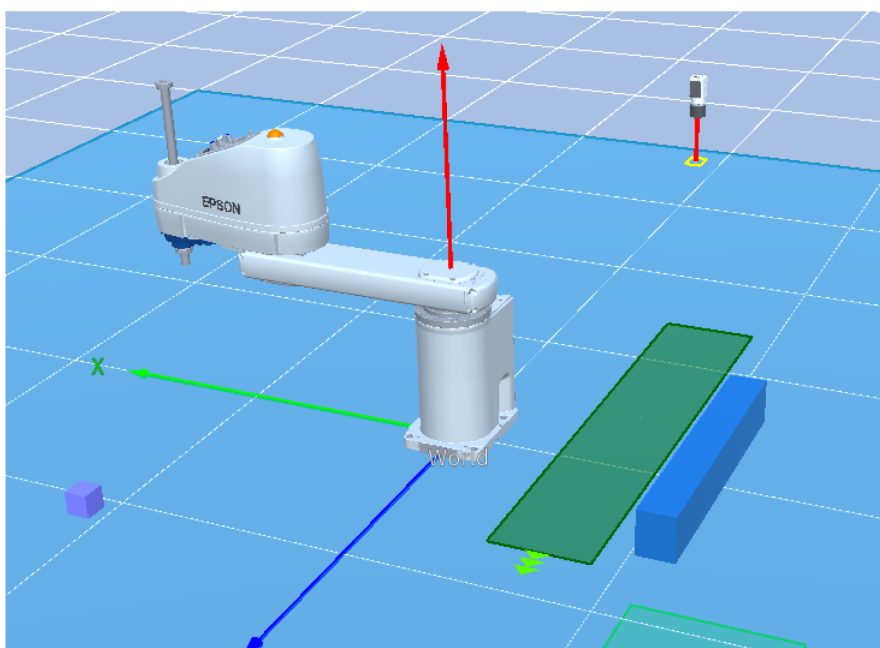
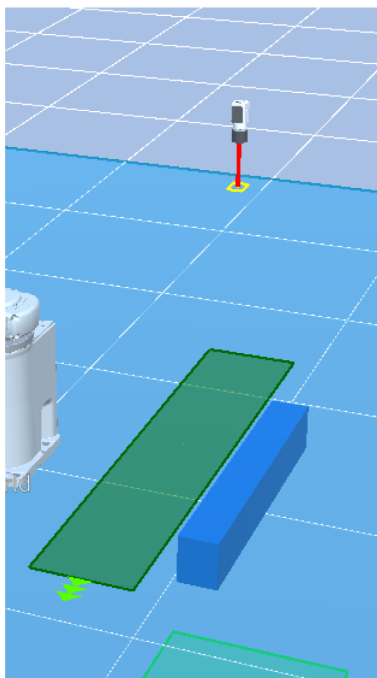


- vii. Add camera settings.
 - a. In [Vision] under the Epson RC+ 8.0 menu - [Setup] - [System Configuration], add a virtual camera.
 - b. Select [Virtual], select "acA640-120gm" as the model, and then click the [Apply] button.



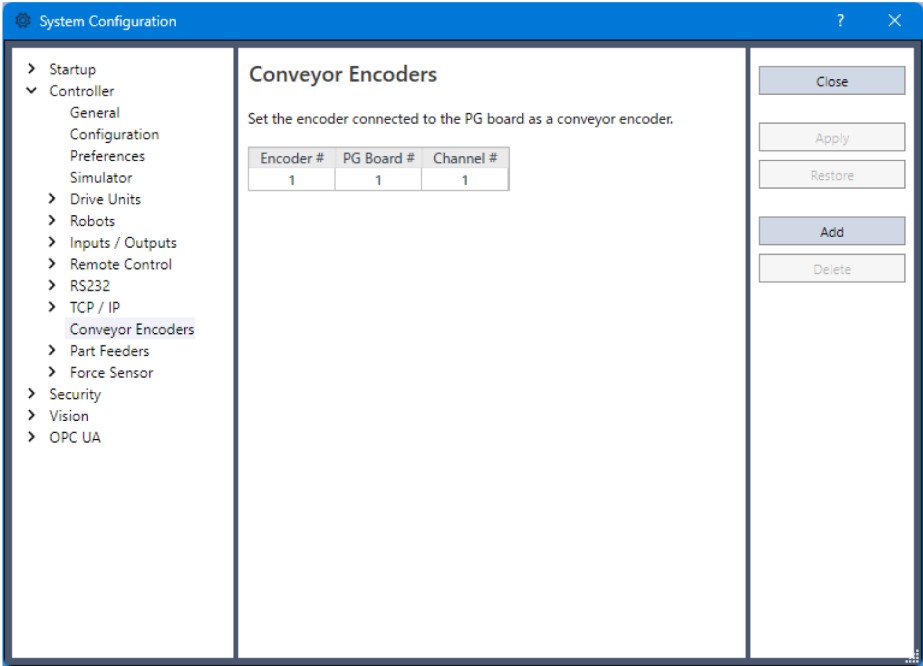
c. Configure the camera object as follows and place it above the conveyor object.

- Position setting (Position X, Y, Z): -400, -400, 700
- Orientation setting (Rotation X): 180

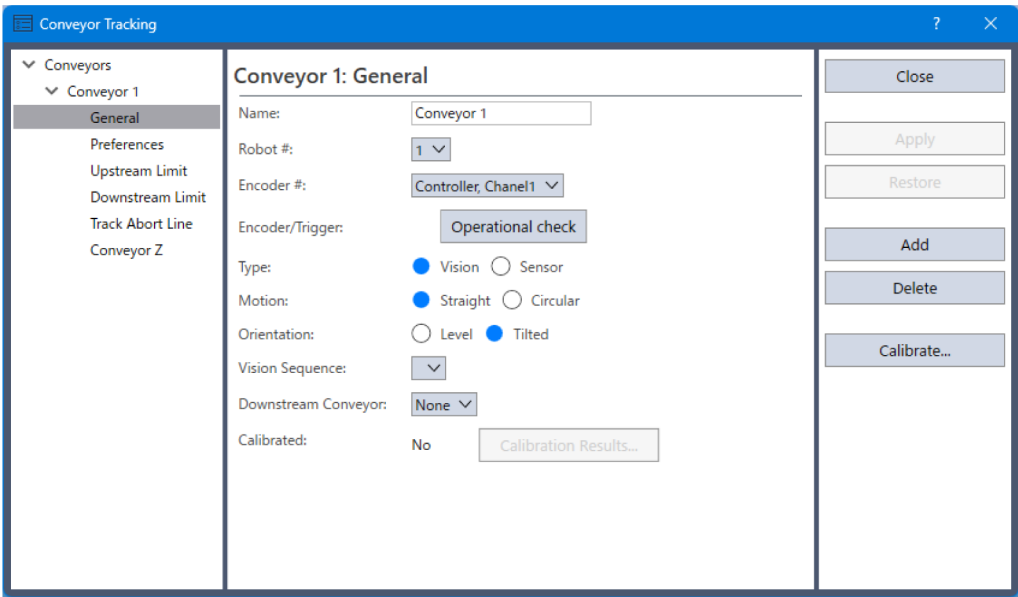


viii. Add a conveyor tracking configuration and configure it as follows.

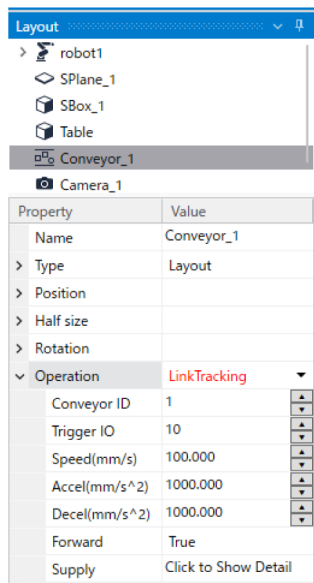
- a. In the Epson RC+ 8.0 menu - [Setup] - [System Configuration], confirm that an encoder has been added under [Controller] - [Conveyor Encoder].



- b. In the Epson RC+ 8.0 menu - [Tools] - [Conveyor Tracking], add a conveyor tracking configuration.
- c. Select [Vision] for [Type].



- d. Configure the conveyor object as follows.
 - Set the "Operation" property to "LinkTracking".
 - Set the "Conveyor ID" property to "1".



ix. Perform vision calibration.

Create and perform a calibration named "ConveyorCalib".

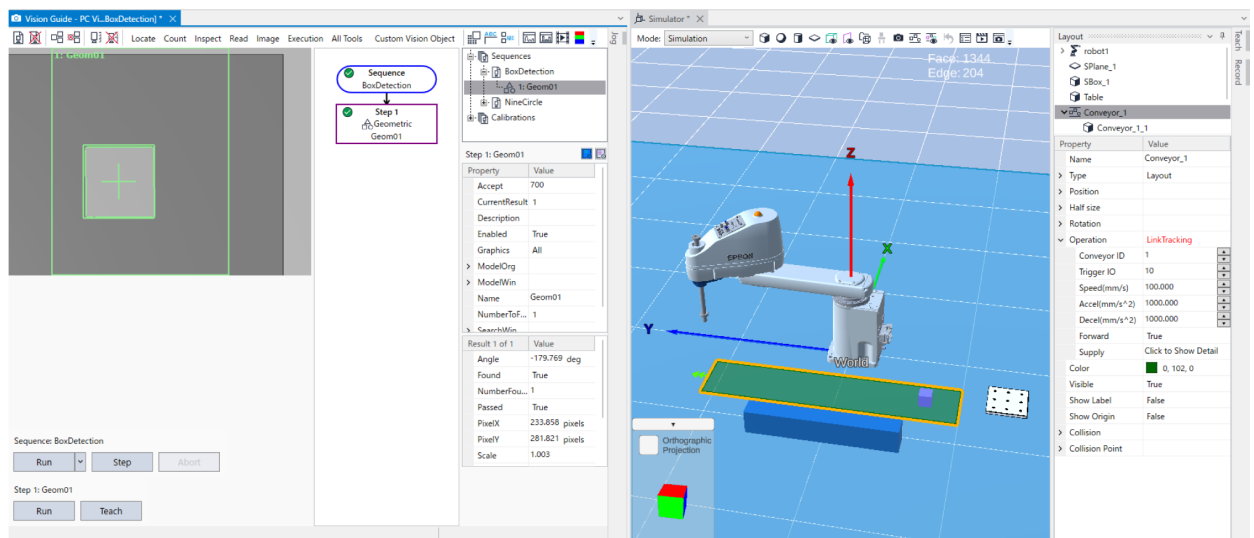
After vision calibration is complete, move the CAD data used for calibration to a location where it will not interfere with the work.

For details on camera calibration, refer to the following manual.

"Epson RC+ Option Vision Guide Software - Vision Calibration - Calibration Procedures - Calibration Procedure: Standalone Camera"

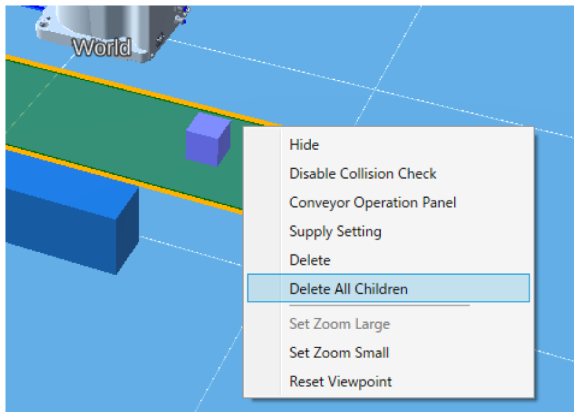
x. Create a vision sequence and follow the steps below to check whether the workpiece (part) is detected correctly.

- Using the Conveyor Operation Panel, move the conveyor object to transport one Box that serves as the workpiece.
- Stop the conveyor object at a position within the camera field of view.
- Create a sequence named "BoxDetection" to recognize this workpiece.
- Run the "BoxDetection" sequence and confirm that the workpiece (part) is recognized correctly.
- Set the "Calibration" property to the calibration "ConveyorCalib" created in the earlier step.



f. After confirming that the workpiece (part) is detected correctly, delete the workpiece (part) from the conveyor for now.

- Right-click the conveyor object and select [Delete All Children].



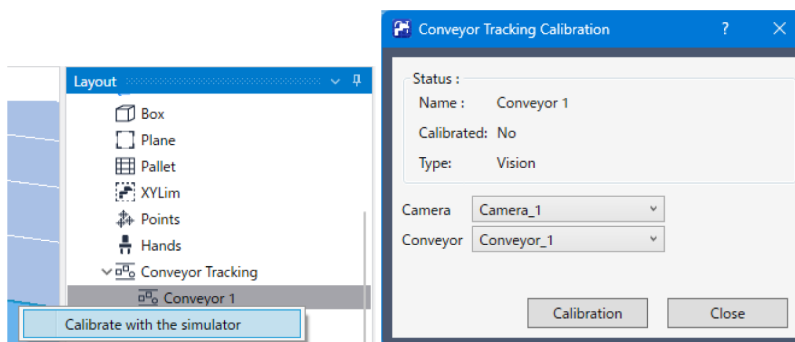
xi. Perform conveyor calibration.

For details on conveyor calibration in the Simulator, refer to the following.

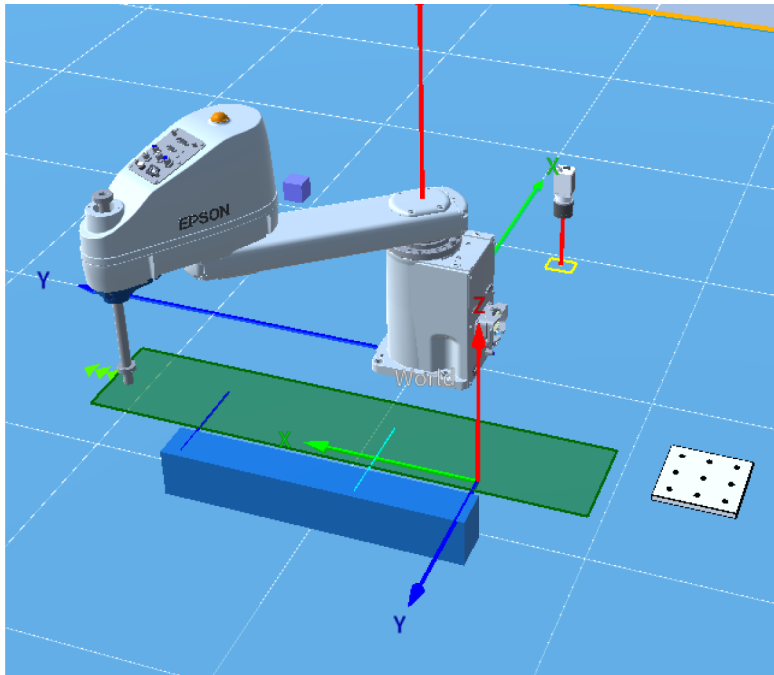
Robot Object - "Conveyor calibration"

Perform simple calibration by following the steps below.

- a. In the layout tree, expand the "Conveyor Tracking" node under the robot node.
- b. Right-click "Conveyor 1", and then click [Calibrate with the simulator].

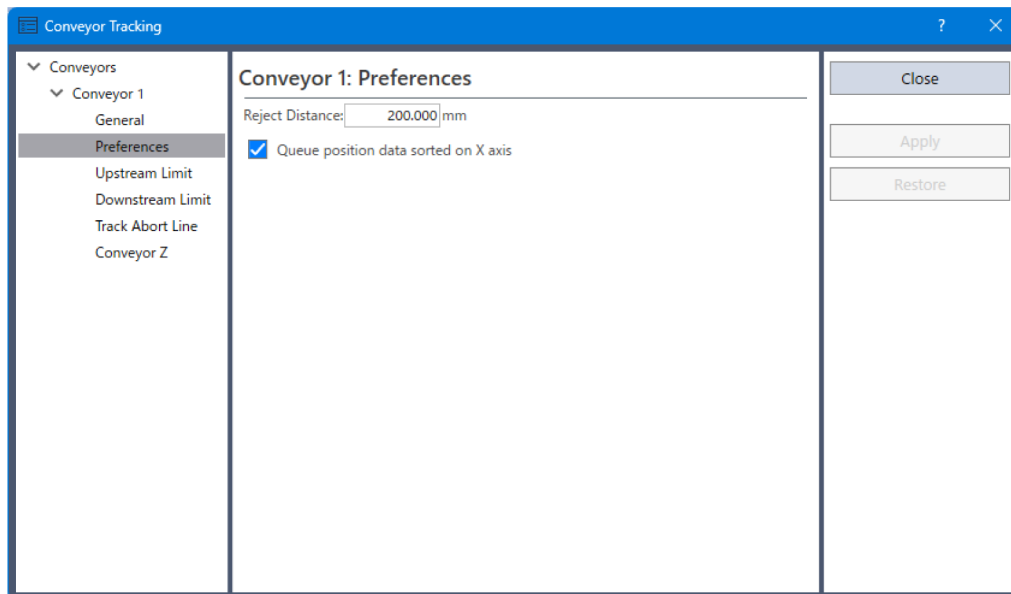


- c. Set the "Visible" property for each of the "Conveyor Origin", "Upstream Limit", and "Downstream Limit" properties to "True".
- d. Confirm the display of the conveyor origin, upstream limit, and downstream limit.



xii. Configure double registration prevention.

Open the Epson RC+ 8.0 menu - [Tools] - [Conveyor Tracking], and set the distance for preventing double registration of workpieces to "200mm".



2. Create a program

Software trigger

Create the following program as Main.prg.

This program performs conveyor tracking operation using the camera software trigger.

```
Function main
  SimSet Conveyor_1.ClearSupply

  Motor On
  Power High
  Speed 100
  Accel 100, 100
```

```
Cnv_Mode 1, 1
Cnv_Accel 1, 2000
Cnv_QueueRemove 1, All

Integer i
String name$

Xqt VisionDetection

TmrReset 0
SimSet Conveyor_1.Start

For i = 1 To 10
    Wait Cnv_QueueLen(1, CNV_QUELEN_PICKUPAREA) > 0
    Wait 0.5

    Jump Cnv_QueueGet(1, 0) +Z(51)

    SimGet robot1.NearestObjToTool(0), name$
    SimSet robot1.Pick, name$

    Jump Here :X(-550) :Y(i * 60 - 320)
    SimSet robot1.Place, name$, Table

    Cnv_QueueRemove 1, 0
Next

SimSet Conveyor_1.Stop
Quit VisionDetection

Print "Finished, ", Tmr(0), "[s]"
Fend

Function VisionDetection
    Integer numFound, i, state
    Real x, y, u
    Boolean found

    Off 10
    Wait 0.5
    Do
        VRun BoxDetection
        Cnv_Trigger (1)

        VGet BoxDetection.Geom01.NumberFound, numFound
        Print "Num Found ", numFound

        For i = 1 To numFound
            VGet BoxDetection.Geom01.CameraXYU(i), found, x, y, u
            Cnv_QueueAdd 1, Cnv_Point(1, x, y)
        Next

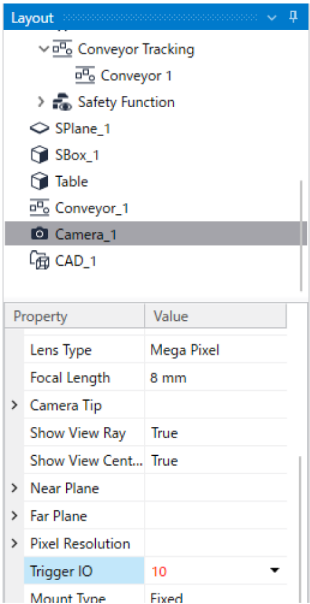
        Wait 1
```

```
Loop
Fend
```

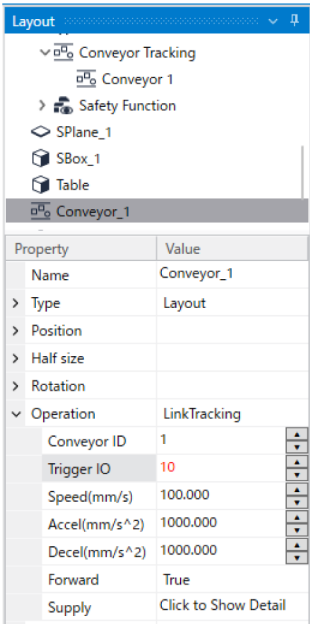
Hardware trigger

Conveyor tracking using the virtual hardware trigger of the camera object is also possible. Configure the hardware trigger by following the steps below.

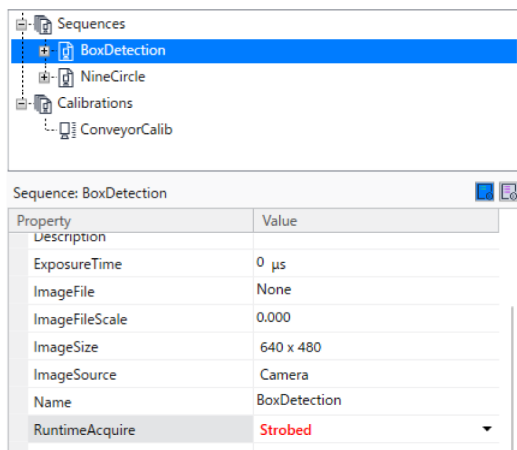
- i. Set the "Trigger IO" property of the camera object to "10".



- ii. Set the "Operation" - "Trigger IO" property of the conveyor object to "10", the same value set in the previous step.



- iii. Set the "RuntimeAcquire" property of the Vision Guide sequence "BoxDetection" to "Strobed".



iv. Modify the function "VisionDetection" in the program created above as follows.

```
Function VisionDetection
    Integer numFound, i, state
    Real x, y, u
    Boolean found

    Off 10
    Wait 0.5
    Do
        VRun BoxDetection
        On 10

        Do
            VGet BoxDetection.AcquireState, state
        Loop Until state = 3

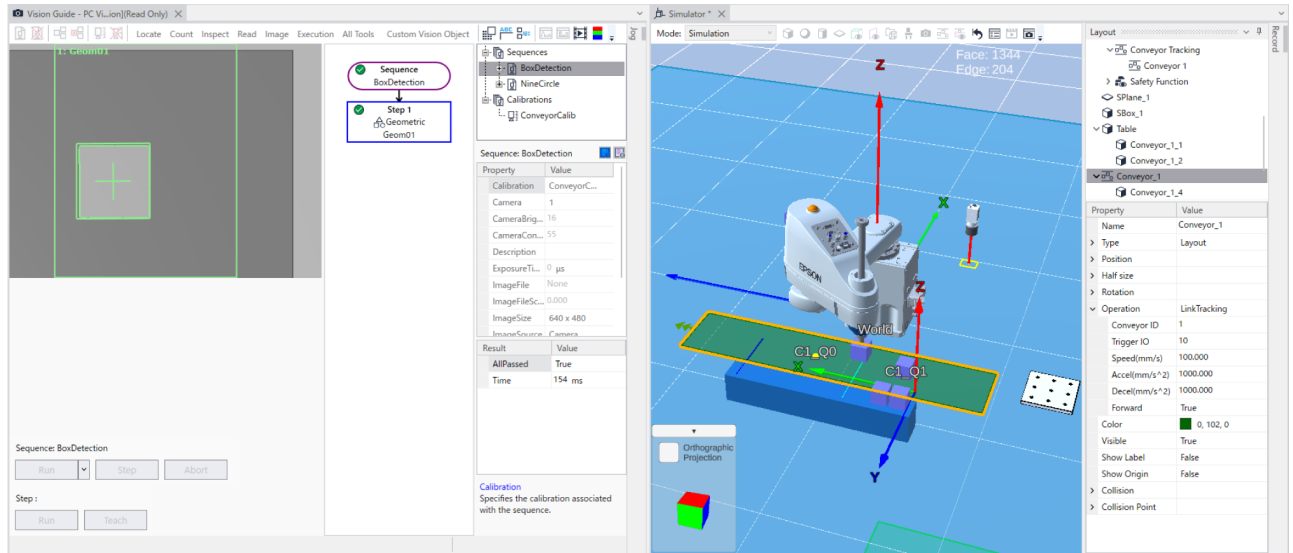
        VGet BoxDetection.Geom01.NumberFound, numFound
        Print "Num Found ", numFound

        For i = 1 To numFound
            VGet BoxDetection.Geom01.CameraXYU(i), found, x, y, u
            Cnv_QueueAdd 1, Cnv_Point(1, x, y)
        Next

        Off 10
        Wait 0.5
    Loop
Fend
```

3. Run the program

- i. Click the [Run Window] button on the toolbar to display the Run window.
- ii. Select the function "main", and then click the [Start] button.



5.18 Virtual Part Feeding Function

In Epson RC+ Standard Edition or higher, you can check part feeding operation in the Simulator. This section describes the procedure for building a simple system using the virtual part feeding function.

Procedure overview

1. Create a virtual controller and configure a robot
2. Create a project
3. Add and configure a part feeder in system configuration
4. Add and configure an object corresponding to the table where parts will be placed
5. Add and configure a virtual camera
6. Perform vision calibration
7. Create a vision sequence
8. Configure parts and the feeder
9. Calibrate the feeder
10. Create and run a program

Procedure details

1. Preparation

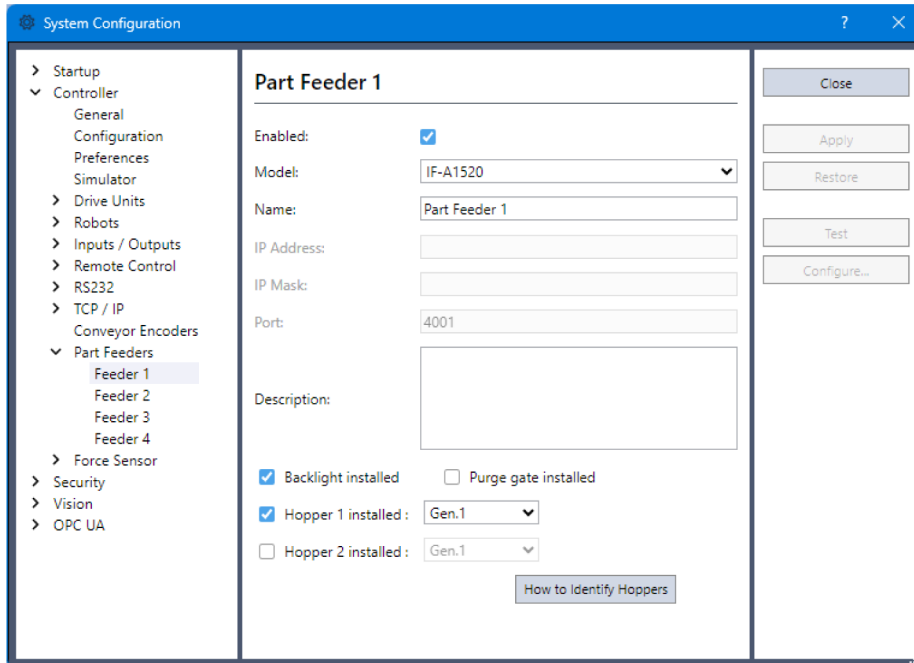
- i. Create a new virtual controller connection.

In system configuration, set Robot 1 to "GX8-C652S" (name: robot1).

- ii. Create a new project named "PF_Sample".

- iii. In the Epson RC+ 8.0 menu - [Setup] - [System Configuration], add a feeder (IF-A1520) under [Controller] - [Part Feeder], and configure the following settings.

- Enable [Hopper 1 Installed].
- Position setting (Position X, Y, Z): -100, 450, 0
- Collision detection setting (Collision Check): false



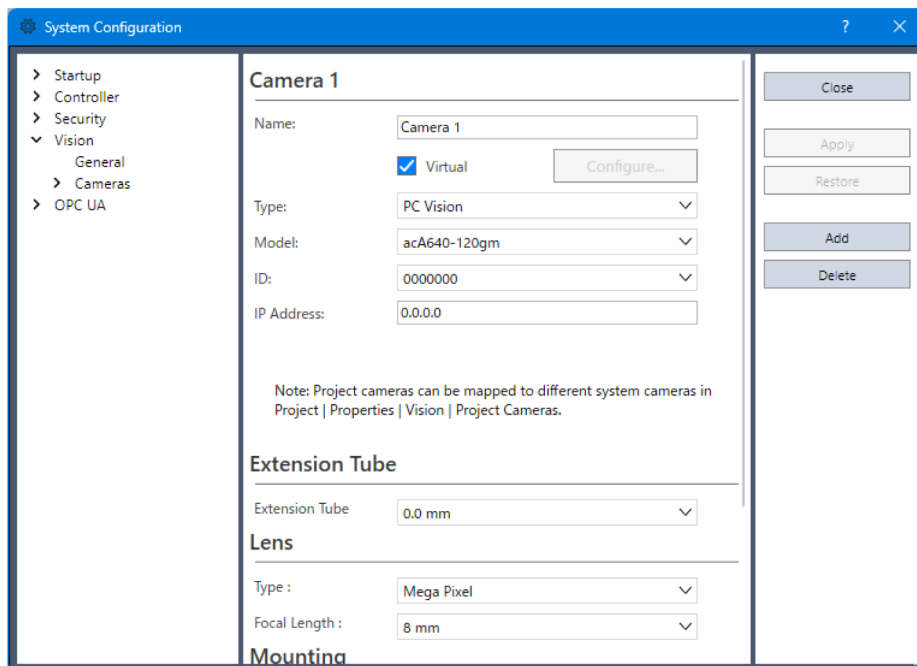
iv. Add a table (Box object) where parts will be placed, and configure it as follows.

- Object name (Name): Table
- Size setting (Half size X, Y, Z): 100, 100, 50
- Position setting (Position X, Y, Z): 350, 0, 50

v. Add camera settings.

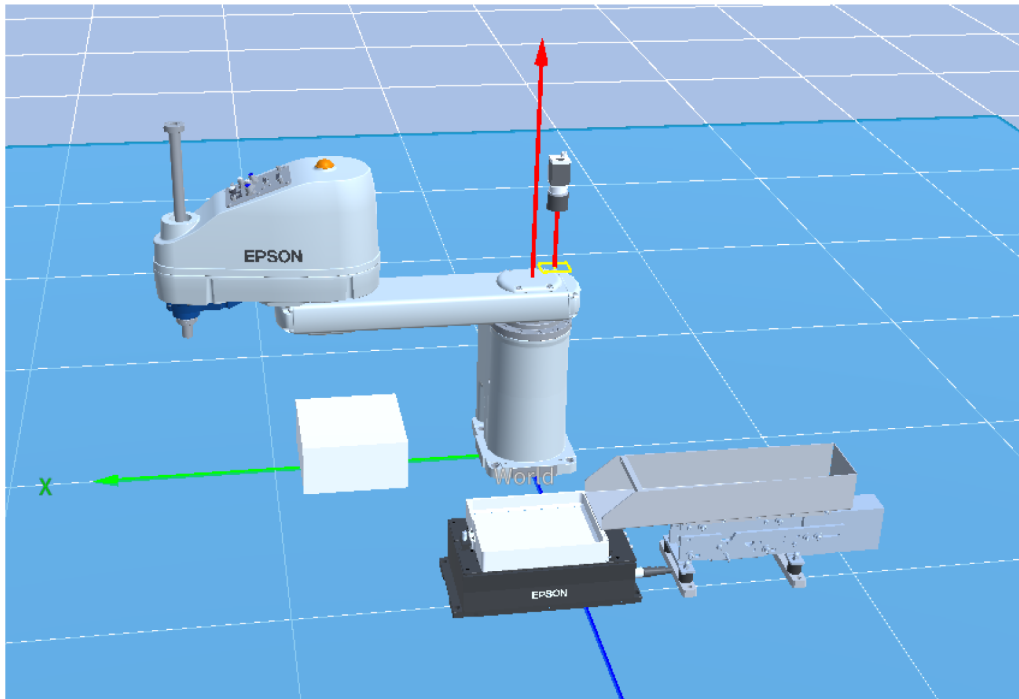
a. In [Vision] under the Epson RC+ 8.0 menu - [Setup] - [System Configuration], add a virtual camera.

b. Select [Virtual], select "acA640-120gm" as the model, and then click the [Apply] button.



c. Configure the camera object as follows and place it above the feeder object.

- Position setting (Position X, Y, Z): 65, 440, 770
- Orientation setting (Rotation X, Y, Z): 180, 0, 90



vi. Perform vision calibration.

Create and perform a calibration named "Calib".

After vision calibration is complete, move the CAD data used for calibration to a location where it will not interfere with the work.

For details on camera calibration, refer to the following video manual.

Procedure for Using the Vision Simulator

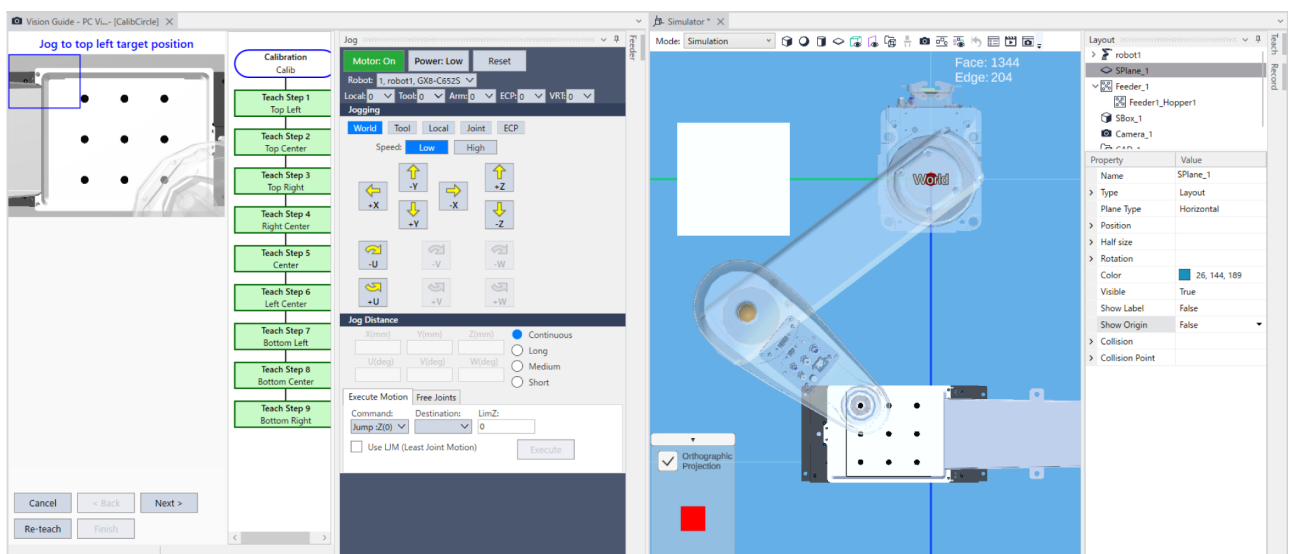
Alternatively, refer to the following manual:

"Vision Calibration" in "Vision Guide 8.0 Software"

Sample CAD data for vision calibration is available in the following folder.

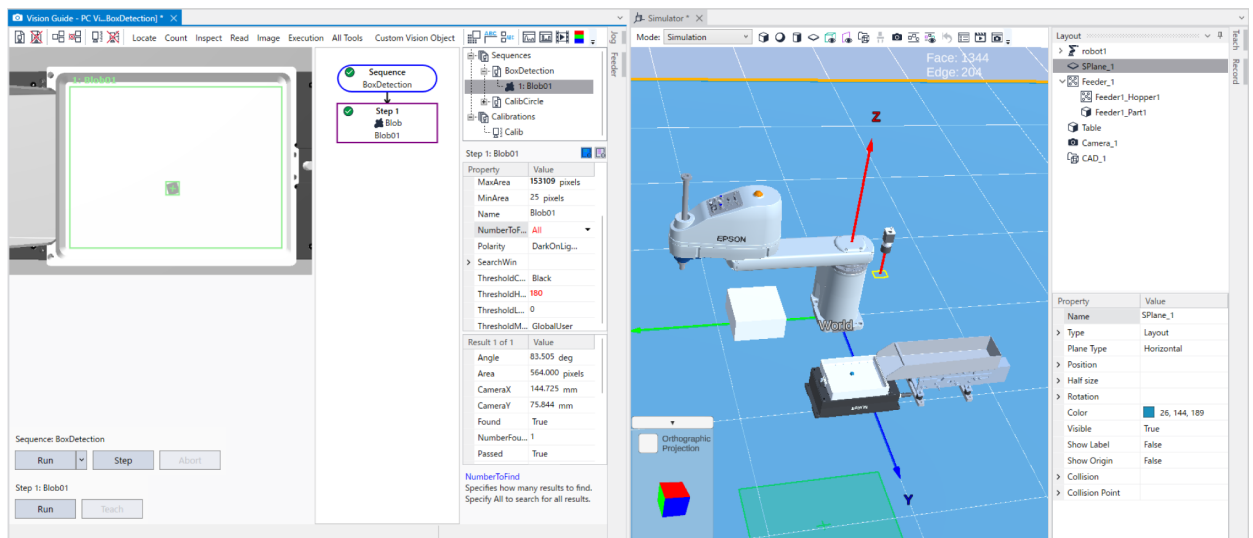
C:\EpsonRC80\Simulator\CAD\CalibBoard

Perform calibration using this CAD data.



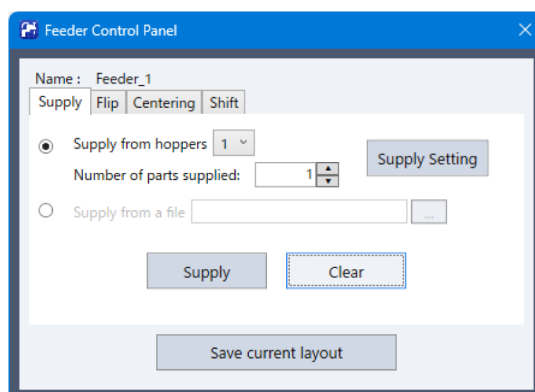
vii. Create a vision sequence and follow the steps below to check whether the parts are detected correctly.

- a. In the Feeder Operation Panel, supply one object serving as a part onto the feeder object.
 - Click the [Supply Setting] button on the Feeder Operation Panel.
 - Select the base object for the part from the objects currently placed in 3D.
 - Select the default "Default Box" here.
- b. Create a sequence named "BoxDetection" to recognize this part.
 - Use a Blob object as the vision object for recognition.
 - If the part is not recognized correctly, set the "ThresholdHigh" property to "180" and adjust it.
 - Change the "NumberToFind" property from "1" to "All" to recognize all parts on the feeder.
- c. Run the "BoxDetection" sequence and confirm that the parts are recognized correctly.
- d. Set the "Calibration" property to the calibration "Calib" created in the earlier step.



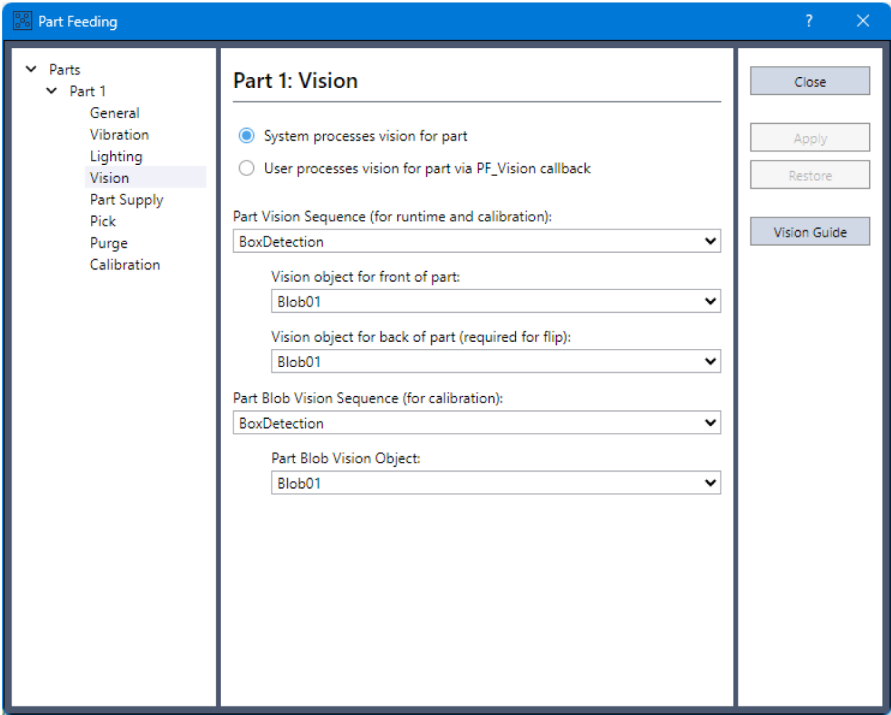
e. After confirming that the parts are recognized, clear the parts from the feeder.

- Click the [Clear] button on the Feeder Operation Panel.

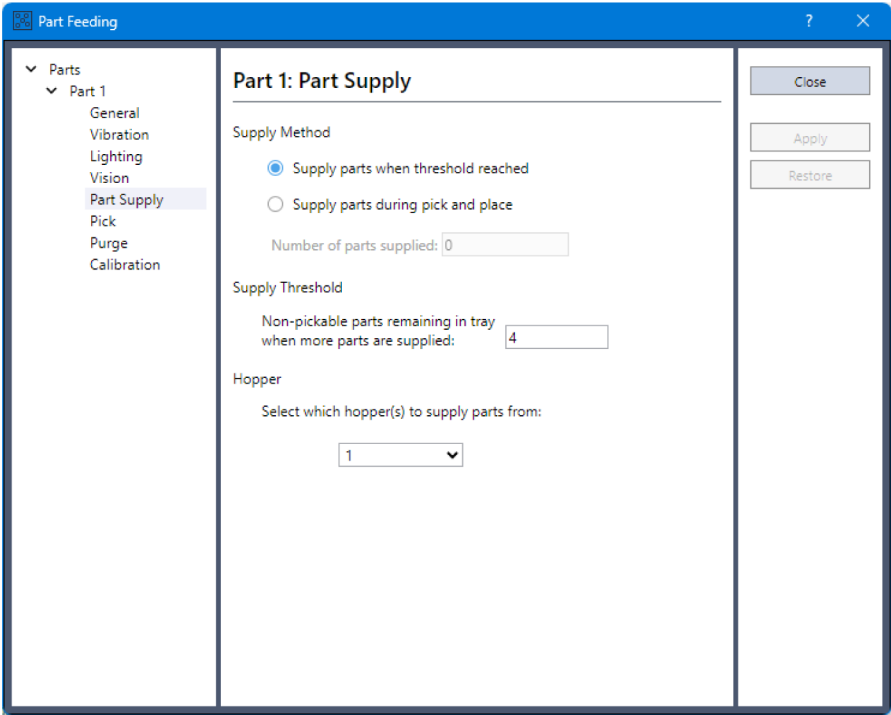


viii. Configure the parts and feeder using the steps below.

- a. Open the Epson RC+ 8.0 menu - [Tools] - [Part Feeding], and add a part.
- b. When a part is added for the first time, PartFeeding.prg is generated automatically.
- c. Vision sequence settings are required. Configure them as follows.



d. In the part supply settings, select "1" as the hopper.



e. Configure the other settings as needed.

For details on the settings, refer to the following manual:

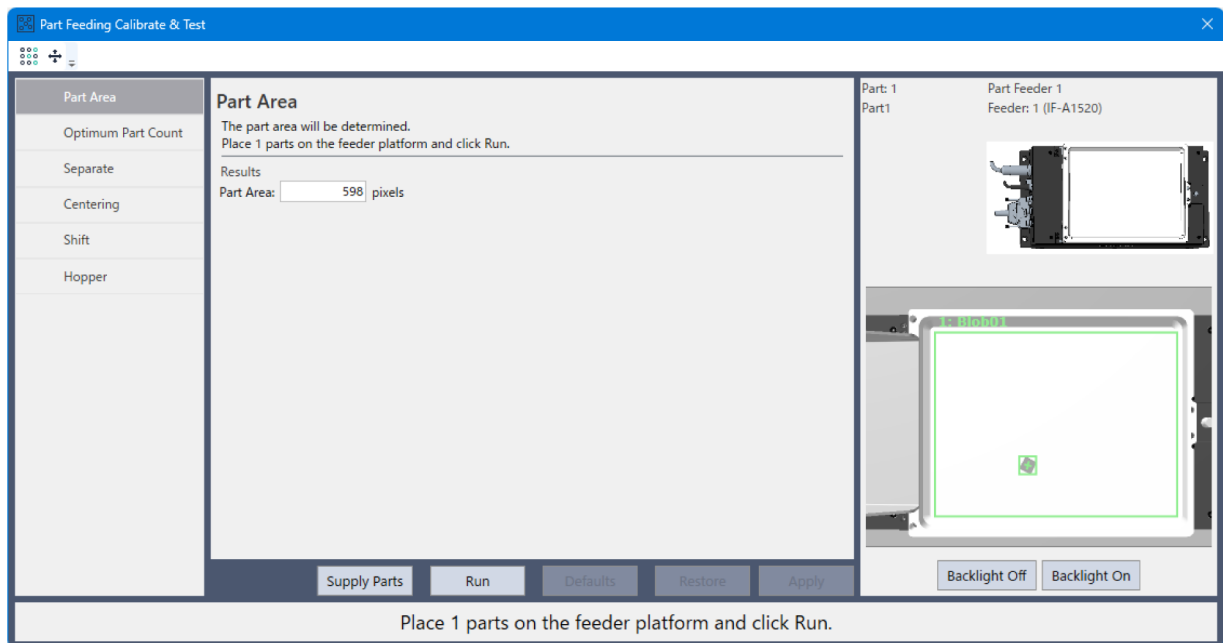
"Part Feeding 8.0 Introduction & Software - Software - Part Feeding GUI - Part Feeding Dialog Box"

Leave the default settings unchanged here.

ix. Calibrate the feeder using the steps below.

a. On the part settings screen, click [Calibrate & Test] under [Calibration].

- b. First, measure the part area.
 - a. Click the [Part Supply] button to open the Feeder Operation Panel, and supply only one part.
 - b. Click the [Execute] button to calculate the part area.
 - c. Configure and adjust the feeder parameters as needed.



For details on the settings, refer to the following.

"Part Feeding 8.0 Introduction & Software - Software - Part Feeding GUI - Calibrate & Test"

2. Create a program

When the first part setting is added, the program files PartFeeding.prg and PartFeeding.inc are created automatically. A template has been added for a callback function that is automatically called from the part feeding operation process when specified conditions are met.

For details on callback functions, refer to the following.

"Part Feeding 8.0 Introduction & Software - Software - Introduction - Part Feeding Software Configuration - Callback Functions"

Here, add the processing required to operate the robot.

This program specifies the number of parts the robot picks and places when program operation starts.

Create the following program as Main.prg.

```
Global Integer gMaxCount ' Number of parts to pick and place
Global Integer gCount    ' Current number of picked parts

Function main
  String input$
  InputBox "Please input number of parts to pick and place", "Number of parts",
"10", input$
  gMaxCount = Val(input$)

  SimSet Feeder_1.ClearSupply
```

```

Motor On
Power High
Accel 100, 100
Speed 100
Jump XY(240, 100, -50, 0)

PF_Start 1

Xqt StartRobot
Fend

Function StartRobot
  TmReset 0
  Do
    If gCount >= gMaxCount Then
      Exit Do
    EndIf
  Loop

  Print "Total: ", Tmr(0), "[s]"

  PF_Stop 1
Fend

```

Add the following to the beginning of PartFeeding.prg.

```

Global Integer gMaxCount
Global Integer gCount

```

Additionally, rewrite the function "PF_Robot" as follows.

```

Function PF_Robot(PartID As Integer) As Integer
  'Robot number is set by [Tool] - [PartFeeding] - [General].
  'Set Tool, Arm, ECP if needed.

  If gCount >= gMaxCount Then
    PF_Robot = PF_CALLBACK_SUCCESS
    Exit Function
  EndIf

  String name$
  Do While PF_QueLen(PartID) > 0
    'Get position of part to be picked in the calibration robot local
    P0 = PF_QueGet(PartID)

    'Pick (Jump P0 etc)
    Go Here :Z(-50)
    Jump P0 /R :Z(-160) :U(0) LimZ -50
    SimGet robot1.NearestObjToTool(0), name$
    SimSet robot1.Pick, name$

    'Place (Jump P1 etc)
    Jump XY(300 + (gCount / 6) * 30, -70 + (gCount Mod 6) * 30, -160, 0) LimZ
  Loop
EndFunction

```

```

-50
    SimSet robot1.Place, name$
    SimSet name$.SetParent, Table

    'Deque
    PF_QueueRemove PartID

    'Check Cycle stop
    gCount = gCount + 1
    If PF_IsStopRequested(PartID) = True Or gCount >= gMaxCount Then
        Exit Do
    EndIf
Loop

PF_Robot = PF_CALLBACK_SUCCESS

Fend

```

Also, rewrite the function "PF_Control" as follows.

```

Function PF_Control(PartID As Integer, Control As Integer) As Integer
    String msg$
    Select Control

        Case PF_CONTROL_SUPPLY_FIRST ' Request for part supply (when empty)
            msg$ = PF_Name$(PartID) + CRLF + CRLF + "Supply " + Str$(PF_Info(PartID,
PF_INFO_ID_FEEDER_CALIB_CORRECT_MAXNUM)) + " parts."

            'Sample for hopper control
            PF_Hopper 1, PartID, 3000
            Wait 3.0

        Case PF_CONTROL_SUPPLY ' Request for part supply (add up to optimum number)
            msg$ = PF_Name$(PartID) + CRLF + CRLF + "Supply additional parts."

            'Sample for hopper control
            PF_Hopper 1, PartID, 3000
            '(For parallel supplying, Wait is not needed here.)

        Case PF_CONTROL_LIGHT_ON ' Request for Front Light On
            msg$ = PF_Name$(PartID) + CRLF + CRLF + "Turn front light On."

        Case PF_CONTROL_LIGHT_OFF ' Request for Front Light Off
            msg$ = PF_Name$(PartID) + CRLF + CRLF + "Turn front light Off."

    Send

    If False And CtrlDev = 21 Then
        MsgBox msg$, MB_ICONINFORMATION
    Else
        Print msg$
    EndIf

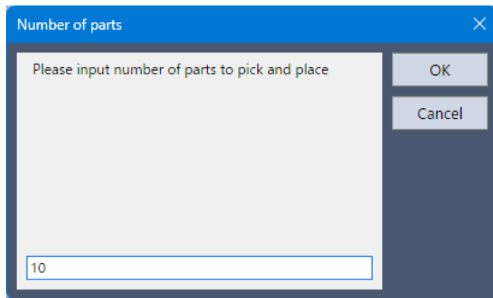
```

```
PF_Control = PF_CALLBACK_SUCCESS
```

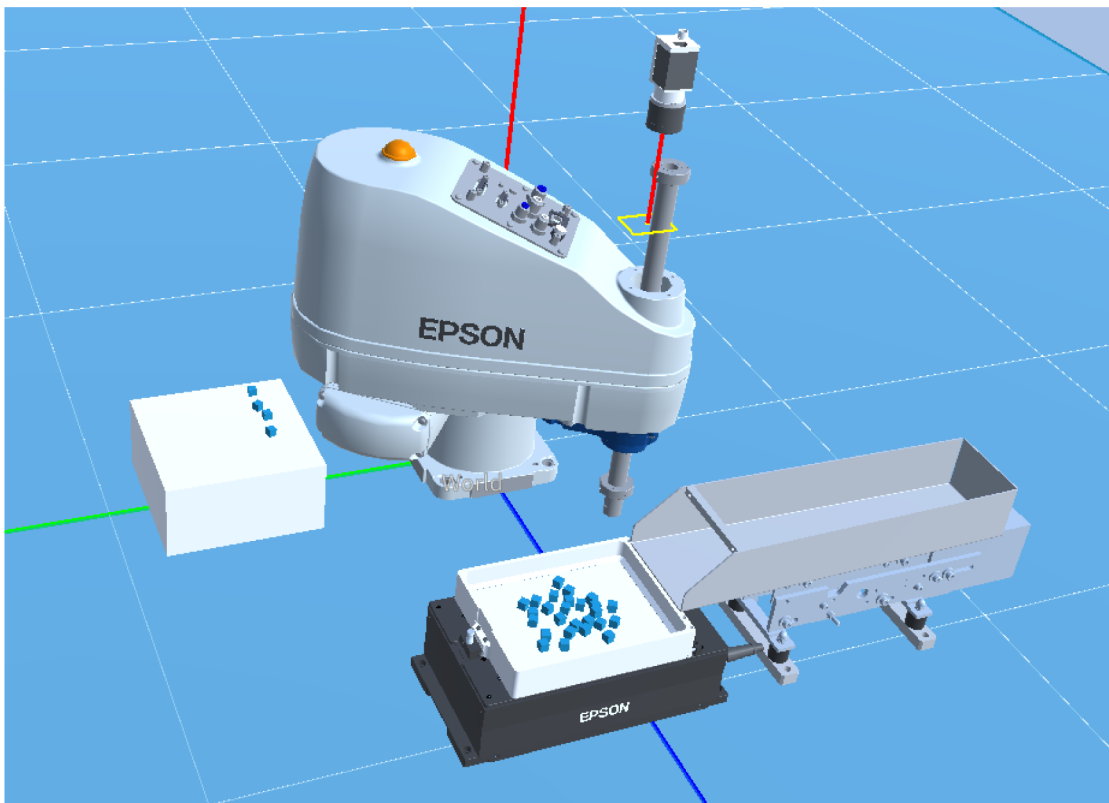
```
End
```

3. Run the program

- i. Click the [Run Window] button on the toolbar to display the Run window.
- ii. Select the function "main", and then click the [Start] button.
- iii. A dialog box for entering the number of parts to Pick & Place appears.
Enter any number, and then click the [OK] button.



- iv. After the parts are supplied to the feeder, confirm that the robot picks them up and moves them to the table.



6. Simulator Specifications and Restrictions

This section describes the simulator specification, its restrictions, and precautionary statements.

6.1 Epson RC+ 8.0 Package

Epson RC+ 8.0 Ver. 8.0.x.x has two packages:

- Epson RC+ 8.0: Standard package for developing the robot system
- Epson RC+ 8.0 Trial: Trial package for limited use (program execution on PC)
It cannot be connected to a controller.

	Simulation, Program execution on PC	Connection with controller	Connection with controller + 3D display
Epson RC+ 8.0	OK *2	OK	OK *1
Epson RC+ 8.0 Trial	OK *2	×	×

*1 Requires the configuration to enable the simulator functions in Epson RC+ 8.0. See below.

Connection with controller

*2 Total execution time of program is limited.



KEY POINTS

The Epson RC+ 8.0 Trial package does not exist in Epson RC+ 8.0 Ver8.1.x.x or later. Instead, during license activation when first starting Epson RC+ 8.0, you can select [Started as a trial version]. In such a case, both the controller connection and 3D display are enabled.

See details below.

"Epson RC+ 8.0 User's Guide - Operation - Starting Epson RC+ 8.0 - License Activation (Online Authentication)"

6.2 Specifications and precautions for the 3D display

Available robots for 3D display

In the future, we will add more robots for 3D display. Please contact the supplier of your region for the latest information.

Some robots cannot use this function. For details on unsupported models, see below.

Appendix A: Simulator Functions List of Unsupported Manipulator Models



KEY POINTS

- The flexible duct is displayed roughly.
 - Check the manipulator manual for the dimensions.
 - The duct actually vibrates while the manipulator is moving, the simulator doesn't display the vibration. Check how the duct vibrates with your real manipulator.
- The bellow for Cleanroom or Protected-model is displayed roughly
 - Check the manipulator manual for the dimensions.

Available CAD data for 3D** display**

The following format is available for 3D display to show the robot hand and CAD object.

- VRML 2.0 *1
- STEP (AP203/AP214) *2
- IGES
- DXF
- AutoCAD R software DXF Format (DXF R13, DXF R14, DXF 2000/2000i, DXF 2002)

*1 Limits of reading: VRML2.0 prototype is not supported.

*2 Limits of reading: The file whose character code is only ASCII can be read. In addition, if Color is configured in Face, the specified Color is displayed.



KEY POINTS

The data file must be saved in the specified folder on the PC. It is not saved in the Epson RC+.

The character code of file path for CAD data

For CAD data files in VRML 2.0 format or IGES format, the data cannot be loaded if character code is included that differs from the language in the operating environment used in the file path (file name, folder name). Change the file and folder name to be the same character code as the language in operating environment.

CAD data loading restrictions

The total number of polygons and polylines in the CAD data loaded is limited to a million each. When the error message appears, reduce the number of polygons and polylines.

CAD data setup orientation

Some CAD data coordinates may be different from those of the simulator.

Adjust the coordinates to the correct position by changing [Property]-[Rotation] after loading the CAD data.

When loading CAD data as a hand, set the origin of the CAD data in the Tool0 position of the manipulator. Set the coordinates to the correct position by changing [Property]-[Position] after loading the CAD data.

Number of available layout objects

You can create as many layout objects as you want.

However, when there are many objects to display, the display update interval becomes longer and the judgment of collision detection becomes rough.

Especially for CAD data, displaying data that is too complicated is not recommended.

Shape of CAD object

The shape of objects may be displayed incorrectly (such as a clearance arises between the faces) depending on the CAD data. In such a case, the shape may be improved by converting the data to a different format.

Front-back relation of objects in semi-transparent display

The front-back relation of the objects may be incorrect when displaying the CAD and Hand objects in semi-transparent display.

Rendering speed

It may take a few seconds to render the objects depending on the display adapter, and operability such as in selecting the object may be decreased. It is recommended to update the driver to the latest version.

6.3 Specifications and precautions for Simulation (program execution on PC)

Overview

The Simulator produces the robot motions virtually on your PC.

It is designed to make the performance gap between the real system and the virtual system as small as possible. However, a few differences in the virtual system are inevitable. The operation time prediction and collision detection do not guarantee the precision.

Fully understand the contents in this chapter and check if the real system operates without any problems before you go to full-scale operation.

Operation time prediction

Operation time displayed in the [Robot Simulator] window is approximate time required for executing the program.

Time for the motion commands such as Go, Jump reflects the Speed and Accel values in the program. The operation time may vary when you operate the real robots from the displayed operation time according to conditions such as the Fine setting and servo delay. In particular, when small ranges are used with the Fine instruction, the real robots need a longer operation time for accurate positioning.

The simulation cannot guarantee the precision but the margin of error in the operation time is within 10% when you execute motions with the standard cycle time (with the default Fine settings).

- Considered in the operation time prediction
 - Robot model
 - Speed settings (Speed, Speeds, etc.)
 - Acceleration settings (Accel, Accels, etc.)
 - Load (Weight, Inertia)
 - Others (ARCH, CP)
- Not considered in the operation time prediction
 - Fine setting
 - Error within 10% from the default (Motions of standard cycle time)
 - With larger setting than the default, the operation time will be shorter.
 - With smaller setting than the default, the operation time will be longer.
 - Servo delay
 - With the real robots, the operation will be longer.

Time for the other commands than the motion commands is a virtually executed time on PC; therefore the actual time varies widely depending on the PC performance.

When measuring the motion time between two points, as simple program as possible is recommended. (See: [Working with the User Created System](#) - "Measure the robot operation time")

Collision Detection Precision

The Simulator Collision Detection provides an indication whether robots collide with the peripheral equipment or not when the program is executed. It does not consider the error in path due to servo delay. Make sure to have a margin when you apply the simulation result for a real robot system.

The Simulator judges collisions more accurately when the robot motion speed is slow.

The judgment of collision detection during program execution is accomplished with the 3D display update. When your PC has high graphics performance, the collision judgment becomes more accurate.

In Playback mode, judgments on collision detections are made in all steps. This allows for more accurate detection.

The Simulator cannot guarantee the precision but the margin of error in the collision detection is within 10 mm when you execute motions with Speed 100% on a PC of the recommended specifications.

Motion duty and Overload error

In the Simulator, you cannot detect overload errors. Even if the motion duty is excessively high and the robot should stop due to overload error, it keeps operating.

Duty 50% - As a measure of possible duty, the robot can really keep moving at duty 50% with the maximum acceleration/deceleration speed and without the overload error. However, it depends on the robot model type, load, points to go to, and acceleration/deceleration speed setting, etc.

Execution on PC that does not meet recommended system requirements

You can install the Epson RC+ and use the Simulator functions on a PC that does not meet the recommended system requirements. However, it doesn't guarantee the correct motions because the following may happen:

- Operation time prediction is not accurate
- Collision Detection has a large margin of error
- 3D display skips updates

6.4 Specifications and Precautions of Controller Setting on Epson RC+

Restriction on the controller settings

When a virtual controller is connected, the following settings cannot be made in [Setup]-[System Settings]-[Controller]. The items that cannot be set are displayed in gray.

- IP Address settings, etc. on [Configuration]
- Dry Run settings, etc. on [Preferences]

Backup and restore of the controller setting

The setting data that you backup in the virtual controller can be restored in a controller. Also, the setting data that you backup in a controller can be restored in a virtual controller.

However, there are restrictions. For details, refer to "Controller Backup" and "Restore Controller" below.

"Epson RC+ 8.0 User's Guide - Epson RC+ 8.0 GUI - [Tools] Menu - [Controller] Command (Tools Menu)"

6.5 Restriction on SPEL+ Command Execution

I/O operation and commands (On, Off, SW, Ctr, etc.)

All I/Os, including optional boards, are available. Operating I/O data is stored in the PC memory (virtual I/O mode). The I/O input status can be changed from the Epson RC+ I/O Monitor window. Also, the I/O input status can be changed using the SetSw or SetIn statements in a SPEL+ program.

KEY POINTS

Even if you specify an asynchronous On/Off command, the I/O status cannot be changed after the specified time. The Ctr function always returns 0.

Ethernet/RS-232C communication command (Print #, Input #, OpenCom, OpenNet, etc.)

All 16 Ethernet ports are available. However, an Ethernet port requires configuration of the IP address and TCP/IP port.

For RS-232C on the Controller, all 8 ports, including the optional RS-232C board, are available.

CAUTION:

For RC800, RC700 and RC90 series Controller, up to 5 ports, including the standard port and the optional RC-232C port, are available. T series and VT series Manipulator do not have RS-232C ports on the Controller. Be careful of the number of the ports when using the project created in the virtual controller to the Controller. Also, some models in the RC800 series do not support optional boards.

As a default, Ethernet / RS-232C communication commands do not perform actual communication.

To use the actual Ethernet/RS-232C ports, be sure to configure as described in (3).

Output data from Print #, etc. is saved in the communication output file. In the input by Input #, etc, the return value is 0 (numeric data) or blank (string). However, if you create a communication response file, the return value depends on the file content.

Communication output file

When an OpenCom or OpenNet command is called, a communication output file is created. For the output destination folder of the communication output file, see below.

- "Epson RC+ 8.0 User's Guide - RS-232C Communication"
- "Epson RC+ 8.0 User's Guide - TCP/IP Communication"

DummySend***.dat: Communication output file (***) is the port number)

When a communication output file already exists, the previous output data is deleted. The file is deleted when you switch the project; save the file in a proper folder if you need.

When executing the following program,

```
OpenCom #1
Print #1, 123
Print #1, "TEST DATA"
CloseCom #1
```

The DummySend001.dat file will contain the following:

```
123
TEST DATA
```

Communication response file

Copy the communication response file to the designated folder in advance. For the communication response file folder, see below.

- "Epson RC+ 8.0 User's Guide - RS-232C Communication"
- "Epson RC+ 8.0 User's Guide - TCP/IP Communication"

The file is deleted when you change the project; save the file in another folder if you need to keep it.

When calling OpenCom or OpenNet command, the communication response file is loaded.

DummyRead***.dat: Communication response file (***) is a port number)

When the following DummyRead001.dat file is used,

```
321
Test Data
```

When executing the following program,

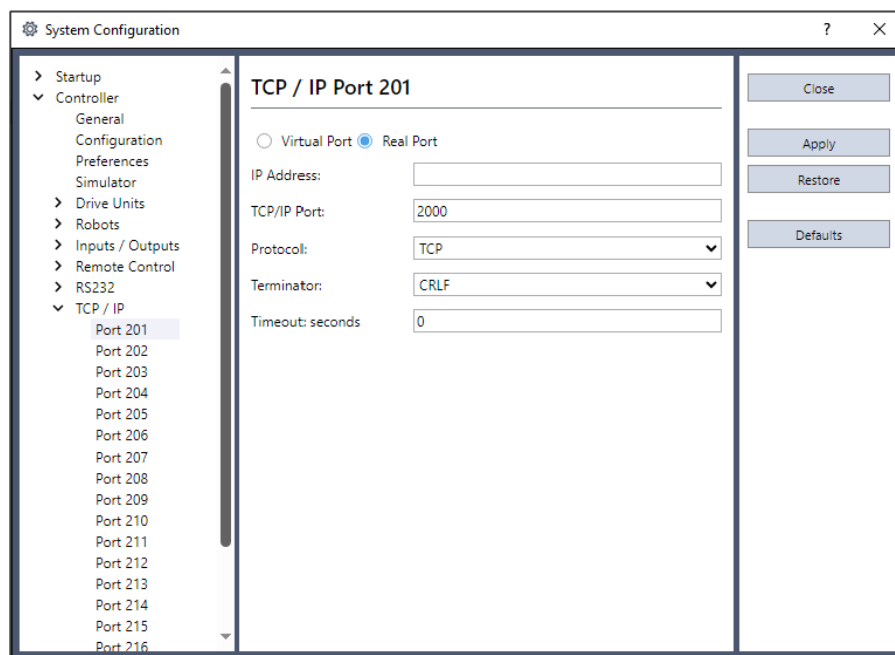
```
Integer i
String s$
OpenCom #1
Input # 1, i
Input # 1, s$
CloseCom #1
Print i
Print s$
```

the return values are i = 321 (numeric data), and s\$ = "Test Data" (string).

How to enable the actual ports of Ethernet/RS-232C in the virtual controller

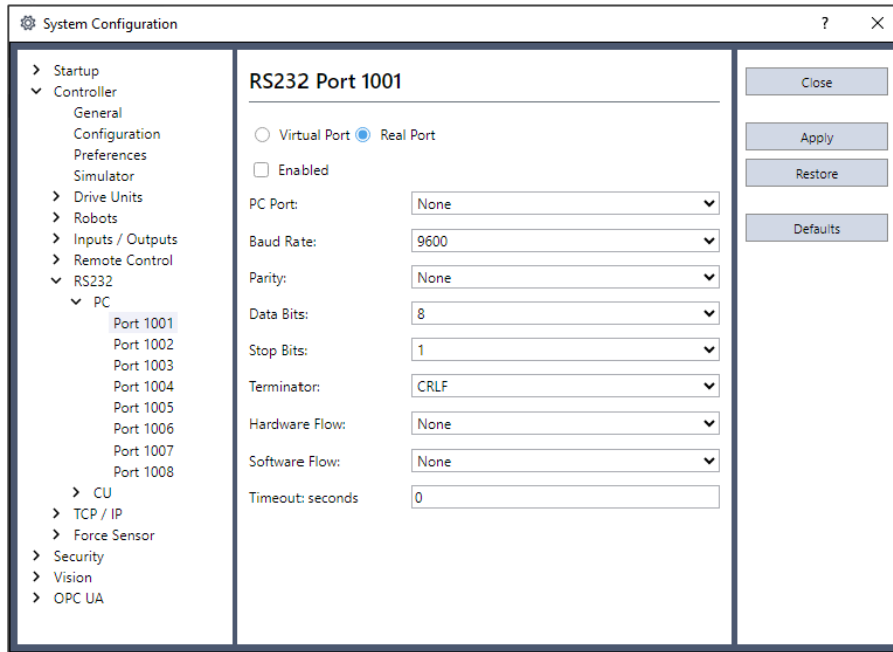
Actual ports become available when [Real] is selected in [Setup]-[System Configuration]-[Controller]-[TCP/IP] from the Epson RC+ 8.0 menu.

Change the port settings, then click the [Apply] button and the [Close] button.



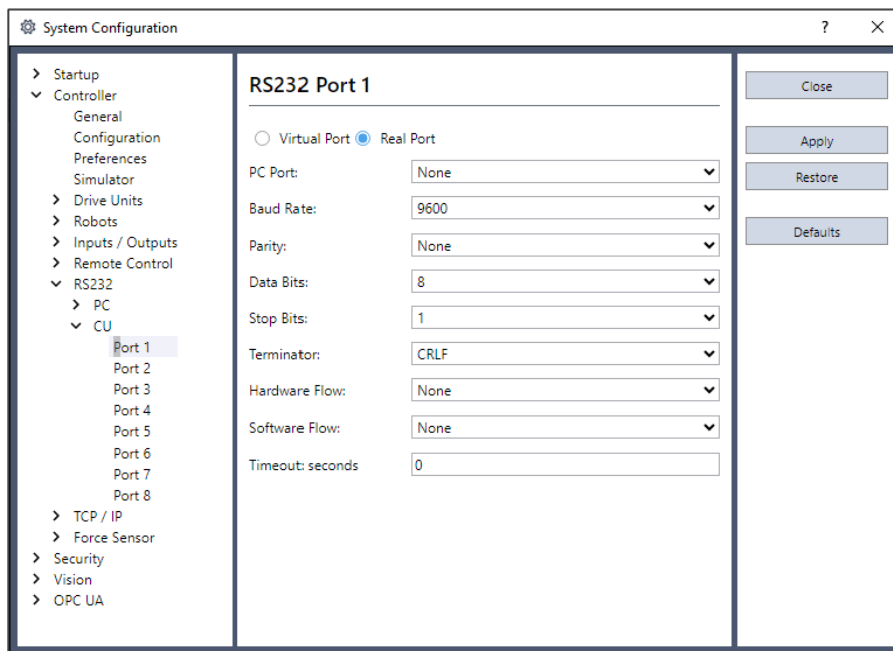
Actual ports become available when [Real] is selected in [Setup]-[System Configuration]-[Controller]-[RS-232]-[PC] from the Epson RC+ 8.0 menu.

Select the PC port, then click the [Apply] button and the [Close] button.



Actual ports become available when [Real] is selected in [Setup]-[System Configuration]-[Controller]-[RS-232]-[Controller].

Select the PC port, then click the [Apply] button and the [Close] button.



To use the actual Ethernet/RC-232C ports, select the [Actual] button in the configuration dialog.

Vision command (VRun, VGet, etc.)

Vision sequence can be executed with an image file set in ImageFile property as an input image. Also the result can be acquired by VGet. When the PC vision is set and the GigE camera is connected, vision commands such as VRun and VGet can be executed using actual camera image. In this case, commands can be executed from the virtual camera function like the Compact Vision, when the GigE camera is not connected.

For details on Vision Guide, refer to the following manual.

"Epson RC+ Option Vision Guide 8.0"

Other restrictions

- For the Wait command, the following syntax is not supported:
Wait InsideBox()
Wait InsidePlane()
- You cannot set the time using the Time/Date command. You can only display it.
- With the SimSet command, motions of parts specified using Pick or Place, and movements or rotations of objects specified using PositionX, PositionY, PositionZ, RotationX, RotationY, or RotationZ, cannot be recorded or played back using the Record/Playback function.

Program total execution time

With licenses up to Epson RC+ Basic Edition, the total execution time of programs in the virtual controller is limited to one hour.

If total execution is over one hour, a warning message appears.

You can execute the program again after the warning is displayed. The total execution timer will be reset.

6.6 Specifications and Precautions of Epson RC+ 8.0 Trial

Version upgrade from Epson RC+ 8.0 Trial to Epson RC+ 8.0

When upgrading from Epson RC+ 8.0 Ver. 8.0.x.x Trial to Epson RC+ 8.0, refer to the following and install Epson RC+ 8.0 on your PC. There is no need to uninstall Epson RC+ 8.0 Ver. 8.0.x.x Trial from your PC.

"Epson RC+ 8.0 User's Guide - Appendix - Appendix B: Epson RC+ 8.0 Software"

KEY POINTS

Projects and virtual controllers (layouts) created with Epson RC+ 8.0 Ver. 8.0.x.x Trial can be directly used with Epson RC+ 8.0.

KEY POINTS

If you are using the trial version of Epson RC+ 8.0 Ver. 8.1.0.0 or later, you can use it as the regular version by authenticating the license. See details below.

"Epson RC+ 8.0 User's Guide - Epson RC+ 8.0 GUI - [Setup] Menu - [License Configuration] Command (Setup Menu) - [Setup] - [License Configuration] - [PC] - [General]"

7. Appendix

7.1 Appendix A: Simulator Functions List of Unsupported Manipulator Models

Simulator functions do not support the following Manipulator models.

X5 series Manipulators

All models do not support the simulator functions.

There is no alternative model.

G6 series Manipulators

Protected-models as described in the table below do not support the simulator functions.

G6-451D-II	G6-551D-II	G6-651D-II
G6-451DR-II	G6-551DR-II	G6-651DR-II
G6-451DW-II	G6-551DW-II	G6-651DW-II
G6-451P-II	G6-551P-II	G6-651P-II
G6-451PR-II	G6-551PR-II	G6-651PR-II
G6-451PW-II	G6-551PW-II	G6-651PW-II
G6-453D-II	G6-553D-II	G6-653D-II
G6-453DR-II	G6-553DR-II	G6-653DR-II
G6-453DW-II	G6-553DW-II	G6-653DW-II
G6-453P-II	G6-553P-II	G6-653P-II
G6-453PR-II	G6-553PR-II	G6-653PR-II
G6-453PW-II	G6-553PW-II	G6-653PW-II

When connecting to Virtual Controller, the following models can be set as an alternative model. However, external dimensions and motion range of arms may differ.

- Standard model: G6-***S*-II
- Cleanroom model: G6-***C*-II

For more details, refer to the following manual.

"SCARA Robot G series Manipulator Manual"

G10 series Manipulators

Protected-models as described in the table below do not support the simulator functions.

G10-651D-II	G10-851D-II
G10-651DR-II	G10-851DR-II
G10-651DW-II	G10-851DW-II
G10-651P-II	G10-851P-II

G10-651PR-II	G10-851PR-II
G10-651PW-II	G10-851PW-II
G10-654D-II	G10-854D-II
G10-654DR-II	G10-854DR-II
G10-654DW-II	G10-854DW-II
G10-654P-II	G10-854P-II
G10-654PR-II	G10-854PR-II
G10-654PW-II	G10-854PW-II

When connecting to Virtual Controller, the following models can be set as an alternative model. However, external dimensions and motion range of arms may differ.

- Standard model: G10-***S*-II
- Cleanroom model: G10-***C*-II

For more details, refer to the following manual.

"SCARA Robot G series Manipulator Manual"

G20 series Manipulators

Protected-models as described in the table below do not support the simulator functions.

G20-851D-II	G20-A01D-II
G20-851DR-II	G20-A01DR-II
G20-851DW-II	G20-A01DW-II
G20-851P-II	G20-A01P-II
G20-851PR-II	G20-A01PR-II
G20-851PW-II	G20-A01PW-II
G20-854D-II	G20-A04D-II
G20-854DR-II	G20-A04DR-II
G20-854DW-II	G20-A04DW-II
G20-854P-II	G20-A04P-II
G20-854PR-II	G20-A04PR-II
G20-854PW-II	G20-A04PW-II

When connecting to Virtual Controller, the following models can be set as an alternative model. However, external dimensions and motion range of arms may differ.

- Standard model: G20-***S*-II
- Cleanroom model: G20-***C*-II

For more details, refer to the following manual.

"SCARA Robot G series Manipulator Manual"