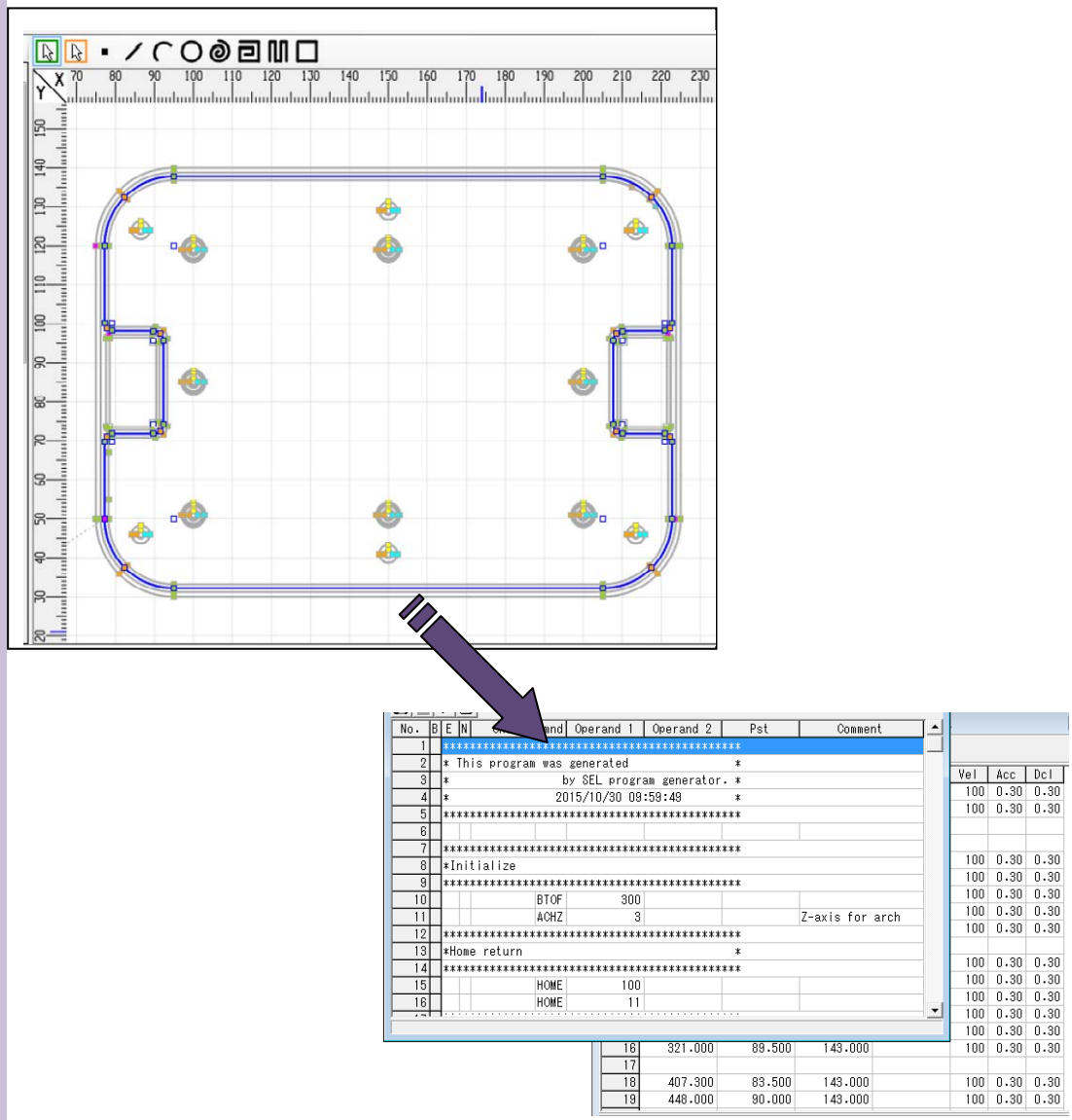
SEL Program Generator (Dispensing Type)

Operation Manual Fourth Edition



IAI Corporation

Please Read Before Use

Thank you for purchasing our product.

In manual, explains how you can use this feature and necessary information to use it safely.
Before the operation, read this manual carefully and fully understand it to operate this product.
The enclosed DVD in this product package includes the Instruction Manual for this product.
For the operation of this product, print out the necessary sections in the Instruction Manual or display them using the personal computer.

After reading through this manual, keep this Instruction Manual at hand so that the operator of this product can read it whenever necessary.

[Important]

- This Manual is original.
- The product cannot be operated in any way unless expressly specified in this Manual.
  IAI shall assume no responsibility for the outcome of any operation not specified herein.
- Information contained in this Manual is subject to change without notice for the purpose of product improvement.
- If you have any question or comment regarding the content of this manual, please contact the IAI sales office near you.
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- The company names, names of products and trademarks of each company shown in the sentences are registered trademarks.

Safety Guide

"Safety Guide" has been written to use the machine safely and so prevent personal injury or property damage beforehand. Make sure to read it before the operation of this product.

Safety Precautions for Our Products

The common safety precautions for the use of any of our robots in each operation.

No.	Operation Description	Description
1	Model Selection	● This product has not been planned and designed for the application where high level of safety is required, so the guarantee of the protection of human life is impossible. Accordingly, do not use it in any of the following applications. 1) Medical equipment used to maintain, control or otherwise affect human life or physical health. 2) Mechanisms and machinery designed for the purpose of moving or transporting people (For vehicle, railway facility or air navigation facility) 3) Important safety parts of machinery (Safety device, etc.) ● Do not use the product outside the specifications. Failure to do so may considerably shorten the life of the product. ● Do not use it in any of the following environments. 1) Location where there is any inflammable gas, inflammable object or explosive 2) Place with potential exposure to radiation 3) Location with the ambient temperature or relative humidity exceeding the specification range 4) Location where radiant heat is added from direct sunlight or other large heat source 5) Location where condensation occurs due to abrupt temperature changes 6) Location where there is any corrosive gas (sulfuric acid or hydrochloric acid) 7) Location exposed to significant amount of dust, salt or iron powder 8) Location subject to direct vibration or impact ● For an actuator used in vertical orientation, select a model which is equipped with a brake. If selecting a model with no brake, the moving part may drop when the power is turned OFF and may cause an accident such as an injury or damage on the work piece.

No.	Operation Description	Description
2	Transportation	● When carrying a heavy object, do the work with two or more persons or utilize equipment such as crane. ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When in transportation, consider well about the positions to hold, weight and weight balance and pay special attention to the carried object so it would not get hit or dropped. ● Transport it using an appropriate transportation measure. The actuators available for transportation with a crane have eyebolts attached or there are tapped holes to attach bolts. Follow the instructions in the instruction manual for each model. ● Do not step or sit on the package. ● Do not put any heavy thing that can deform the package, on it. ● When using a crane capable of 1t or more of weight, have an operator who has qualifications for crane operation and sling work. ● When using a crane or equivalent equipments, make sure not to hang a load that weighs more than the equipment's capability limit. ● Use a hook that is suitable for the load. Consider the safety factor of the hook in such factors as shear strength. ● Do not get on the load that is hung on a crane. ● Do not leave a load hung up with a crane. ● Do not stand under the load that is hung up with a crane.
3	Storage and Preservation	● The storage and preservation environment conforms to the installation environment. However, especially give consideration to the prevention of condensation. ● Store the products with a consideration not to fall them over or drop due to an act of God such as earthquake.
4	Installation and Start	(1) Installation of Robot Main Body and Controller, etc. ● Make sure to securely hold and fix the product (including the work part). A fall, drop or abnormal motion of the product may cause a damage or injury. Also, be equipped for a fall-over or drop due to an act of God such as earthquake. ● Do not get on or put anything on the product. Failure to do so may cause an accidental fall, injury or damage to the product due to a drop of anything, malfunction of the product, performance degradation, or shortening of its life. ● When using the product in any of the places specified below, provide a sufficient shield. 1) Location where electric noise is generated 2) Location where high electrical or magnetic field is present 3) Location with the mains or power lines passing nearby 4) Location where the product may come in contact with water, oil or chemical droplets

No.	Operation Description	Description
4	Installation and Start	(2) Cable Wiring ● Use our company's genuine cables for connecting between the actuator and controller, and for the teaching tool. ● Do not scratch on the cable. Do not bend it forcibly. Do not pull it. Do not coil it around. Do not insert it. Do not put any heavy thing on it. Failure to do so may cause a fire, electric shock or malfunction due to leakage or continuity error. ● Perform the wiring for the product, after turning OFF the power to the unit, so that there is no wiring error. ● When the direct current power (+24V) is connected, take the great care of the directions of positive and negative poles. If the connection direction is not correct, it might cause a fire, product breakdown or malfunction. ● Connect the cable connector securely so that there is no disconnection or looseness. Failure to do so may cause a fire, electric shock or malfunction of the product. ● Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Failure to do so may cause the product to malfunction or cause fire.
		(3) Grounding ● The grounding operation should be performed to prevent an electric shock or electrostatic charge, enhance the noise-resistance ability and control the unnecessary electromagnetic radiation. ● For the ground terminal on the AC power cable of the controller and the grounding plate in the control panel, make sure to use a twisted pair cable with wire thickness 0.5mm^2 (AWG20 or equivalent) or more for grounding work. For security grounding, it is necessary to select an appropriate wire thickness suitable for the load. Perform wiring that satisfies the specifications (electrical equipment technical standards). ● Perform Class D Grounding (former Class 3 Grounding with ground resistance 100Ω or below).

No.	Operation Description	Description
4	Installation and Start	(4) Safety Measures ● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● When the product is under operation or in the ready mode, take the safety measures (such as the installation of safety and protection fence) so that nobody can enter the area within the robot's movable range. When the robot under operation is touched, it may result in death or serious injury. ● Make sure to install the emergency stop circuit so that the unit can be stopped immediately in an emergency during the unit operation. ● Take the safety measure not to start up the unit only with the power turning ON. Failure to do so may start up the machine suddenly and cause an injury or damage to the product. ● Take the safety measure not to start up the machine only with the emergency stop cancellation or recovery after the power failure. Failure to do so may result in an electric shock or injury due to unexpected power input. ● When the installation or adjustment operation is to be performed, give clear warnings such as "Under Operation; Do not turn ON the power!" etc. Sudden power input may cause an electric shock or injury. ● Take the measure so that the work part is not dropped in power failure or emergency stop. ● Wear protection gloves, goggle or safety shoes, as necessary, to secure safety. ● Do not insert a finger or object in the openings in the product. Failure to do so may cause an injury, electric shock, damage to the product or fire. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity.
5	Teaching	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the teaching operation from outside the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the "Stipulations for the Operation" and make sure that all the workers acknowledge and understand them well. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign "Under Operation" at the position easy to see. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.

No.	Operation Description	Description
6	Trial Operation	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● After the teaching or programming operation, perform the check operation one step by one step and then shift to the automatic operation. ● When the check operation is to be performed inside the safety protection fence, perform the check operation using the previously specified work procedure like the teaching operation. ● Make sure to perform the programmed operation check at the safety speed. Failure to do so may result in an accident due to unexpected motion caused by a program error, etc. ● Do not touch the terminal block or any of the various setting switches in the power ON mode. Failure to do so may result in an electric shock or malfunction.
7	Automatic Operation	● Check before starting the automatic operation or rebooting after operation stop that there is nobody in the safety protection fence. ● Before starting automatic operation, make sure that all peripheral equipment is in an automatic-operation-ready state and there is no alarm indication. ● Make sure to operate automatic operation start from outside of the safety protection fence. ● In the case that there is any abnormal heating, smoke, offensive smell, or abnormal noise in the product, immediately stop the machine and turn OFF the power switch. Failure to do so may result in a fire or damage to the product. ● When a power failure occurs, turn OFF the power switch. Failure to do so may cause an injury or damage to the product, due to a sudden motion of the product in the recovery operation from the power failure.

No.	Operation Description	Description
8	Maintenance and Inspection	● When the work is carried out with 2 or more persons, make it clear who is to be the leader and who to be the follower(s) and communicate well with each other to ensure the safety of the workers. ● Perform the work out of the safety protection fence, if possible. In the case that the operation is to be performed unavoidably inside the safety protection fence, prepare the “Stipulations for the Operation” and make sure that all the workers acknowledge and understand them well. ● When the work is to be performed inside the safety protection fence, basically turn OFF the power switch. ● When the operation is to be performed inside the safety protection fence, the worker should have an emergency stop switch at hand with him so that the unit can be stopped any time in an emergency. ● When the operation is to be performed inside the safety protection fence, in addition to the workers, arrange a watchman so that the machine can be stopped any time in an emergency. Also, keep watch on the operation so that any third person can not operate the switches carelessly. ● Place a sign “Under Operation” at the position easy to see. ● For the grease for the guide or ball screw, use appropriate grease according to the Instruction Manual for each model. ● Do not perform the dielectric strength test. Failure to do so may result in a damage to the product. ● When releasing the brake on a vertically oriented actuator, exercise precaution not to pinch your hand or damage the work parts with the actuator dropped by gravity. ● The slider or rod may get misaligned OFF the stop position if the servo is turned OFF. Be careful not to get injured or damaged due to an unnecessary operation. ● Pay attention not to lose the cover or untightened screws, and make sure to put the product back to the original condition after maintenance and inspection works. Use in incomplete condition may cause damage to the product or an injury. * Safety protection Fence : In the case that there is no safety protection fence, the movable range should be indicated.
9	Modification and Dismantle	● Do not modify, disassemble, assemble or use of maintenance parts not specified based at your own discretion.
10	Disposal	● When the product becomes no longer usable or necessary, dispose of it properly as an industrial waste. ● When removing the actuator for disposal, pay attention to drop of components when detaching screws. ● Do not put the product in a fire when disposing of it. The product may burst or generate toxic gases.
11	Other	● Do not come close to the product or the harnesses if you are a person who requires a support of medical devices such as a pacemaker. Doing so may affect the performance of your medical device. ● See Overseas Specifications Compliance Manual to check whether complies if necessary. ● For the handling of actuators and controllers, follow the dedicated instruction manual of each unit to ensure the safety.

Alert Indication

The safety precautions are divided into “Danger”, “Warning”, “Caution” and “Notice” according to the warning level, as follows, and described in the Instruction Manual for each model.

Level	Degree of Danger and Damage	Symbol
Danger	This indicates an imminently hazardous situation which, if the product is not handled correctly, will result in death or serious injury.	Danger
Warning	This indicates a potentially hazardous situation which, if the product is not handled correctly, could result in death or serious injury.	Warning
Caution	This indicates a potentially hazardous situation which, if the product is not handled correctly, may result in minor injury or property damage.	Caution
Notice	This indicates lower possibility for the injury, but should be kept to use this product properly.	Notice

Construction of Instruction Manual and This Manual

● Basic Specifications

• Tracking Control

(Dispensing) Operation — SEL Program Generator (this manual) ME0351

★ Program

• SEL Program Language — SEL Language Programming Manual ME0224

■ Applicable Controller (including actuator integrated type)

• TTA — TTA Instruction Manual ME0320

• MSEL — MSEL Instruction Manual ME0336

■ Teaching Tool

• PC Software — PC Software ME0154

Contents

1. Introduction

1.1 Overview of SEL Program Generator (Dispensing Type)

"SEL Program Generator (Dispensing Type)" is software which enables you to have the SEL program and the position data generated easily from the figures drawn on the screen or CAD data only by tracking them. This makes dispensing operation so easy.

1.2 Environment for Operation

In order to operate this software, it is necessary that your personal computer satisfies the following conditions.

OS	Windows 7 (Note 1) Windows 8 Windows 8.1 Windows 10 Note 1 It is necessary to install Microsoft .NET Framework 4.x separately.
Computer Main Unit	Personal computer capable to operate the OS above
Memory Capacity	Capacity required to operate the OS above
Open Capacity in Hard Disk	10MB or more
Display Resolution	XGA (1024×768) or more

Windows is registered trademark of Microsoft Corporation.

1.3 Applicable Controllers

This software is applicable for the following controllers.

- Table-Top Type Robot TTA (with built-in controller)
- MSEL-PC/PG/PCF/PGF (Cartesian, Single-Axis Robot Control Type)
  (It is applicable only for those with the same construction as TTA has, which is 1st axis = X-axis, 2nd axis = Y-axis, 3rd axis = Z-axis and 4th axis = R-axis)

⚠ Caution:
SEL program generator is not applicable for the work and tool coordinate system features.
When the TTA and MSEL controller to be used is applicable for the work and tool coordinate system features [*1], set the of the work coordinate offset and tool coordinate offset to “0.000mm” for all the axes before executing the program.

When the work coordinate offset and tool coordinate offset are not set to “0.000mm” for all the axes, unexpected operation may occur, which could cause interference of robot, tool, workpiece, etc., and cause malfunction.

*1 Supported versions of work and tool coordinate systems
TTA : Main application part V2.00 and later
MSEL : Main application part V2.00 and later

The SEL programs, position data and simulations generated in SEL program generator should be applicable only when using the table top type robot and cartesian robot.
They are not applicable when using only the single axis (including gripper, rotary, etc.), wrist unit (including cartesian robot combined) or SCARA Robot (IXP).

1.4 Interface to Dispensing Device

PIO (24V input and output) is to be used for the interface with the dispensing device. Connect the dispensing command input signal of the dispensing device to controller output signal. Also, when the quantitative dispensing which dispenses for fixed amount is to be selected, connect also between the complete response signal of the dispensing device and controller input signal.
Assignment setting of each connected signal is to be conducted in [7.7 Dispensing Setting].
[Refer to the instruction manual for each controller for details for such as the specifications of PIO]

2. Installation

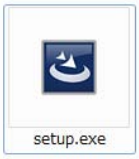
2.1 How to Acquire SEL Program Generator

There are ways as shown below to acquire it.
1) Download from IAI homepage

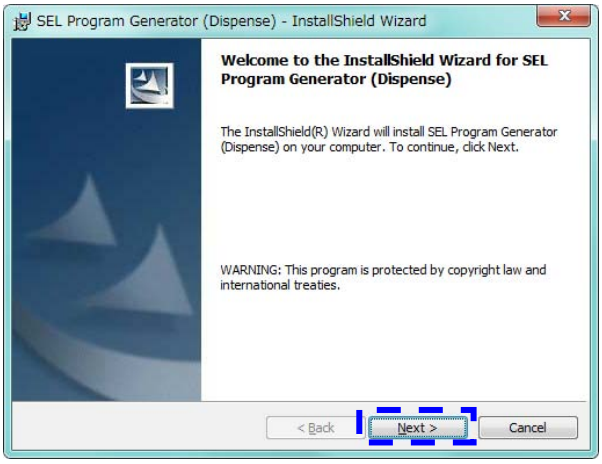
2.2 Installation of SEL Program Generator

Install the software in the following procedure.

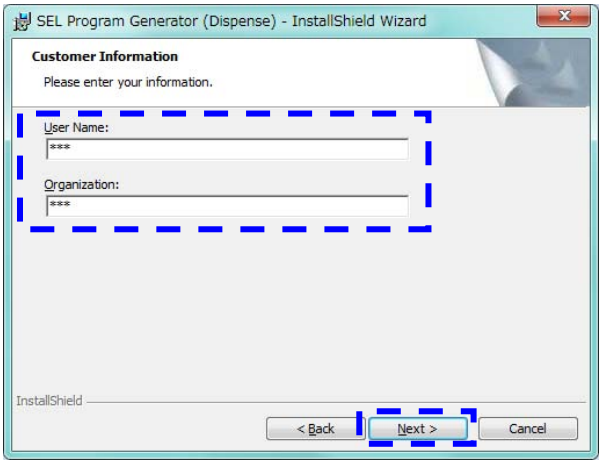
(1) Double-click “Setup.exe”.



(2) Once the installer is ready, click on Next button.

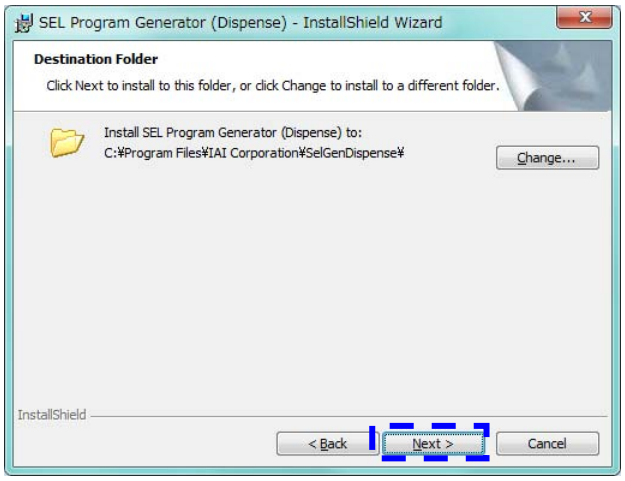


(3) Input the information in “User Name” and “Organization”, and click on Next button.



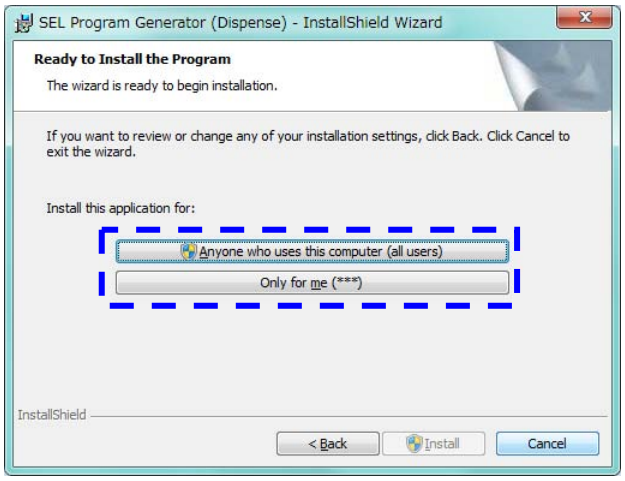
(4) Click on Next button.

(Note) When it is necessary to change the domain to install, click on Change... button and select a domain to install.

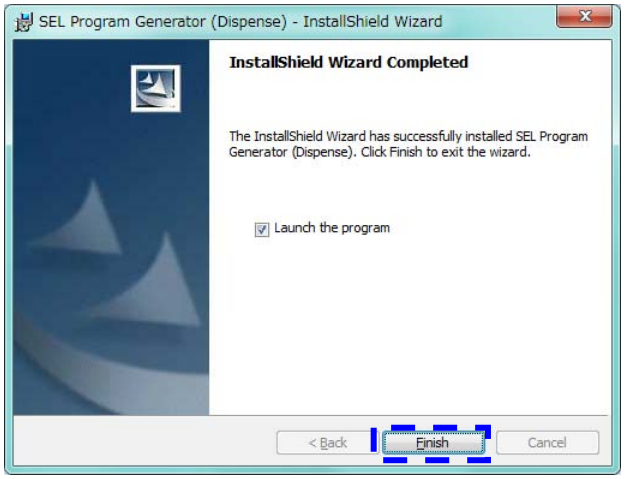


(5) Select a subject to install (click a button) and installation process will start.

(Note) If “User Account Control” dialog window appears, click on Yes button to continue the installation process.



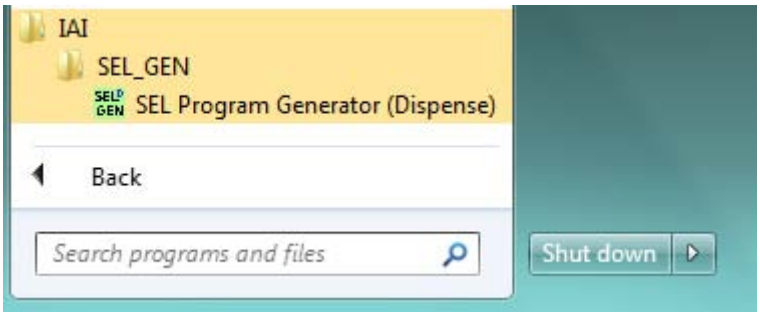
(6) Click on Finish to finish the installation.



3. Startup and Finish

3.1 Startup

Select [All Programs] - [IAI] - [SEL_GEN] - [SEL Program Generator (Dispense)] in Start Menu of Windows.



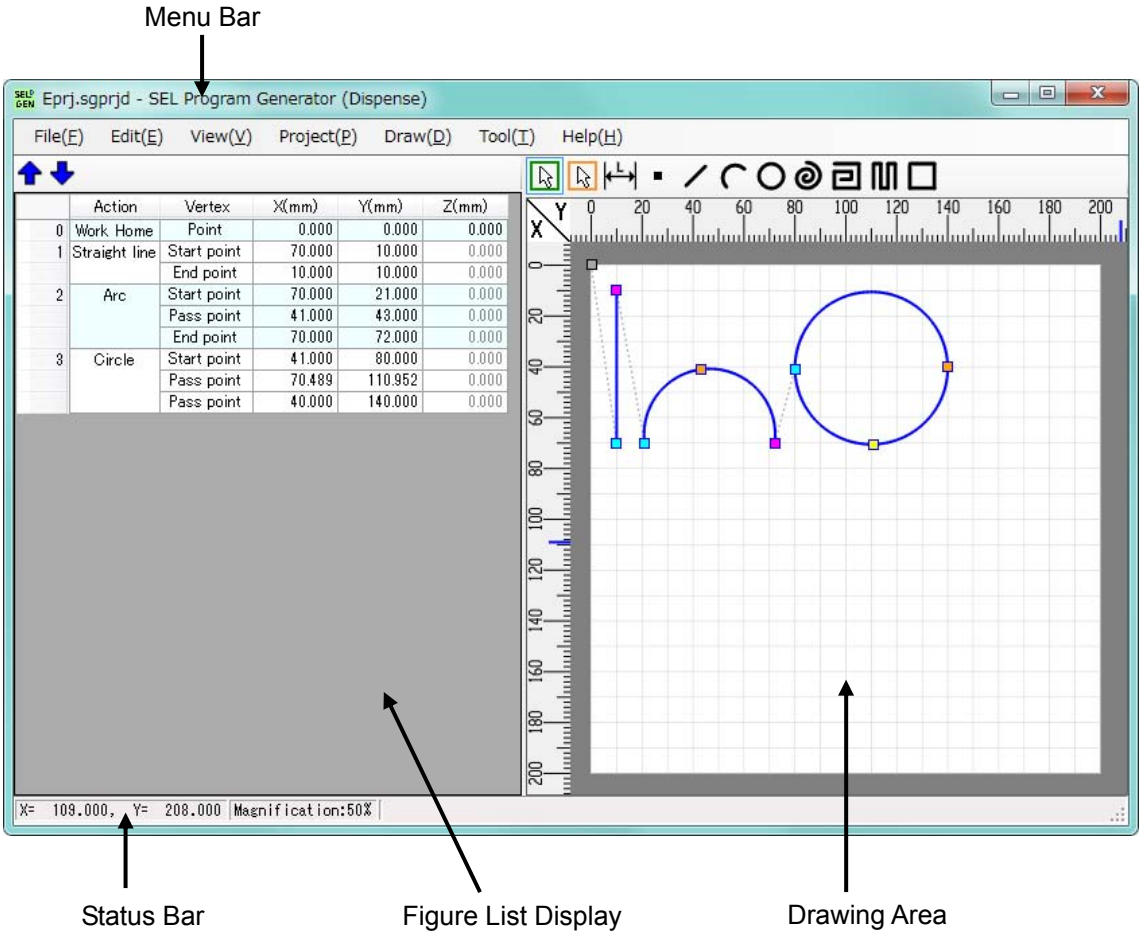
3.2 Finish

Choose either way to exit.

- Select [File (F)] - [Exit (X)] in the menu bar.
- Click on [×] button on the top right of the main window.

4. Explanation of Windows

If you start up this software, the “Main Window” as shown below will appear.



4.1 Menu Bar

You can execute each type of operation from the pull-down menu.

Menu	Sub Menu	Functions
File (F)	New Project (N)	A new project can be created.
	Open Project (O)	An existing project can be opened.
	Save As (A)	An edited project can be saved with a name.
	Save (S)	An edited project can be saved by overwriting.
	Dxf data (D)	• Read (R) DXF figure data can be read out from a file. • Clear (C) The DXF figure already read in can be cleared.
	Reference data (F)	• Read (R) Figure data for reference can be read out from a file. • Clear (C) The figure data for reference already read in can be cleared.
	Background image (B)	• Read (R) (.jpg Data) Background image data can be read out from a file. • Clear (C) The image data for background already read in can be cleared.
	Track data (T)	• Read (R) (.csv Data) Track data can be read out from a file. • Clear (C) The data for track already read in can be cleared.
	Exit (X)	The application can be closed.
Edit (E)	Undo (U)	The figure editing operation can be undone.
	Redo (R)	The figure editing operation can be redone.
	Cut (T)	The selected figure can be cut.
	Copy (C)	The selected figure can be copied.
	Paste (P)	The figure which was cut or copied can be pasted.
	Delete (D)	The selected figure can be deleted.
	Select all (A)	All of the figure can be selected.

Menu	Sub Menu	Functions
View (V)	Display lines (W)	Created figure can be selected whether to show or hide.
	Display DXF lines (X)	DXF figure can be selected whether to show or hide.
	Display reference lines (R)	Reference figure can be selected whether to show or hide.
	Display track lines (T)	Track data can be selected whether to show or hide.
	Zoom (Z)	Display magnification in the drawing area can be changed.
Project (P)	Generate (G) (Refer to [11. Generate SEL Program] for detail)	SEL program and position data can be generated.
	Simulate (S)	Simulation should be performed to check the operation track and cycle time.
	Property (P) (Refer to [7. Set Properties] for detail)	Property setting of a project can be established.
Draw (D) (Refer to [9. Draw Figures] for detail)	Select drawing items (W)	The edit mode can be changed to “Select drawing items mode”.
	Select DXF items (X)	The edit mode can be changed to “Select DXF items mode”.
	Measure distance (M)	The edit mode can be changed to “Measure distance mode”.
	Point (P)	The edit mode can be changed to “Point drawing mode”.
	Straight line (L)	The edit mode can be changed to “Straight line drawing mode”.
	Arc (A)	The edit mode can be changed to “Arc drawing mode”.
	Circle (C)	The edit mode can be changed to “Circle drawing mode”.
	Involute (Circle) (S)	The edit mode can be changed to “Involute (circle) drawing mode”.
	Involute (Rectangle) (E)	The edit mode can be changed to “Involute (rectangle) drawing mode”.
	Zig-Zag (Z)	The edit mode can be changed to “Zig-Zag drawing mode”.
	Rectangle (Q)	The edit mode can be changed to “Rectangle drawing mode”.
	Translation (T)	The selected figure can be moved.
	Rotation (R)	The selected figure can be rotated.
	Invert (I)	The selected figure can be inverted.
Tool (T)	Option (O)	Tool option setting can be established.
Help (H)	About (A)	The version information of this application can be shown.

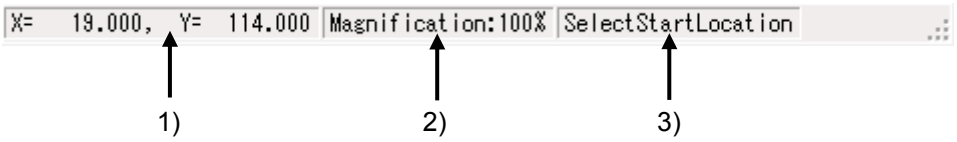
4.2 Status Bar

The status bar shows you the following information.

1) Coordinates of mouse cursor position
The coordinates (X coordinate and Y coordinate) of the mouse cursor displayed position should be shown.

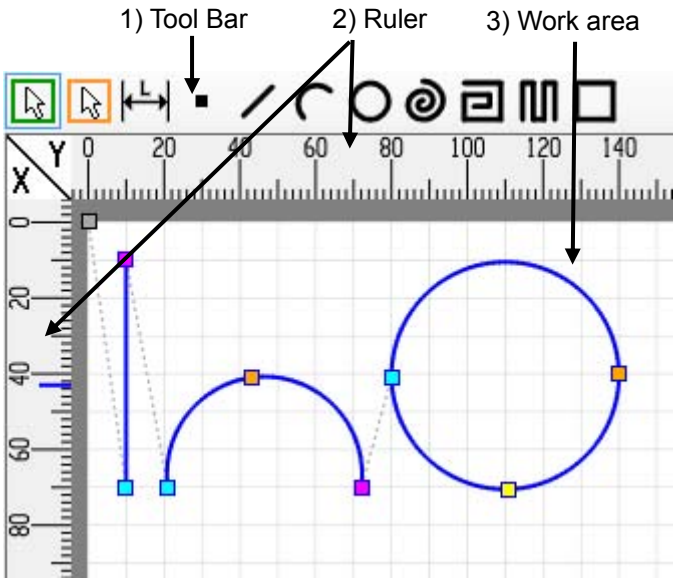
2) Magnification
Magnification of the drawing area is shown.

3) Drawing Operation / Two-Point Distance
The current action of drawing operation such as “Select Start Location” and “Select End Location” is shown.
If the drawing mode is “Measure distance”, the distance between the indicated two points should be displayed.



4.3 Drawing Area

Create figures such as dots and lines (motion path) in this area.
The drawing area is constructed as shown below.



1) Tool Bar
There are buttons allocated to switch the edit mode.
(Refer to “4.3.4 Edit Mode” for the edit mode.)

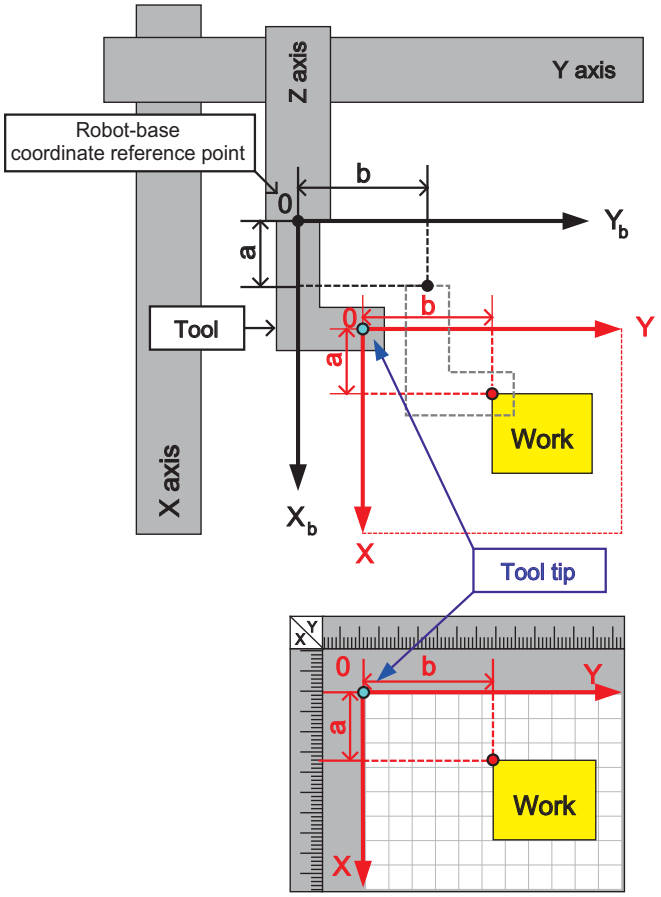
Button	Functions
	Mode changed “Select drawing items mode”.
	Mode changed “Select dxf items mode”.
	Mode changed “Measure distance mode”.
	Mode changed “Point drawing mode”.
	Mode changed “Straight line drawing mode”.
	Mode changed “Arc drawing mode”.
	Mode changed “Circle drawing mode”.
	Mode changed “Involute (circle) drawing mode”.
	Mode changed “Involute (rectangle) drawing mode”.
	Mode changed “Zig-Zag drawing mode”.
	Mode changed “Rectangle drawing mode”.

2) Ruler
Scales of X-axis and Y-axis are shown. (Unit: mm)

3) Work area
It is the work area of X-axis and Y-axis.
A figure (motion path) should be created in the range of this area.

4.3.1 Coordinate System in Work Area

Shown below is the relation between the coordinate system of the work area and that of the robot.
Shown with “a” and “b” in the figure is the relation between the position of the tool tip and that of the workpiece when X-axis and Y-axis are positioned at the robot base coordinate datum (0, 0).
Confirm “a” and “b” in advance in a device drawing and so on.



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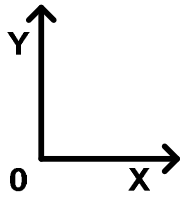
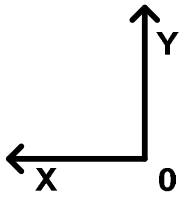
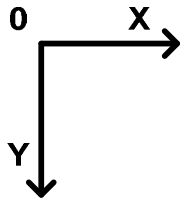
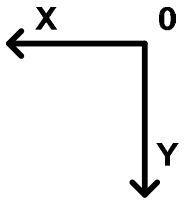
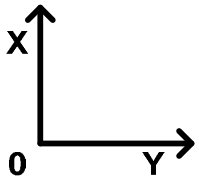
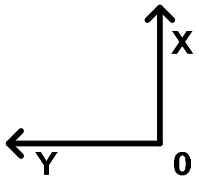
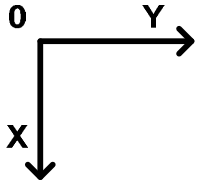
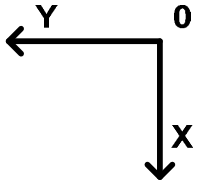
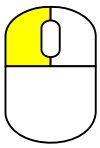
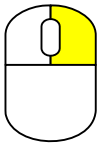
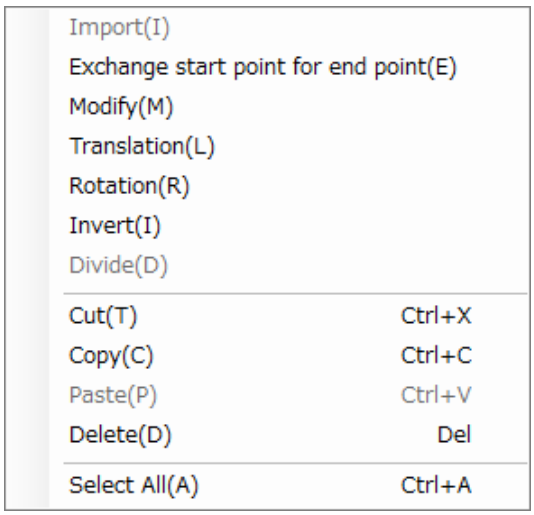
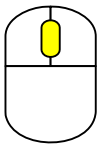
The orientation of the coordinates display in the work area should be selected from the eight types below.

TYPE 1	TYPE 2
	
TYPE 3	**TYPE 4**
	
TYPE 5	**TYPE 6**
	
TYPE 7	**TYPE 8**
	

4.3.2 Basic Operation

Basic operations should be performed on a mouse and keyboard.

Button	Operation	Functions
	Click	• In Select Drawing Items Mode / Select DXF Items Mode, A figure which the cursor is pointing on can be selected Press [Shift] key and hold it down while clicking on a figure and multiple figures can be selected at once.
		• In each drawing mode / Measure Distance Mode, This determines the peak points (measurement start point in measure distance mode).
	Drag	• When a figure is selected The position of the selected figure can be moved.
		• When no figure is selected Range of a figure can be selected.
	Click	Popup menu should open. 
	Rotate	• When [Ctrl] key is held down Display can be zoomed in and out. (10% to 8000%)
		• When [Shift] key is held down Display can be scrolled right and left.
		• In condition other than above Display can be scrolled up and down.
	Drag	Display can be scrolled to the direction that you dragged.

4.3.3 Types of Displayed Points and Lines

The types of dots and lines displayed in the work area are as shown below.

Display	Contents
	Work Home
	Point / Starting Point of a Line / Starting Point of a Circle / Starting Point of an Arc
	End Point of a Line / End Point of an Arc
	1st Pass Point of a Circle
	2nd Pass Point of a Circle / Pass Point of an Arc
	Center Point of a Circle
	Linked Point of a Line / Circle / Arc
	Created Figure (without dispensing)
	Created Figure (with dispensing)
	Created Figure (selected)
	Figure read out of a DXF file
	Figure read out of a DXF file (selected)
	Figure under working
	Movement Route between Figures

4.3.4 Edit Mode

Create Drawing / Edit can be switched over by switching the edit mode in the work area.
See below for the feature of each edit mode and how to switch between them.

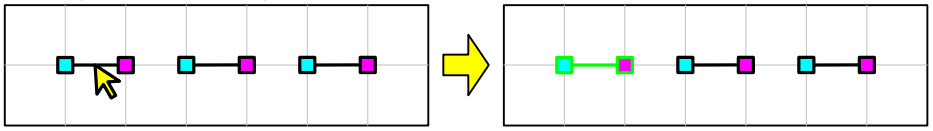
Mode	Functions
Select drawing items	A created figure can be selected on a mouse. [Mode Change in Menu Bar] Execute [Draw (D)] - [Select drawing items (W)] [Mode Change in Tool Button] Click on  button
Select dxf items	A figure read out of a DXF file can be selected on a mouse. [Mode Change in Menu Bar] Execute [Draw (D)] - [Select DXF items (X)] [Mode Change in Tool Button] Click on  button
Measure distance	Distance can be measured between any two points. [Mode Change in Menu Bar] Execute [Draw (D)] - [Measure distance (M)] [Mode Change in Tool Button] Click on  button
Point drawing	A dot can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Point (P)] [Mode Change in Tool Button] Click on  button
Straight line drawing	A straight line can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Straight line (L)] [Mode Change in Tool Button] Click on  button
Arc drawing	An arc can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Arc (A)] [Mode Change in Tool Button] Click on  button
Circle drawing	A circle can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Circle (C)] [Mode Change in Tool Button] Click on  button
Involute (circle) drawing	An involute (circle) can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Involute (Circle) (S)] [Mode Change in Tool Button] Click on  button

Mode	Functions
Involute (rectangle) drawing	An involute (rectangle) can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Involute (Rectangle) (E)] [Mode Change in Tool Button] Click on  button
Zig-Zag drawing	A Zig-Zag can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Zig-Zag (Z)] [Mode Change in Tool Button] Click on  button
Rectangle drawing	A rectangle can be drawn. [Mode Change in Menu Bar] Execute [Draw (D)] - [Rectangle (Q)] [Mode Change in Tool Button] Click on  button

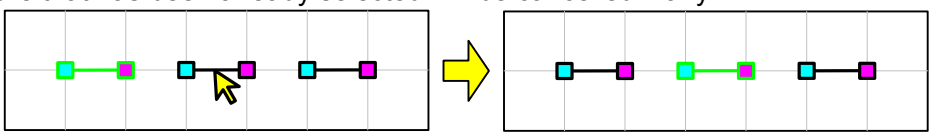
4.3.5 Selecting a Figure

Change the edit mode to “Select drawing items” and the created figure gets available to select.
Also, choose “Select dxf items” and DXF figures get available.
There are four types of figure select.

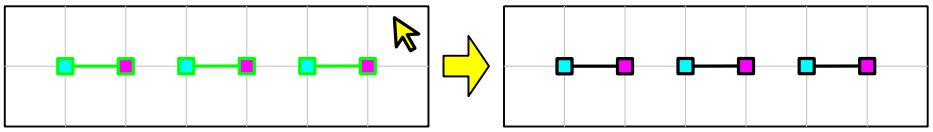
- Single Select
  Click in a figure and this figure can be selected.



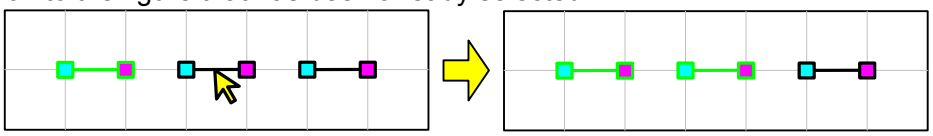
A figure that has been already selected will be cancelled if any.



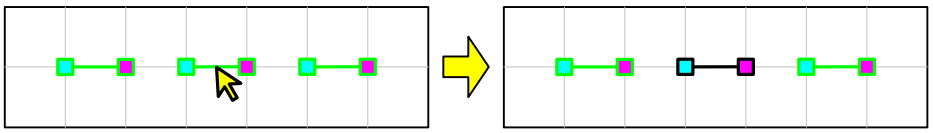
Also, if a space with no figure gets clicked, all the selection of the figures should be cancelled.



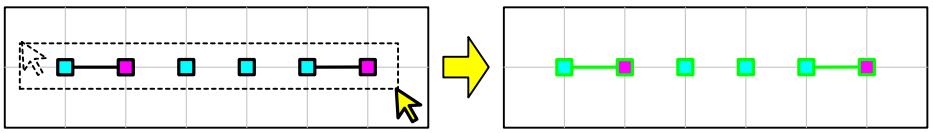
- Multiple Select
  Hold down [Shift] key while selecting a figure, and the figure will be selected in addition to the figure that has been already selected.



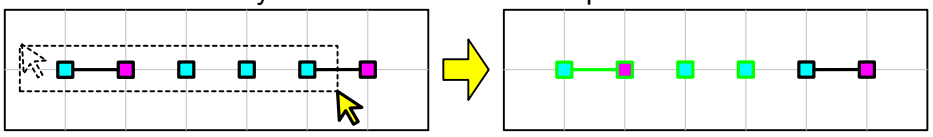
Click on a figure that is already selected, and the selection of this figure will be cancelled.



- Range Select
  Drag the cursor and all the figures included in the dotted rectangle can be selected at once.



A line can be selected only when both start and end points are included.



(An arc can be selected only when all of start point, way point and end point are included in the range, and a circle when start point, way point 1 and way point 2.)

- Select All
  All the figures can be selected at once in either of the ways below.
  - Execute [Edit (E)] - [Select all (A)] from the menu bar
  - Execute [Select All (A)] from the popup menu

4.3.6 Show Reference Figure Data

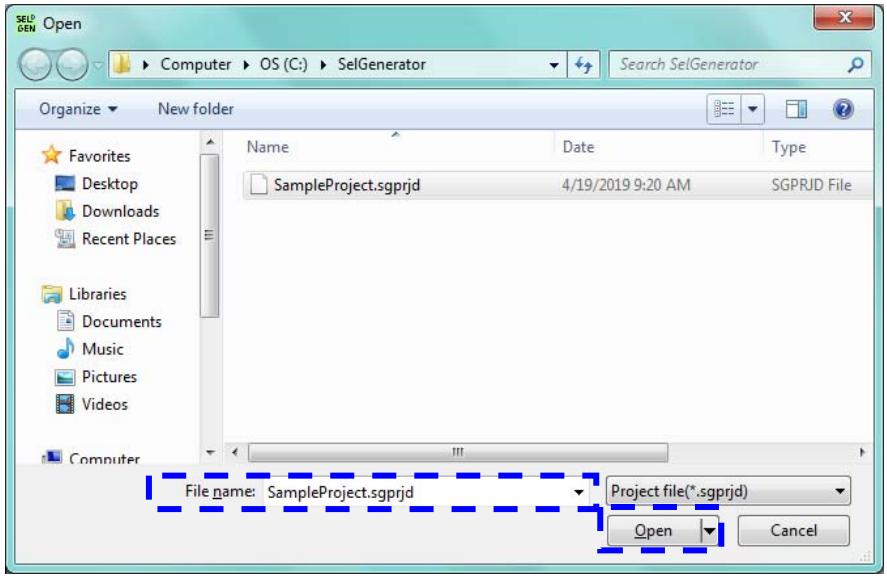
Drawing data in an existing project file can be shown (Note 1) as a reference drawing.
Note 1 Only the lines of the figure should be shown and peak points will not.

[1] Read

In order to read the reference figure data, follow the procedure below.

(1) Execute [File (F)] - [Reference data (F)] - [Read (R)] from the menu bar.

(2) Select a file name that you would like to show as a reference, and click on Open button.

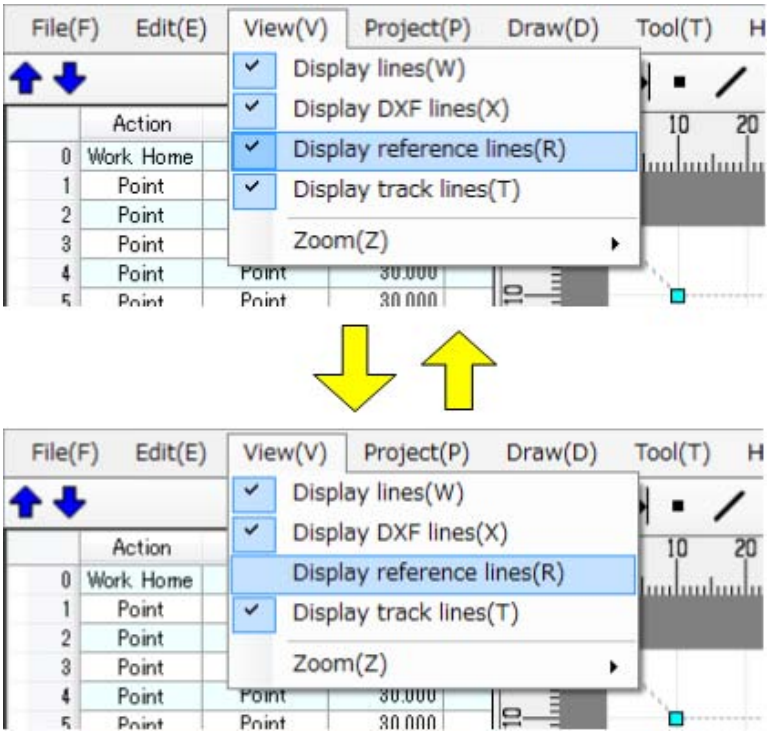


[2] Clear

Execute [File (F)] - [Reference data (F)] - [Clear (C)] in the menu bar, and the reference data being displayed can be cleared.

[3] Switchover of Show/Hide

Execute [View (V)] - [Display reference lines (R)] in the menu bar, and the reference figure can be switched between show and hide.



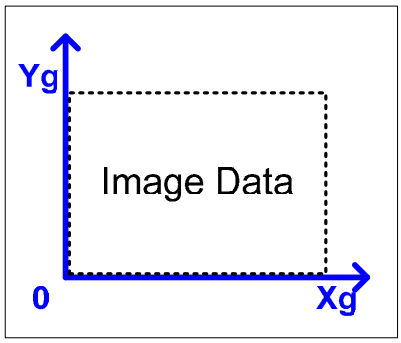
4.3.7 Show Background Image Data

An image file (jpeg format) can be read in and shown as the background of the work area.

Coordinate System for Image Data (Xg, Yg)

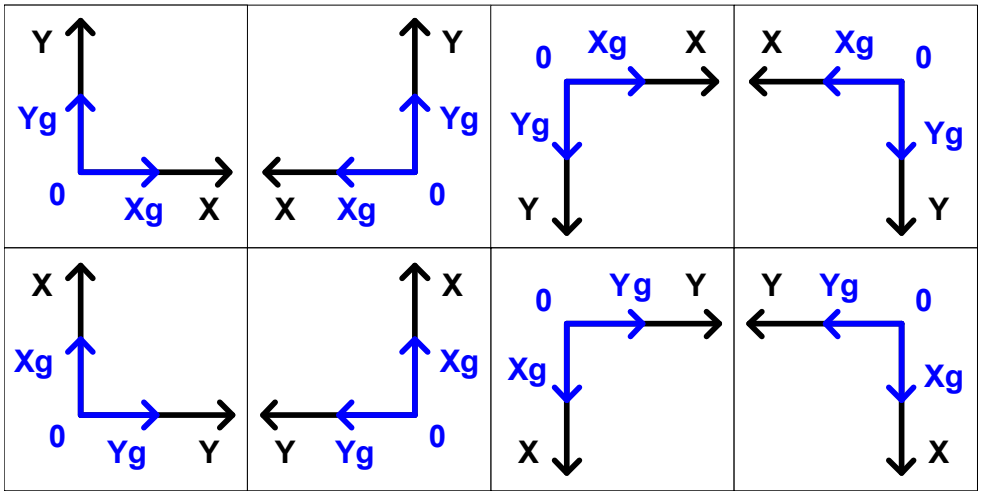
The coordinate system for image data Xg, Yg should be defined as follows.

- Positive Direction of Xg: Right Side in Horizontal
- Positive Direction of Yg: Upper Side in Vertical



Relation between Coordinate System for Image Data (Xg, Yg) and Coordinate System in Work Area (X, Y)

Shown below is how to read in image data and set directions of Xg and Yg in line with directions of X and Y in the work area, and set (0, 0) of the image data coordinates at (0, 0) of the work area coordinates.

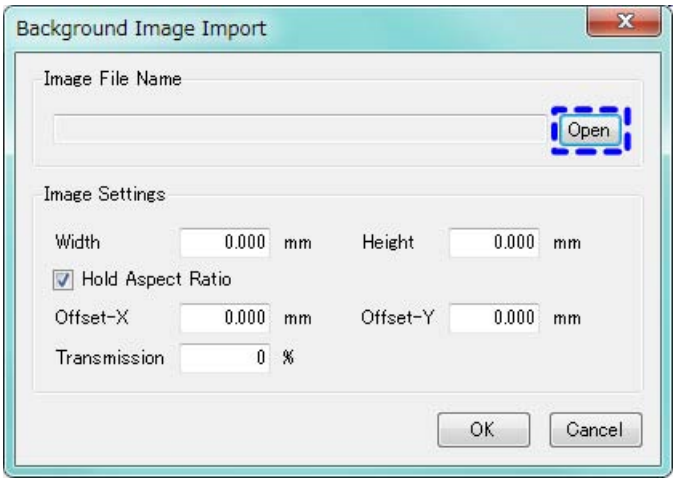


[1] Read

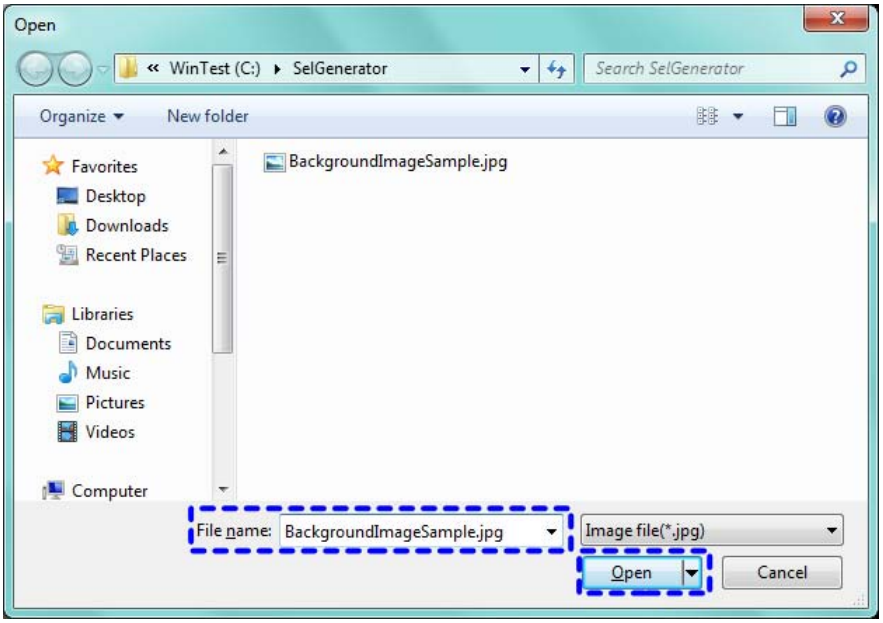
In order to read the background image data, follow the procedure below.

(1) Execute [File (F)] - [Background image (B)] - [Read (R)] from the menu bar.

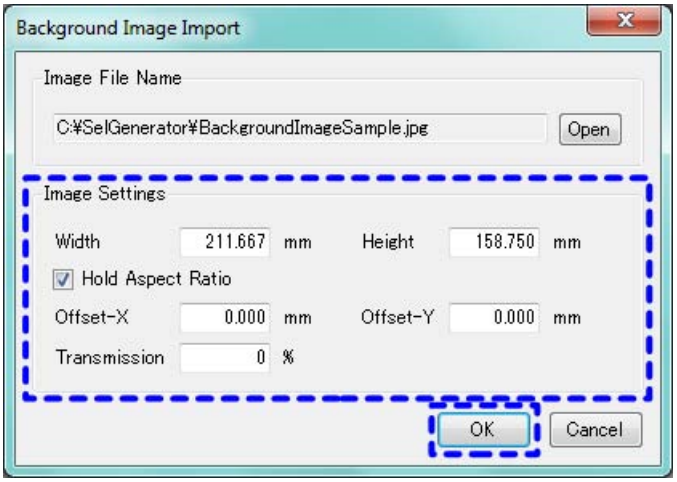
(2) Click on Open button in “Background Image Import” window.



(3) Select a file name of the image data that you would like to show as a background image, and click on Open button.



(4) Establish the display setups for the image, and click on OK button.



Width	:	Set the display width (X direction) of the image. (Unit: mm)
Height	:	Set the display height (Y direction) of the image. (Unit: mm)
Hold Aspect Ratio	:	Display height (width) should be automatically adjusted in response to the aspect ratio of the image data when the width (height) has been changed.
Offset-X	:	Set the offset position in X direction. (Unit: mm)
Offset-Y	:	Set the offset position in Y direction. (Unit: mm) By having an offset, the relation between the coordinate system in the work area and the position of a workpiece should be adjusted to the actual positions.
Transmission	:	Set the transmittance of background image. (Unit: %)

[2] Clear

Execute [File (F)] - [Background image (B)] - [Clear (C)] in menu bar, and the background image being displayed can be cleared.

4.3.8 Show Track Data

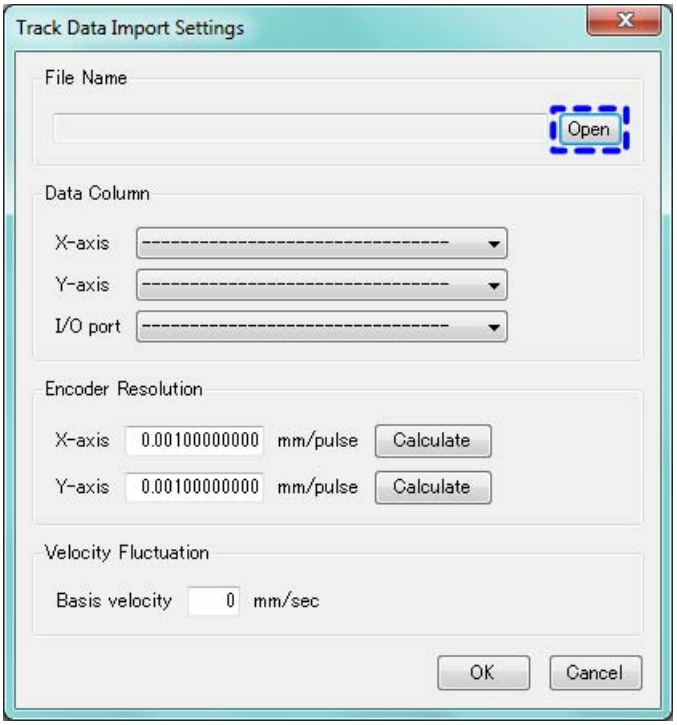
The feedback pulse at the actual operation gathered by “XSEL PC Software” is able to be shown as the actual operation tracks.
By putting the drawing data (motion path) and the actual operation tracks together to show in the same screen, it is possible to adjust the drawing data while checking dispersion.

[1] Read

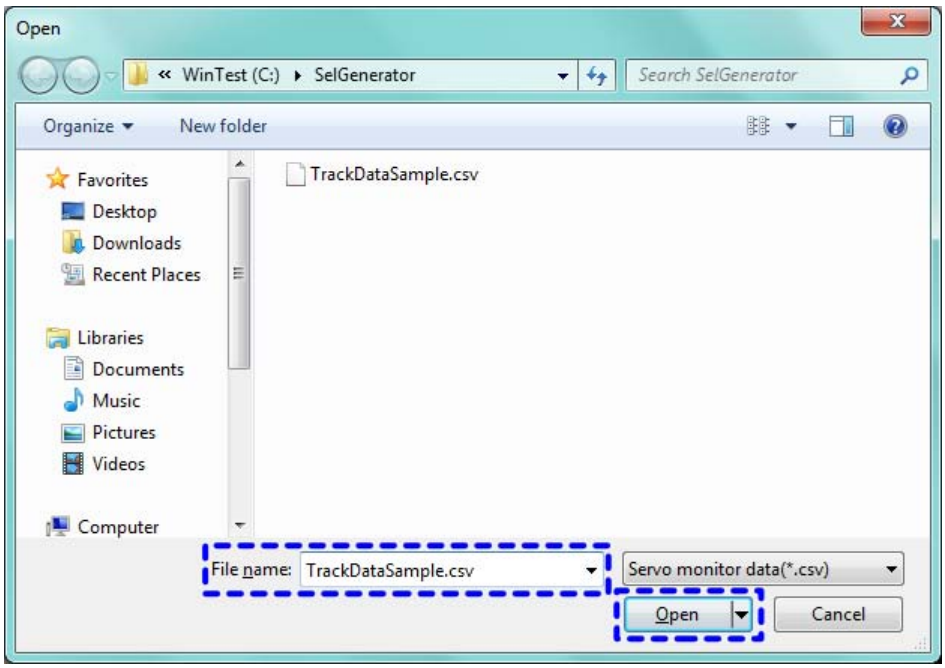
In order to read the track data, follow the procedure below.

(1) Execute [File (F)] - [Track data (T)] - [Read (R)] from the menu bar.

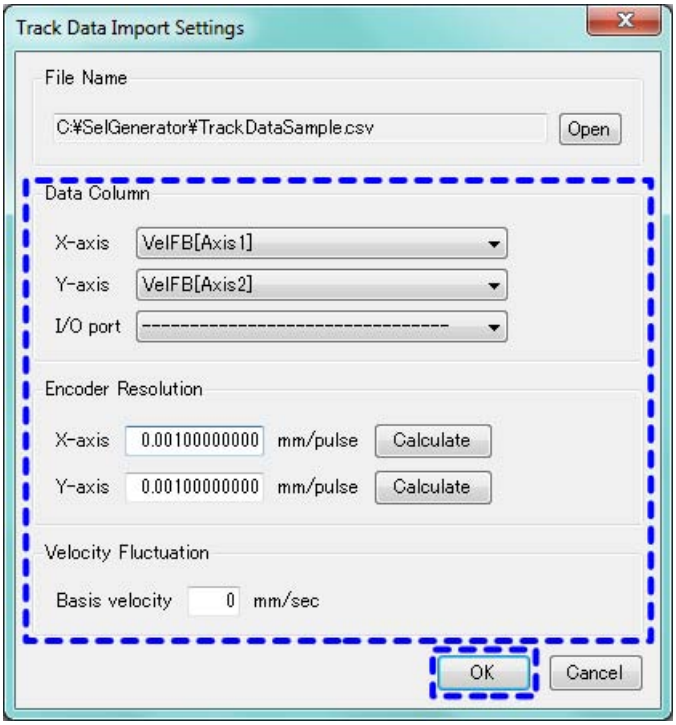
(2) Click on Open button in “Track Data Import Settings” window.



(3) Select a file name of the tracks, and click on Open button.



(4) Establish the settings for “Data Column”, “Encoder Resolution” and “Velocity Fluctuation”, and click on OK button.



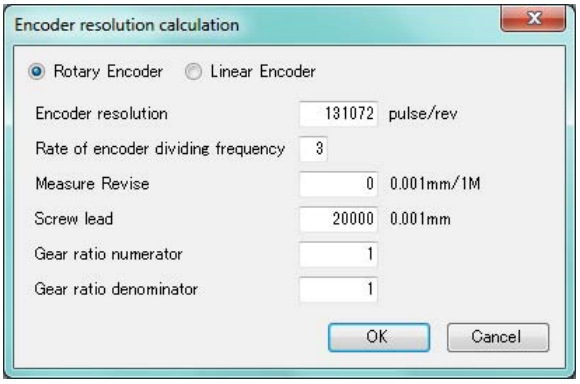
Setting of “Data Column”

X-axis : Indicate the feedback pulse data train in X-axis.
Y-axis : Indicate the feedback pulse data train in Y-axis.
I/O port : Indicate the I/O monitor data train.
Indicate this item and only the tracks while the applicable I/O port (or flag) is ON will be shown.
If “--------” is indicated, tracks in all the sections should be displayed.

Setting of “Encoder Resolution”

X-axis : Setup of the encoder resolution for X-axis can be established. (Unit: mm/pulse)
Y-axis : Setup of the encoder resolution for Y-axis can be established. (Unit: mm/pulse)

* Click on [Calculate] button, and the following window shows up. Establish the settings for the indicated items only and the encoder resolution can be figured out.
For the settings of each item, look in the setting values for each applicable item in each axis parameter in “XSEL PC Software”.



Setting of “Velocity Fluctuation”

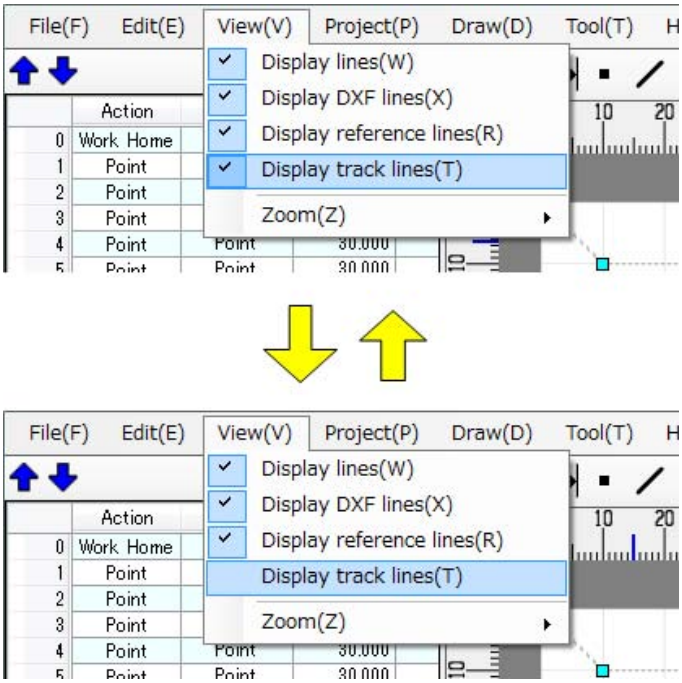
Basis velocity : If you desire to change the width of the track lines in response to the operation speed, it is necessary to set up the standard speed (such as the indicated speed when track data was gathered). (Unit: mm/sec)
The operation tracks in the area that is faster than the standard speed should be expressed in narrow lines while that which is slower expressed in wide lines.
Set to “0” and the track lines will be expressed in constant width.

[2] Clear

Execute [File (F)] - [Track data (T)] - [Clear (C)] in the menu bar, and the track line data being displayed can be cleared.

[3] Switchover of Show/Hide

Execute [View (V)] - [Display track lines (T)] in the menu bar, and the track line can be switched between show and hide.



4.4 Figure List Display

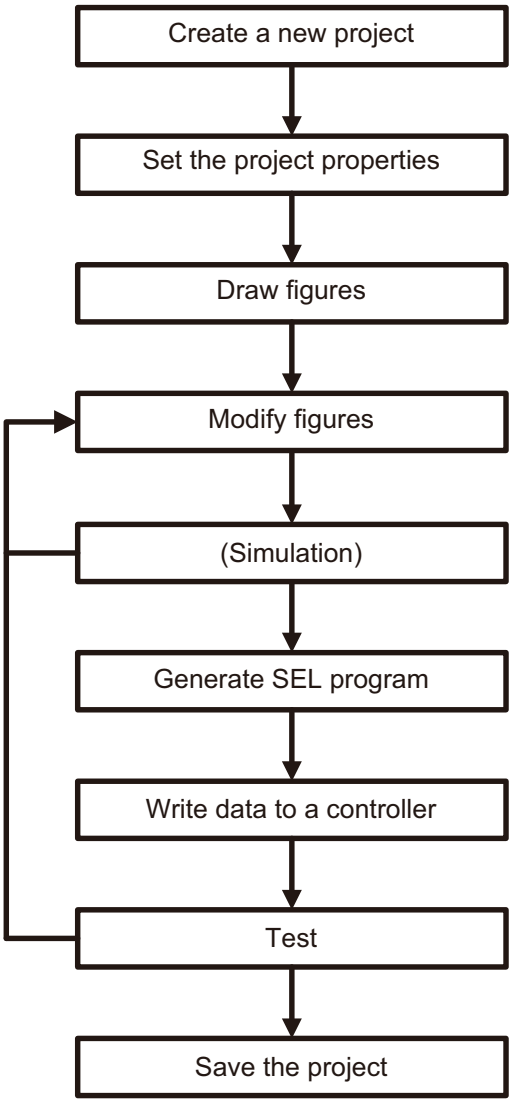
In this section, shows the list of the information of figures that were drawn in the drawing area.

Click  button, and the order for operation for the selected figure goes up.

Click  button, and the order for operation for the selected figure goes down.

5. Work Flow Chart

Refer to the following flow in order to generate and check the SEL program and position data.



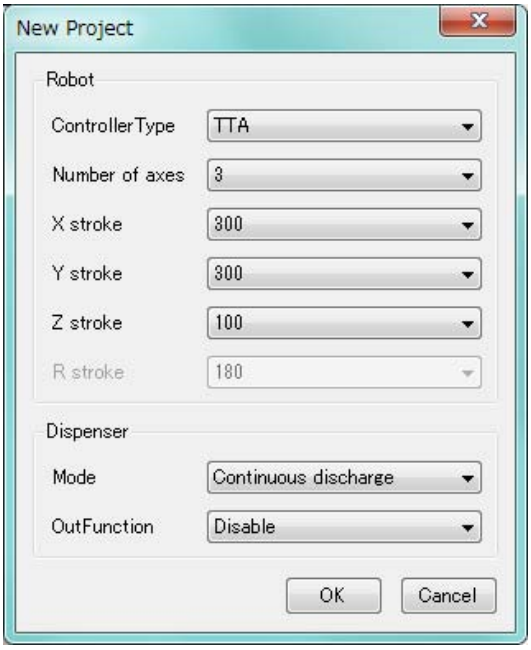
……“6.1 Create a New Project”
……“7. Set Properties”
……“9. Draw Figures”
……“10. Modify Figures”
……“11.5 Simulation”
……“11. Generate SEL Program”
……“12.1 Write Data to a Robot Controller”
……“12.2 Test”
……“6.2 Save the Project”

6. Creating and Saving a Project

6.1 Create a New Project

Create a project following the process below.

(1) Execute [File (F)] - [New Project (N)] in the menu bar and open [New Project Drawing Window].



(2) Set up the robot and paining device.

[Robot]

Item	Contents
Controller Type	The type of the robot controller should be selected.
Number of axes	The number of axes on a robot should be selected.
X stroke	X-axis stroke should be selected.
Y stroke	Y-axis stroke should be selected.
Z stroke	Z-axis stroke should be selected.
R stroke	R-axis stroke should be selected.

[Dispenser]

Item	Contents
Mode	Select an operation mode from those below; • Continuous discharge It is a mode to control the start and end of discharge by turning ON and OFF the exhalation instruction output port on the controller. Dotted dispensing and lined dispensing are available. • Constant discharge It is a mode to conduct dispensing till the response input port turns ON after dispensing is started by turning ON the exhalation instruction output port on the controller. Only dotted dispensing is available.
Out Function	Select a setting from those below; • Disable Position output operation feature should not be used. • Enable Position output operation feature is to be used. Some features (eg. prevent liquid accumulation feature) need to have the position output operation feature activated.

In order to use the position output operation feature, it is necessary that the controller is applicable for the position output operation feature[*1] and also the feature is activated.

*1 Versions that support position output operation feature
TTA : Main application part V2.00 and later
MSEL : Main application part V2.00 and later

For how to activate the position output operation feature, refer to SEL Language Programming Manual (ME0224).

6.2 Save the Project

There are two ways as shown to save a project.

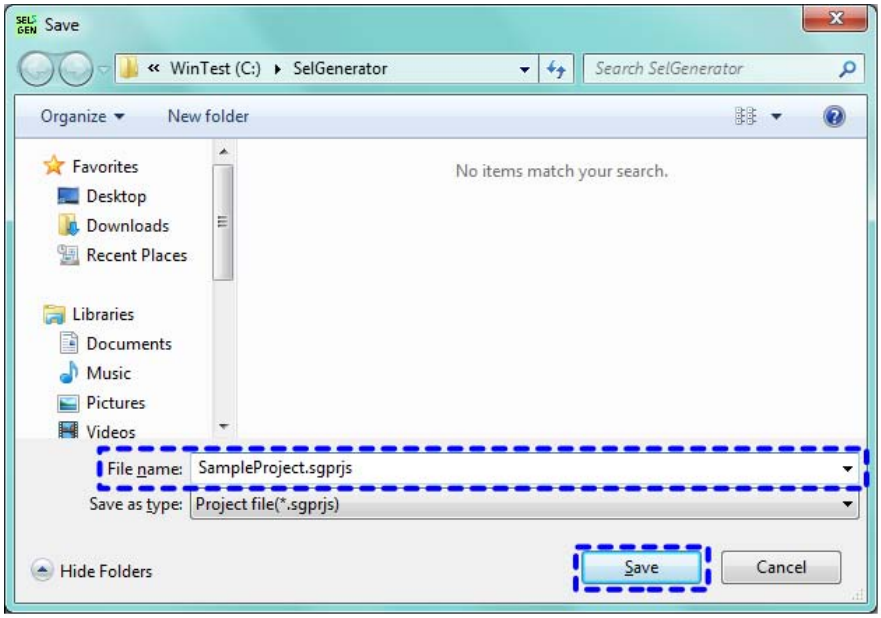
- Save As
- Save

6.2.1 Save As

A file should be saved as a new name.

(1) Execute [File (F)] - [Save As (A)] from the menu bar.

(2) Indicate a file name to save and click on Save button.



6.2.2 Save

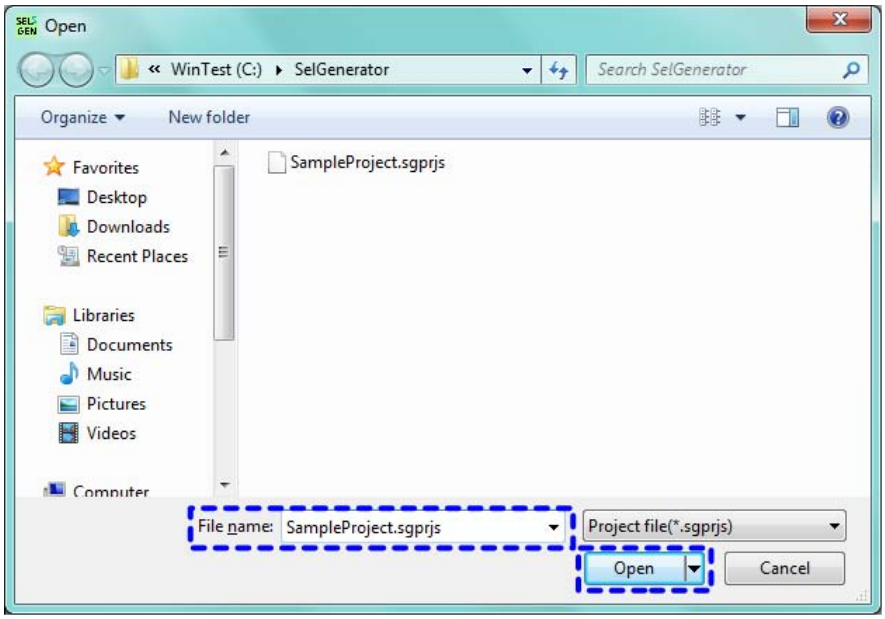
Execute [File (F)] - [Save (S)] in the menu bar and the project file under editing should be overwritten.

6.3 Open a Project

To open an existing project in a file, follow the process described below.

(1) Execute [File (F)] - [Open Project (O)] from the menu bar.

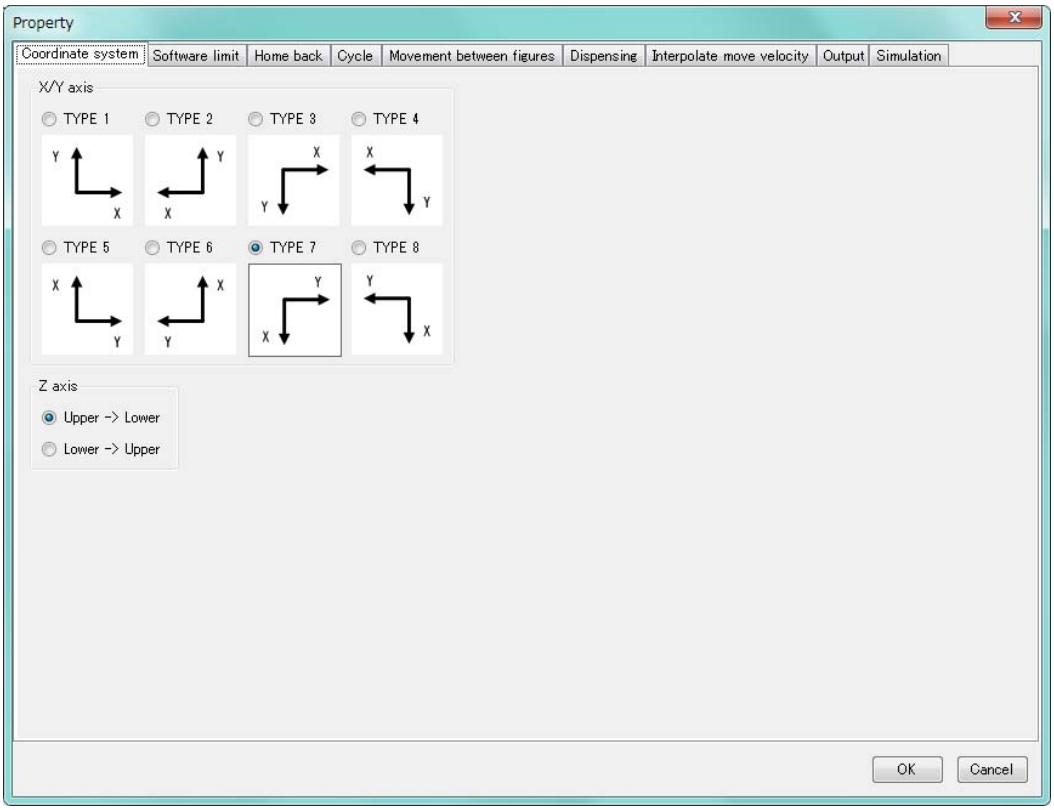
(2) Select a file in a project that you would like to open, and click on Open button.



7. Set Properties

Open “Property Setting Window” and settings can be conducted on the following items.

- Coordinate System Setting
- Software Limit Setting
- Home Back Setting
- Cycle Setting
- Movement between Figures Setting
- Dispensing Setting
- Interpolate Move Velocity Setting
- Output Setting
- Simulation Setting

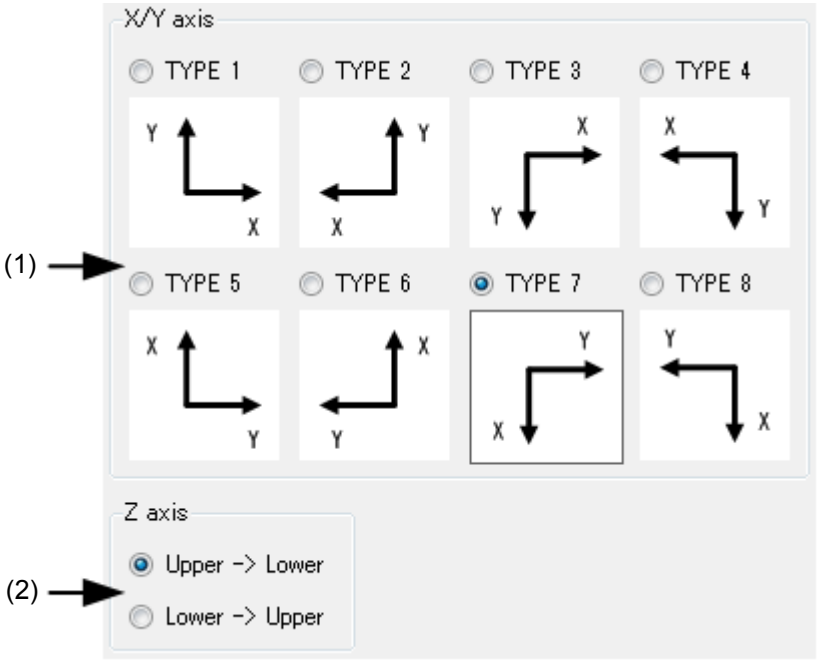


7.1 How to Show Property Setting Window

Execute [Project (P)] - [Property (P)] from the menu bar of the main window.

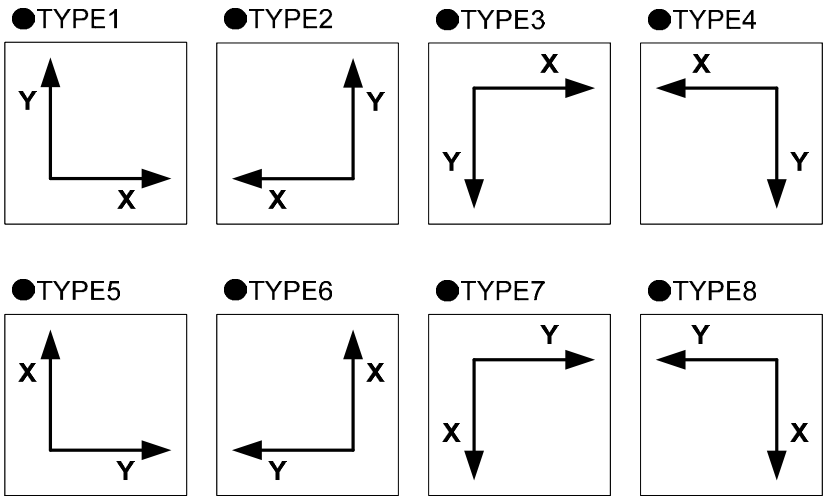
7.2 Coordinate System Setting

Setting of the orientation of the coordinates in the working area can be selected.
(Note) It will not change the direction of the actual robot operation.



(1) X/Y axis

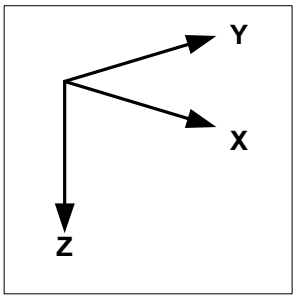
Select an orientation of the coordinates from these below for the working area (main window drawing area).



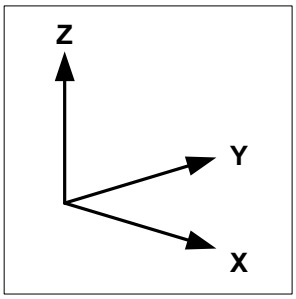
(2) Z axis

Select the direction of the Z-axis upward end in the motion path simple display (Generate SEL Program Window).

- Upper → Lower
  It shows the negative side of the soft limit as the upward end.

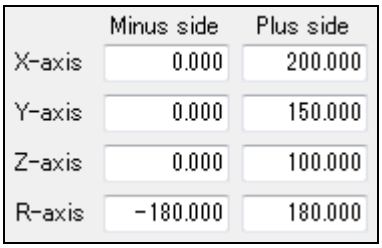


- Lower → Upper
  It shows the positive side of the soft limit as the upward end.



7.3 Software Limit Setting

Setting of the display range of the working area can be conducted.
(Note) It will not change the range of actual the robot operation.
Also, as the initial setting can be established in response to the stroke set when the project was created, it is not necessary to have this setting changed in normal use.

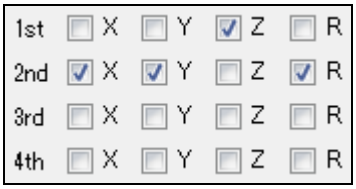


	Minus side	Plus side
X-axis	0.000	200.000
Y-axis	0.000	150.000
Z-axis	0.000	100.000
R-axis	-180.000	180.000

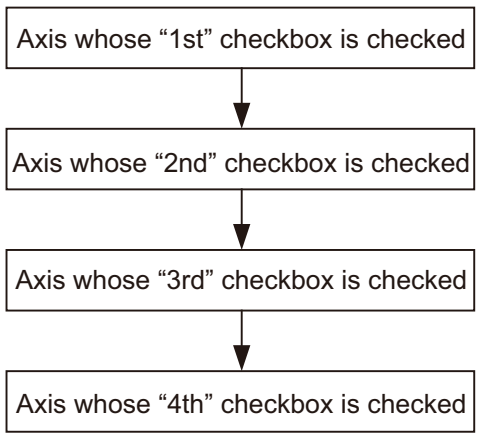
Item		Contents
X-axis	Minus side	Soft limit value in negative side on X-axis should be set. (Unit: mm)
	Plus side	Soft limit value in positive side on X-axis should be set. (Unit: mm)
Y-axis	Minus side	Soft limit value in negative side on Y-axis should be set. (Unit: mm)
	Plus side	Soft limit value in positive side on Y-axis should be set. (Unit: mm)
Z-axis	Minus side	Soft limit value in negative side on Z-axis should be set. (Unit: mm)
	Plus side	Soft limit value in positive side on Z-axis should be set. (Unit: mm)
R-axis	Minus side	Soft limit value in negative side on R-axis should be set. (Unit: deg)
	Plus side	Soft limit value in positive side on R-axis should be set. (Unit: deg)

7.4 Home Back Setting

Set the order to perform home back operation.



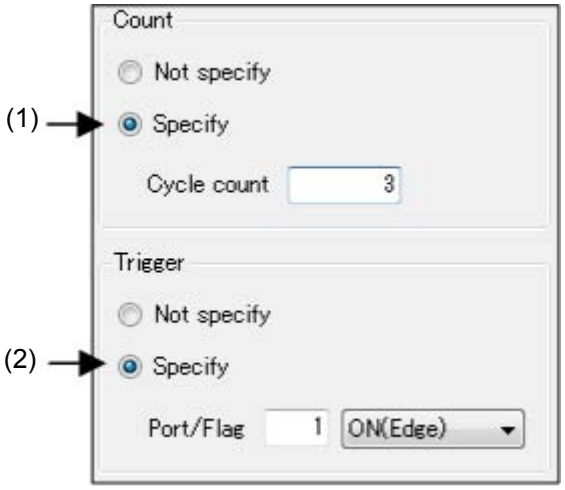
Home-return operation should be conducted in the following procedures.



Remove all the check marks from “1st” to “4th” in case it is not necessary to have the home-return operation performed.
It is not necessary to have the home-return operation conducted in the absolute type (including battery-less type).

7.5 Cycle Setting

Setting of the way to have a cycle operation should be established.



(1) Count

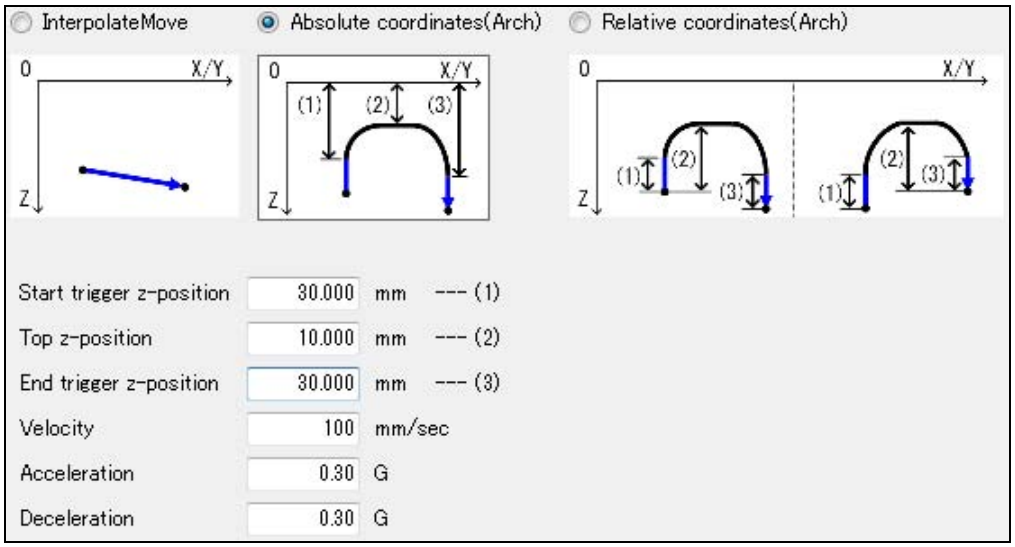
Item	Contents
Not specify	A cycle should be repeated infinitely.
Specify	A cycle should be executed for the indicated number of times and the program finishes.
Cycle count	Set the number of cycles to be executed.

(2) Trigger

Item	Contents
Not specify	A cycle starts as soon as moved to the working home position.
Specify	Waits for the start trigger signal getting input before starting a cycle after moved to the home position.
Port/Flag	Setting of a port / flag number and the signal level used as the start trigger signal should be established. Signal level should be selected from the followings. • OFF (Level) • ON (Level) • OFF (Edge) • ON (Edge)

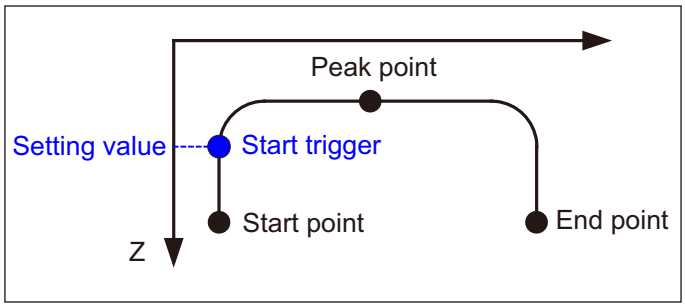
7.6 Movement between Figures Setting

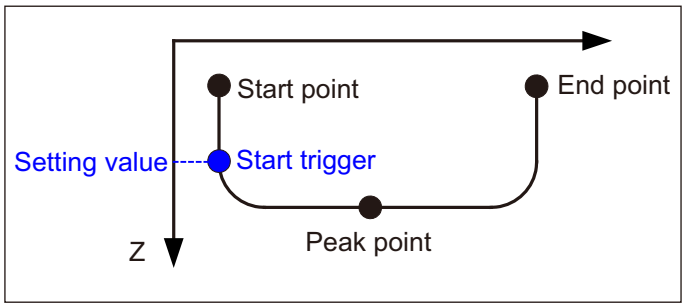
The setting of how to move between figures (from the end point of the previous figure to the start point of the next figure) should be established.



Item	Contents
Operation Method	Select from those below for how to move. • Interpolate Move Movement should be made with a linear interpolation motion. • Absolute coordinates (Arch) Movement should be made with an arch motion. The start point trigger Z-coordinate, peak point Z-coordinate and end point trigger Z-coordinate should be indicated in the absolute coordinate values. • Relative coordinates (Arch) Movement should be made with an arch motion. The start point trigger Z-coordinate, peak point Z-coordinate and end point trigger Z-coordinate should be indicated in the relative coordinate values to the start point and the end point.

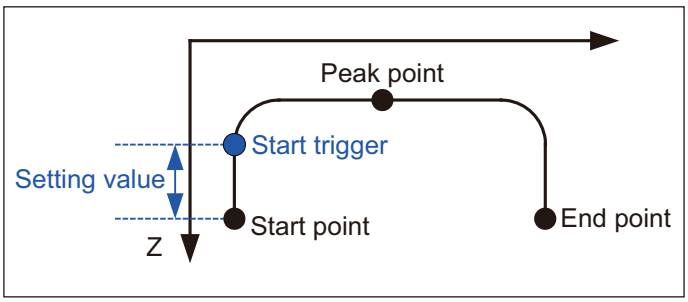
Item	Contents
Start trigger z-position	Set the start point trigger Z-coordinate for an arch motion.

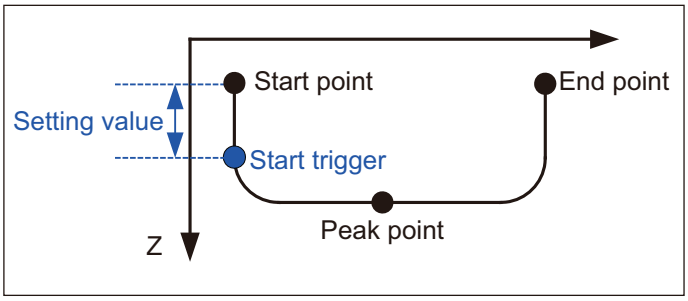


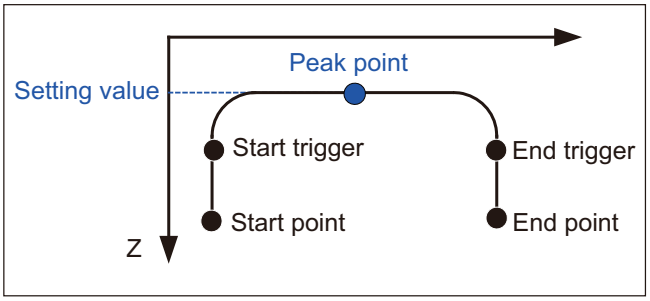
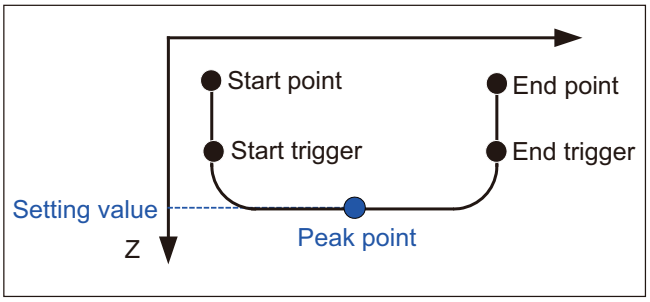
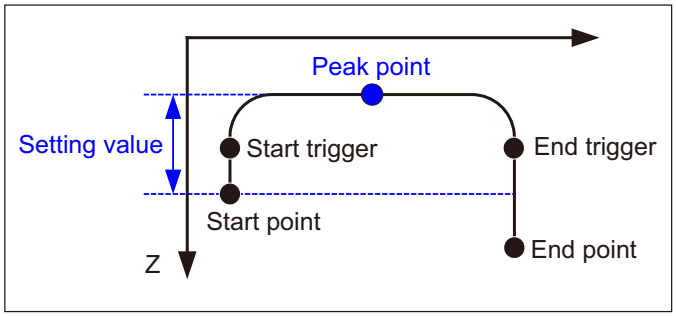
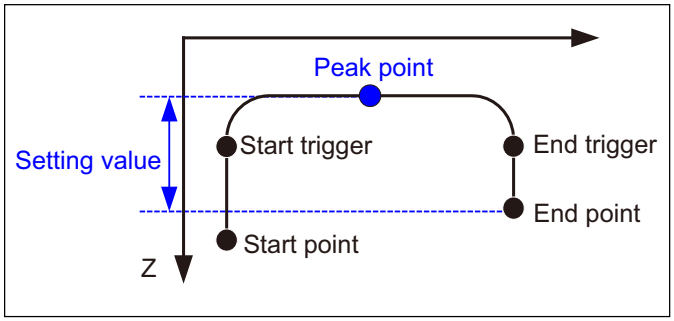


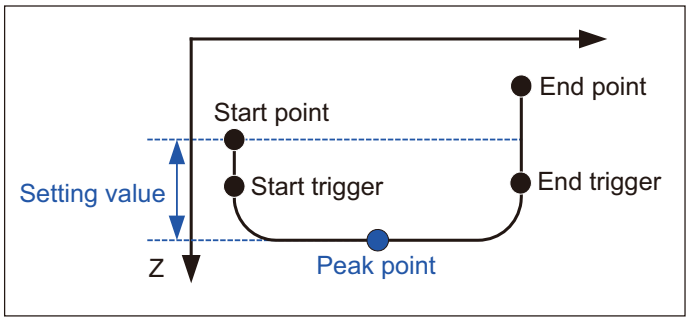
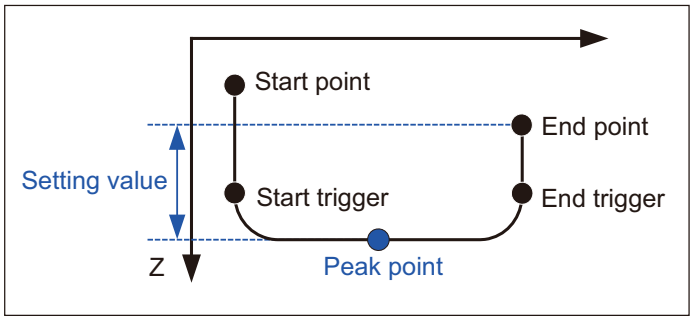
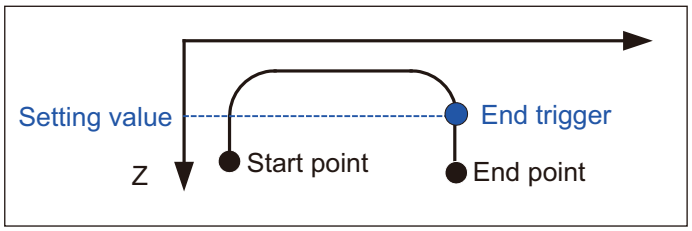
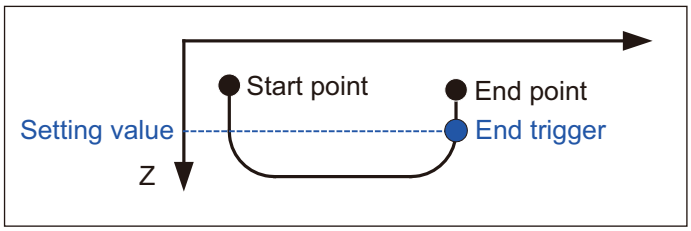
For the relative-coordinate indicated arch motion, the result of this setting added to the start point coordinate value should be the start position trigger Z-coordinate.

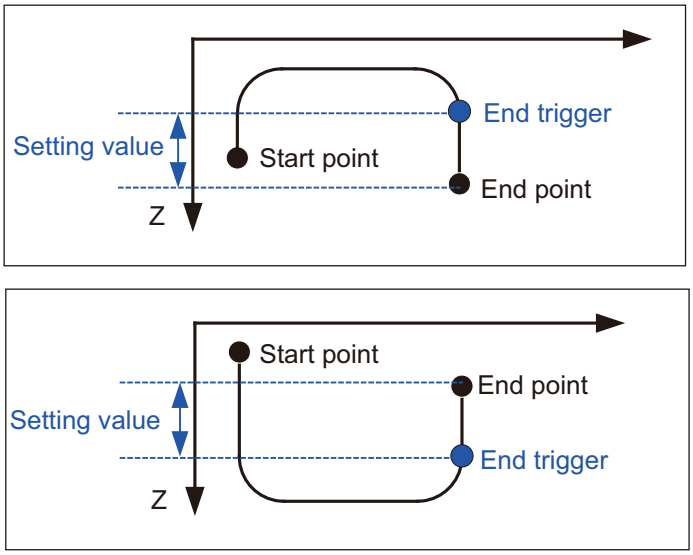
(Note) The relation of the start point and end point trigger positions will be determined by the sign (positive / negative) of the value set in this.





Item	Contents
Top z-position	Set the peak point Z-coordinate for an arch motion.   For the relative-coordinate indicated arch motion, the result of this setting added to the start point or end point Z-coordinate value should be the peak position Z-coordinate. The coordinate subject to addition will be determined by the relation of positions for the start point and the start point trigger. • When Start Point Trigger Z-Coordinate < Start Point Z-coordinate; Addition should be conducted to the smaller of Start Point Z-Coordinate and End Point Z-Coordinate  

Item	Contents
Top z-position	• When Start Point Trigger Z-Coordinate > Start Point Z-coordinate; Addition should be conducted to the larger of Start Point Z-Coordinate and End Point Z-Coordinate  
End trigger z-position	Set the end point trigger Z-coordinate for an arch motion.  

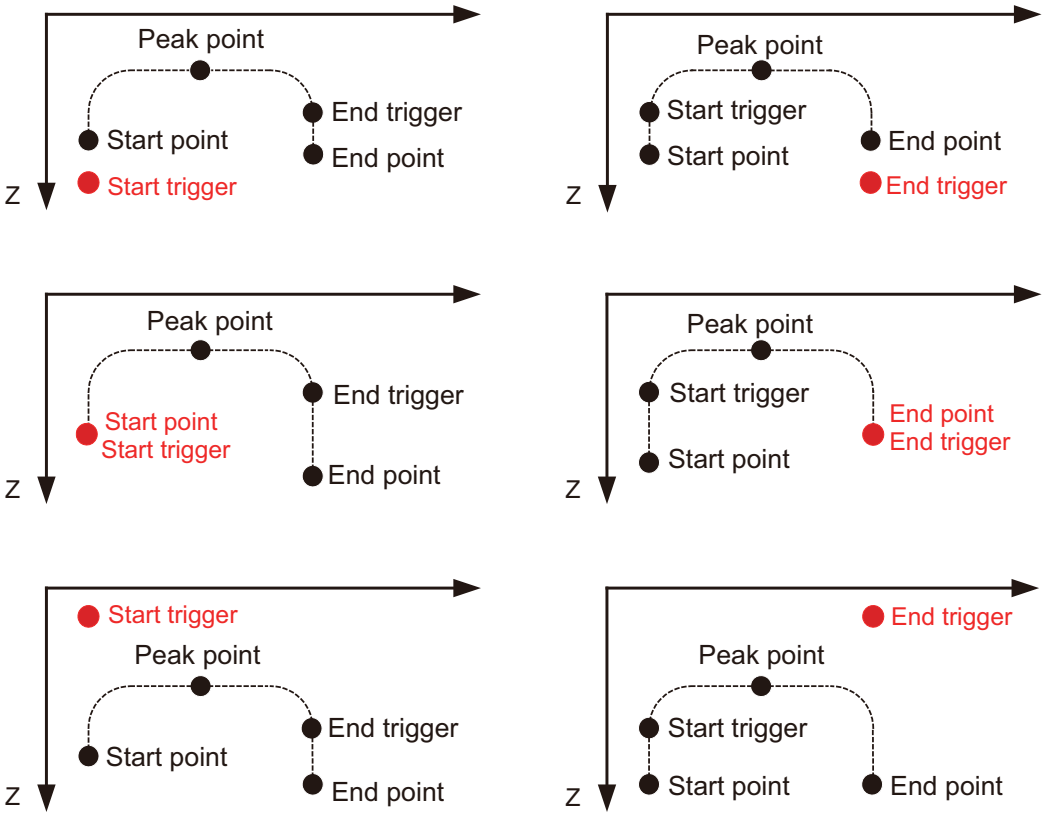
Item	Contents
End trigger z-position	For the relative-coordinate indicated arch motion, the result of this setting added to the end point coordinate value should be the end position trigger Z-coordinate. **(Note) The relation of the start point and end point trigger positions will be determined by the sign (positive / negative) of the value set in this.** 
Velocity	Set the speed. (Unit: mm/sec)
Acceleration	Set the acceleration. (Unit: G)
Deceleration	Set the deceleration. (Unit: G)

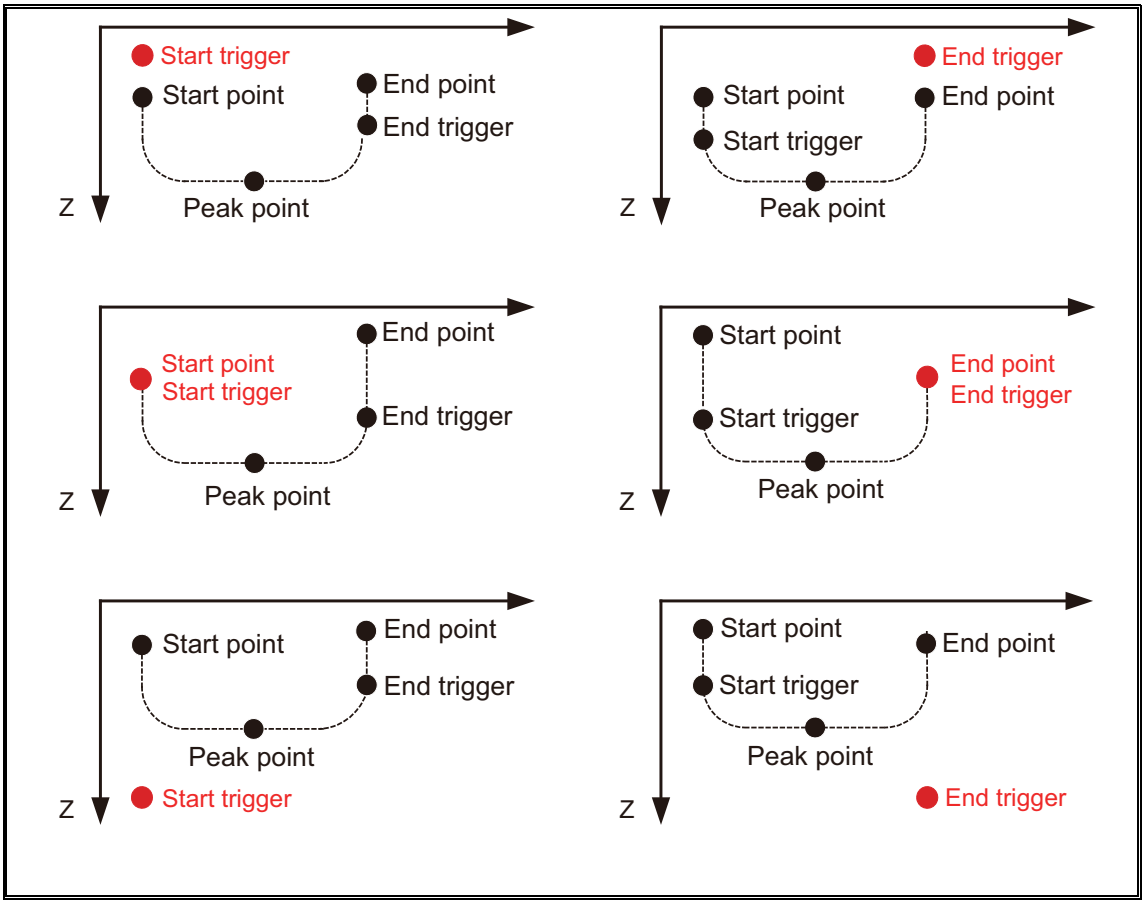
⚠ Caution:
Make sure that the following conditions are satisfied for the relation of the positions for “Start point”, “Start trigger” and “Peak point” and for the relation of the positions for “End point”, “End trigger” and “Peak point”.

- For arch motion to coordinate negative direction;
  Start point Z-Coordinate < Start trigger Z-Coordinate ≤ Peak point Z-Coordinate
  End point Z-Coordinate < End trigger Z-Coordinate ≤ Peak point Z-Coordinate

- For arch motion to coordinate positive direction;
  Start point Z-Coordinate > Start trigger Z-Coordinate ≥ Peak point Z-Coordinate
  End point Z-Coordinate > End trigger Z-Coordinate ≥ Peak point Z-Coordinate

In case these conditions are not satisfied, an error could occur at execution or an unexpected operation could occur.

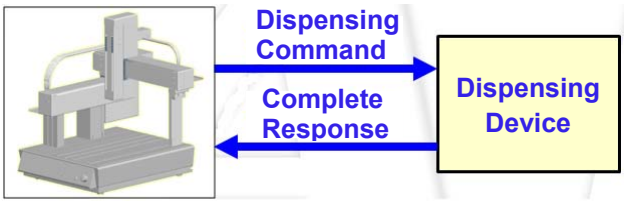



Start trigger
Start point
End point
End trigger
Peak point
Z
End trigger
Start point
End point
Start trigger
Peak point
Z
End point
Start point
Start trigger
End trigger
Peak point
Z
Start point
End point
End trigger
Start trigger
Peak point
Z
Start point
End point
End trigger
Peak point
Start trigger
Z
Start point
End point
Start trigger
Peak point
End trigger
Z

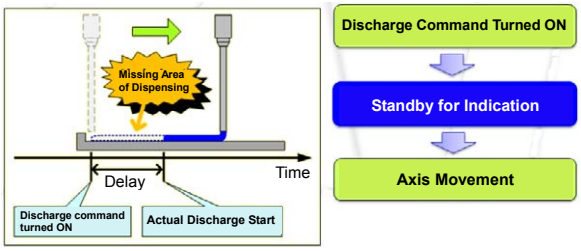
7.7 Dispensing Setting

Establish the settings related to dispensing operation.
Setting should be established in accordance with the operation that you would require.

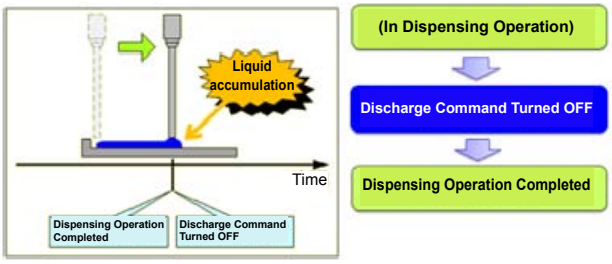
1) Dispensing Device and I/F Setting
Set the communication condition for the signals between the robot and dispensing device.



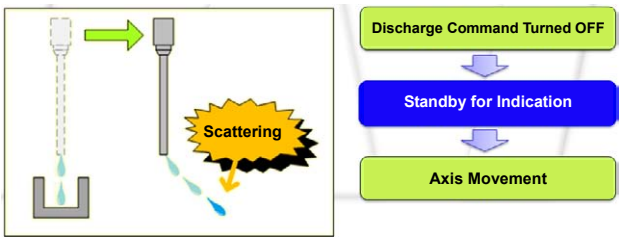
2) Prevention Setting for Missing Area of Dispensing
Prevention of missing area of dispensing due to delay of actual discharge start after discharge command turned ON



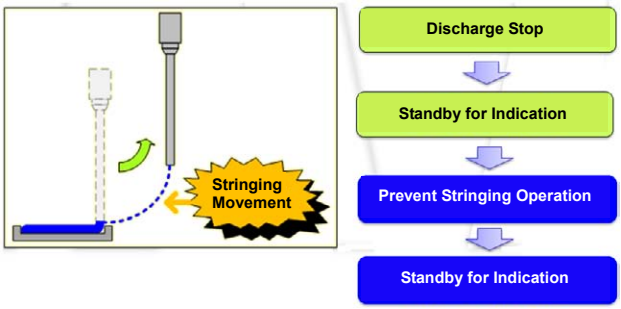
3) Prevent Liquid Accumulation Setting [*1]
It prevents liquid accumulation caused due to delay in stop of discharge actually happens after the dispensing operation finishes



4) Scatter Prevention Setting
Prevention of scattering of dispensing agent due to delay of actual discharge stop after dispensing command turned OFF



5) Prevention Setting for Stringing Movement
Prevention for dispensing agent to be stretched out and drip around



*1 In order to use the prevent liquid accumulation feature, it is necessary to have the position output operation feature activated when you create a new project.

7.7.1 Common Settings

Settings related to dispensing common items should be established.

Item	Contents
Command output port	Set the port number for the dispensing command signal output to the dispensing device.
Response input port	Set the port number for the complete reply signal input from the dispensing device. * It is not necessary to establish the setting if the operation mode of the dispensing device is “Continuous Discharge”.

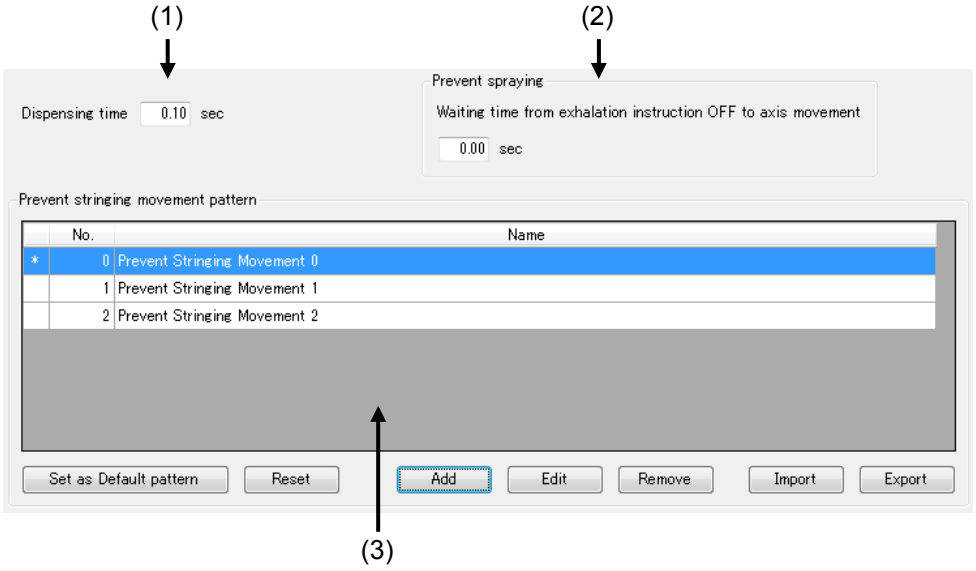
Commands to the dispensing device and response are to be conducted on each port of PIO (24V input and output signals).
Set the numbers of the command output port and response input port.

* As the available ports may differ for each robot, refer to the instruction manual for each robot and select from the ports assigned for general input.

<Reference>
If the robot is TTA, the ports set for general output and general input at the delivery are as shown below.
Output : 321 to 331
Input : 17, 18, 20 to 22, 31

7.7.2 Point Dispensing Settings

Settings related to point dispensing should be established.



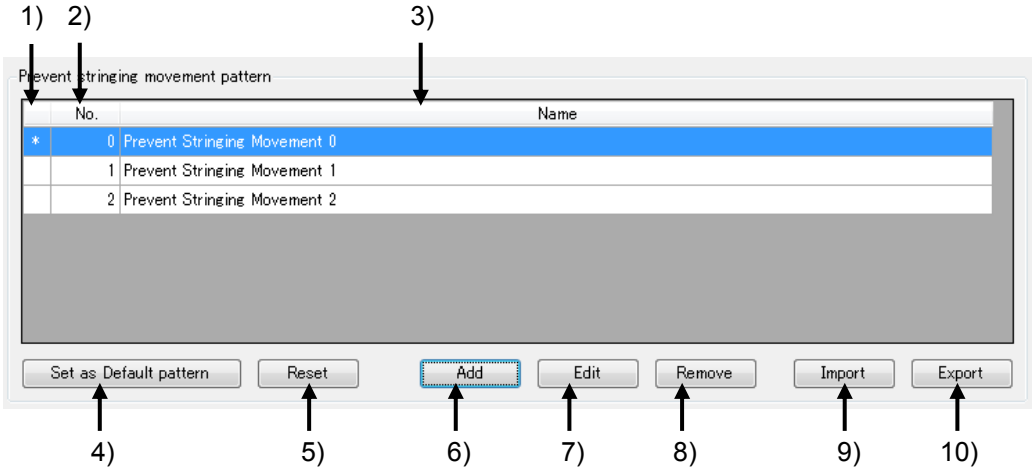
(1) Dispensing setting

Item	Contents
Dispensing time	In case the operation mode of the dispensing device is “Continuous Discharge”, the point dispensing time should be set. (0.00 to 99.00sec) * It is not necessary to establish the setting if the operation mode of the dispensing device is “Constant Discharge”.

(2) Prevent spraying setting

Item	Contents
Waiting time from exhalation instruction OFF to axis movement	Set the standby time since the dispensing command signal is turned OFF till prevent stringing movement is started. (0.00 to 99.00sec)

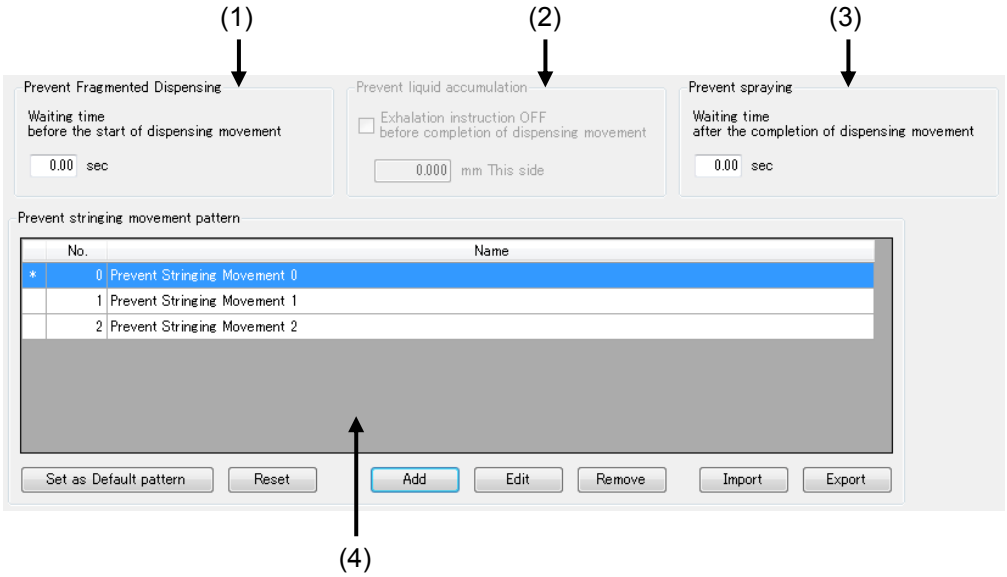
(3) Prevent stringing movement pattern setting



No.	Contents
1)	"*" should be displayed when it is set as the initial value in drawing.
2)	Prevent stringing movement pattern number should be displayed.
3)	Prevent stringing movement pattern name should be displayed.
4)	The prevent stringing movement pattern in the line pointed with the cursor should be set as the initial setting for the new drawing.
5)	Initial setting for the new drawing should be cancelled.
6)	Prevent stringing movement pattern should be registered additionally. For how to register, refer to [8. Prevent Stringing Movement Setting].
7)	The prevent stringing movement pattern in the line pointed with the cursor should be edited. For how to edit, refer to [8. Prevent Stringing Movement Setting].
8)	The prevent stringing movement pattern in the line pointed with the cursor should be deleted.
9)	The prevent stringing movement pattern should be read in from a file.
10)	The prevent stringing movement pattern should be output to a file.

7.7.3 Lined Dispensing Setting

Settings related to lined dispensing should be established.



(1) Prevent fragmented dispensing setting

Item	Contents
Waiting time before the start of dispensing movement	Set the standby time since the dispensing command signal is turned ON till dispensing movement is started. (0.00 to 99.00sec)

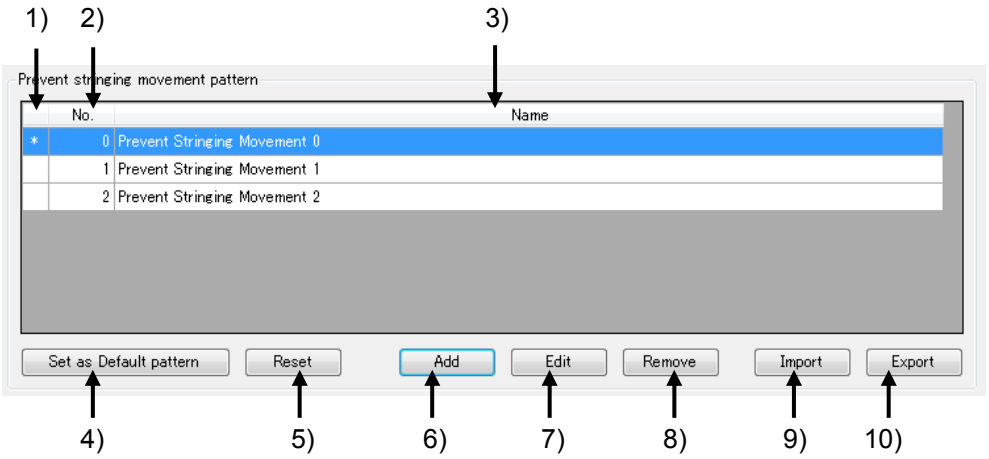
(2) Prevent liquid accumulation settings

Item	Contents
Exhalation instruction OFF before completion of dispensing movement	Check it up and the exhalation instruction turns OFF before dispensing operation completes. * This feature is available to use only in a project with the position output operation feature activated.
mm This side	Indication should be made for the position to turn OFF the exhalation instruction in distance before the end point of the dispensing operation. (Unit: mm)

(3) Prevent spraying setting

Item	Contents
Waiting time after completion of dispensing movement	Set the standby time since the dispensing operation is finished till prevent stringing movement is started. (0.00 to 99.00sec)

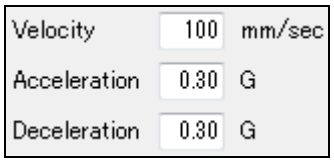
(4) Prevent stringing movement pattern settings



No.	Contents
1)	"*" should be displayed when it is set as the initial value in drawing.
2)	Prevent stringing movement pattern number should be displayed.
3)	Prevent stringing movement pattern name should be displayed.
4)	The prevent stringing movement pattern in the line pointed with the cursor should be set as the initial setting for the new drawing.
5)	Initial setting for the new drawing should be cancelled.
6)	Prevent stringing movement pattern should be registered additionally. For how to register, refer to [8. Prevent Stringing Movement Setting].
7)	The prevent stringing movement pattern in the line pointed with the cursor should be edited. For how to edit, refer to [8. Prevent Stringing Movement Setting].
8)	The prevent stringing movement pattern in the line pointed with the cursor should be deleted.
9)	The prevent stringing movement pattern should be read in from a file.
10)	The prevent stringing movement pattern should be output to a file.

7.8 Interpolate Move Velocity Setting

The setting of the velocity / acceleration / deceleration for the interpolation motion (movement between start point and end point on a line) should be established.

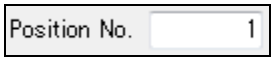


Item	Contents
Velocity	Set the velocity for the interpolation motion. (Unit: mm/sec)
Acceleration	Set the acceleration for the interpolation motion. (Unit: G)
Deceleration	Set the deceleration for the interpolation motion. (Unit: G)

Set the speed and acceleration / deceleration for dispensing movement to satisfy the required applied volume considering the amount of discharge of the dispensing device.

7.9 Output Setting

Settings related to the output data when SEL program / position data get generated should be established.



Item	Contents
Position No.	Set the top position number.

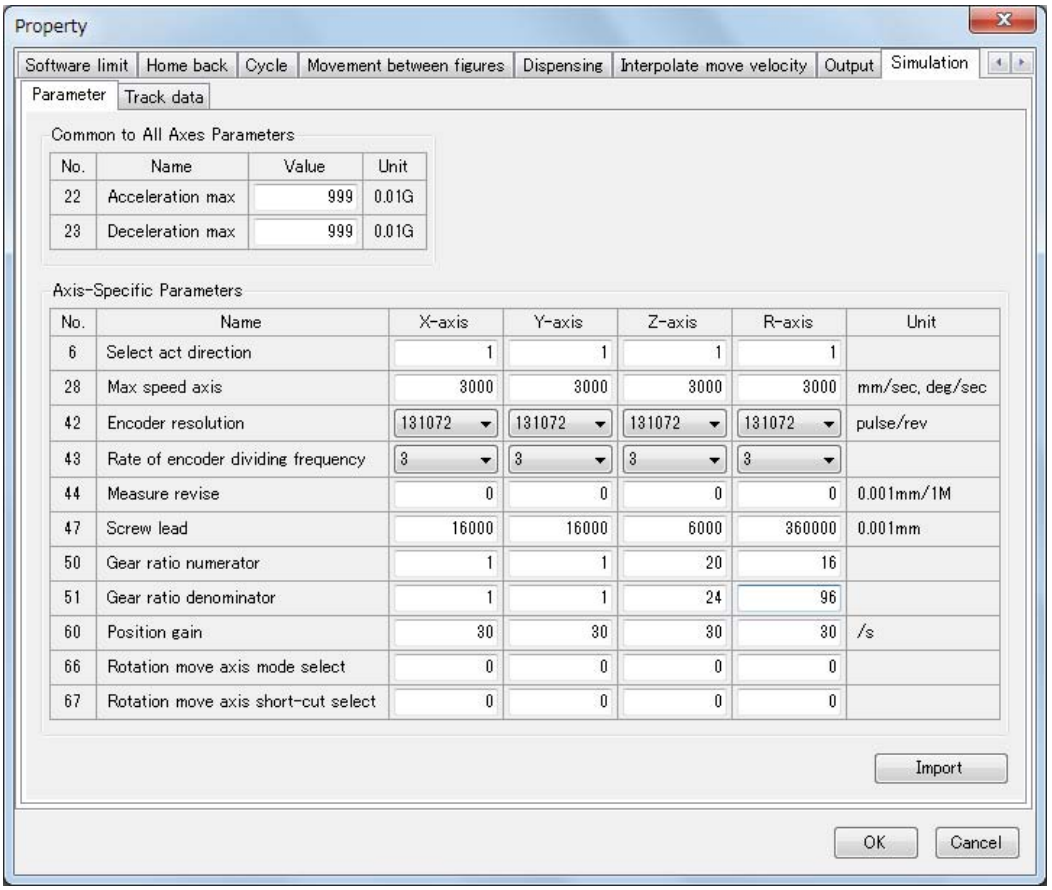
7.10 Simulation Setting

Settings should be established regarding simulation.

(1) Parameter

Controller parameters in simulation should be set up. It is available establish the setting by reading in values from another project file or controller parameter file by using the import button.

* In case the parameter setting values differ from the actual device, dispersion in simulation for the cycle time and operation track may get large.



[Details of Common to All Axes Parameters Contents]

No.	Parameter Name	Input Range	Unit	Remarks
22	Acceleration max	1 to 999	0.01G	
23	Deceleration max	1 to 999	0.01G	

[Details of Axis-Specific Parameters Contents]

No.	Parameter Name	Input Range	Unit	Remarks
6	Select act direction	0 to1		Do not attempt to change the initial values or the values in the parameter file.
28	Max speed axis	1 to 3000	mm/s	
42	Encoder resolution	800, 131072	pulse/rev	Set it to 800 in incremental and to 131072 in battery-less absolute.
43	Rate of encoder dividing frequency	0, 2 to 5		Set it to 0 in incremental, to 4 in battery-less absolute and pulse motor at the same time and to 3 in battery-less absolute and AC servomotor at the same time.
44	Measure revise	-99999999 to 99999999	0.001mm/1M	It changes coordinates in proportion. Valid only for linear drive axes
47	Screw lead	1 to 99999999	0.001mm	Make sure to establish the setting to satisfy “Lead Described in Catalog or Instruction Manual” = “Screw Lead” × “Numerator of Gear Ratio” / “Denominator of Gear Ratio” for X, Y and Z-axes. * Do not attempt to change the initial value or the values in the parameter file for R-axis.
50	Gear ratio numerator	1 to 99999999		
51	Gear ratio denominator	1 to 99999999		
60	Position gain	1 to 9999	/s	Set it to 50 for pulse motor type TTA and to 30 for servomotor type TTA.
66	Rotation move axis mode select	0 to 5		0: Normal Mode, 1: Index Mode
67	Rotation move axis short-cur select	0 to 5		0: Not Selected, 1: Selected (Valid only in index mode and INC encoder at the same time)

* Example of Setting for Axis-Specific Parameters 47, 50 and 51

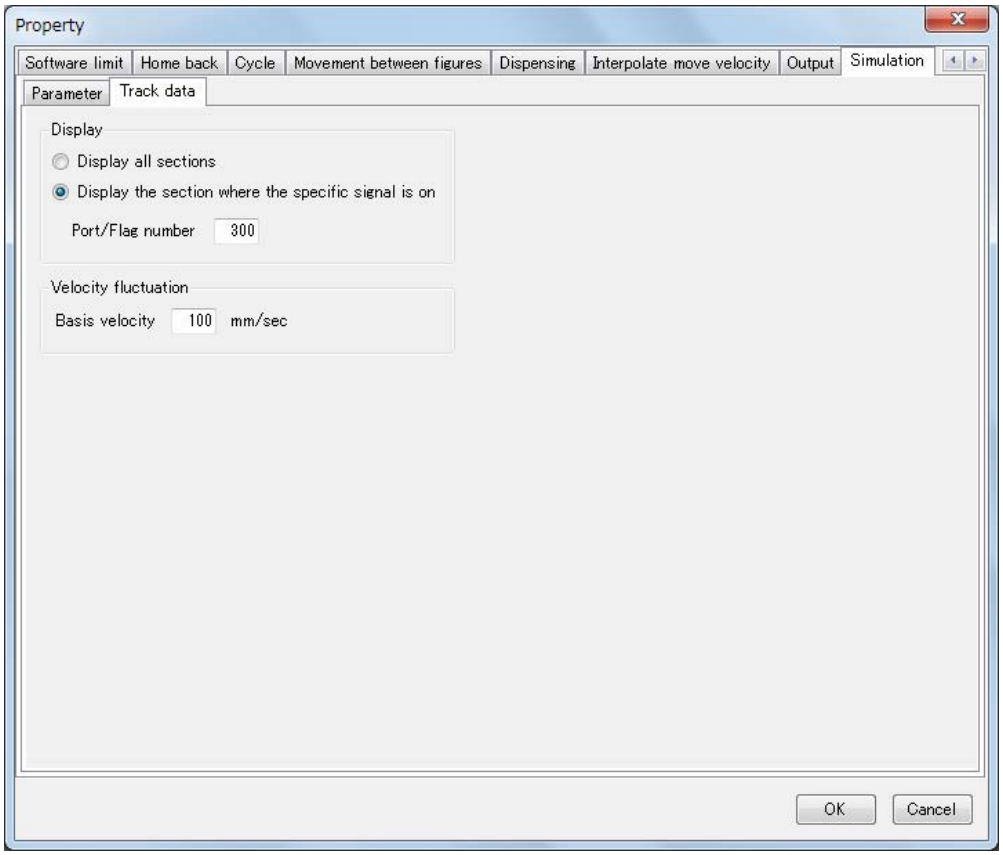
Lead [mm]	Axis-Specific Parameter Setting Value		
	47	50	51
24 or equivalent	16000	36	24
16	16000	1	1
3	3000	1	1

(2) Track data

Display settings for the operation track in simulation should be established.

- Display
  Select either “Display all sections” or “Display the section where the specific signal is on”. It is required to set a signal to be specified (eg. value set in Dispensing Device I/F Command Output Number) in the Port/Flag number box when “Display the section where the specific signal is on” is selected.

- Velocity fluctuation
  It is necessary to establish the standard velocity when you would like to change the track line thickness in response to the operation velocity. (Unit: mm/sec)
  The operation track should be shown thin in the area faster than the standard while the track shown thick in the area slower than the standard.
  The track line should be shown in constant width when the parameter is set to “0”.



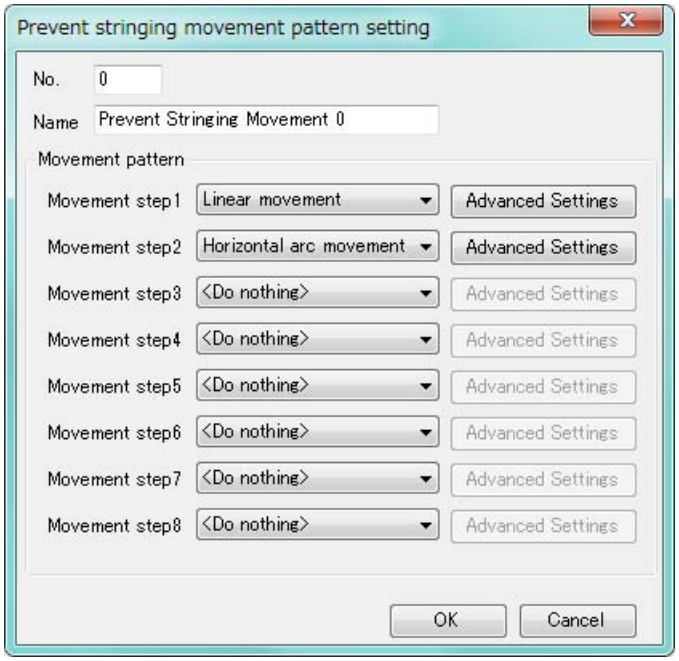
* The settings above should be reflected only to the simulation track display (not to the track display in the actual device servo monitor data).

8. Prevent Stringing Movement Setting

Setting should be established for the operation (prevent stringing movement) after dispensing on each figure is finished till it starts to move to a next figure.

8.1 Prevent stringing movement pattern setting

Setting should be established for the prevent stringing movement pattern.



(1) No.

Indicate the prevent stringing movement pattern identification number.
(Available Indication Range: 0 to 512)

- When Adding a Pattern
  Indicate an empty number. An error should occur when an occupied pattern is indicated.
- When Editing a Pattern
  When the number is not to be changed, contents of the applicable pattern should be changed. When an empty number is indicated, a pattern should be additionally registered to the indicated number. An error should occur when an occupied pattern is indicated.

(2) Name

Set a name to the prevent stringing movement pattern.
(Settable Range: Character string with size from 0 to 32 bytes)

The name should be displayed in the prevent stringing movement pattern select list in “Drawing Information Edit Window”.

(3) Movement pattern

Setting of the prevent stringing movement pattern should be established. It is available to set eight steps at the maximum.
Movements from Movement step 1 to Movement step 8 should be executed in order after dispensing is finished.

Operation in each step should be selected from those below.
- <Do nothing>
  No operation should be taken.
- Linear movement
  Linear movement should be executed.
- Horizontal arc movement
  Horizontal arc movement should be executed.

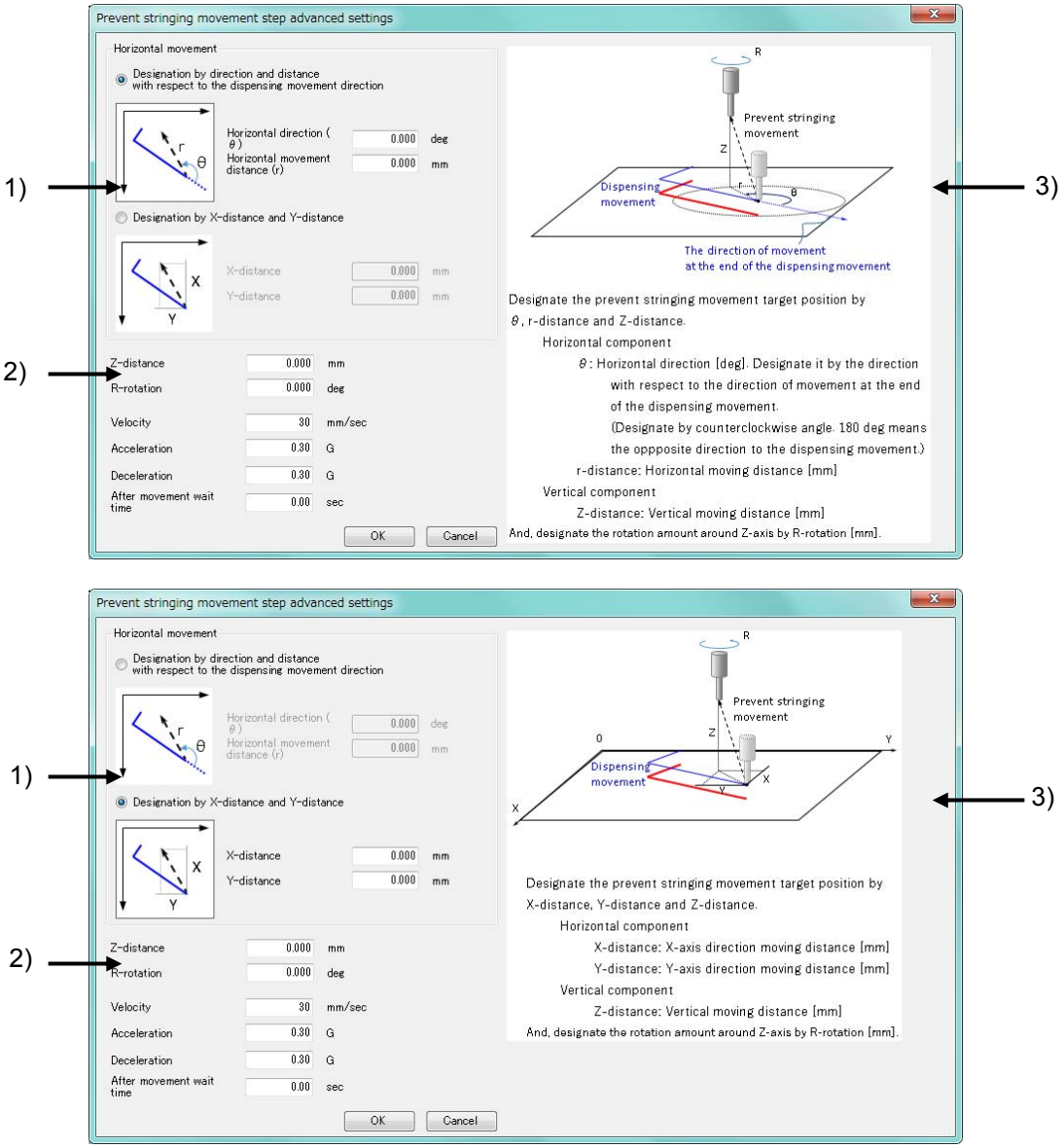
After an operation pattern is selected, click Advanced Settings button to proceed to detail operation settings for each step. Detail settings for movement operation and standby time after movement are available. In case only standby time is required to be set up, select Linear movement and set the movement distance to 0 in the detail setting.

8.2 Prevent stringing movement step advanced settings

Detail data settings for a prevent stringing movement step should be established.

8.2.1 Linear Movement

Set up the detail data for when Linear movement is indicated.



(1) Horizontal movement

Item	Contents
Designation by direction and distance with respect to the dispensing movement direction	Linear movement horizontal component should be designated in direction and distance with respect to the dispensing movement direction. It is available only for lined dispensing.
Designation by X-distance and Y-distance	Prevent stringing movement horizontal component should be designated in distance to move in X-axis and Y-axis directions.
Horizontal direction (θ)	Direction for horizontal movement when “Designation by direction and distance with respect to the dispensing movement direction” is selected should be designated in an angle counterclockwise. (-99999.999 to 99999.999deg) In case it is designated to 180 [deg], the direction should be that in return to the dispensing movement direction.
Horizontal movement distance (r)	Distance of horizontal movement when “Designation by direction and distance with respect to the dispensing movement direction” is selected should be designated. (-99999.999 to 99999.999mm)
X-distance	Setting should be established for the distance to move in X-axis direction when “Designation by X-distance and Y-distance” is selected. (-99999.999 to 99999.999mm)
Y-distance	Setting should be established for the distance to move in Y-axis direction when “Designation by X-distance and Y-distance” is selected. (-99999.999 to 99999.999mm)

(2) Others

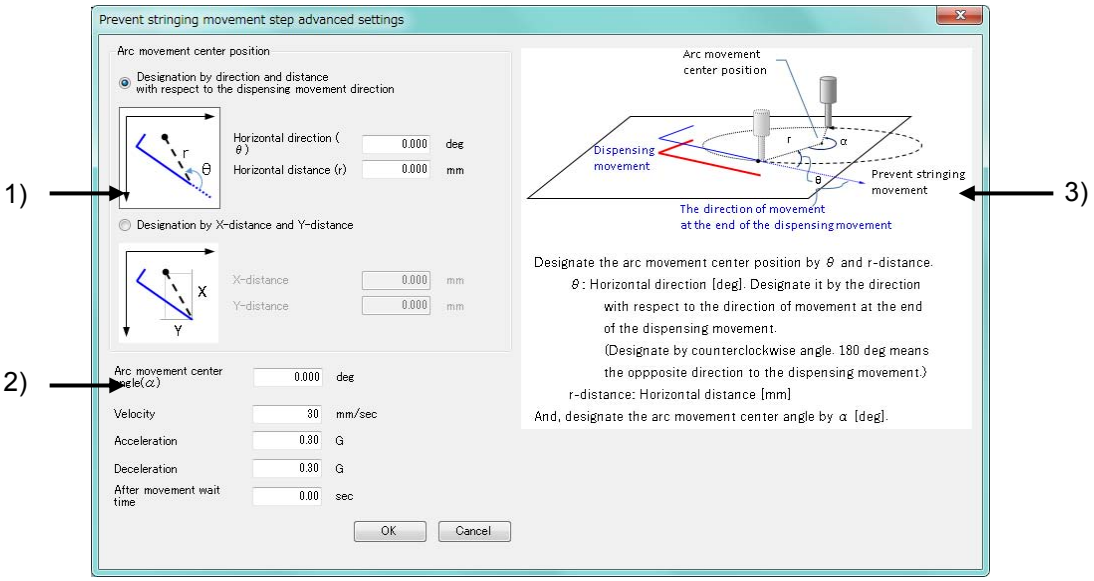
Item	Contents
Z-distance	Setting should be established for the distance to move in Z-axis direction. (-99999.999 to 99999.999mm)
R-rotation	Setting should be established for the rotating amount around Z-axis. (-99999.999 to 99999.999deg)
Velocity	Set the velocity. (1 to 9999mm/sec)
Acceleration	Set the acceleration. (0.01 to 9.99G)
Deceleration	Set the deceleration. (0.01 to 9.99G)
After movement wait time	Setting should be established for the standby time after moved to the applicable step. (0.00 to 99.00sec)

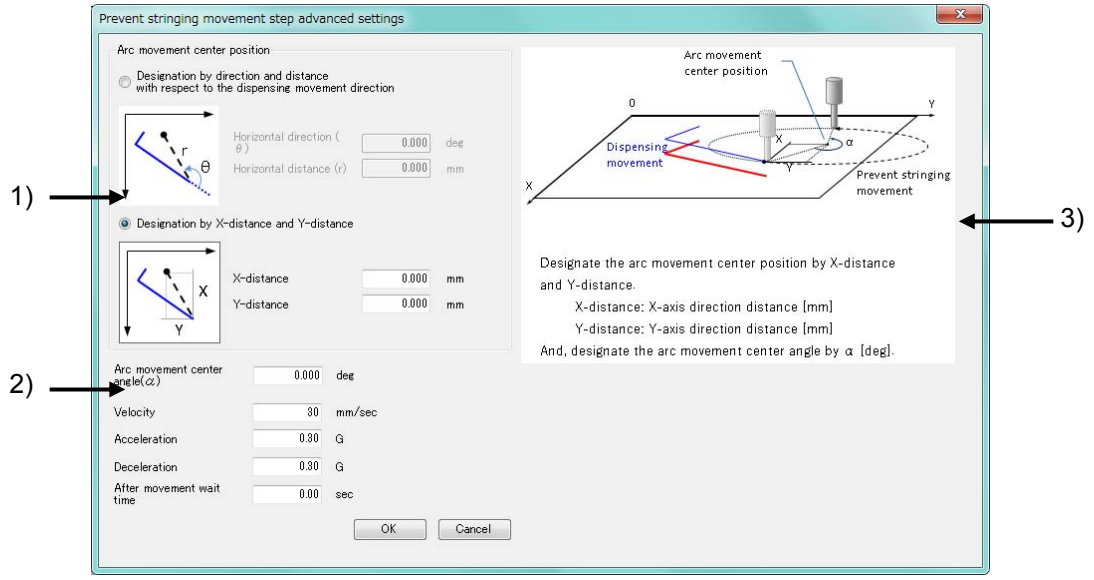
(3) Help Display

Explanations regarding movement settings should be shown.

8.2.2 Horizontal Arc Movement

Set up the detail data for when Horizontal Arc movement is indicated.





(1) Arc movement center position

Item	Contents
Designation by direction and distance with respect to the dispensing movement direction	The coordinate for the center of the arc movement should be designated in direction and distance with respect to the dispensing movement direction. It is available only for lined dispensing.
Designation by X-distance and Y-distance	The coordinate of the center for the arc movement should be designated in distance to X-axis direction and Y-axis direction.
Horizontal direction (θ)	Horizontal direction when “Designation by direction and distance with respect to the dispensing movement direction” is selected should be designated in an angle counterclockwise. (-99999.999 to 99999.999deg) In case it is designated to 180 [deg], the direction should be that in return to the dispensing movement direction.
Horizontal distance (r)	Horizontal distance when “Designation by direction and distance with respect to the dispensing movement direction” is selected should be designated. (-99999.999 to 99999.999mm)
X-distance	Setting should be established for the distance to move in X-axis direction when “Designation by X-distance and Y-distance” is selected. (-99999.999 to 99999.999mm)
Y-distance	Setting should be established for the distance to move in Y-axis direction when “Designation by X-distance and Y-distance” is selected. (-99999.999 to 99999.999mm)

(2) Others

Item	Contents
Arc movement center angle (α)	Amount of horizontal arc movement should be designated in an angle counterclockwise. (-3600.000 to 3600.000deg)
Velocity	Set the velocity. (1 to 9999mm/sec)
Acceleration	Set the acceleration. (0.01 to 9.99G)
Deceleration	Set the deceleration. (0.01 to 9.99G)
After movement wait time	Setting should be established for the standby time after moved to the applicable step. (0.00 to 99.00sec)

(3) Help Display

Explanations regarding movement settings should be shown.

9. Draw Figures

Create drawing in one of the ways below.

- Reading figures in from CAD data
- Creating figures with mouse operation

9.1 Reading Figures in from CAD Data

Figures (points / lines / arc / circle) necessary for work can be read in from the CAD data in work.

9.1.1 CAD Data Format Available for Reading

The CAD data format available to read in is as shown below.

- Format : DXF (ASCII Format)
- Version : AutoCAD Release14

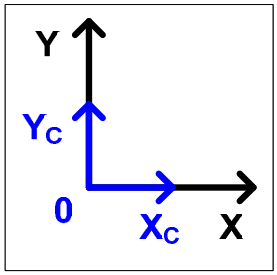
9.1.2 Types of Figures Available for Reading

The figure available to read in is as shown below.

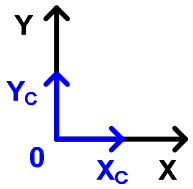
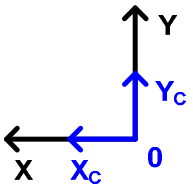
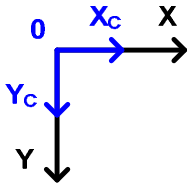
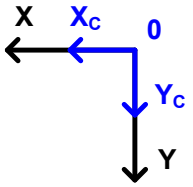
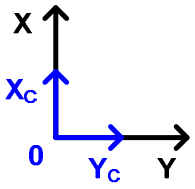
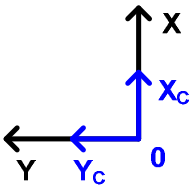
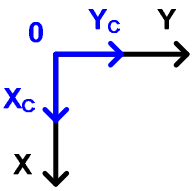
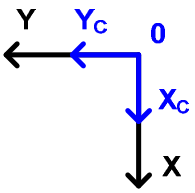
- POINT
- LINE
- CIRCLE
- ARC
- POLYLINE
- LWPOLYLINE
- SPLINE
- ELLIPSE
- TRACE
- SOLID

9.1.3 Relation of CAD Drawing Coordinates and Working Area Coordinates

The relation of the CAD drawing coordinates Xc, Yc and the working area coordinates X, Y are as shown below.



The orientation of the CAD drawing should change in relation to the coordinate orientation of the working area.

Coordinate Operation of Working Area: TYPE 1	Coordinate Operation of Working Area: TYPE 2
	
Coordinate Operation of Working Area: TYPE 3	**Coordinate Operation of Working Area: TYPE 4**
	
Coordinate Operation of Working Area: TYPE 5	**Coordinate Operation of Working Area: TYPE 6**
	
Coordinate Operation of Working Area: TYPE 7	**Coordinate Operation of Working Area: TYPE 8**
	

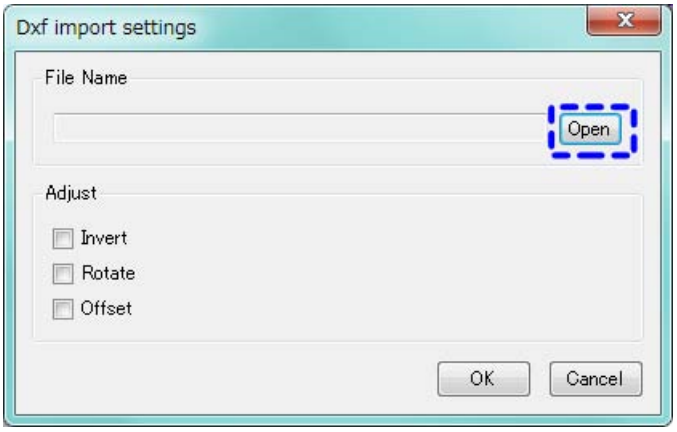
9.1.4 Read the DXF Data

In order to read the DXF data, follow the procedure below.

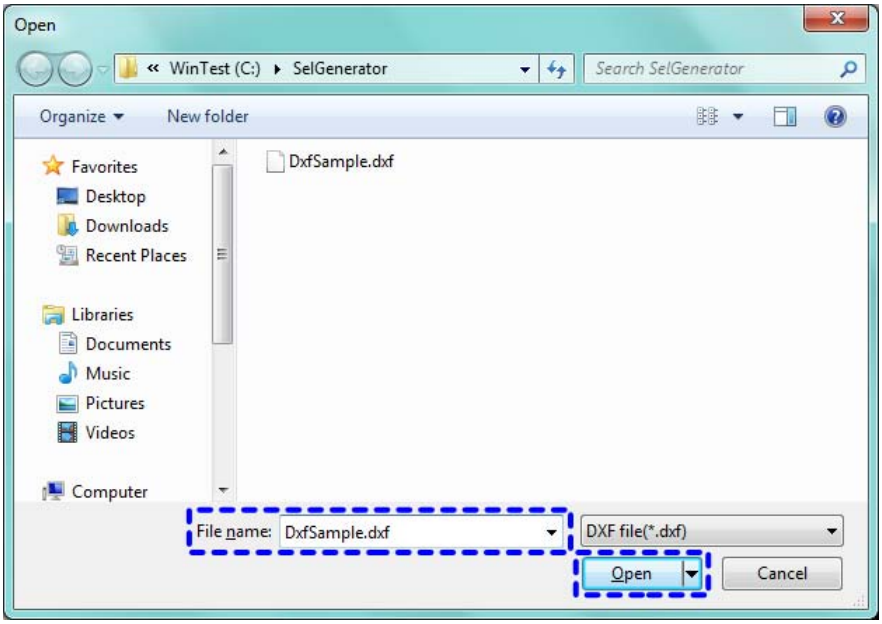
(1) Prepare a DXF data for work drawing.

(2) Execute [File (F)] - [Dxf data (D)] - [Read (R)] from the menu bar.

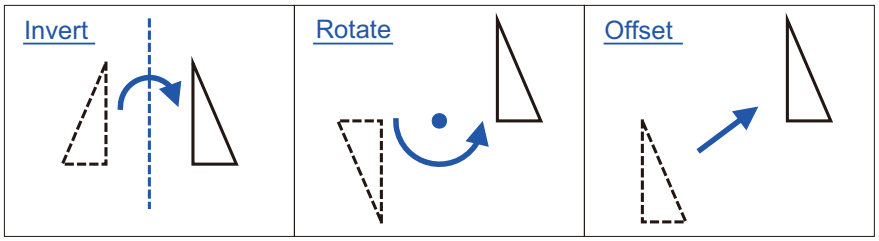
(3) Click on Open button in “Dxf import settings” window.



(4) Select a file name of the DXF data, and click on Open button.

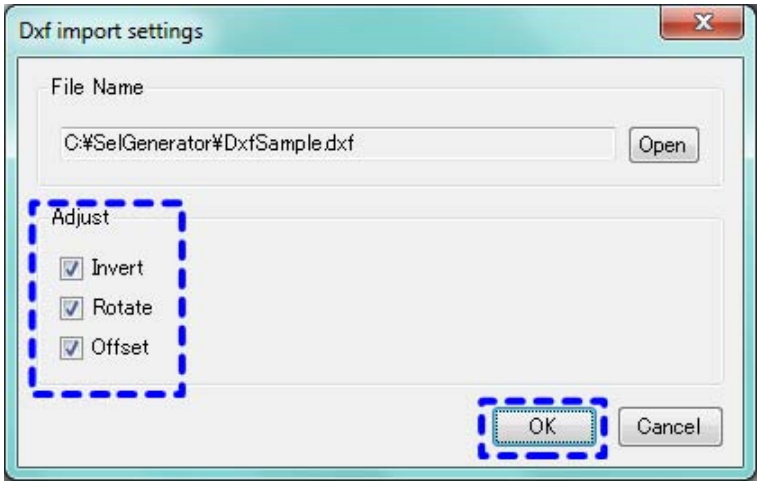


(5) In order to adjust the relation between the coordinates (0, 0) (= tool tip position) of the working area and the work position, operate the figures that was read in to “Invert”, “Rotate” and “Offset”.



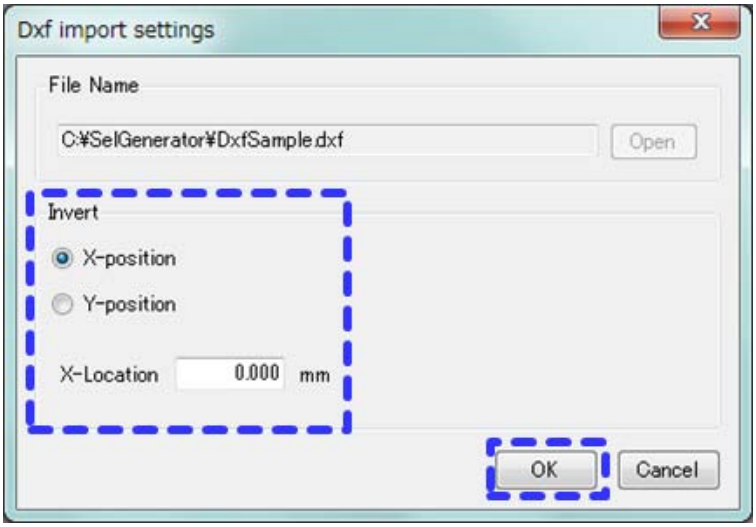
Select an item to execute, and click on OK button.

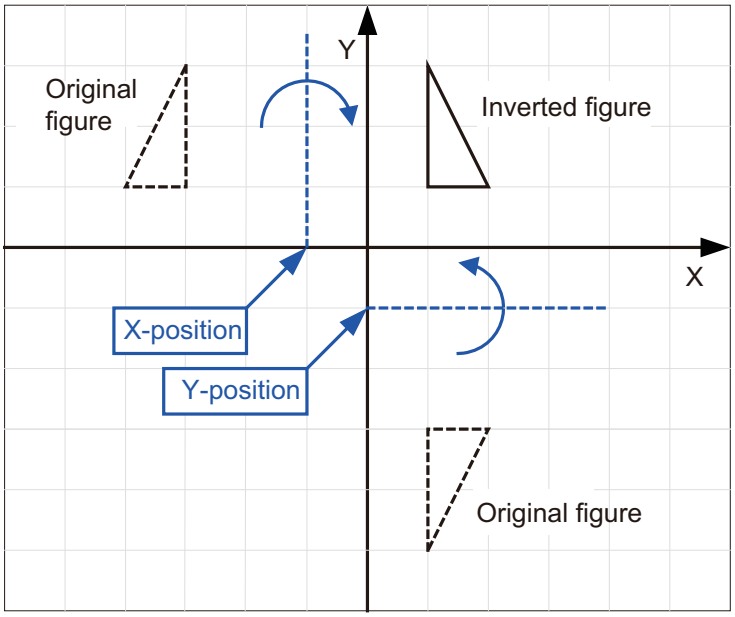
(Note) If multiple items are selected, the coordinates should be converted in the order of “Invert” ⇒ “Rotate” ⇒ “Offset”.



(6) Set the datum coordinate for inversion and click on OK button.

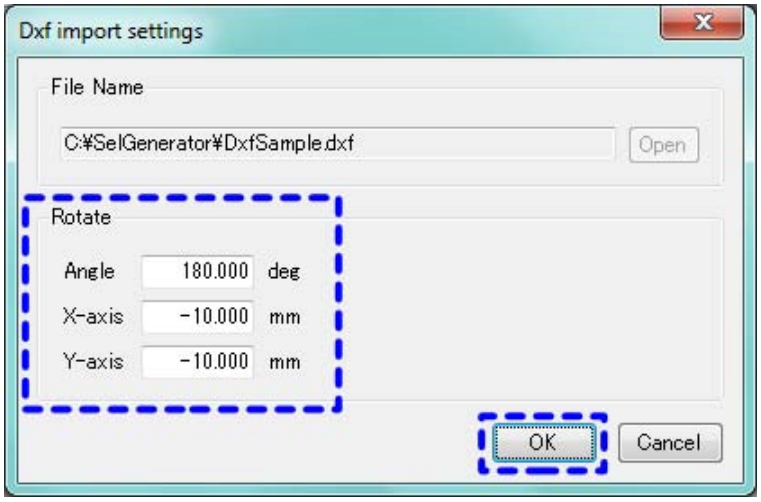
[If "Invert" is selected in (5)]

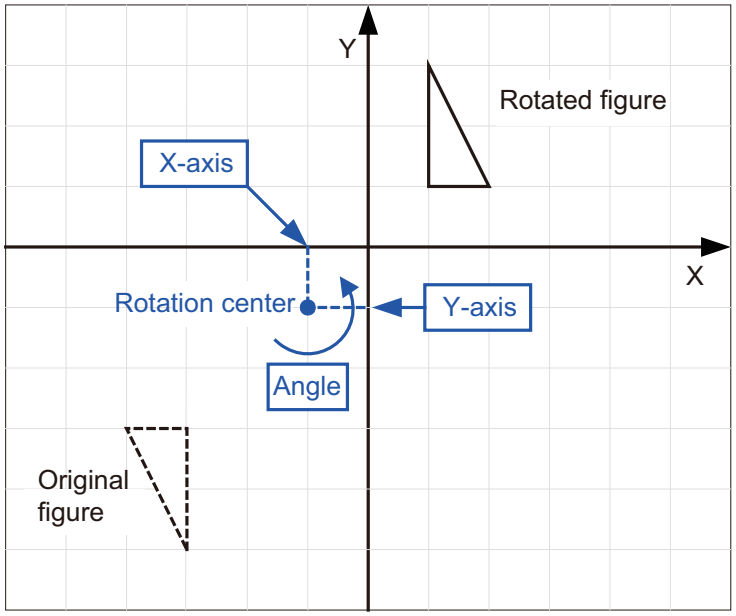




(7) Set the rotation angle and the center coordinate and click on OK button.

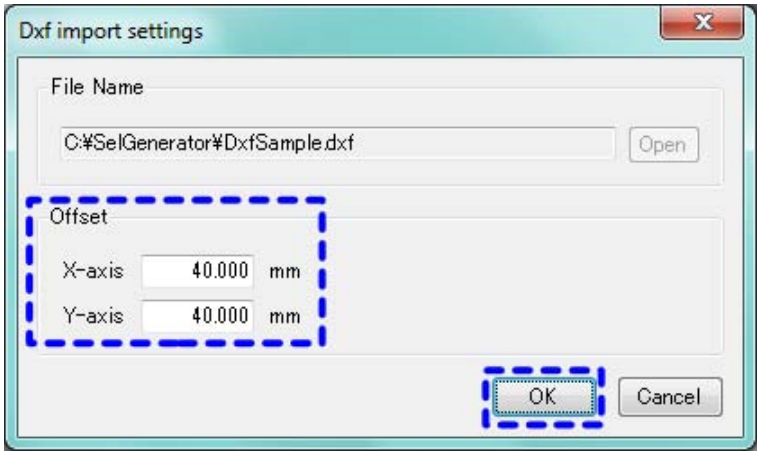
[If "Rotate" is selected in (5)]

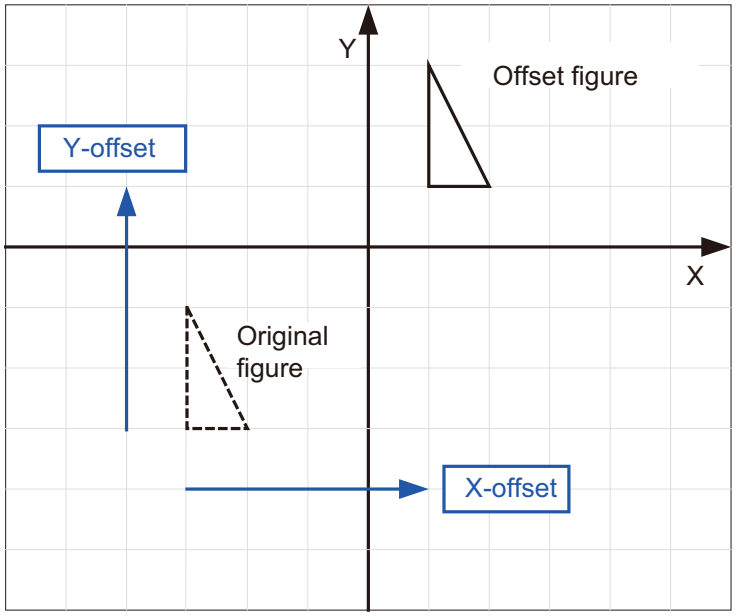




(8) Set the offset values and click on OK button.

[If "Offset" is selected in (5)]



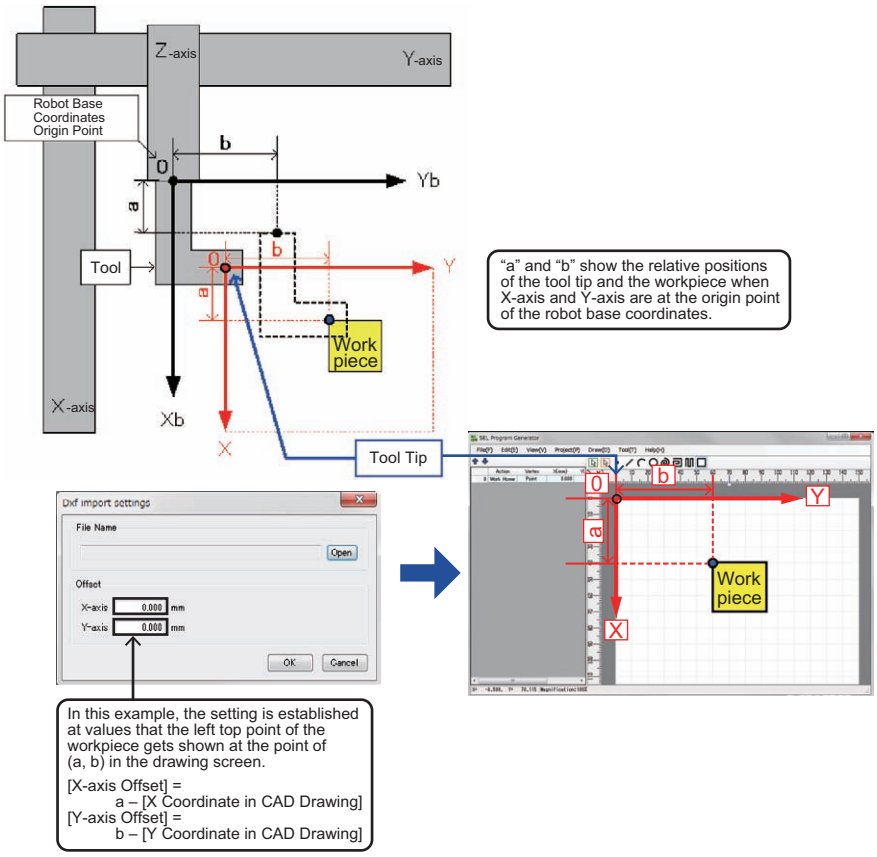


Adjust the relation of positions of the coordinates (0, 0) (= tool tip position) and the workpiece in the drawing window to the actual position relation [*1] by the offset setting.

* 1 When the X-axis and Y-axis are positioned to the base coordinate datum point (0, 0) of the robot, make sure to check the position relation of the tool tip and workpiece in the device drawing in advance.

The relation between the coordinates in the CAD drawing and the coordinates in the drawing window should be as shown below.

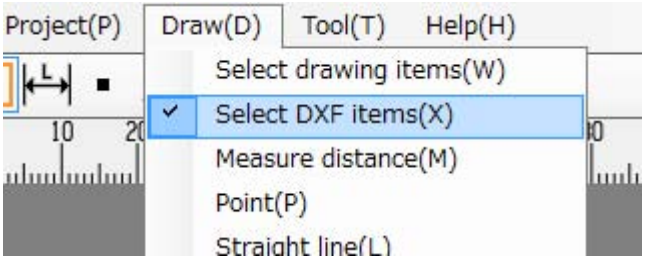
- X Coordinate in Drawing Window = [X Coordinate in CAD Drawing] + [X-axis Offset]
- Y Coordinate in Drawing Window = [Y Coordinate in CAD Drawing] + [Y-axis Offset]



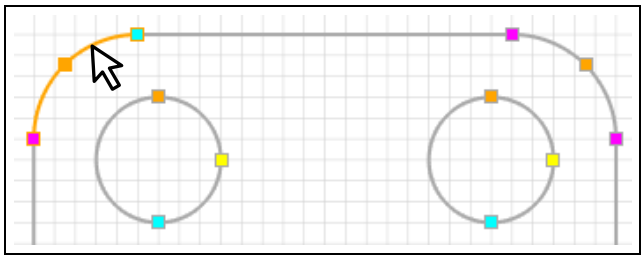
9.1.5 Import the Figure

Figures can be read in from DXF data with the following steps.

(1) The edit mode can be changed to “Select DXF items (X)”.



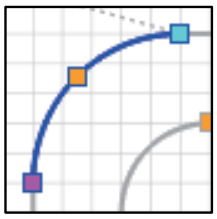
(2) Select the figure that you would like to read in by clicking on the left mouse button.



(3) Click on the right mouse button to open the popup menu and execute [Import (I)]. By executing [Import (I)] with holding down [Ctrl] key, start point and end point (1st pass point and 2nd pass point for a circle) can be swapped to each other to be read in.

In normal

With [Ctrl] held down



Start and end points swapped to each other

If you wish to continue to read in other figures, repeat (2) and (3).

Setting should be established for the coordinate of the work home position (standby position) that is the start point to execute a program after a figure is read in and height on the dispensing path (Z-axis).

The coordinate of the work home position (standby position) should be set up in the steps described below.

1) Execute “Draw (D)” – “Select drawing items (W)” from the menu
2) Click on “Work Home” at the top of the created data list to select it, and click on the right button and execute “Modify (M)” from the popup menu that appears
3) Set the coordinate in the peak tab.

<Reference>
Setting can be established at any position.
Set the position considering not to have interference when a replacing workpiece.

The height on the dispensing path (Z-axis) should be set up in the steps described below.

1) Execute “Draw (D)” – “Select drawing items (W)” from the menu
2) Click on the figure in the second line of the drawing data list to select, right-click on it to show the popup menu and execute “Modify (M)”.
3) Set the coordinate in the peak tab.

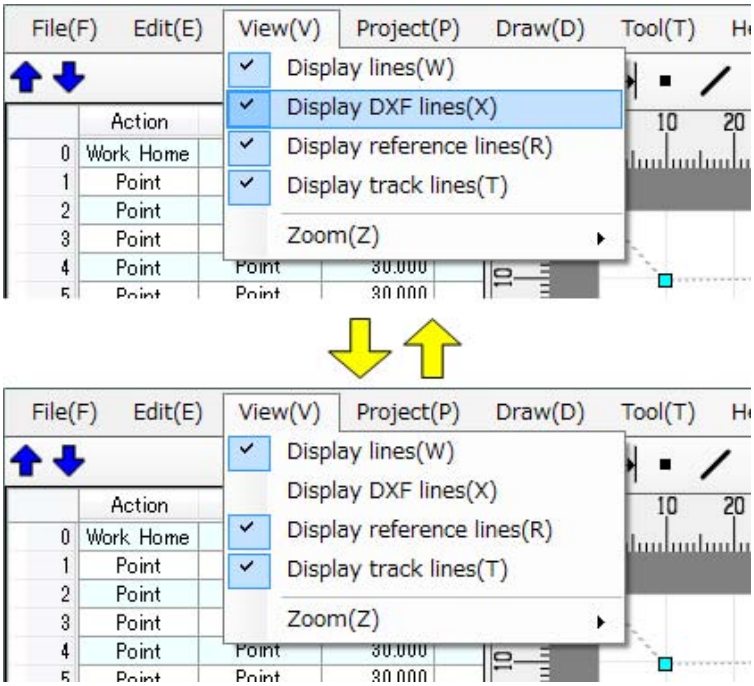
Refer to [10.13.2 Vertex Setting] for detail of setup.

9.1.6 Clear the Figure

Execute [File (F)] - [Dxf data (D)] - [Clear (C)] in the menu bar, and the DXF figure being displayed can be cleared.

9.1.7 Show / Hide a Figure

Execute [View (V)] - [Display DXF lines (X)] in the menu bar, and the DXF figure can be switched between show and hide.



9.2 Creating a Figure with Mouse Operation

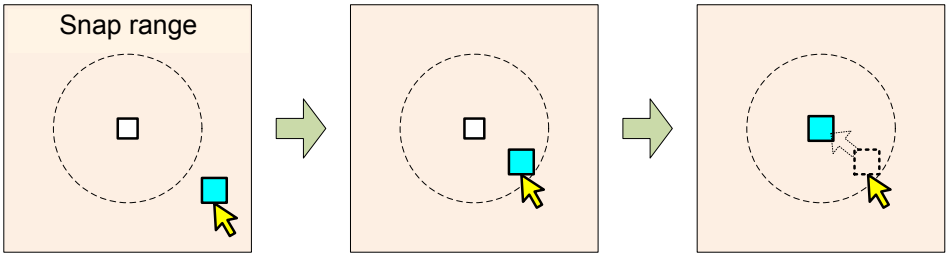
In this section, explains how to draw by mouse operation.

9.2.1 Common Items

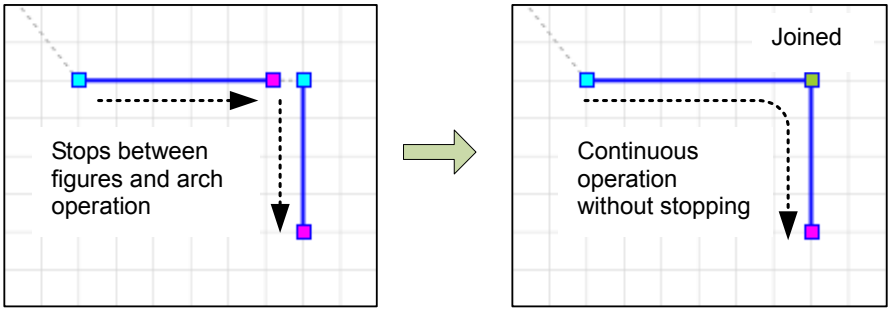
(1) Peak Snap

When you put the mouse cursor near a peak point of a figure while in drawing, it gets snapped (gripped) to the peak point. (The snapping range can be changed in the tool option.)

* When you desire not to have the cursor snapped, hold down [Ctrl] key and [Shift] key while you move the mouse cursor.



By snapping the start point of a figure (line, arc or circle) to the end point of another figure, the figures can be joined.
At the joined point of the figures, operation can be performed continuously without making a stop.



(2) How to Change Edit Mode

There are two types for how to change the edit mode.

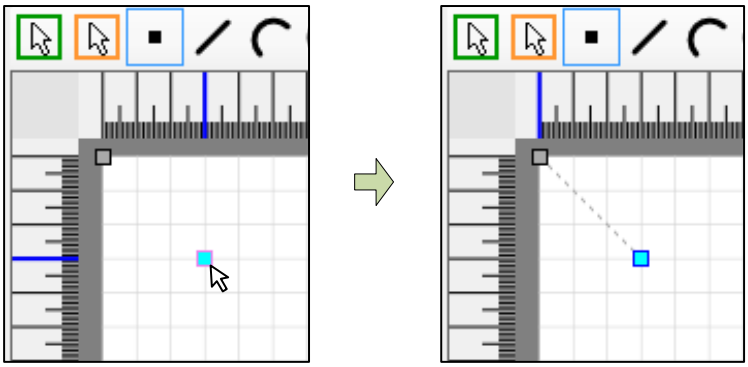
- Selection in [Draw (D)] menu on the menu bar
- Selection by tool button

Mode	Change Method	
	Menu Bar [Draw (D)] Menu	Tool Button
Select Drawing Items	[Select drawing items (W)]	
Select DXF Items	[Select DXF items (X)]	
Measure Distance	[Measure distance (M)]	
Point Drawing	[Point (P)]	
Straight Line Drawing	[Straight line (L)]	
Arc Drawing	[Arc (A)]	
Circle Drawing	[Circle (C)]	
Involute (Circle) Drawing	[Involute (Circle) (S)]	
Involute (Rectangle) Drawing	[Involute (Rectangle) (E)]	
Zig-Zag Drawing	[Zig-Zag (Z)]	
Rectangle Drawing	[Rectangle (Q)]	

9.2.2 Point Drawing

(1) The edit mode can be changed to “Point Drawing Mode”.

(2) Click at a position you would like to start drawing.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.

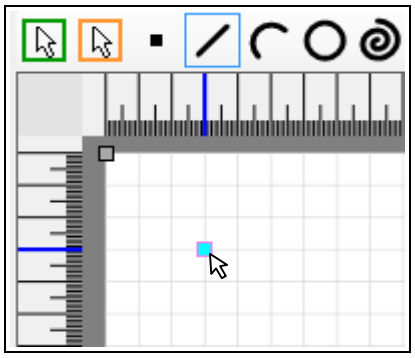


Repeat (2) when it is necessary to continue drawing a point.

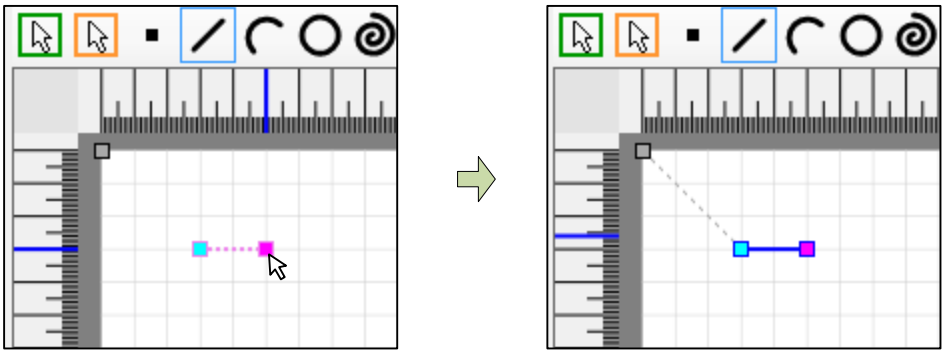
9.2.3 Straight Line Drawing

(1) The edit mode can be changed to “Straight Line Drawing Mode”.

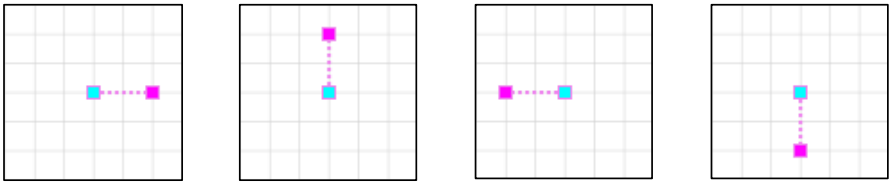
(2) Click at a position you would like to start drawing.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.



(3) Click at a position you would like to have the end point of drawing.
* Press [ESC] key and it goes back to (2) (Start Position Select).



Hold down [Ctrl] key when you move the mouse cursor, and the direction of the end point can be fixed at 0deg, 90deg, 180deg and 270deg.

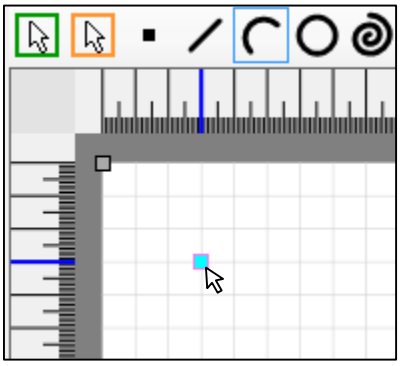


Repeat (2) and (3) when it is necessary to continue drawing a line.

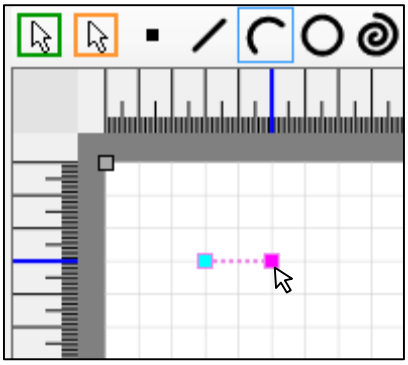
9.2.4 Arc Drawing

(1) The edit mode can be changed to “Arc Drawing Mode”.

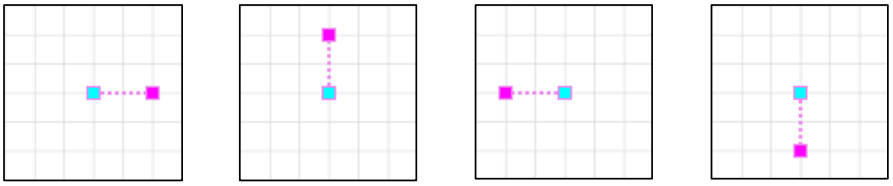
(2) Click at a position you would like to start drawing.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.



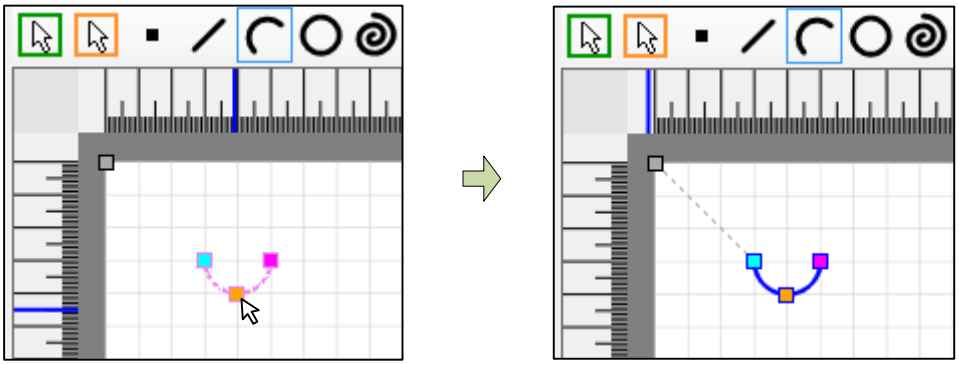
(3) Click at a position you would like to have the end point of drawing.
* Press [ESC] key and it goes back to (2) (Start Position Select).



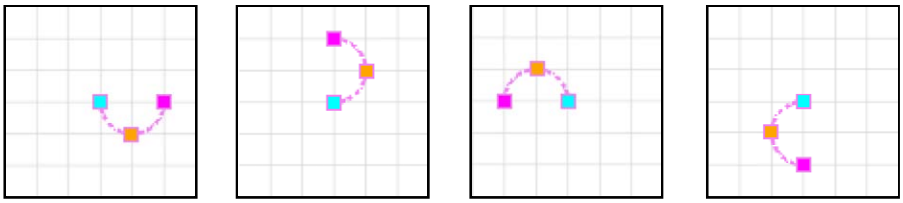
Hold down [Ctrl] key when you move the mouse cursor, and the direction of the end point can be fixed at 0deg, 90deg, 180deg and 270deg.



(4) Click at a position you would like to have the waypoint of drawing.
* Press [ESC] key and it goes back to (3) (End Position Select).



Hold down [Ctrl] key when you move the mouse cursor, and the angle of the arc center can be fixed at 180deg (semicircle).

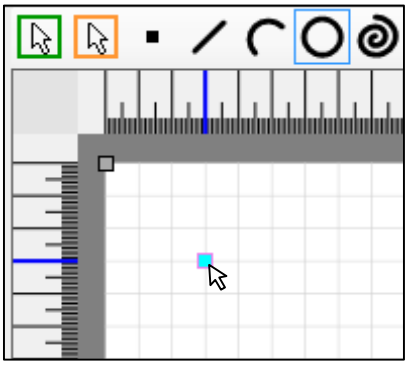


Repeat (2) to (4) when it is necessary to continue drawing an arc.

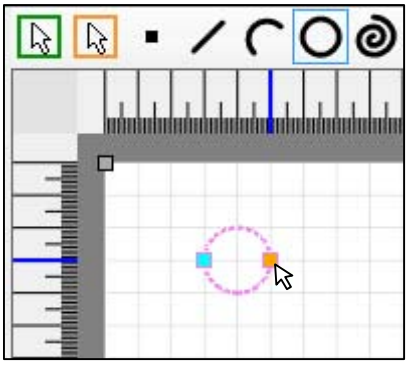
9.2.5 Circle Drawing

(1) The edit mode can be changed to “Circle Drawing Mode”.

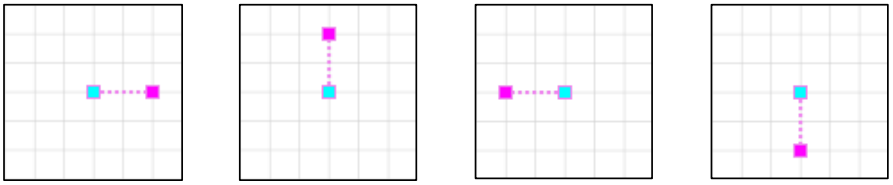
(2) Click at a position you would like to start drawing.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.



(3) Click at a position you would like to have the 2nd pass point of drawing.
* Press [ESC] key and it goes back to (2) (Start Position Select).

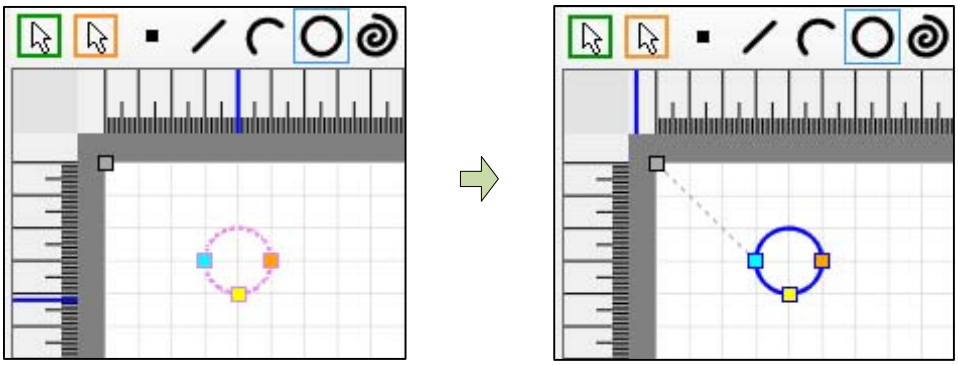


Hold down [Ctrl] key when you move the mouse cursor, and the direction of the 2nd pass point can be fixed at 0deg, 90deg, 180deg and 270deg.



(4) Click at a position you would like to have the 1st pass point (point to determine the rotating direction of the circle) of drawing.

* Press [ESC] key and it goes back to (3) (2nd pass point position select).

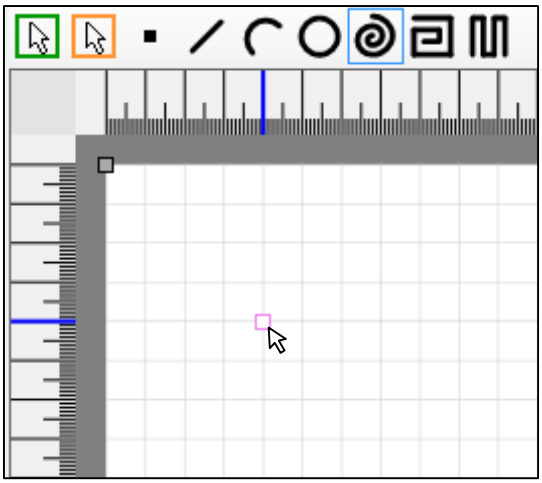


Repeat (2) to (4) when it is necessary to continue drawing a circle.

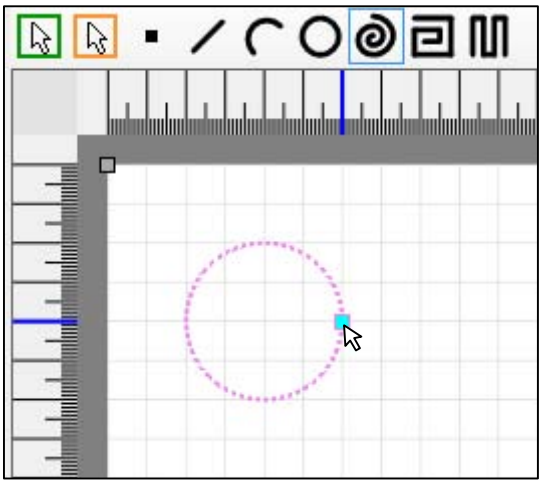
9.2.6 Involute (Circle) Drawing

(1) The edit mode can be changed to “Involute (Circle) Drawing Mode”.

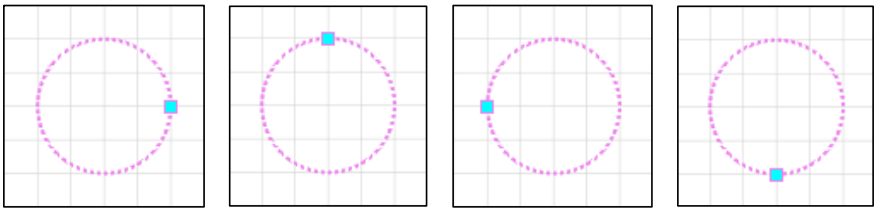
(2) Click at a position you would like to have the center point.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.



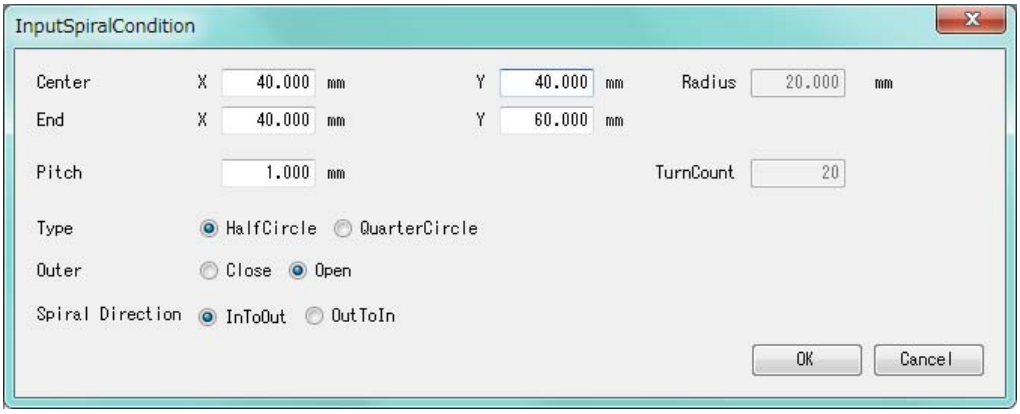
(3) Click at a position you would like to have the outer end point.
* Press [ESC] key and it goes back to (2) (Center Point Position Select).



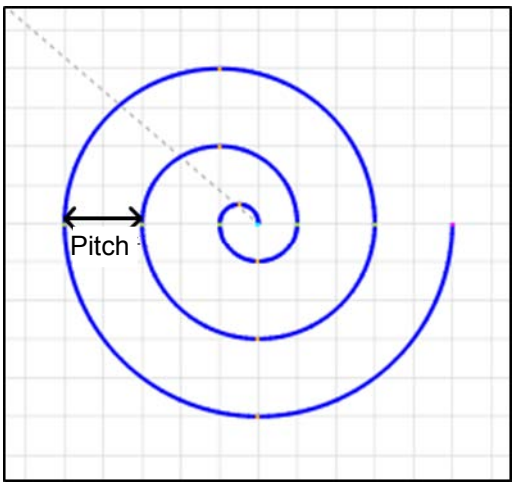
Hold down [Ctrl] key when you move the mouse cursor, and the direction of the outer end point can be fixed at 0deg, 90deg, 180deg and 270deg.



(4) Establish the condition settings in the Input Spiral Condition window.

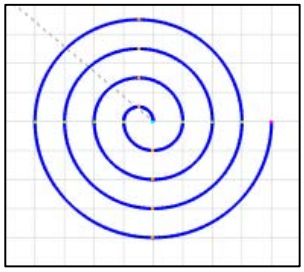


- Center
  Change the coordinates (mm) of the center point indicated in (2) if necessary.
- End
  Change the coordinates (mm) of the outer end point indicated in (3) if necessary.
- Pitch
  Indicate the pitch (mm) of an involute.

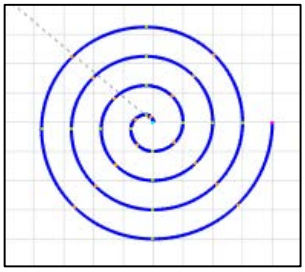


* In case the radius cannot be divided by the pitch, the most inner pitch will be smaller than the indicated pitch.

- Type
  Indicate the involute type.
  - [Half Circle] : An involute is created with a combination of arcs with 180deg of the central angle with different radii.
  - [Quarter Circle]: An involute is created with a combination of arcs with 90deg of the central angle with different radii.
    It is closer to the perfect circle than “Half Circle”.

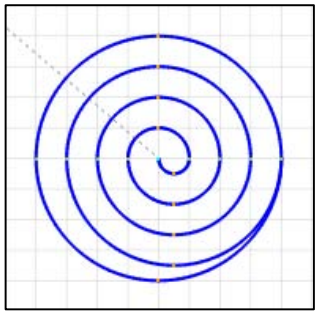


[Half Circle]

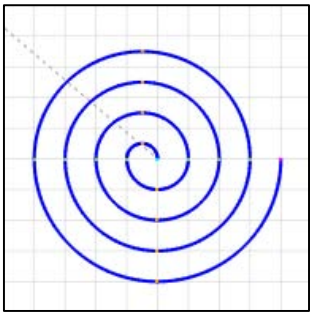


[Quarter Circle]

- Outer
  Indicate whether you would like to close the outer end or not.



Close



Open

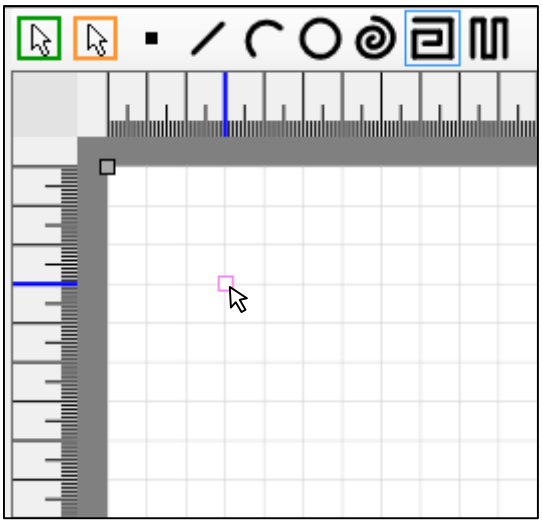
- Spiral Direction
  Designate the direction to dispense.
  - [In To Out]: Center should be the starting point and the point on the outer end should be the end point.
  - [Out To In]: The point on the outer end should be the starting point and center should be the end point.

Repeat (2) to (4) when it is necessary to continue drawing an involute (circle).

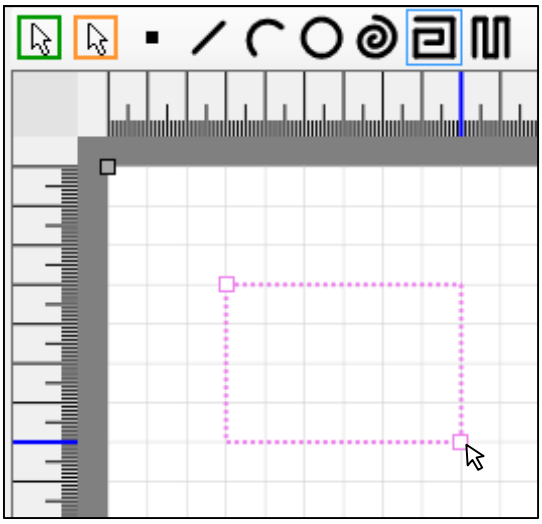
9.2.7 Involute (Rectangle) Drawing

(1) The edit mode can be changed to “Involute (Rectangle) Drawing Mode”.

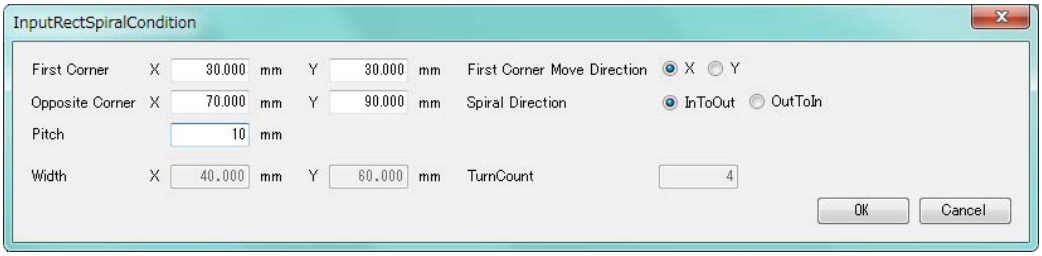
(2) Click at a position where you would like to have the start point.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.



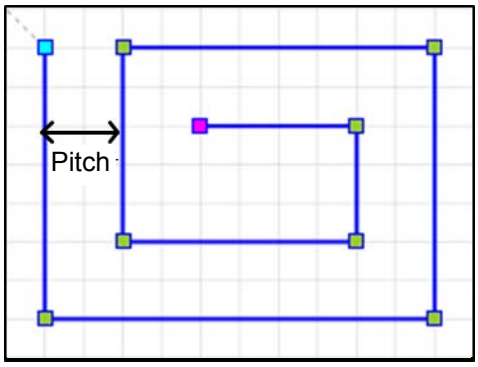
(3) Click at a position where you would like to have the end point (a point on the opposite side of the start point) to determine a rectangle.
* Press [ESC] key and it goes back to (2) (Start Point Position Select).



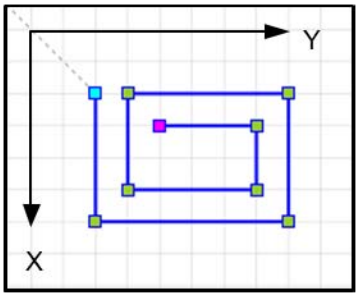
(4) Establish the condition settings in the Input Rect Spiral Condition window.



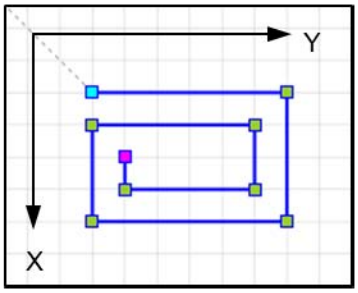
- First Corner
  Change the coordinates (mm) of the first corner indicated in (2) if necessary.
- Opposite Corner
  Change the coordinates (mm) of the opposite corner indicated in (3) if necessary.
- Pitch
  Indicate the pitch (mm) of an involute.



- First Corner Move Direction
  Designate the movement direction (X or Y) at First Corner.



X direction



Y direction

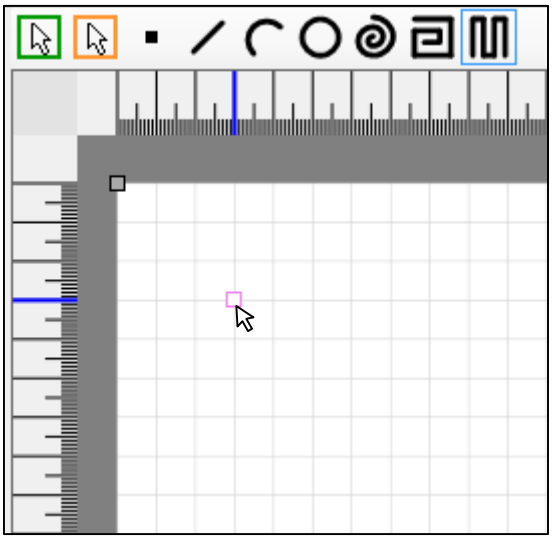
- Spiral Direction
  Designate the direction to dispense.
  - [In To Out]: First Corner should be the end point.
  - [Out To In]: First Corner should be the start point.

Repeat (2) to (4) when it is necessary to continue drawing an involute (rectangle).

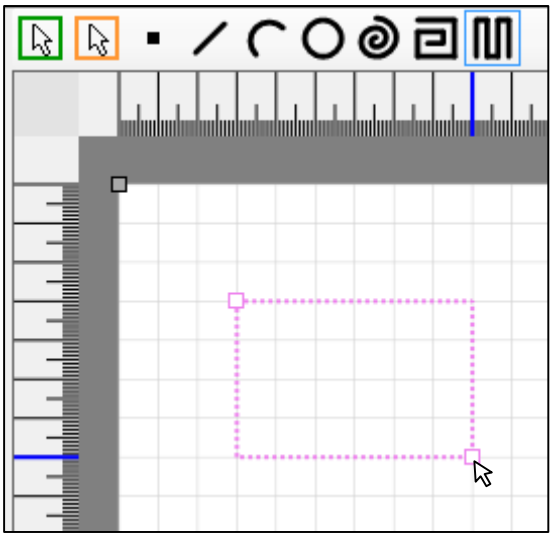
9.2.8 Zig-Zag Drawing

(1) The edit mode can be changed to “Zig-Zag Drawing Mode”.

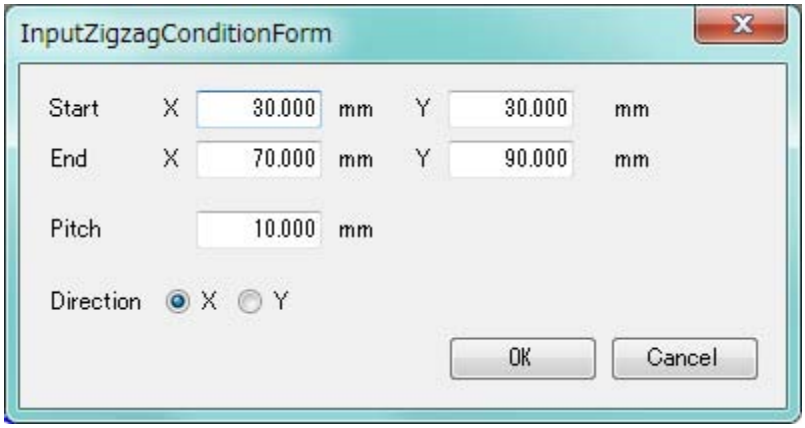
(2) Click at a position where you would like to have the start point.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.



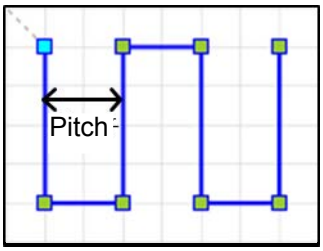
(3) Click at a position where you would like to have the end point (a point on the opposite side of the start point) to determine a rectangle.
* Press [ESC] key and it goes back to (2) (Start Point Position Select).



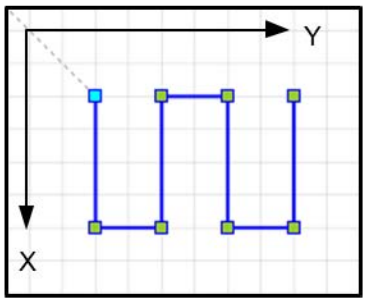
(4) Establish the condition settings in the Input Zigzag Condition Form window.



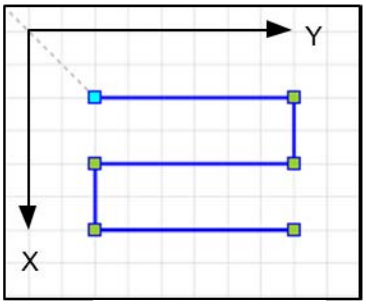
- Start
  Change the coordinates (mm) of the start point indicated in (2) if necessary.
- End
  Change the coordinates (mm) of the end point indicated in (3) if necessary.
- Pitch
  Indicate the pitch (mm) of a zig-zag.



- Direction
  Indicate the direction (X or Y) to get moving first.



X direction



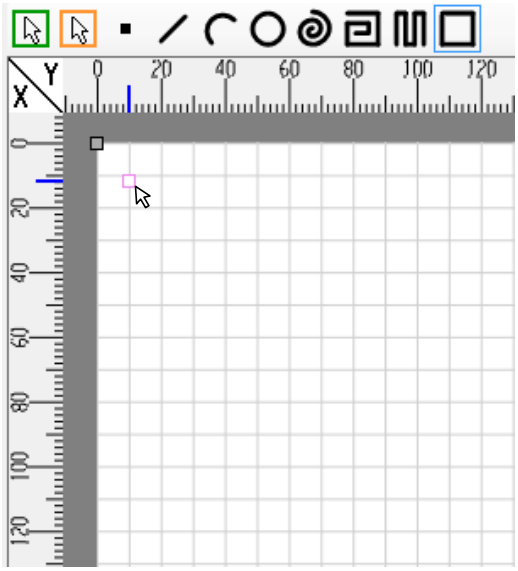
Y direction

Repeat (2) to (4) when it is necessary to continue drawing a zig-zag.

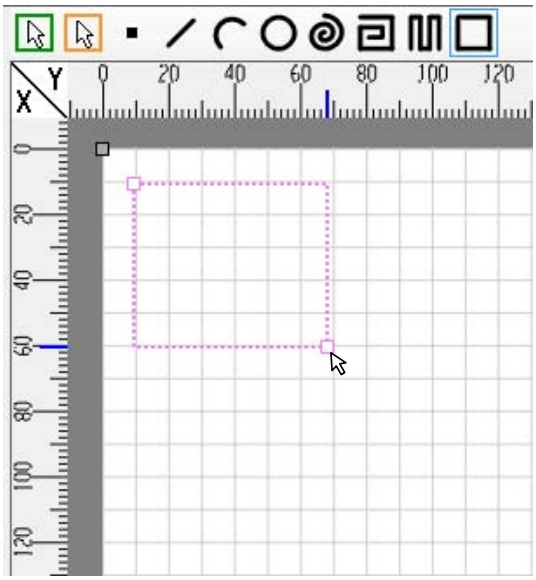
9.2.9 Rectangle Drawing

(1) The edit mode can be changed to “Rectangle Drawing Mode”.

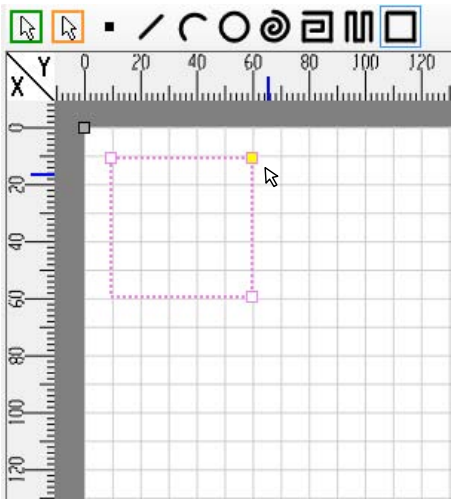
(2) Click at a position where you would like to have the start point.
* Press [ESC] and drawing word finishes, and the mode changes to the created drawing select mode.



(3) Click at a position where you would like to have the end point (a point on the opposite side of the start point) to determine a rectangle.
* Press [ESC] key and it goes back to (2) (Start Point Position Select).



(4) Click at a position you would like to have the 1st waypoint (point to determine the direction to create the rectangle) of drawing.
* Press [ESC] key and it goes back to (3) (point to determine the direction to create the rectangle)



Repeat (2) to (4) when it is necessary to continue drawing a rectangle.

10.Modify Figures

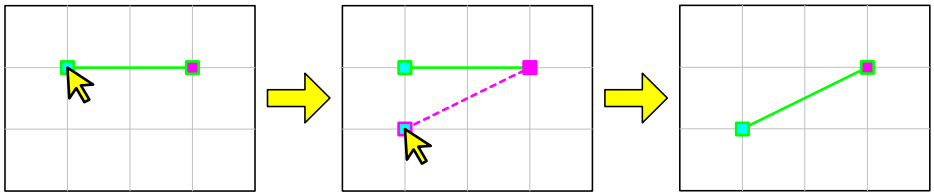
10.1 Moving Peak Point / Figure by Mouse Drag

Drag a created figure with the mouse and the peak point or figure can change its position. (It is limited only to when the edit mode is set to “Select drawing items”.)

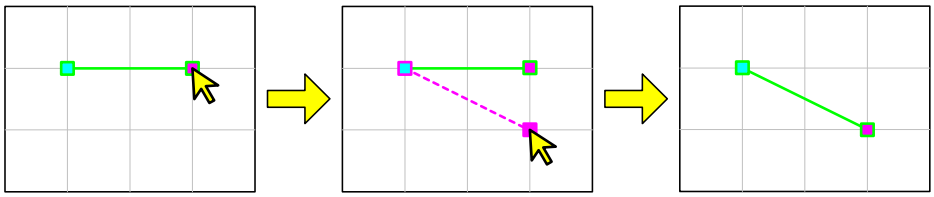
[1] Moving a Peak Point

Drag a peak point of a figure, and the position of the peak point can be moved.

- Move the start point of a line by dragging

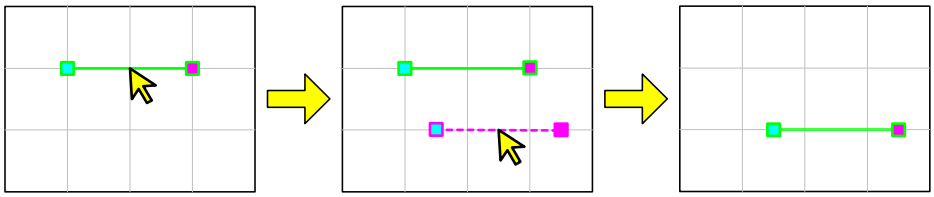


- Move the end point of a line by dragging



[2] Moving a Figure

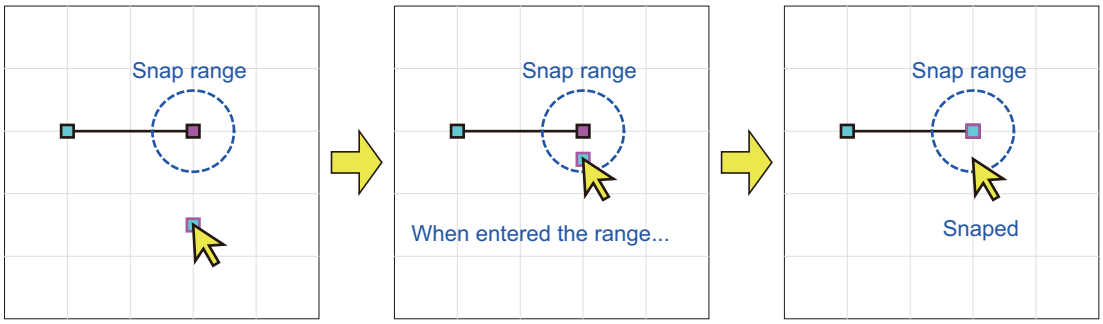
Drag a line of a figure, and the figure will be moved in parallel orientation.



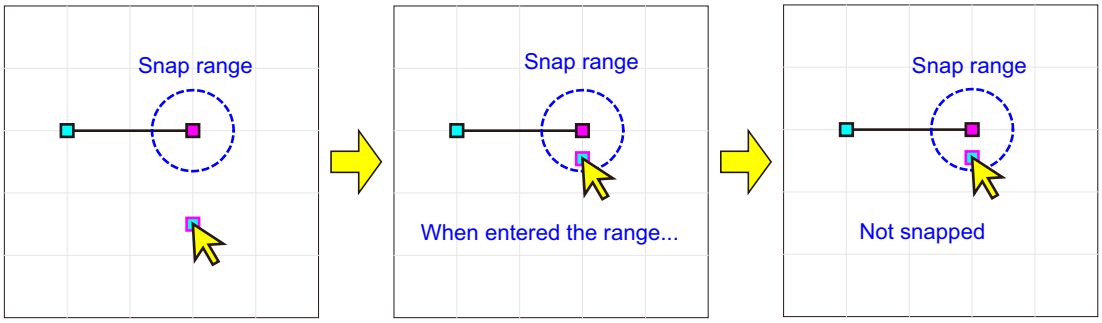
* In both cases of [1] and [2], press [ESC] key before releasing the button and dragging action can be cancelled.

10.2 Peak Snap

When selecting a peak point, get the mouse cursor close to a peak point of another figure, and the dragged point will get snapped to that peak point.



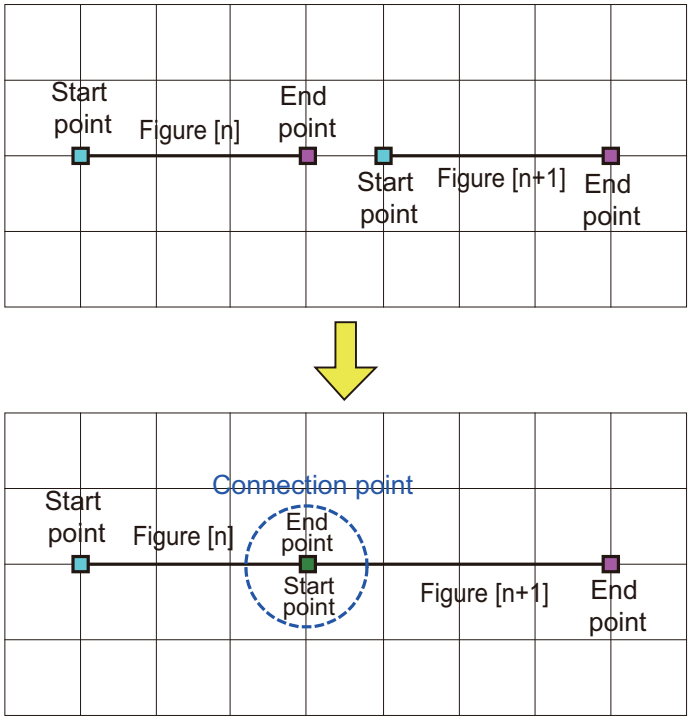
When you desire not to have the cursor snapped, hold down [Ctrl] key and [Shift] key while you move the mouse cursor.



The snap range can be changed in the tool option ([13.3 Drawing Setting]).

10.3 Link up Figures

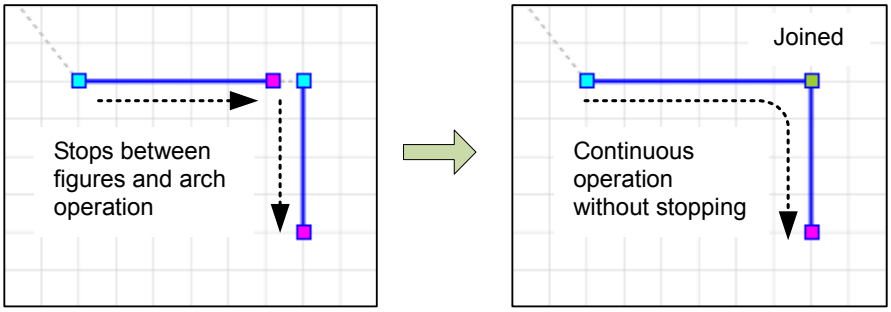
If two figures get joined at the start point and the end point (make the points placed on the same coordinates) with such an action as peak point snap, these figures will get linked.



However, linkup will not be established in such cases as stated below;

- The orders of figures are not in a row
- One of the two figures or both is/are a point
- Two figures possess different Z-coordinate or R-coordinate
- Setting of dispensing activated / inactivated is different
  (One figure is set to activate dispensing while the other inactivated)

At the joined point of the figures, operation can be performed continuously without making a stop.



10.4 Cut

The created figure can be cut in the procedures below.

(1) Select a created figure that you would like to cut.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

(2) Execute an operation from those below.

- Execute [Edit (E)] - [Cut (T)] from the menu bar
- Right-click in a working area to open the popup menu, and execute [Cut (T)]

10.5 Copy

The created figure can be copied in the procedures below.

(1) Select a created figure that you would like to copy.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

(2) Execute an operation from those below.

- Execute [Edit (E)] - [Copy (C)] from the menu bar
- Right-click in a working area to open the popup menu, and execute [Copy (C)]

10.6 Paste

A figure that has been cut / copied can be pasted by any operation of those below.

- Execute [Edit (E)] - [Paste (P)] from the menu bar
- Right-click in a working area to open the popup menu, and execute [Paste (P)]

10.7 Delete

The created figure can be deleted in the procedures below.

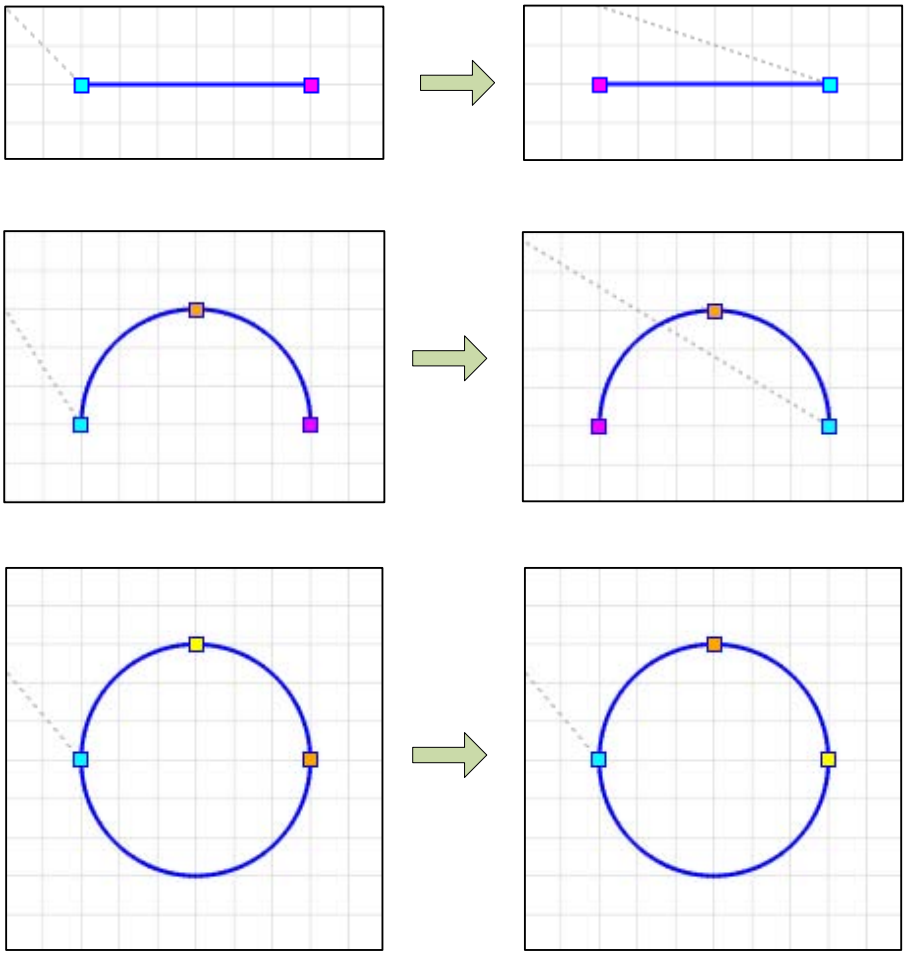
(1) Select a created figure that you would like to delete.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

(2) Execute an operation from those below.

- Execute [Edit (E)] - [Delete (D)] from the menu bar
- Right-click in a working area to open the popup menu, and execute [Delete (D)]

10.8 Swapping Start Point and End Point

The start point and end point of a created figure (1st waypoint and 2nd waypoint for a circle) can be swapped with each other.



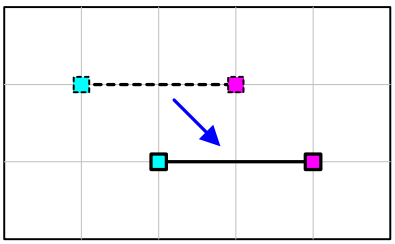
The procedures are as follows.

(1) Select a created figure.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

(2) Right-click in a working area to open the popup menu, and execute [Exchange start point for end point (E)].

10.9 Translation

A created figure can be moved in parallel orientation.



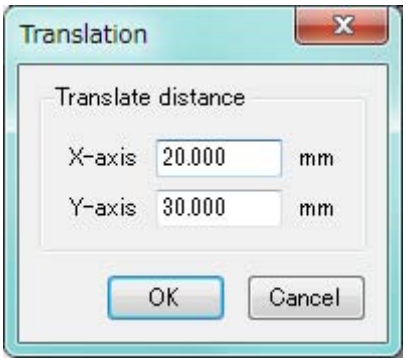
The procedures are as follows.

(1) Select a created figure.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

(2) Execute an operation from those below.

- Execute [Draw (D)] - [Translation (T)] from the menu bar
- Right-click in a working area to open the popup menu, and execute [Translation (L)]

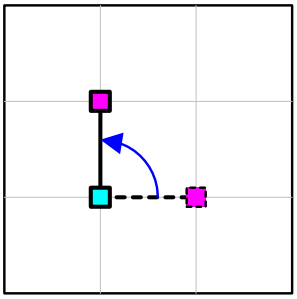
(3) Set the amount to move for X-axis and Y-axis, and click on OK button.



Item	Contents
X-axis	Set the movement amount for X-axis. (Unit: mm)
Y-axis	Set the movement amount for Y-axis. (Unit: mm)

10.10 Rotation

A created figure can be rotated.



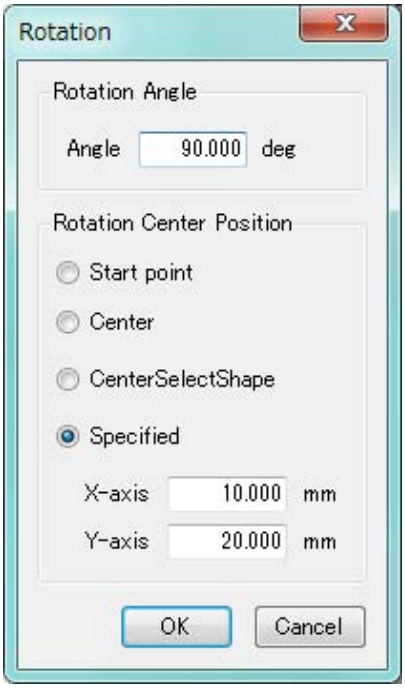
The procedures are as follows.

(1) Select a created figure.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

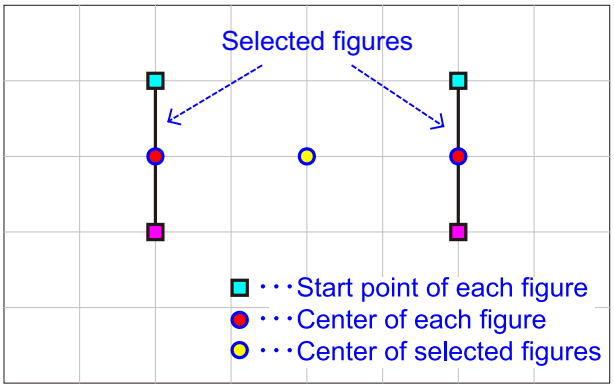
(2) Execute an operation from those below.

- Execute [Draw (D)] - [Rotation (R)] from the menu bar
- Right-click in a working area to open the popup menu, and execute [Rotation (R)]

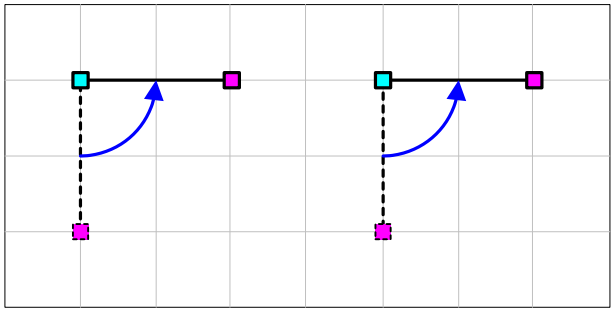
(3) Set the rotation angle and the rotation center coordinate, and click on OK button.

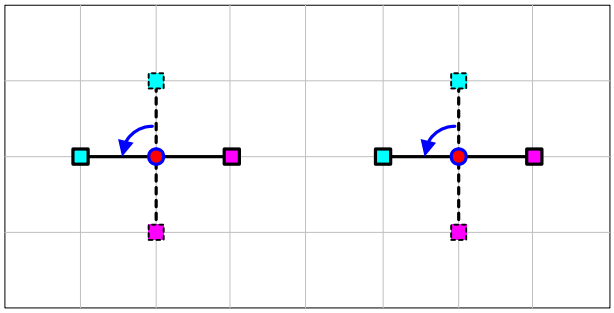
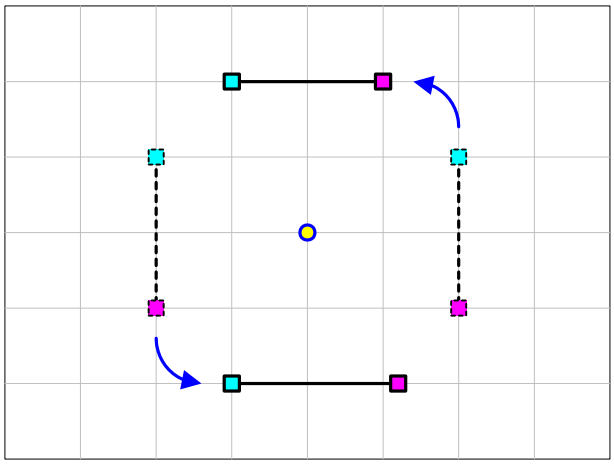
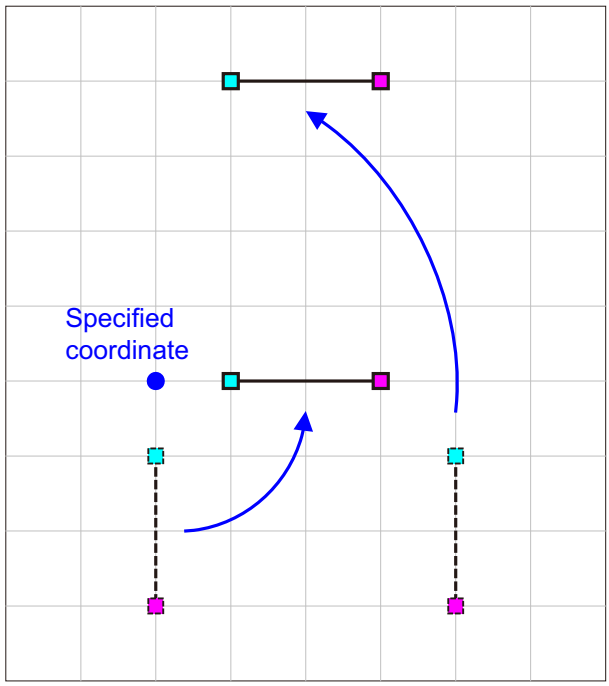


Item	Contents
Rotation Angle	Set the rotation angle. (Unit: deg)
Rotation Center Position	Select / specify the coordinates that should be the center for rotation.



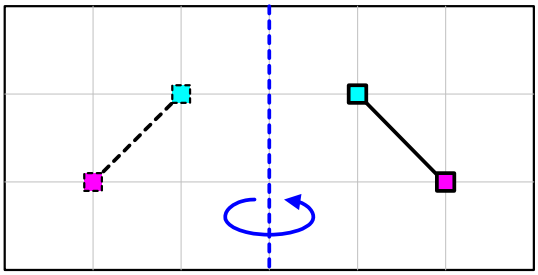
• Start point



Item	Contents
Rotation Center Position	• Center  • Center Select Shape  • Specified 

10.11 Invert

A created figure can be inverted.



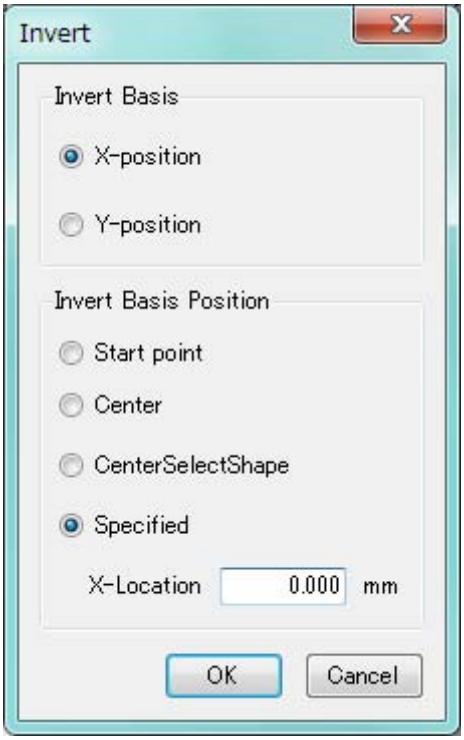
The procedures are as follows.

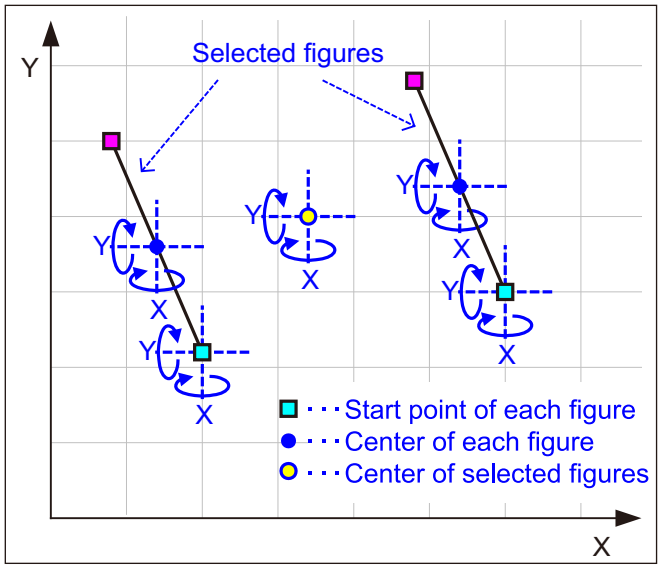
(1) Select a created figure.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

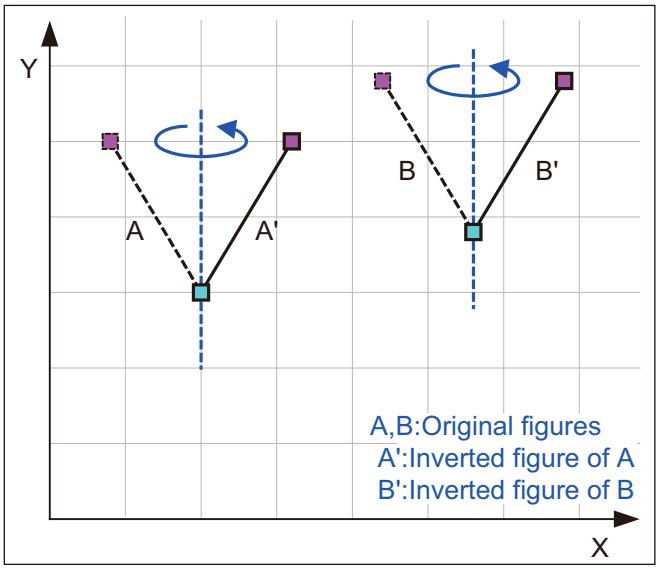
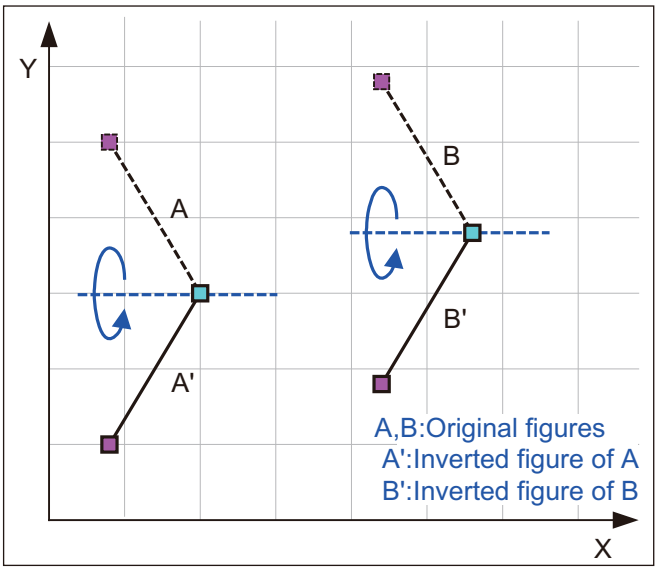
(2) Execute an operation from those below.

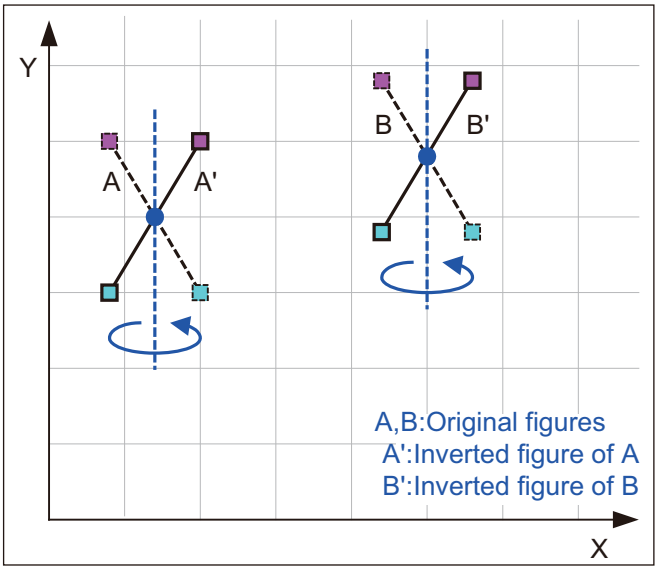
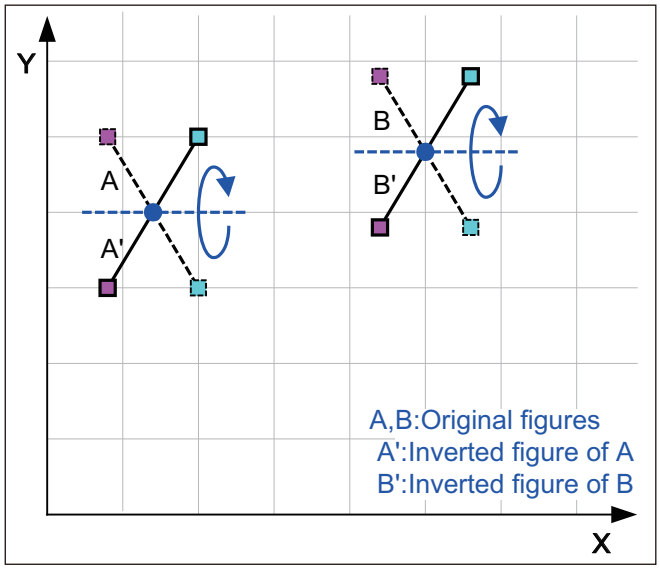
- Execute [Draw (D)] - [Invert (I)] from the menu bar
- Right-click in a working area to open the popup menu, and execute [Invert (I)]

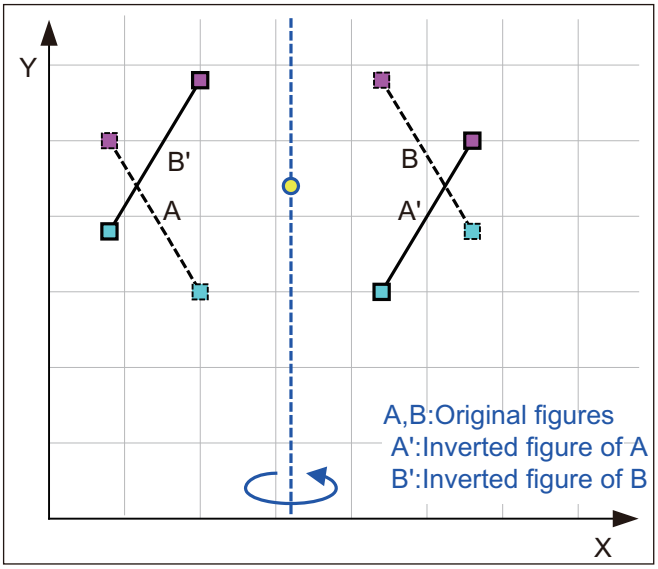
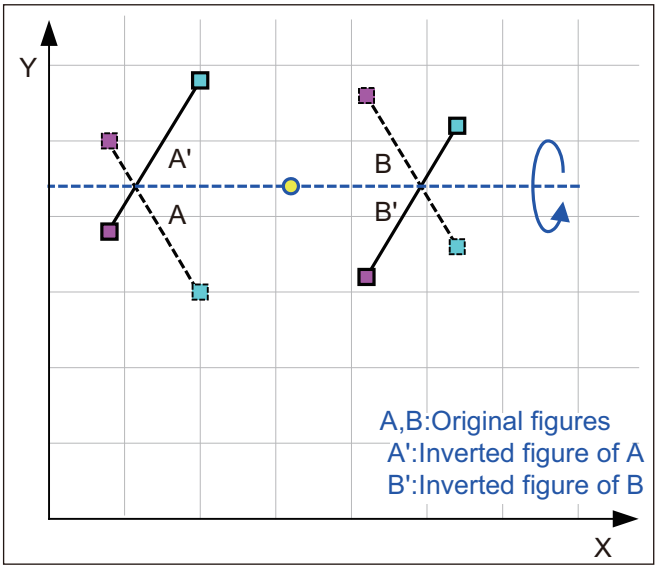
(3) Set the inversion datum and the inversion datum coordinate, and click on OK button.

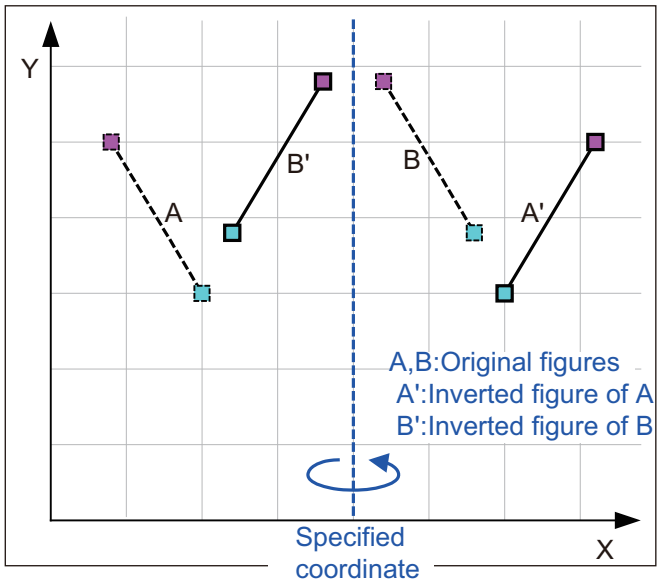
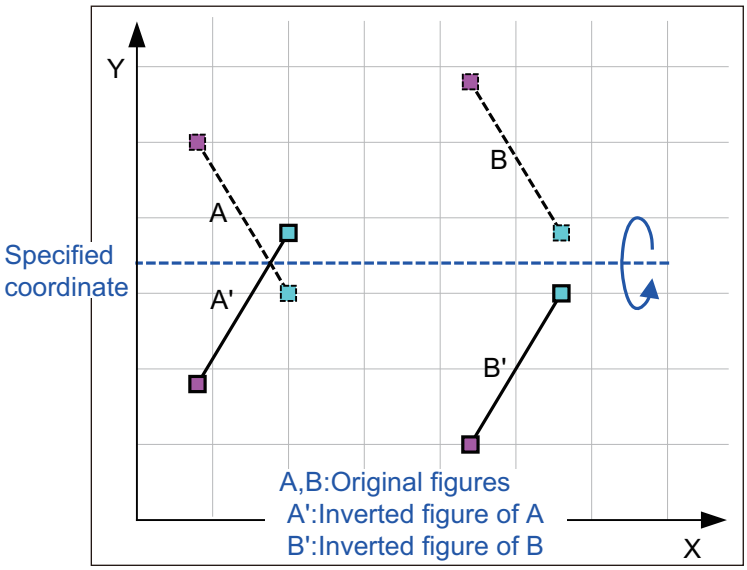


Item	Contents
Invert Basis	Select a coordinate (X-coordinate or Y-coordinate) that should be the datum for inversion.
Invert Basis Position	Select / specify the inversion datum coordinate. 

Item	Contents
Invert Basis Position	• Start point (X-position)  • Start point (Y-position) 

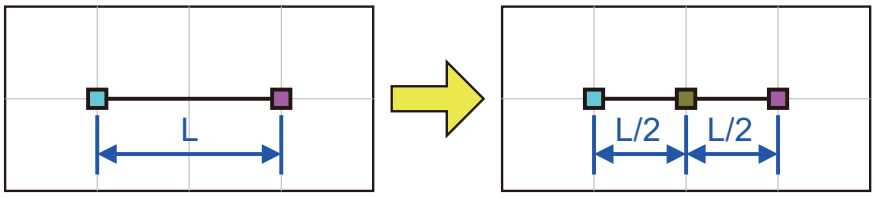
Item	Contents
Invert Basis Position	• Center (X-position)  • Center (Y-position) 

Item	Contents
Invert Basis Position	• Center Select Shape (X-position)  • Center Select Shape (Y-position) 

Item	Contents
Invert Basis Position	• Specified (X-position)  • Specified (Y-position) 

10.12 Divide

A created line can be divided (in half).



The procedures are as follows.

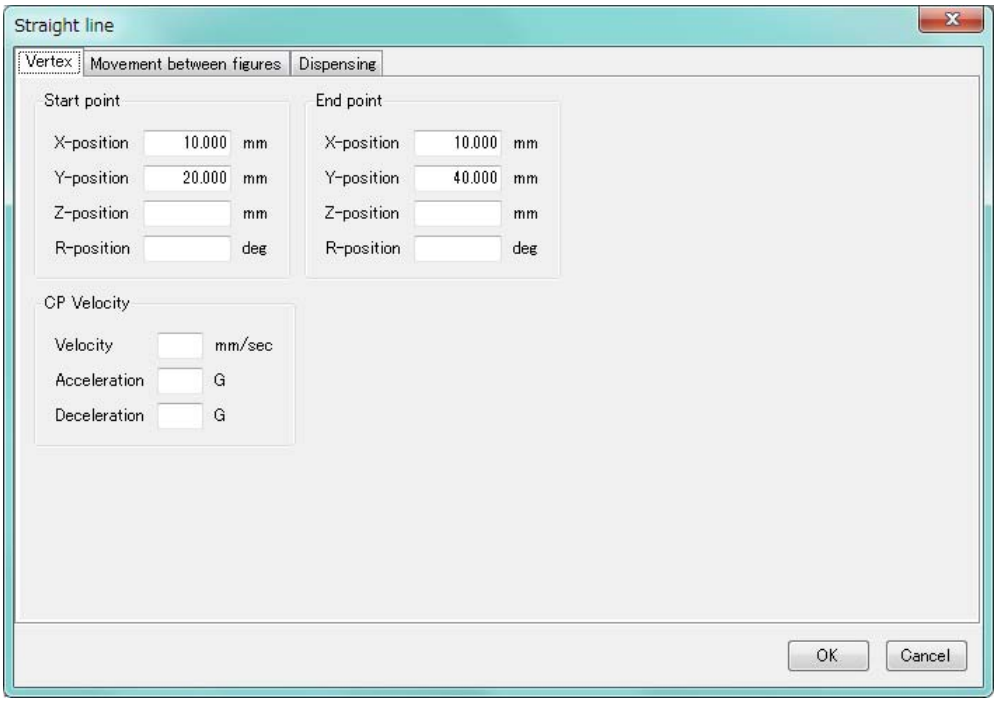
(1) Select a created figure.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

(2) Right-click in a working area to open the popup menu, and execute [Divide (D)].

10.13 Editing Information of a Figure

Information of a created figure can be edited.
The figure information available to edit is as shown below.

- Vertex Setting
- Movement between Figures Setting
- Dispensing Setting



10.13.1 How to Display Edit Window

Show “Figure Information Edit Window” in the procedures stated below.

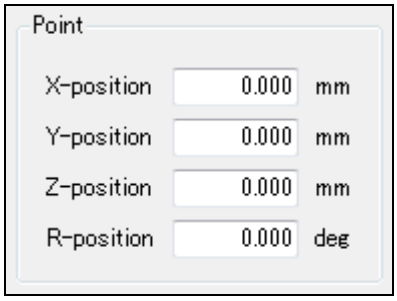
(1) Select a created figure that you would like to edit.
(For how to select a figure, refer to [4.3.5 Selecting a Figure].)

(2) Right-click in the working area or on the drawing data list to open the popup menu, and execute [Modify (M)].

10.13.2 Vertex Setting

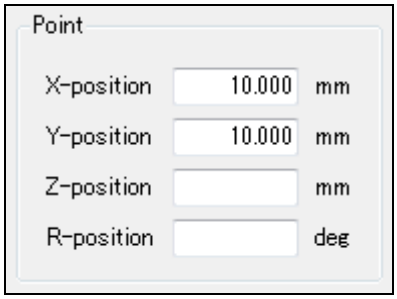
Establish the settings such as coordinates for a peak point of each figure.

[1] Work home



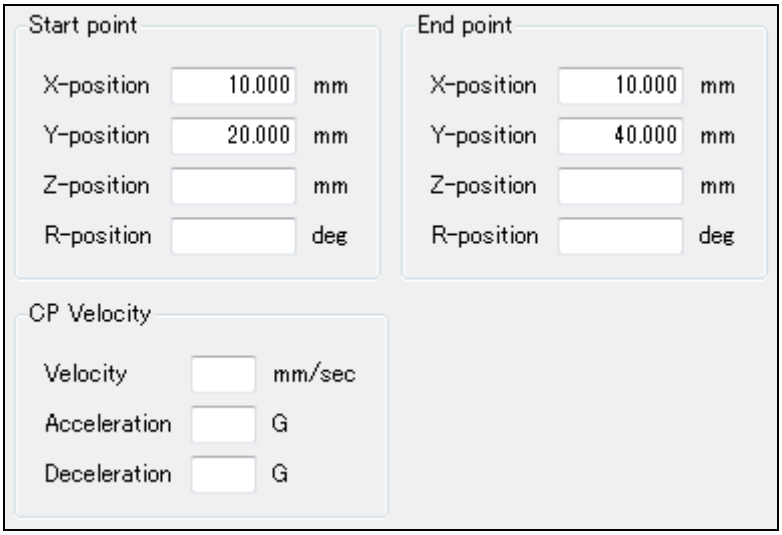
Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Set the Z-coordinate. (Unit: mm)
R-position	Set the R-coordinate. (Unit: deg)

[2] Point



Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Set the Z-coordinate. (Unit: mm) If no setting is conducted (blank), the Z-coordinate of the end point for the figure before it should be applied.
R-position	Set the R-coordinate. (Unit: deg) If no setting is conducted (blank), the R-coordinate of the end point for the figure before it should be applied.

[3] Straight line



(1) Start point

Set the coordinates of the start point.

Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Set the Z-coordinate. (Unit: mm) If no setting is conducted (blank), the Z-coordinate of the end point for the figure before it should be applied.
R-position	Set the R-coordinate. (Unit: deg) If no setting is conducted (blank), the R-coordinate of the end point for the figure before it should be applied.

(2) End point

Set the coordinates of the end point.

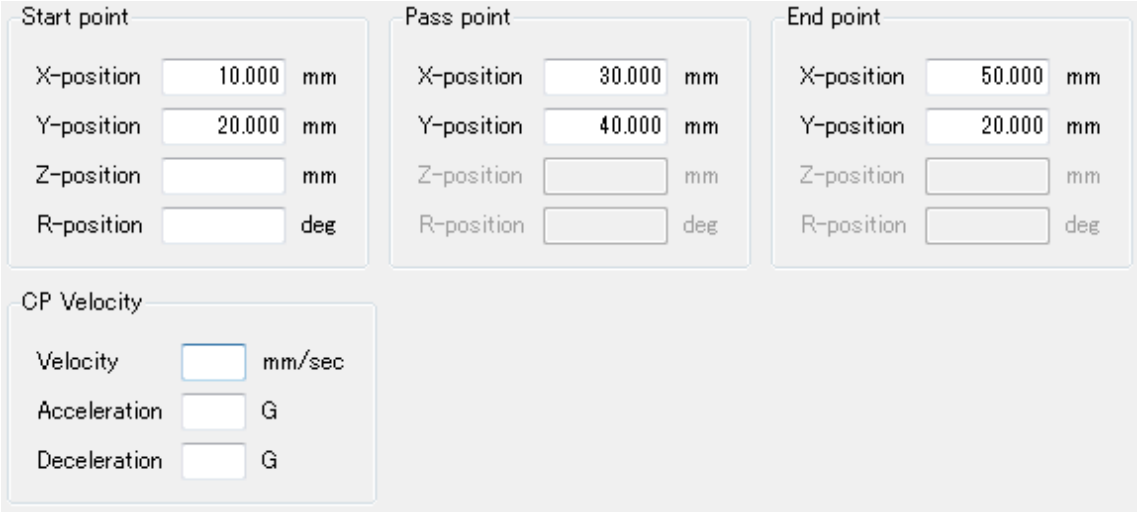
Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Set the Z-coordinate. (Unit: mm) If no setting is conducted (blank), the Z-coordinate of the start point should be applied.
R-position	Set the R-coordinate. (Unit: deg) If no setting is conducted (blank), the R-coordinate of the start point should be applied.

(3) CP Velocity

Set the interpolation speed between the start and end points.

Item	Contents
Velocity	Set the velocity. (Unit: mm/sec) If no setting is conducted (blank), the interpolation speed set in the project property should be applied.
Acceleration	Set the acceleration. (Unit: G) If no setting is conducted (blank), the interpolation acceleration set in the project property should be applied.
Deceleration	Set the deceleration. (Unit: G) If no setting is conducted (blank), the interpolation deceleration set in the project property should be applied.

[4] Arc



(1) Start point

Set the coordinates of the start point.

Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Set the Z-coordinate. (Unit: mm) If no setting is conducted (blank), the Z-coordinate of the end point for the figure before it should be applied.
R-position	Set the R-coordinate. (Unit: deg) If no setting is conducted (blank), the R-coordinate of the end point for the figure before it should be applied.

(2) Pass point

Set the coordinates of the pass point.

Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Z-axis at the start point should be applied. It cannot be changed.
R-position	R-axis at the start point should be applied. It cannot be changed.

(3) End point

Set the coordinates of the end point.

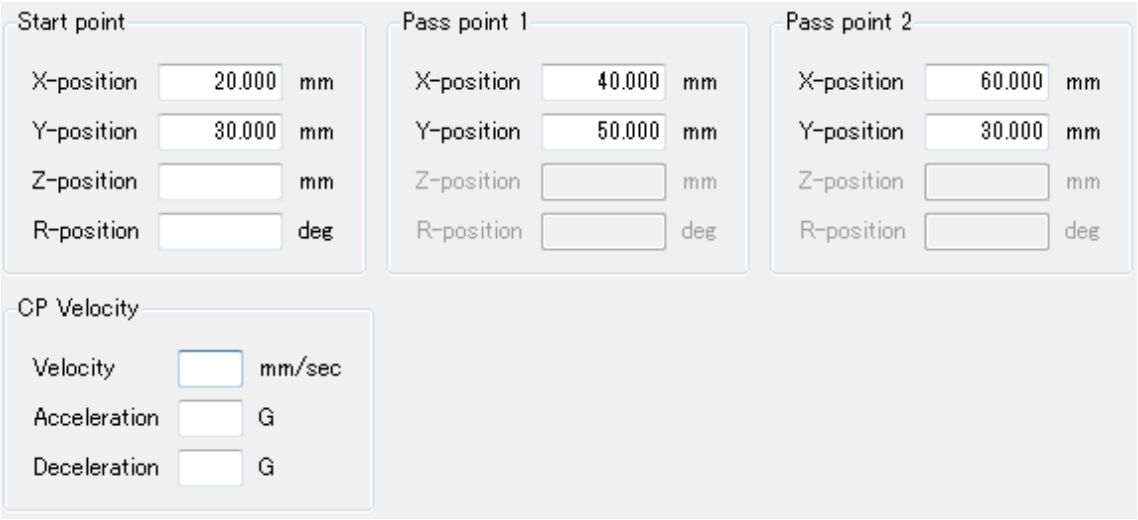
Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Z-axis at the start point should be applied. It cannot be changed.
R-position	R-axis at the start point should be applied. It cannot be changed.

(4) CP Velocity

Setting should be established for Interpolation movement speed among Start Point ~ Way Point ~ End Point.

Item	Contents
Velocity	Set the velocity. (Unit: mm/sec) If no setting is conducted (blank), the interpolation speed set in the project property should be applied.
Acceleration	Set the acceleration. (Unit: G) If no setting is conducted (blank), the interpolation acceleration set in the project property should be applied.
Deceleration	Set the deceleration. (Unit: G) If no setting is conducted (blank), the interpolation deceleration set in the project property should be applied.

[5] Circle



(1) Start point

Set the coordinates of the start (end) point.

Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Set the Z-coordinate. (Unit: mm) If no setting is conducted (blank), the Z-coordinate of the end point for the figure before it should be applied.
R-position	Set the R-coordinate. (Unit: deg) If no setting is conducted (blank), the R-coordinate of the end point for the figure before it should be applied.

(2) Pass point 1

Set the coordinates of the pass point 1.

Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Z-axis at the start point should be applied. It cannot be changed.
R-position	R-axis at the start point should be applied. It cannot be changed.

(3) Pass point 2

Set the coordinates of the pass point 2.

Item	Contents
X-position	Set the X-coordinate. (Unit: mm)
Y-position	Set the Y-coordinate. (Unit: mm)
Z-position	Z-axis at the start point should be applied. It cannot be changed.
R-position	R-axis at the start point should be applied. It cannot be changed.

(4) CP Velocity

Setting should be established for Interpolation movement speed among Start (End) Point ~ Way Point 1 ~ Way Point 2 ~ Start (End) Point.

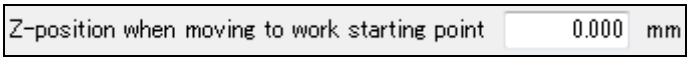
Item	Contents
Velocity	Set the velocity. (Unit: mm/sec) If no setting is conducted (blank), the interpolation speed set in the project property should be applied.
Acceleration	Set the acceleration. (Unit: G) If no setting is conducted (blank), the interpolation acceleration set in the project property should be applied.
Deceleration	Set the deceleration. (Unit: G) If no setting is conducted (blank), the interpolation deceleration set in the project property should be applied.

10.13.3 Movement between Figures Setting

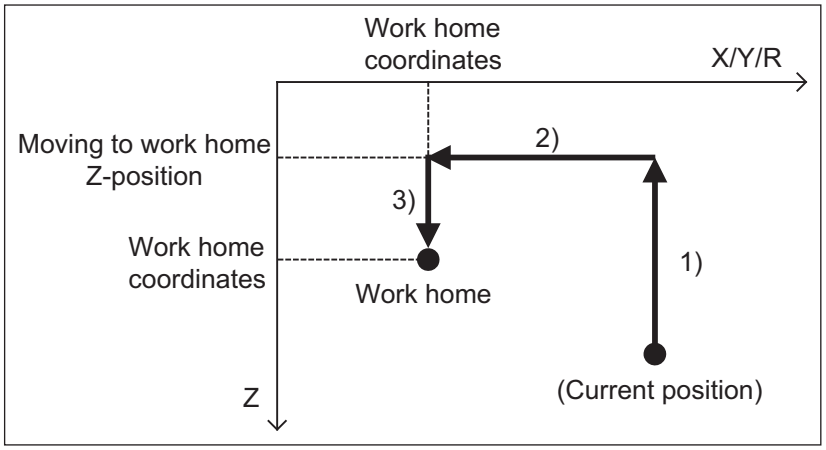
Set the way to move from the end point of the previous figure to the start point of the applicable figure.

[1] Work home

Set the Z-axis of when moving to the work home point. (Unit: mm)

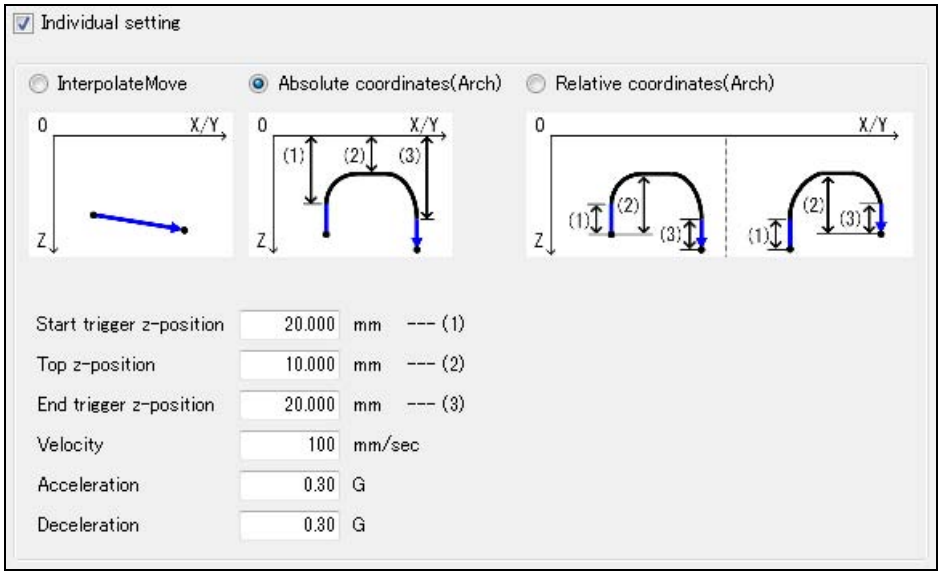


The movement to the work home point should be performed in the order from 1) to 3) as shown in the figure below.



[2] Figures other than work home point

Set the way to move from the end point of the previous figure to the start point of the applicable figure.



(1) Individual setting

Select whether to set the way to move to the start point of the applicable figure.
If no setting is conducted, the movement setting between figures set in the project property should be applied.

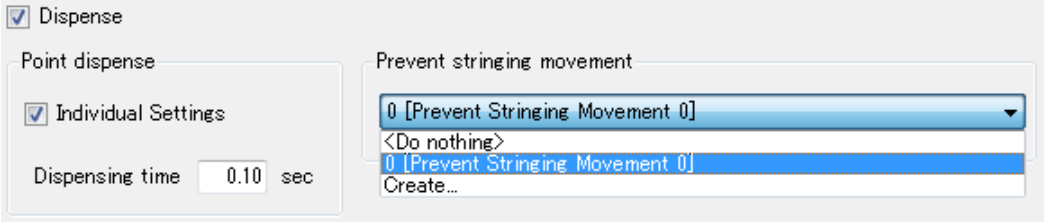
(2) Individual setting for movement between figures

The contents of settings are the same as those in the movement setting between figures in the project property.
Refer to [7.6 Movement between Figures Setting] for more details.

10.13.4 Dispensing Setting

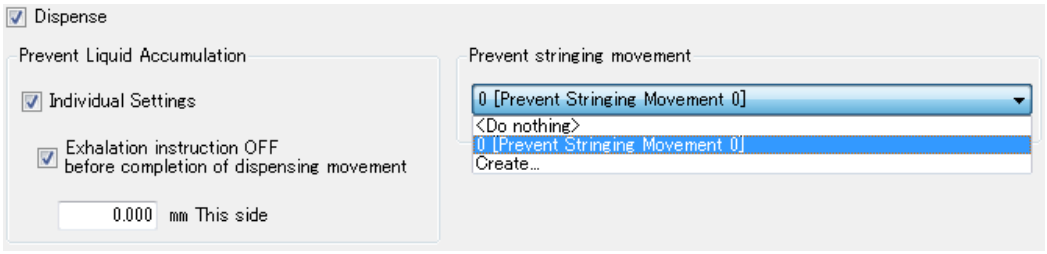
Settings related to dispensing actions performed in the applicable figure (except for work home position) should be established.

[1] Point



Item	Contents
Dispense	Put a check mark and dispensing operation will be conducted.
Point dispense	Set the point dispensing time for when the dispensing device is in “Continuous Discharge” mode. Put a check mark in “Individual Settings” to apply this setting, and remove the check mark to apply the settings in the project property.
Prevent stringing movement	Select a prevent stringing movement pattern to execute. Select <Do nothing> and prevent stringing movement will not be performed. Also, select “Create...” and a new prevent stringing movement pattern can be registered. For how to register a prevent stringing movement pattern, refer to [8. Prevent Stringing Movement Setting].

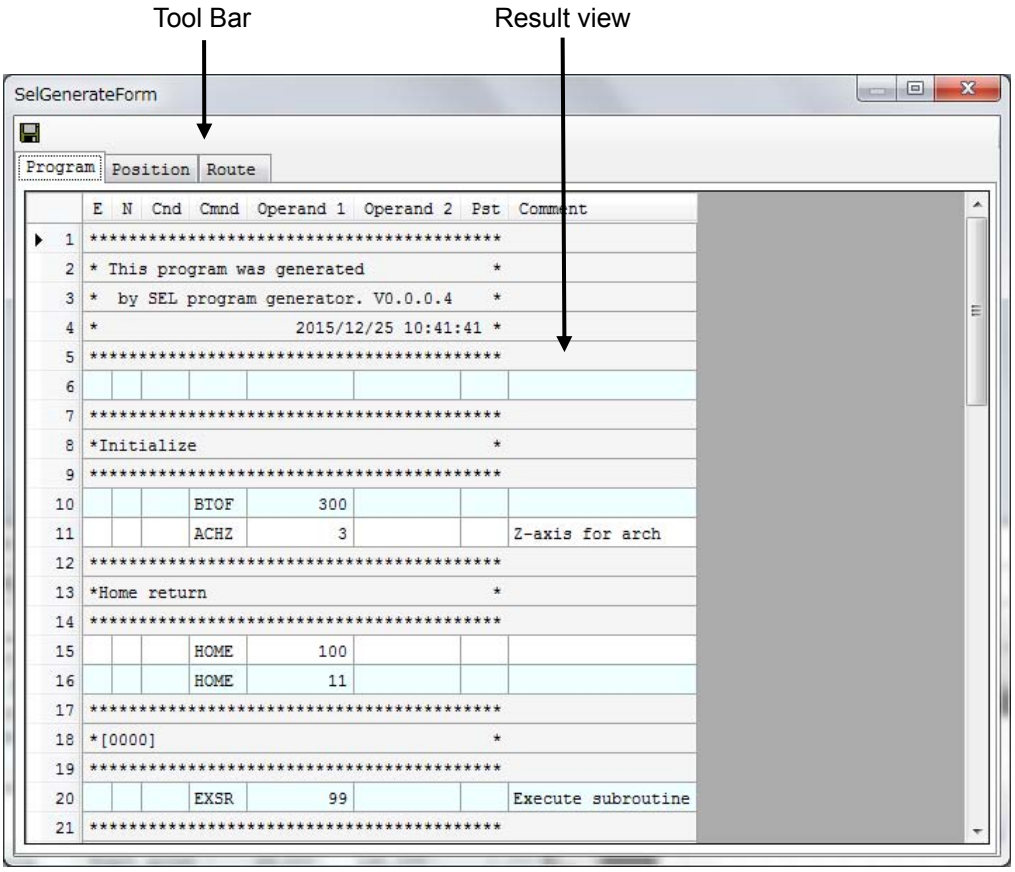
[2] Straight line, Arc, Circle



Item	Contents
Dispense	Put a check mark and dispensing operation will be conducted.
Prevent Liquid Accumulation	Set the prevent liquid accumulation movement. Put a check mark in “Individual Settings” to apply this setting, and remove the check mark to apply the settings in the project property. Contents of setting are the same as those of prevent liquid accumulation setting in the project property. Refer to [7.7.3 Lined Dispensing Setting] for detail.
Prevent stringing movement	Select a prevent stringing movement pattern to execute. Select <Do nothing> and prevent stringing movement will not be performed. Also, select “Create...” and a new prevent stringing movement pattern can be registered. For how to register a prevent stringing movement pattern, refer to [8. Prevent Stringing Movement Setting].

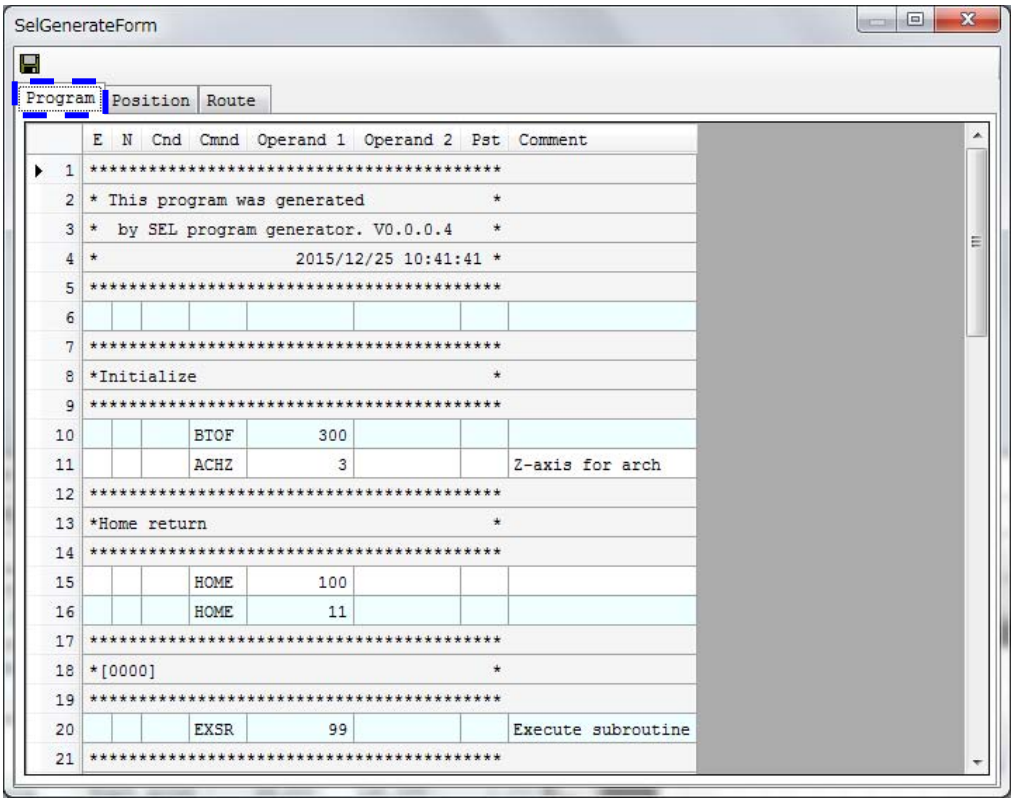
11. Generate SEL Program

Execute [Project (P)] - [Generate (G)] in the menu bar to generate a SEL program.
Once it is finished to be generated, “Sel Generate Form Window” shows up.



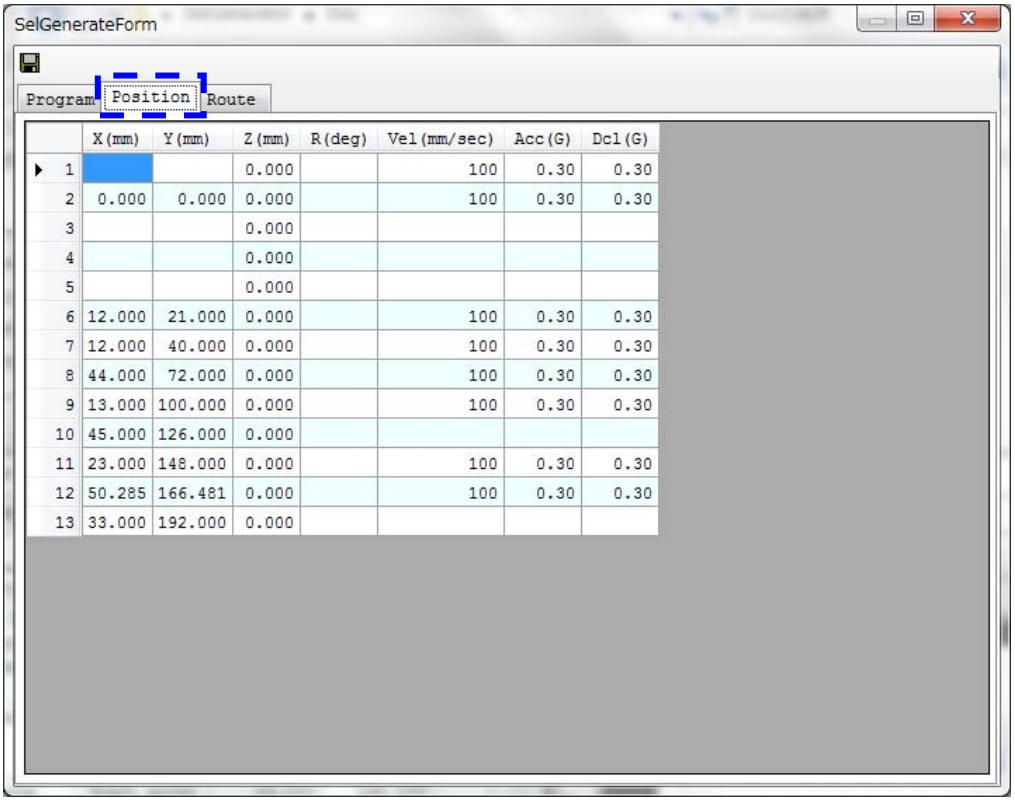
11.1 SEL Program Display

Select “Program” Tab in the Generation Result Display Area, and the generated SEL program should be displayed.



11.2 Position Data Display

Select “Position” Tab in the Generation Result Display Area, and the generated position data should be displayed.

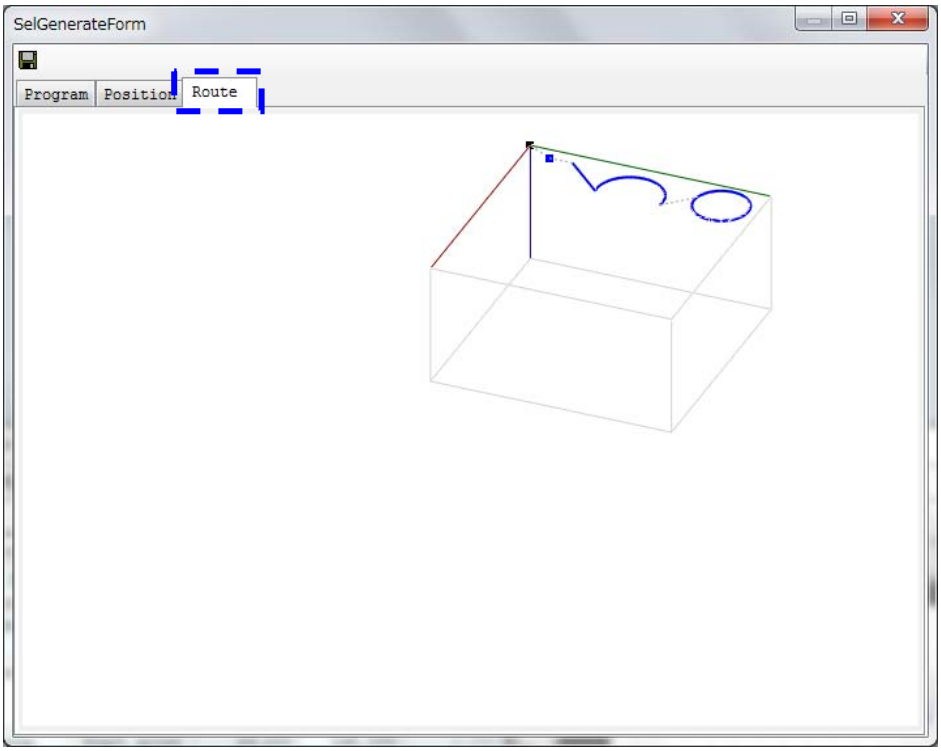


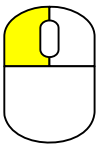
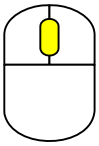
	X(mm)	Y(mm)	Z(mm)	R(deg)	Vel(mm/sec)	Acc(G)	Dcl(G)
1			0.000		100	0.30	0.30
2	0.000	0.000	0.000		100	0.30	0.30
3			0.000				
4			0.000				
5			0.000				
6	12.000	21.000	0.000		100	0.30	0.30
7	12.000	40.000	0.000		100	0.30	0.30
8	44.000	72.000	0.000		100	0.30	0.30
9	13.000	100.000	0.000		100	0.30	0.30
10	45.000	126.000	0.000				
11	23.000	148.000	0.000		100	0.30	0.30
12	50.285	166.481	0.000		100	0.30	0.30
13	33.000	192.000	0.000				

11.3 Simple Motion Path Display

Select “Route” Tab in the Generation Result Display Area, and the generated motion path should be displayed in a simple form.

> ⚠ Caution:
> - The route of evacuation / return operation at home return operation or error detection should not be displayed.
> - This display would not guarantee the actual motion path and its accuracy.



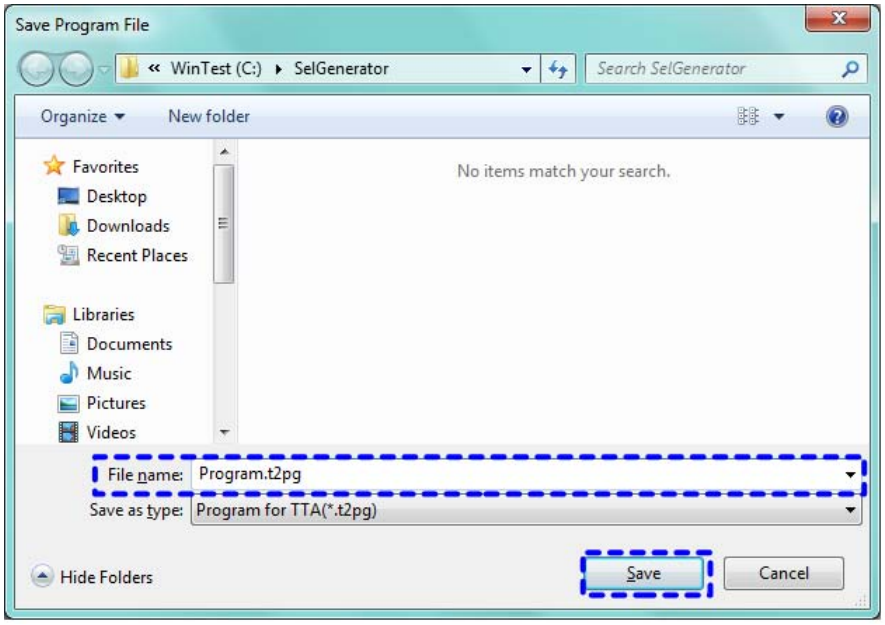
Button	Operation	Functions
	Drag	The display rotates in the dragged direction.
	Rotate	• When [Ctrl] key is held down Display can be zoomed in and out.
		• When [Shift] key is held down Display can be scrolled right and left.
		• In condition other than above Display can be scrolled up and down.
	Drag	Display can be scrolled to the direction that you dragged.

11.4 How to Save the SEL Program/Position Data

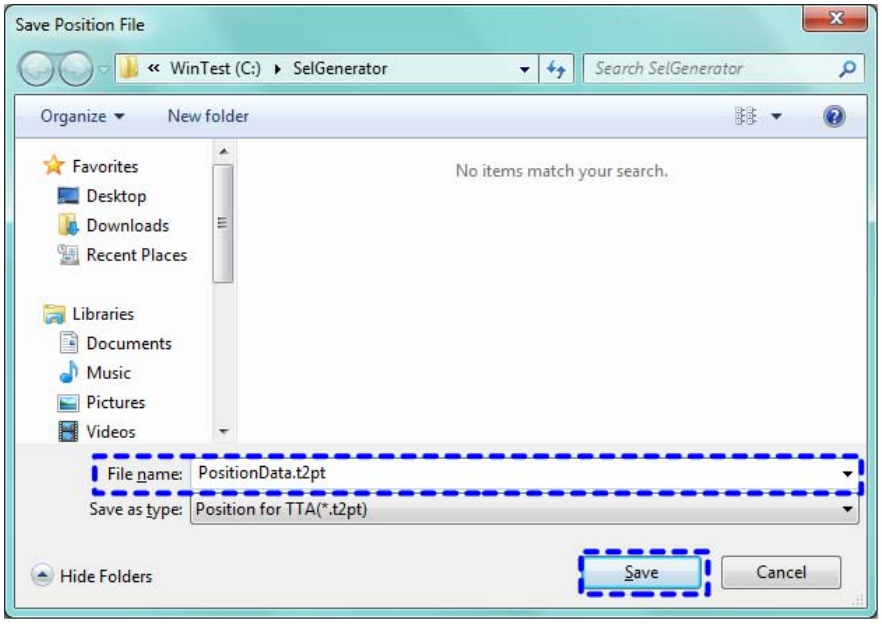
The generated SEL program and position data should be able to be saved to a file with a format capable to be read in “XSEL PC Software”.

(1) Click on (Save As) button in the tool bar.

(2) Indicate a file name of a SEL program to be saved, and click on Save button.



(3) Indicate a file name of a position data to be saved, and click on Save button.

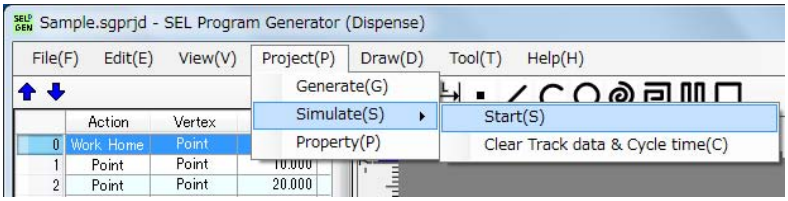


11.5 Simulation

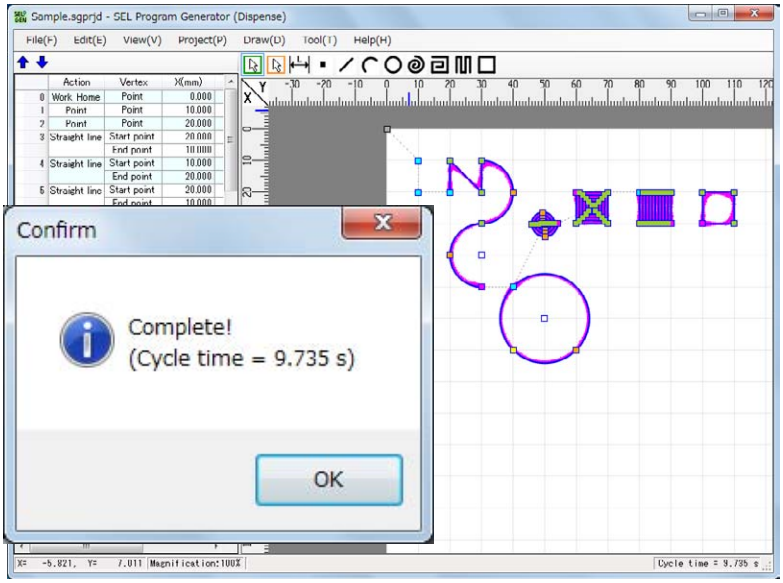
The generated program can be simulated so you can get to know the operation track and cycle time as a reference.

- Note that the operation track is a movement command to a controller, and it does not include the dispersion (caused by load, finishing, etc.) which can be assumed in the actual use of the device.
- The cycle time display may change depending on the performance or load of your computer, and it does not include the dispersion (caused by load, finishing, etc.) which can be assumed in the actual use of the device. Close all the softwares other than this software as much as possible when running a simulation and use it as a reference.
- The cycle time should be calculated assuming that the external input standby operation gets cancelled immediately.
- The cycle time should be calculated assuming that the home-return operation gets completed immediately.

1) Execute [Project (P)] - [Simulate (S)] - [Start (S)] from the menu bar.



2) Operation track and cycle time should be displayed after the simulation is complete.



[Cycle Time]

It is the sum total of the operation time in one cycle of “work home position → drawn figure → work home position” and time required for related processes. It shows the process time required to perform “Cycle top (DWLT Command in figure)” → “Cycle end (EDDO Command in figure)” in the generated program.

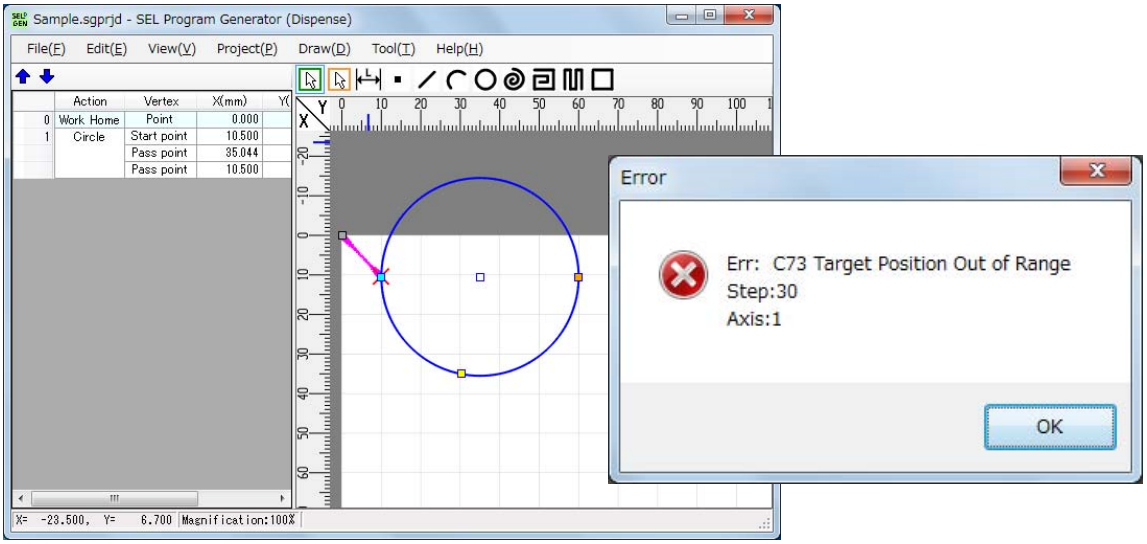
* The program shown in the figure on the right is an example.

A set of process subject to cycle time calculation

	E	N	Cnd	Cmnd	Operand 1	Operand 2	Pst	Comment
1	**********							
2	* This program was generated						*	
3	* by SEL program generator. V3.0.0.1						*	
4	*				2017/05/17 20:31:55		*	
5	**********							
6								
7	**********							
8	*Initialize						*	
9	**********							
10				BTOF	300			
11				ACHZ	3			Z-axis for arch
12	**********							
13	*Home return						*	
14	**********							
15				HOME	100			
16				HOME	11			
17	**********							
18	*[0000]						*	
19	**********							
20				EXSR	99			Execute subroutine
21	**********							
22	*Cycle top						*	
23	**********							
24				DWLT	1099	100		
25	**********							
26	*[0001]-[0003]						*	
27	**********							
28				MOVL	6			
29				BTON	300			
30				PATH	7	9		[0001]-[0003]
31				BTOF	300			
32	**********							
33	*[0000]						*	
34	**********							
35				EXSR	99			Execute subroutine
36	**********							
37	*Cycle end						*	
38	**********							
39				ADD	1099	1		Counter increment
40				EDDO				Jump to cycle top
41	**********							
42	*Program end						*	
43	**********							
44				EXIT				Program end
45								

[Error Display]

If an error gets detected in the simulation, content as shown below should be displayed in the error window, and a cross (x) mark should be shown on the figure or track that the error was detected. Correct the figure or track referring to the information.



[Contents Displayed in Error Window (display to be shown only for contents with information)]

- Err : Error Number and Error Name
- Step : Error Detection Program Step *
- Axis : Error Detected Axis Number
- Pos : Error Detected Position Number *

* Applicable for SEL Program Generation Window Display displayed by selecting [Project (P)] - [Generate (G)]

12.Operation Check of Generated SEL Program

The generated SEL program should be written in the robot controller and checked the operation in the actual device.

12.1 Write Data to a Robot Controller

Write the SEL program and position data saved in a file in the robot controller with using “XSEL PC Software”.
For the procedures how to write in, refer to the instruction manual for “XSEL PC Software”.

12.2 Test

Execute the written SEL program to check the operation.
For how to execute a program, refer to the instruction manual for “XSEL PC Software”.

This software is not applicable for the work and tool coordinate system features. When the controller to be used is applicable for the work and tool coordinate system features [*1], set the work coordinate offset and tool coordinate offset to “0.000mm” for all the axes before executing the program.
When the work coordinate offset and tool coordinate offset are not set to “0.000mm” for all the axes, unexpected operation may occur, which could cause interference of robot, tool, workpiece, etc., and cause malfunction.

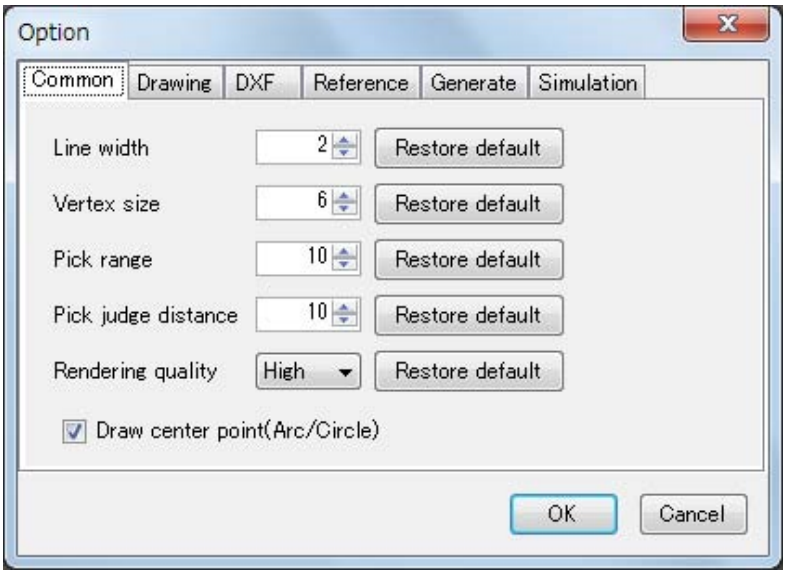
*1 Supported versions of work and tool coordinate systems
TTA : Main application part V2.00 and later
MSEL : Main application part V2.00 and later

The SEL programs, position data and simulations generated in SEL program generator should be applicable only when using the table top type robot and cartesian robot.
They are not applicable when using only the single axis (including gripper, rotary, etc.), wrist unit (including cartesian robot combined) or SCARA Robot (IXP).

13.Tool Option Setting

Setting should be established for each option in this software.

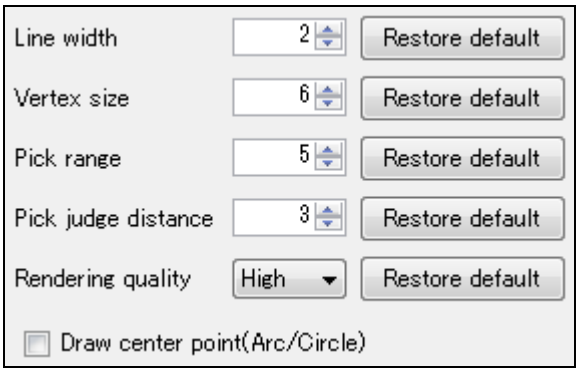
- Common Setting
- Drawing Setting
- DXF Setting
- Reference Setting
- Generate Setting
- Simulation



13.1 How to Display Setting Window

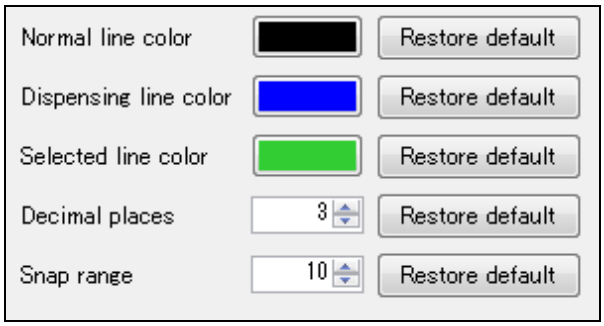
Execute [Tool (T)] - [Option (O)] from the menu bar.

13.2 Common Setting



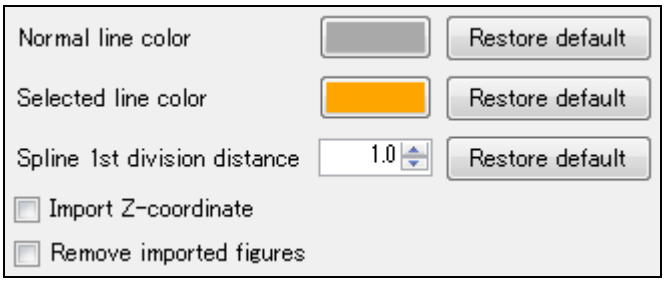
Item	Contents
Line width	Set the line width of a line figure. Unit: Pixel Settable Range: 1 to 10 (Default: 2)
Vertex size	Set the size of a peak point. Unit: Pixel Settable Range: 0 to 10 (Default: 6)
Pick range	Set the picking range of the mouse cursor when clicking a figure with a mouse. Unit: Pixel Settable Range: 1 to 10 (Default: 5)
Pick judge distance	A figure starts moving after the figure gets picked (selected) and dragged for the distance set in this setting or more. Unit: Pixel Settable Range: 0 to 10 (Default: 3)
Rendering quality	Set the drawing quality of a figure. Set it to “Low” and the load of drawing process should be reduced. Settable Range: Low or High (Default: High)
Draw center point (Arc/Circle)	Set if a center of a circle / arc should be shown.

13.3 Drawing Setting



Item	Contents
Normal line color	Set the color to display normal figures (figures not selected and no dispensing conducted).
Dispensing line color	Set the color to display figures with dispensing conducted.
Selected line color	Set the color to display selected figures.
Decimal places	Set the number of digits under decimal point for the coordinate values at the position where the mouse cursor points at. Unit: Digit Settable Range: 0 to 3 (Default: 3)
Snap range	Set the snap range of a peak point. Set it to “0” and the snap function will be inactivated. Unit: Pixel Settable Range: 0 to 100 (Default: 10)

13.4 DXF Setting

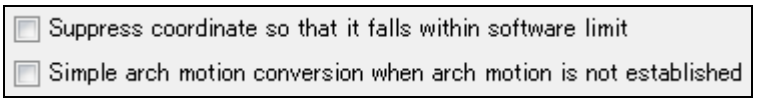


Item	Contents
Normal line color	Set the color to display figures not selected.
Selected line color	Set the color to display selected figures.
Spline 1st division distance	Set the distance to divide a spline figure into straight lines. Settable Range: 0.1 to 100.0 (Default: 1.0)
Import Z-coordinate	Set if the Z-axis should be read in when a dxf drawing is read in.
Remove imported figures	Set if the read dxf drawing should be deleted.

13.5 Reference Setting

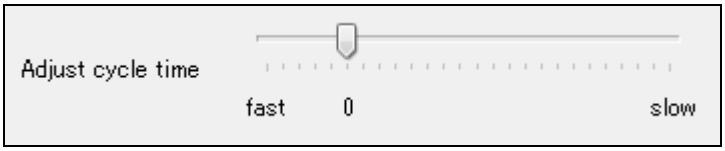
Item	Contents
Line color	Set the color to display reference figures.

13.6 Generate Setting



Item	Contents
Suppress coordinate so that it falls within software limit	Set if adjustment should be conducted to get in the soft limit range when a figure falls out of the soft limit range. A warning message will appear if no adjustment is conducted.
Simple arch motion conversion when arch motion is not established	Set whether to switch to the simple arch motion (go up in Z-axis → move horizontally → go down in Z-axis) when “Relative Coordinate Indicated Arch Motion” should not satisfy the arch motion conditions.

13.7 Simulation Setting



Item	Contents
Adjust cycle time	It is for adjustment at the manufacturer. Keep it set at 0.

14.Version Information

Execute [Help (H)] - [About (A)] from the menu bar, display the “Version Information Window”

15.Appendix

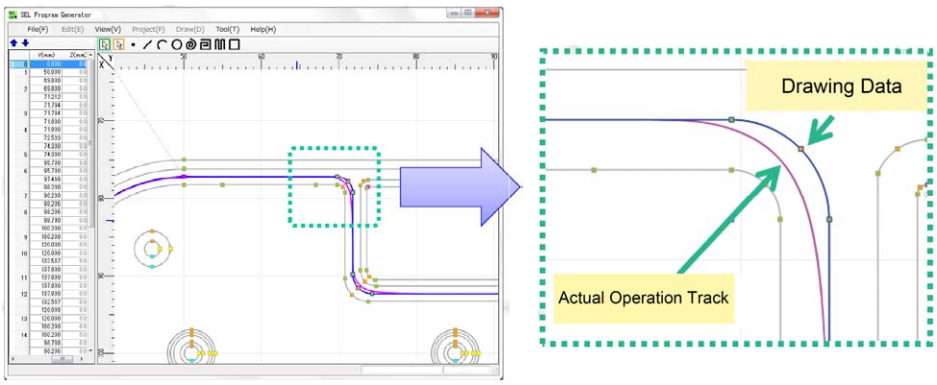
15.1 Correction of Track

The feedback pulse of X and Y-axes collected by the PC software can be displayed on the drawing window as the actual operation track.

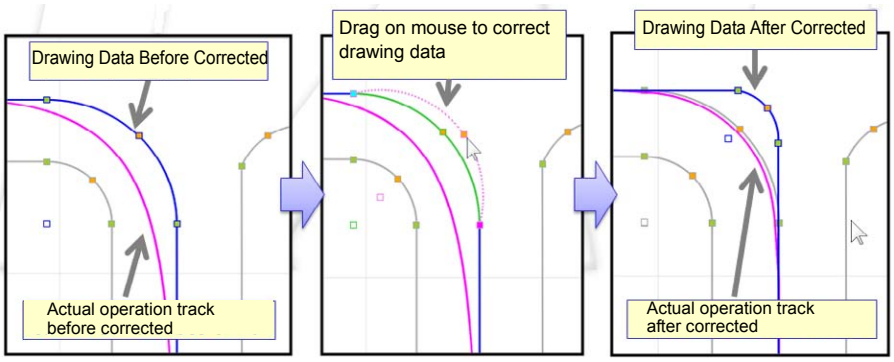
1) Reading of Wave Forms
   Start up the servomotor feature in the PC software.
   Check on the feedback pulse of X and Y-axes and execute the SEL program generated and transferred to the controller in Chapter 6. (1 cycle)
   Save the collected data to PC.

2) Start SEL Program Generator up and read in the servo monitor data (csv files) collected in (1). Execute “File (F)” – “Track Data (T)” – “Read in (R)” from the menu.

3) By putting the drawing data and the actual operation track together in the display, amount of misalignment can be checked on the screen.



4) Correct the drawing data while checking the misalignment, and generate the program again.



Change History

Revision Date	Revision Description
2016.01	First Edition
2016.07	Second Edition • Caution points added for when transferring grogram • Supplement note added for program execution start position • Explanation added for coordinates in drawing window and actual coordinates
2017.09	Third Edition • “MSEL” added in applicable controllers • Simulation feature added
2019.06	Fourth Edition • Descriptions revised in general • Prevent liquid accumulation feature added • Prevent stringing feature extended

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