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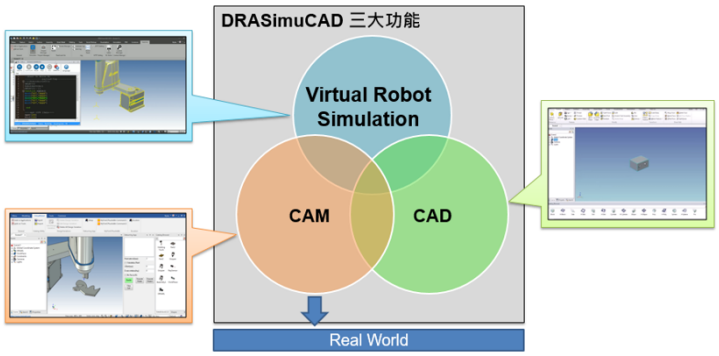
1. Introduction & Licensing

1.1 Introduction to DRASimuCAD

Robotic Simulation Platform **DRASimuCAD** is a software platform with CAD/CAM design capabilities for workstation design & robot simulation, which supports user to perform 3D/2D design, modelling, robot programming, Jogging, point teaching, RL editing, automatic path generation as well as project management.

DRASimuCAD is a PC application for CAD/CAM modeling, offline programming (OLP), and simulation of robotic cells that allows user to work with an off-line controller, Virtual Robot Controller (VRC) running locally on user PC for controlling the robot, allowing users to perform robot and workstation simulation. This user manual is common for DRS / DRV series of Delta Industrial robot.



DRASimuCAD benefits user to simulate the actual workflow in 3D environment to visualize estimate and evaluate the Robot motion, analyze limitations like collision detection, reachability. DRASimuCAD reduces the teaching time through automatic path generation CAM capability that will bring down the installation and commissioning time and improves efficiency of robot automation.

Major features of DRASimuCAD

- Virtual Robot Simulation
- CAD(Computer Aided Design): Creation , modification , analysis and optimization of 3D design
- CAM (Computer Aided Manufacturing): Integral tool for generation of path to improve productivity and increase efficiency

1.2 Software Installation & Licensing : New User

User should have administration privilege on the PC before installing DRASimuCAD software.
DRASimuCAD offers the below installation options

- New User
- Existing user

Note: For existing users to update to the latest release of DRASimuCAD, please refer Software Installation & Licensing: Existing User Section 1.3 to uninstall, remove old files and steps to install the updated release.

Below procedure is for software installation & Licensing of DRASimuCAD for New User

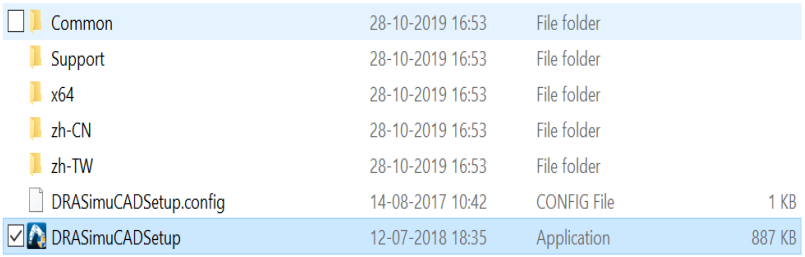
Prerequisites for Software Installation: Hardware Specification

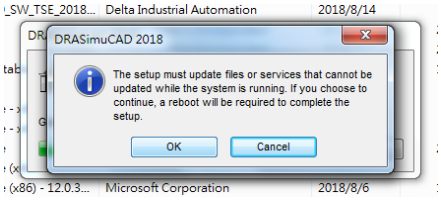
◆Hardware Spec:

■Windows System：Win10 64bit
■If the simulation is advanced its recommended for CPU i7, RAM 16G and discrete graphics card .

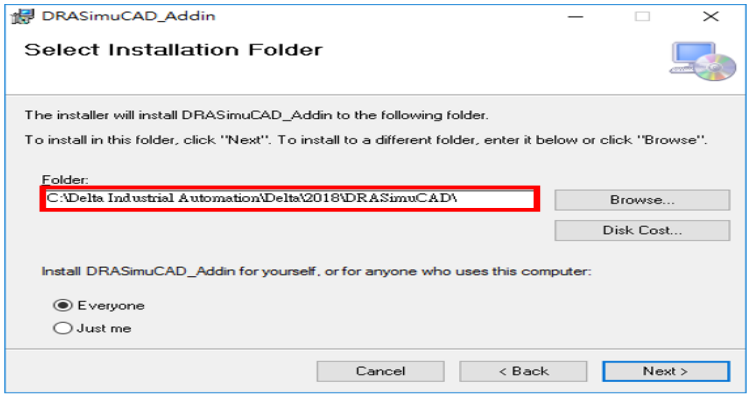
Hardware	Spec
CPU	Minimum demand i5 2GHz or AMD same level CPU
RAM	Minimum demand 8GB
ROM	Minimum demand 5GB
Display card	Display card compatible with DirectX, OpenGL

DRASimuCAD software comes with two zipped files of ***Setup*** and user shall extract the first folder (***001***), click DRASimuCADSetup.exe file, and continue to install.



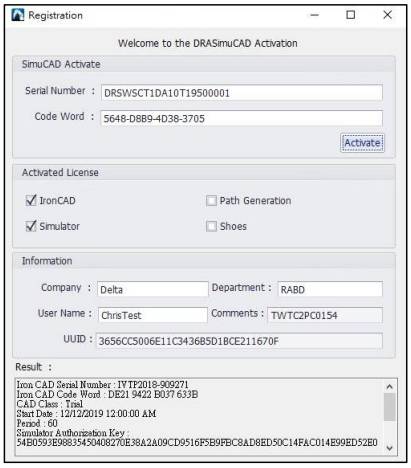


If the window shown above appears during installation, please click **OK** to continue

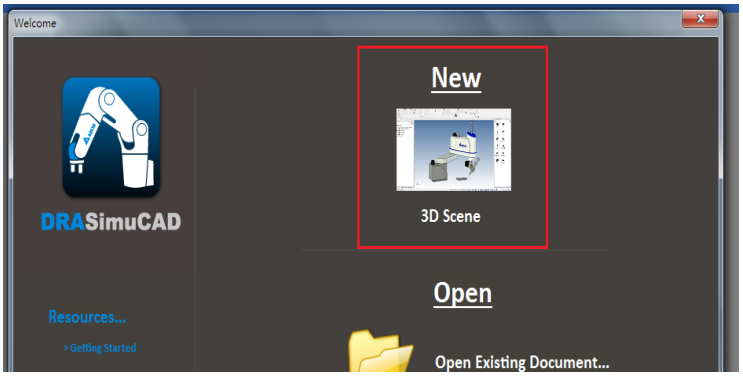


Users shall follow the installation wizard stepwise

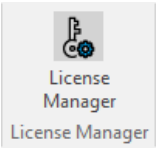
1. In the end of installation wizard, product activation screen pops up.
2. User needs to input the Serial number and code word provided by Delta Electronics, Inc. in the corresponding box.



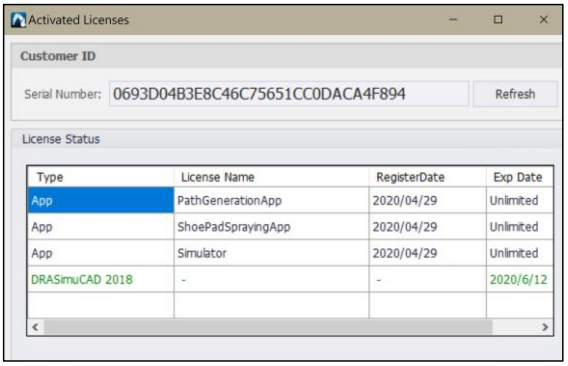
3. Upon successful registration of product key, depending on the PC setting skip the firewall alert in case required.
4. In case firewall alert pops up after the successful registration of the Product key, skip the alert message.
5. Launch DRASimuCAD and click New 3D Scene available on the top to enter the initial screen of application



6. Open the License Manager tab available in the toolbar.



7. User can cross verify the license registration with register date and expiration date. If the data are OK, installation procedure is successfully completed.

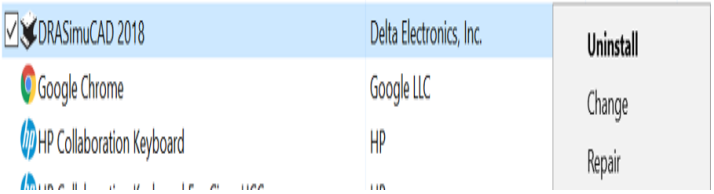


8. Shortcut to DRASimuCAD desktop icon is generated automatically

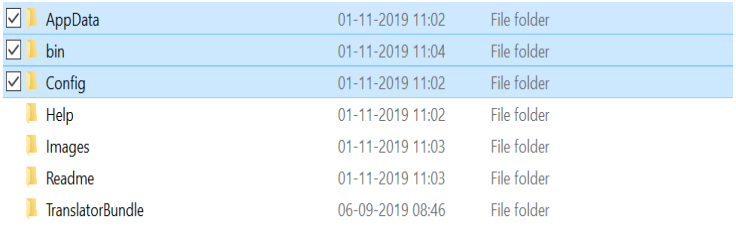
1.3 Software Installation & Licensing : Existing User

If user has to update the version with latest release of DRASimuCAD, the following would be the recommended steps

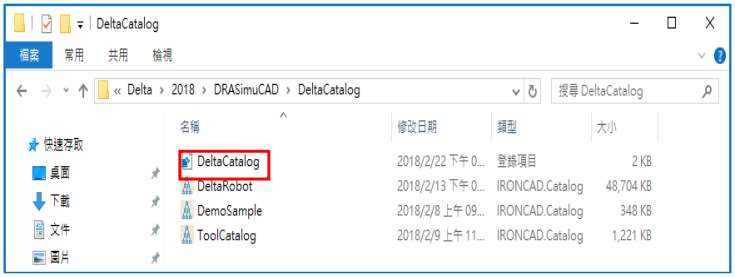
1. Uninstall DRASimuCAD from the control panel



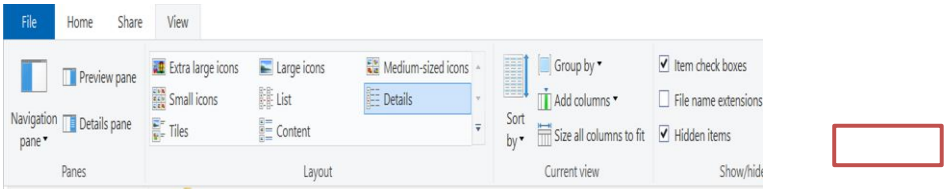
2. Locate DRASimuCAD folder - Default Path (C:\Delta Industrial Automation\ DRASimuCAD) in C: drive of the computer, manually delete the App Data, bin, and Config folders. Translator Bundle folder cannot be deleted and hence shall be ignored.



Locate another DRASimuCAD folder – Default Path C:drive - C: \ Users \ "user name" \ AppData \ Roaming \ Delta \DRASimuCAD folder and delete the entire file .Its recomended to switch ON “show hidden folders” options



Note: In case if the above folder is not accessible, check in the option to show hidden folder in View Tab.



3. After completing Section 1.3 Step1 & 2 User to continue DRASimuCAD Software Installation & Licensing New User Section 1.2 to install DRASimuCAD updated version.

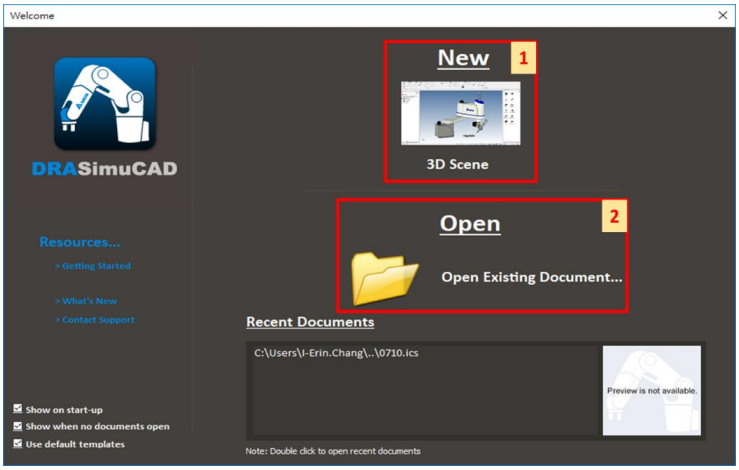
Note: Any discrepancy in following and completing the above-mentioned procedure for Software Installation & Licensing user requested to contact Delta Electronics Inc.

2. Basic Operation

2.1 Introduction to operating environment

2.1.1 User Interface (UI)

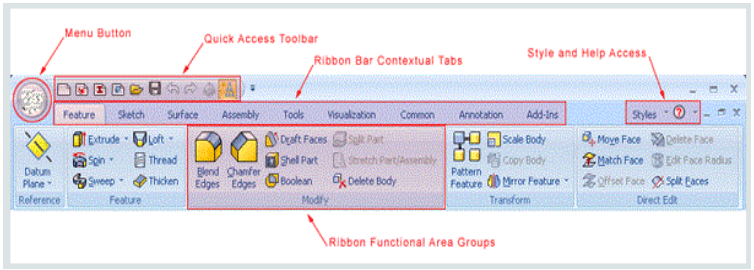
- **Startup view**



Description

1. Click New: Open New project
2. Click Open: Open the existing project

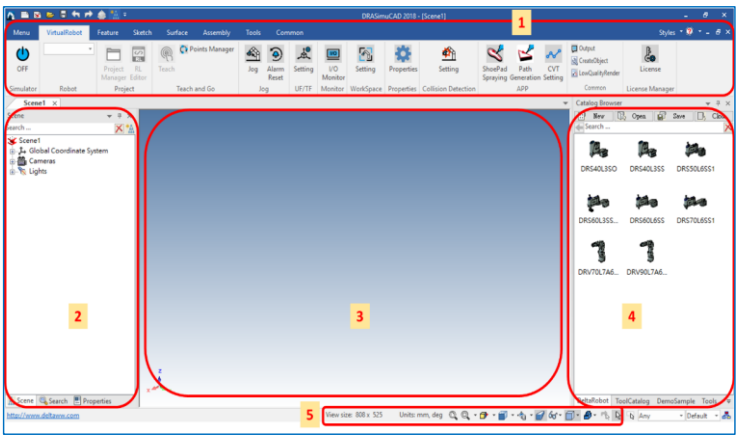
- **Operating environment**



■ Quick Access Toolbar

The Quick Access toolbar provides a single location for quick access to common commands or tools. For example, commands to start new scenes/drawings, open, save, undo/redo, and the TriBall available in Quick Start toolbar. Users can customize this toolbar to add additional common actions to match their design process.

■ Operating Environment



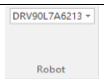
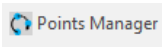
Description

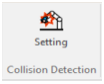
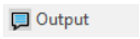
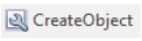
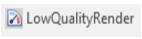
Functions	Description
Menu	Menu
Virtual Robot	Robot simulation
Feature	3D drawing
Sketch	2D drawing
Surface	Drawing of curved surface
Assembly	Assembly
Tools	TriBall, dimensions, attachment points for Tool, positioning constraints
Common	Default setting for Scene browser, catalog browser, Units etc.

1. Toolbar: List of commonly used functions tabs
2. Scene browser : Hierarchical tree chart viewer of component in simulation window
3. Simulation screen window : Workspace for 3D modelling & robot simulation
4. Catalog browser: Built-in library with Delta Robot, Demo Sample, Tool catalog, shapes etc.
5. Status bar: Displays status information of view size, units, camera view, setting, tools and related attributes.

■ **Main toolbar [Virtual Robot]**

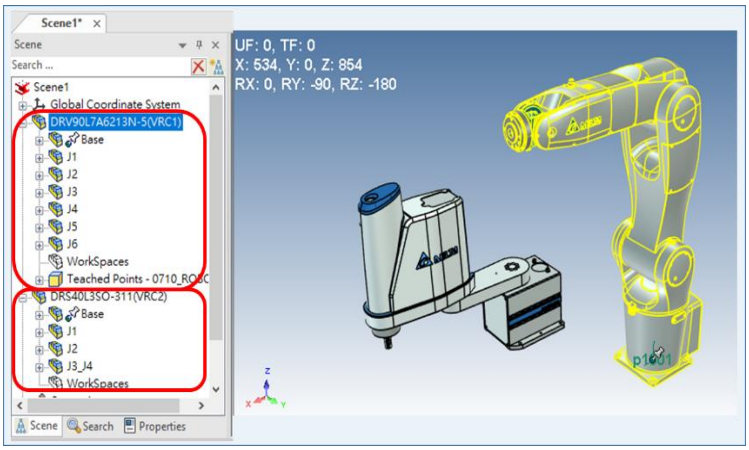
Icons on the main tool bar

Icon	Function	Description
	ON/OFF	Toggle button to enable and disable Simulator ON/OFF
	Robot selection	Select active Robot (Supports multiple robot with drop down menu)
	Project Manager	Select project for the current robot and related Project management functions
	RL Editor	Edit the Robot Language for the selected project in the project manager.
	Teach	Function to Teach and edit point manager under selected project /robot
	Points Manager	Displays the information pertaining to teach points coordinates , posture UF & TF data
	Jog	Menu to jog the robot on the work space
	Alarm Reset	Menu to reset the robot alarm if any
	UF/TF Setting	Menu to define the user frame and tool frame setting

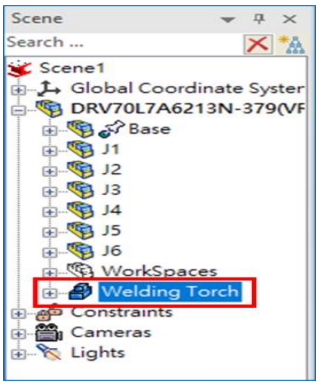
	I/O Monitor	Monitor Input /Output status of the robot
	Workspace Setting	Define work space limit of the robot – Working / restricted area
	Properties	Menu to define Properties & parameters of the selected function under scene browser
	Collision Detection	Menu to set parameters of Collision detection
	Shoe Pad Spraying	Menu to configure application parameters for the automatic path generation dedicated to shoe pad spraying
	Path Generation	Menu to configure application parameters for the automatic path generation
	CVT Setting	Menu to configure Conveyor Tracking application parameters
	Output	Window to view cycle time
	Create Object	Menu to configure User-defined simulation components
	Low Quality Render	Reduce screen resolution to optimize realistic simulation speed
	License	Menu to check the installed license information

2.2 Scene Browser

Hierarchical tree viewer of component in simulation window. Scene browser will group the list of components in the simulation window with the parent component. All parts/ assemblies used in the simulation window listed on the scene browser with a tree structure.
Multiple parts / assemblies as required by the user can be created on the scene browser. .

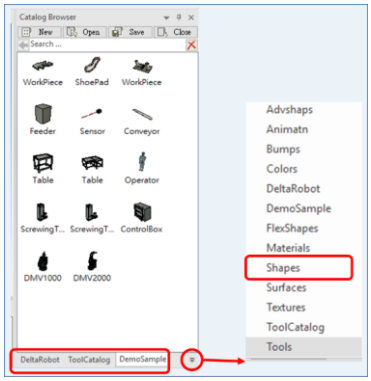


Note: If the welding torch is imported under the robot DRV70LA6213N then the scene browser will show as below picture



2.2.1 Catalog Browser

Catalog browser will list the inbuilt library of the Delta Robot models, tools catalog, demo samples, shapes etc. To view complete built-in library functions click ▼ button in bottom right corner to choose the appropriate function



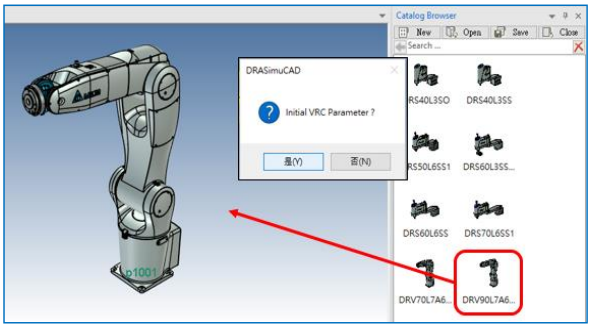
Note: Default path to access the built-in library is as below

- Path to access built-in library of Delta Robot, Demo Sample, Tool Catalog
  C:\Delta Industrial Automation\DRASimuCAD\AppData\en-us\Catalogs\Scene\DeltaCatalog
- Path to access the built-in library of Shapes
  C:\Delta Industrial Automation\DRASimuCAD\AppData\en-us\Catalogs\Scene\Metric

■ **Delta Robot**

Built-in library of the Delta robot models of SCARA and vertical articulated robots. User can choose the robot model as per the application requirement and generate a simulation to check and confirm the robot suitability to the particular application.

- Path - [Virtual Robot] → [Catalog Browser] →Delta Robot
- Type: SCARA & Vertical Articulated robot (VA)
- Operation: Choose the required robot in path Virtual robot →Catalog browser→Delta Robot (SCARA / VA), left click continuously drag and drop the Robot to the Simulation workspace.



Note: A dialog box with “Initial VRC parameters?” will appear and user to choose the options based on the below definition.

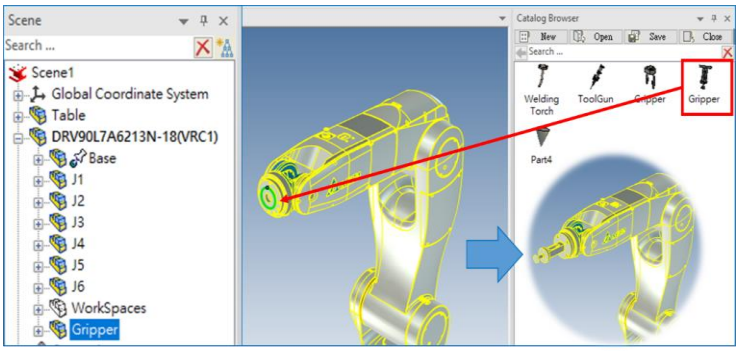
“ YES ”- Performs initialization of TF, UF, Workspace parameters.
(TF, UF and Workspace parameters reset to default values of Zero)

“ NO ”- TF, UF, Workspace parameters will be retained without change

■ Tool Catalog

Tools catalog has several reference tools, to mount on the robot for simulation. To attach tool user needs to move the robot to Home position, drag and drop the required tool on the Robot flange. After successful attachment of tool/gripper on the robot, user can locate the tool/gripper under the robot tree in scene browser with Robot as the parent component.

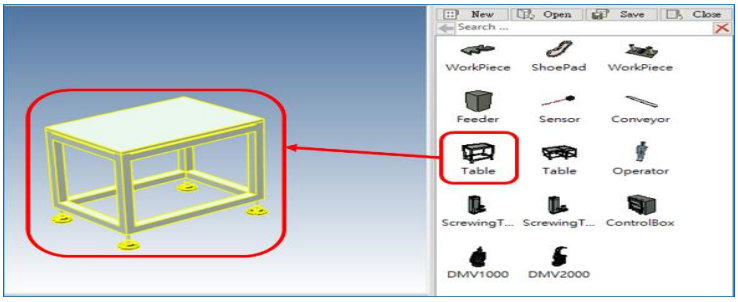
- In built Library types: Welding Torch, Glue Gun, Mechanical Gripper
- Import Operation: Move robot to home position → Select Robot → Select Gripper tool and press left mouse button continuously, drag the Gripper tool to the flange of Robot. Tool will automatically attached to the robot flange end if the attachment point is predefined. Flange will have a predefined attachment point EndP



■ Demo Sample

For simulation and programming in DRASimuCAD, user shall utilize built in library models of work pieces and equipment for standard simulation. Models of such standard equipment libraries predefined in DRASimuCAD as demo sample. User defined work piece & customized CAD models in neutral formats imported as geometries inside DRASimuCAD.

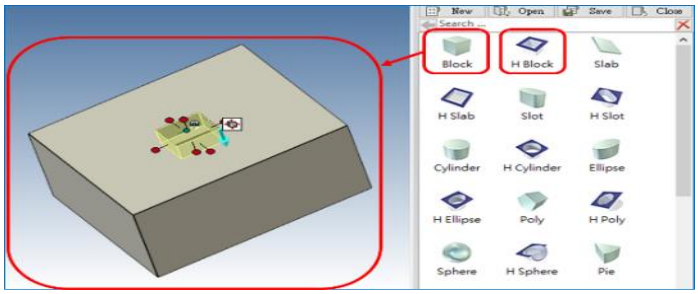
- Type: Feeder, Sensor, Table, Conveyor, Work Piece, etc.
- Operation: Select Demo Sample, press the left button, drag, and drop to the simulation screen.



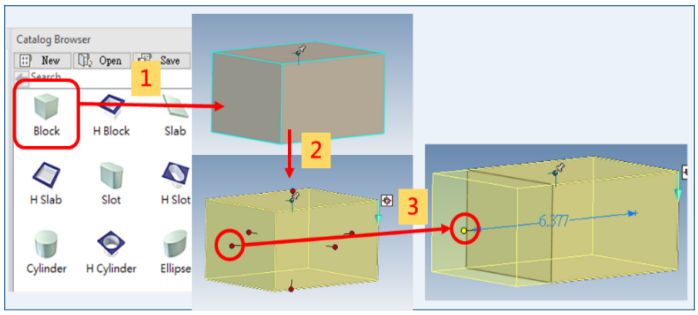
■ Shapes

Build-in catalog contains IntelliShapes with drag-and-drop solid modeling to provide the easiest part/assembly design environment .User can custom design and develop the own model, of tools / Grippers / Mechanism for simulation. Shapes will have built-in library for quick use of widely used innovative parts.

- Type: Block, H Block, Cylinder, etc.
- Operation: Select Shape, press the left button, drag, and drop to the simulation screen.



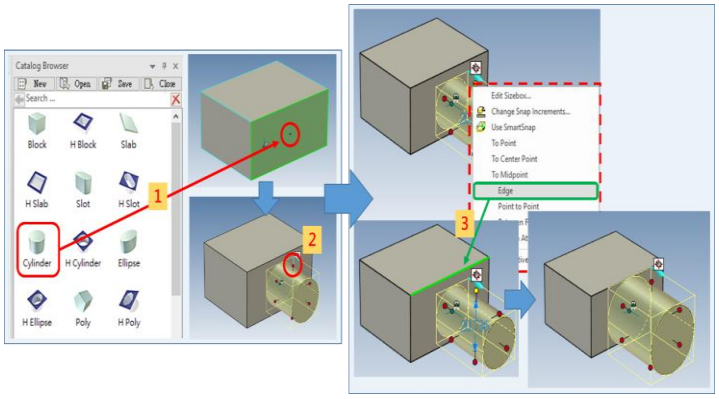
a. IntelliShape Shape Handles -Modify length, width, height etc.



Description

1. Left click on shape and drag to the simulation screen
2. Left click on the object twice
3. Drag the red handle to adjust the length, width and height of the object

b. Technique to align points, lines, and surfaces



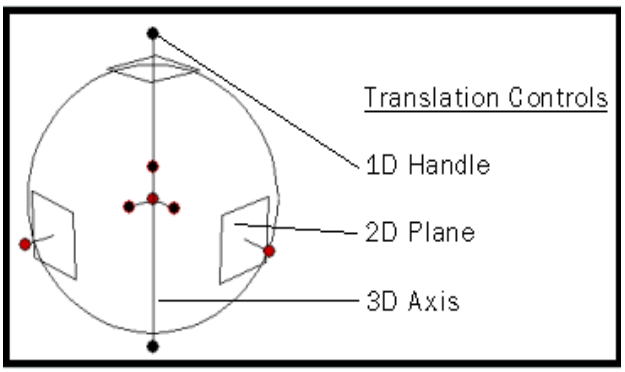
Description

1. Left click on shape and drag to the simulation screen
2. Choose another shape part and drag & drop to the center point of a side as illustrated above
3. Right click twice to choose the axis to align select the respective axis
4. Right click and select “Edge”
5. Select edge to align the part size

2.2.2 TriBall operation

TriBall is a very effective and versatile multipurpose tool for positioning of components, alignment of components, creation of new multiple components and editing of imported models. TriBall is a used for panning, rotation and positioning of objects in the workspace

The TriBall translation controls consist of three handles and three planes on its surface that allow user to move a part along or around any of its axes

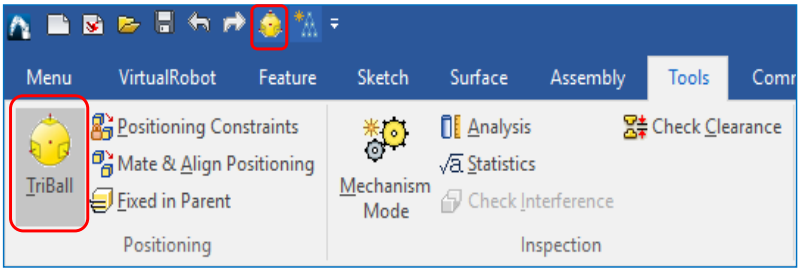


1D (line movement)
Drag a 1D handle to move an object along an axis. As user drag, a distance value appears beside the handle, indicating how far the object moved from its original location. User can enter a distance value directly after dragging the handle or after the direct input field is deselected user, can right-click the distance value, choose Edit Value from the resulting pop-up menu, and enter the desired distance value in the dialog box.

2D (plane movement)
When user place the cursor inside a plane, the cursor displayed as four arrows, indicating that the shape or part can be dragged up, down, left, or right along the 2D plane. As user drag, a distance value for each direction in the plan will appear indicating how far the object moved from its original location

3D (rotation)
When user click a 3D handle, its axis of rotation is selected and highlighted. To rotate an object around the selected axis, move the cursor within the TriBall. When the cursor changes to a hand and arrow, click and drag to rotate the object around the axis. As user drag, the current angle of rotation displayed in degrees

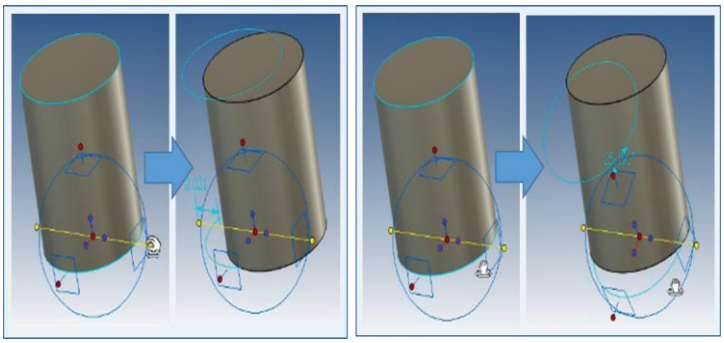
- Operation: Select the object; enable TriBall in Tools Tab or from the quick access toolbar.
- Shortcut key : F10



a. Panning and rotation

The external handles used for the pan and rotation.

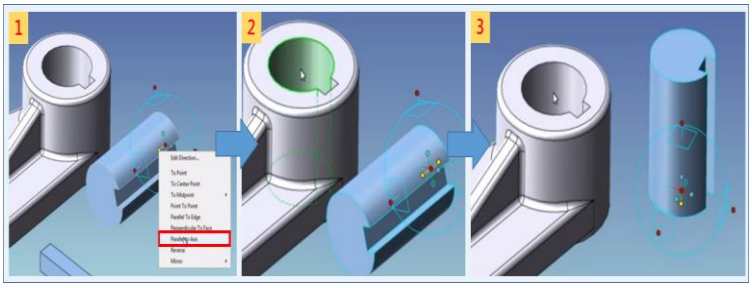
- Pan Operation: Enable TriBall → Drag a 1D handle to move an object along an axis. User can directly pan on the workspace or input the distance in the window
- Rotation Operation: Click the 3D handle, axis of rotation selected and highlighted → Drag the cursor to rotate around the selected axis.



b. Aligning and positioning

Internal handle used for alignment and positioning the object to the target position

- Operation: Click on the internal handle→ Right click on the internal handle → Select option to align and position the selected part

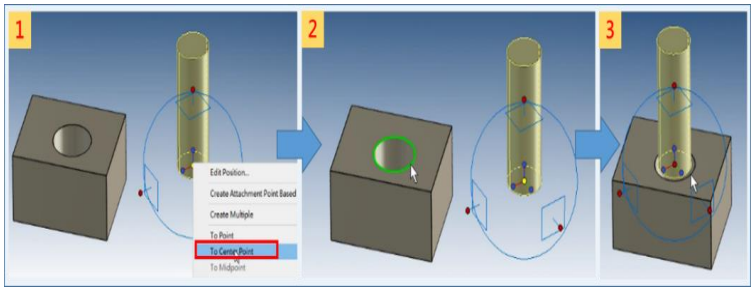


- Align Parallel to axes

Description

1. Click on the internal handle → Right-click select "Parallel to Axis"
2. Select the surface to be aligned with (axis)
3. Selected part will be aligned parallel to the surface

- Aligning center points



Description

1. Click on the internal handle → Right-click select "To Center Point".
2. User can move the mouse to the target position system will automatically guide to the center point of the chosen part
3. Selected part will get aligned to the center point

c. Anchor adjustment

Every shape and part has an anchor composed of a green dot and two "whiskers" or short, perpendicular lines. When a shape dropped into the scene as an independent part, a pushpin also displayed at the anchor location. The anchor indicates the point where that shape or part connects to others. For example, when user drop one shape on another one, the second shape's anchor lands on the surface of the first shape.

The two green "whiskers" on the anchor indicate the orientation of the object relative to the global coordinate system of the 3D scene, as illustrated by the scene grid.

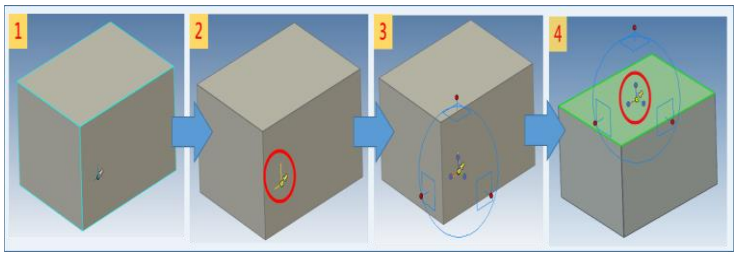
The object's up direction

Indicated by the longer vertical green line. When user first drop a shape or part in the scene, aligned to "up" direction with the height axis of the scene.

The object's forward direction

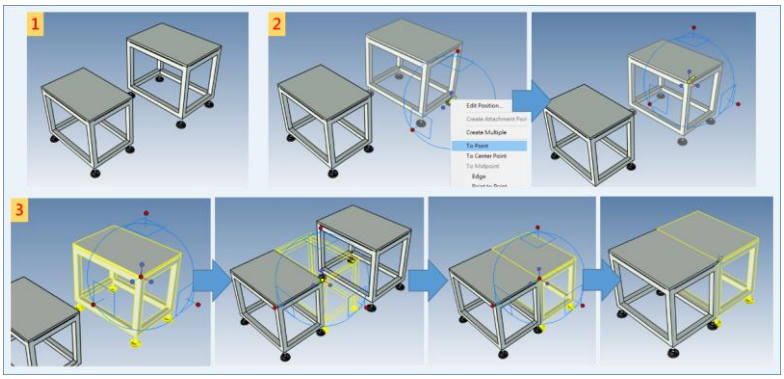
The shorter, horizontal green line, points forward. Initially, the forward direction of an object aligned with the length axis of the scene.

Operation: Using TriBall to move the anchor of object



Description

1. Select Part
2. Click start point on the pushpin of anchor
3. Press F10 to call out the TriBall function to move the anchor point
4. Choose target position to modify anchor location



Description

1. Drag two tables independently into the simulation window.
2. Modify table anchor position: Click on the table, choose anchor and activate TriBall →Right-click to select **To Point** to move the anchor to the corner of the desktop.→Close TriBall of anchor.
3. Modify table position: Select table → Press F10 to activate TriBall→Pan directly to move the table or right-click on the TriBall center point select **To Point** move to the corner of another table.→Deactivate TriBall to complete table alignment operation

2.2.3 Camera Setting

The camera represents your eye as you view the 3D scene. User can adjust the position of the camera, the angle of its lens, and other features using the options on the Camera properties. User can access the camera dialog by right-click in the scene and selecting camera from the resulting menu

Projection

1. Perspective- Select this option to display objects in the scene in perspective.
2. Field of view angle. Enter the value in this field to view angle of the camera lens.

Panoramic Mode.

A typical camera will yield a realistic rendering of exactly what is visible in the DRASimuCAD window. The Panoramic mode enabled to cause the rendering to show 360 degrees of the scene. This is quite useful when generating 3D Environments.

■ **Zoom In, zoom Out, Pan, Rotate, Fit scene on the screen**

Use the mouse and keyboard shortcuts to adjust the angle of view.

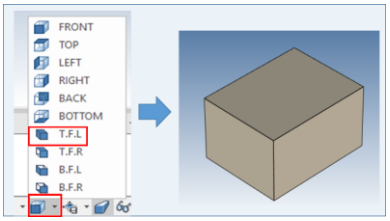
View	Operation
Screen Pan	Shift + middle button +Pan
Screen Rotation	Press middle button and reorient
Focus Zoom	Mouse wheel rotate back and forth
Fixed Zoom	Ctrl + mouse middle button
Fit to view entire screen	-  in the status bar - Shortcut key F8
Zoom view to fill rectangle	-  in the status bar - Ctrl+F5

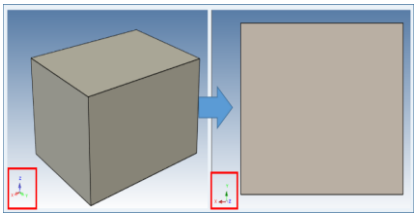
■ **Camera Tools for Application window View**

To alter view of the scene, use the camera tools. The user should note that the object shall remain in the same position while the camera changes the view angle. User adjusting the camera's viewpoint and target point to view objects from different perspectives and angles Shortcuts for the camera tools listed below

- Shortcut : F7

	Zoom Camera (F5). Use the cursor to zoom the camera in or out.
	Window Zoom (CTRL + F5). Zoom view to fill rectangle.
	Zoom to Selection). Zoom to the select assembly/part/feature and center camera.
	Look At (F7). Set camera to look directly at a selected surface.
	Target Camera (CTRL + F7). Shift center for camera orbit to the selected shape.
	Fit Scene (F8). Enlarge or shrink the view to fit the entire scene.
	Save Camera. Save the camera configuration.
	Custom Camera Manager. Manage previously saved camera configurations.
	Undo Camera. Undo the camera changes in the scene.
	Redo Camera. Redo the camera changes that have been undone.
	Perspective Camera (F9). Use the perspective camera.
	Front. Orient the camera view to the front.
	Top. Orient the camera view to the top.
	Left. Orient the camera view to the left.
	Right Orient the camera view to the right.
	Back. Orient the camera view to the back.
	Bottom. Orient the camera view to the bottom.
	Top-front-left. Orient the camera view to the top-front-left. .
	Top-front-right. Orient the camera view to the top-front-right. .
	Bottom-front-left. Orient the camera view to the bottom-front-left. .
	Bottom-front-right. Orient the camera view to the bottom-front-right. .





Description

1. Import part to the scene window
2. In status bar choose camera view point icon and choose option

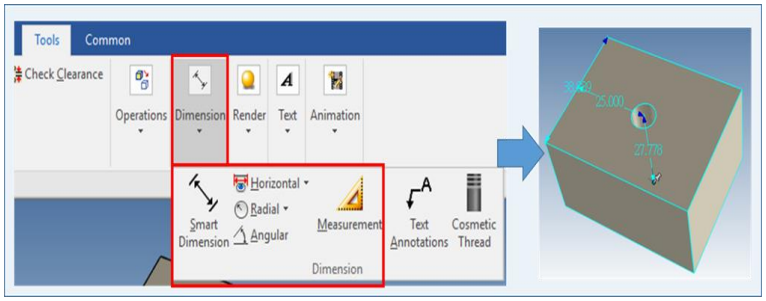
2.2.4 Measurement Tools

The Measurement Tool allows user to take measurements between features on a part or between parts in an assembly

Measurement types:

1. Minimum Distance Dimension: Displays the minimum distance between two selected items.
2. Linear Dimension: Measures the straight distance between 2 points or a point and a face.
3. Horizontal Linear Dimension: Measures the horizontal distance between two points relative to the screen viewpoint.
4. Vertical Linear Dimension: Measures the vertical distance between two points relative to the screen viewpoint.
5. Angular Dimension: Measures the angle between edges or faces.
6. Radial Dimension: Measures the radius of a circle or arc.
7. Diameter Dimension: Measures the diameter of a circle or arc.
8. Curve Measurement: Measures the total distance of a curve(s) or edge(s).
9. Face Measurement: Measures the area of a face or selected faces.

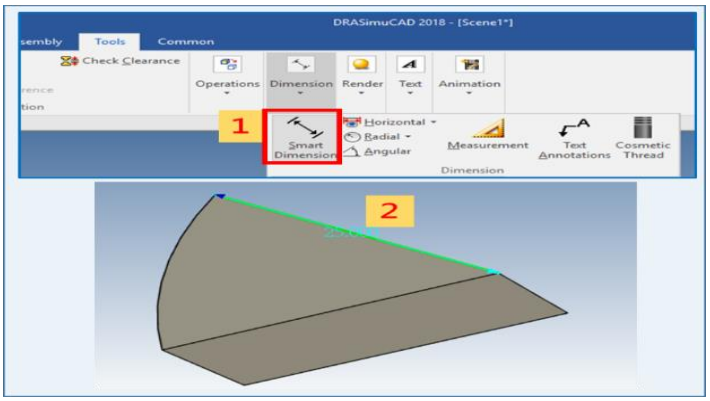
■ Operation: Toolbar [Tool] → [Dimension] → Choose appropriate tool



■ Length measurement

Measures the straight distance between two points or a point and a face

- Operation

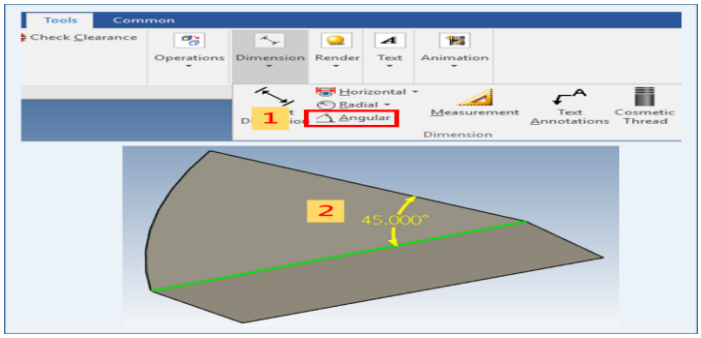


Description

1. Click [Tool]→ [Dimension] → [Smart Dimension].
2. Select the edge to measure the length

■ Angle Measurement

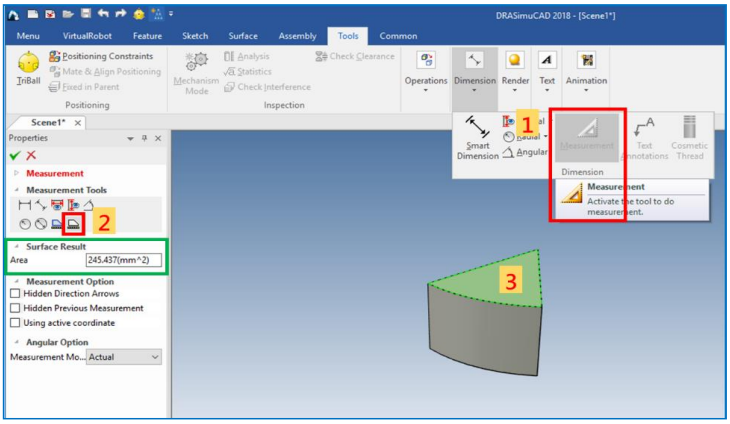
- Operation



Description

1. Click [Tool]→ [Dimension] → [Angular].
2. Select two edge to measure the angle between the two edges

■ Area Measurement



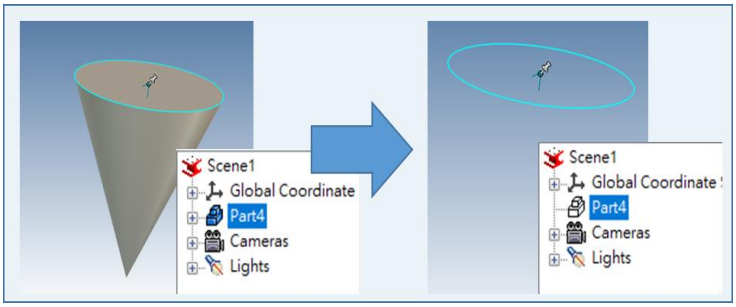
• Operation

Description

1. Click [Tool] → [Dimension] → [Measurement].
2. Click (Face Measurement)
3. Click on the face to be measured → View result → Surface result (Highlighted)

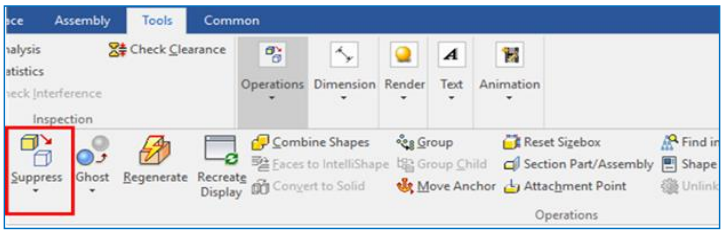
2.2.5 Hide Objects (Suppress)

If user looks to hide any part / assembly to have a better view on the simulation window, hide option (Suppress) is available.

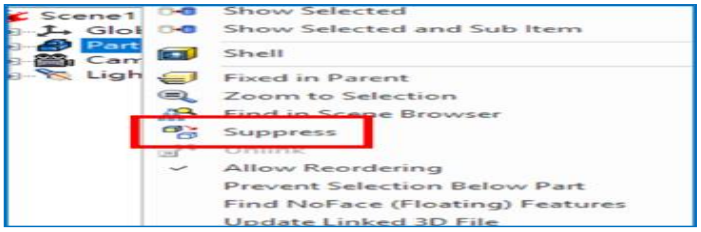


■ Operation: Right Click on the object → [Suppress].

• Method 1: Toolbar [Tool] → [Operations] → [Suppress]



• Method 2: Right-click on the object → [Suppress]



Note: To UN-suppress, the part user can select the object →Tools →Un-suppress part or in scene →Right click→again choose suppress option again

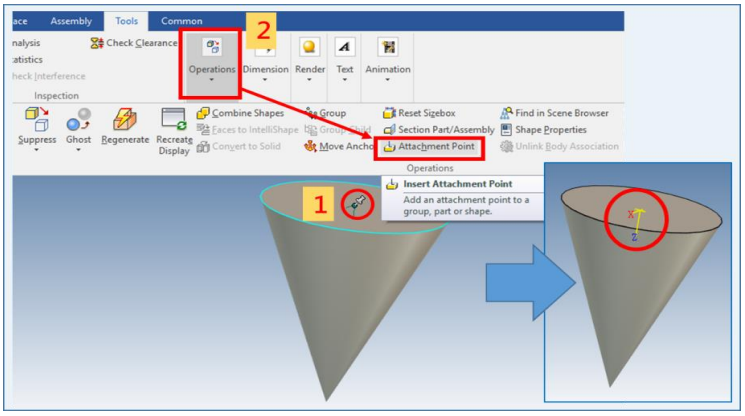
2.2.6 Attachment Point

Even though objects are joined at their anchors, by default, they can be joined at alternate locations by adding attachment points. Attachment points can be added anywhere on a shape or part, then another shape can be attached directly to that point.

Delta robots will have predefined attachment points on the flange with name EndP. In case user has to create a custom-made gripper, an attachment point of the same name needed to be created to attach the gripper on the Robot flange.

- Operation: Select part →Tools → Attachment points
- Add attachment point

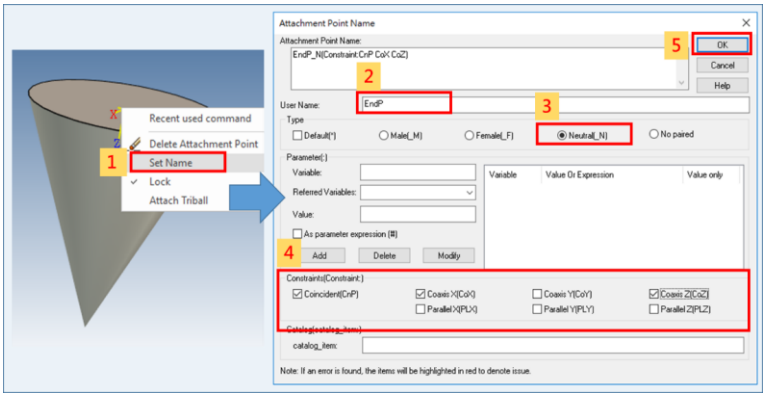
When adding an attachment point, watch for the Z-axis orientation direction and use TriBall to set the proper orientation to avoid mismatch of directional error.



Description

1. Click a point on the part → Adjust the direction of the coordinates (Z-axis) for the attachment point using TriBall.
2. Operations → Attachment Point

- Parameter setting for attachment point



Description

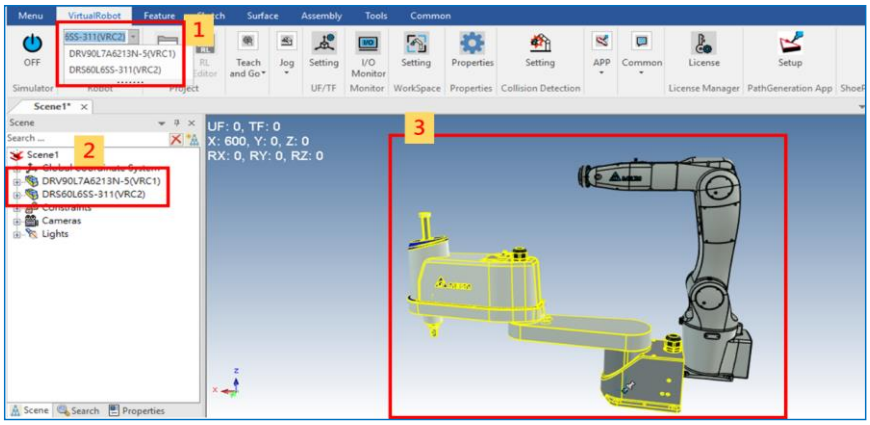
1. Right-click on the attachment point → **Set Name**
2. Set Tool attachment name as “EndP”
3. Select “Neutral” under **Type**.
4. Check **CoP** (coincident), **CoX** (coaxis), and **CoZ**(coaxis) under Constraint.
5. Click **OK** to complete the setting.
6. Drag and drop the part to a new catalog
7. Select the robot and zoom in to flange position
8. New Catalog →Left click mouse →drag and drop part to the robot flange
9. The new tool attachment point will be attached to the robot predefined attachment point

2.3 Robot Simulation

DRASimuCAD control the Robot in the simulation screen through virtual controller VRC running in the background. When user turns “ON” the Simulator function, robot will be active to perform simulation. Robot will be updated with the current jogging position, teach position, over travel limit, UF & TF data etc.

■ Switching robots

Methods to switch between robots when there are multiple robots



Description

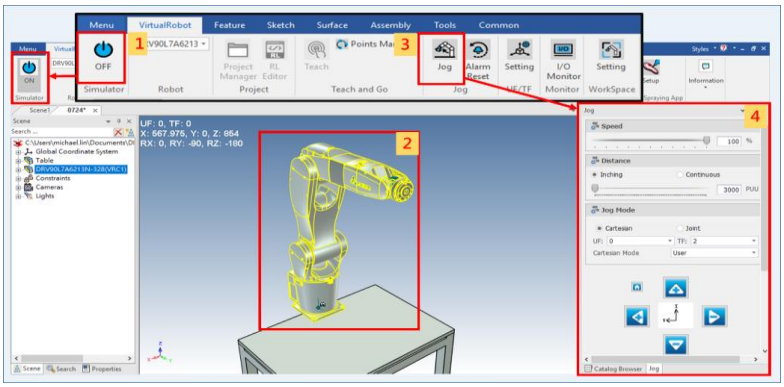
1. Method 1: Choose the robot from the drop down menu in Virtual robot →Robot
2. Method 2: Select the robot from the scene browser
3. Method 3: Select robot directly in the simulation screen.

2.4 Jog & Alarm Reset

2.4.1 Jog

Functional menu to move the robot axis and choose parameters like speed, distance, and mode (Cartesian or joint), active UF, TF, coordinate system etc.

■ Operation



Description

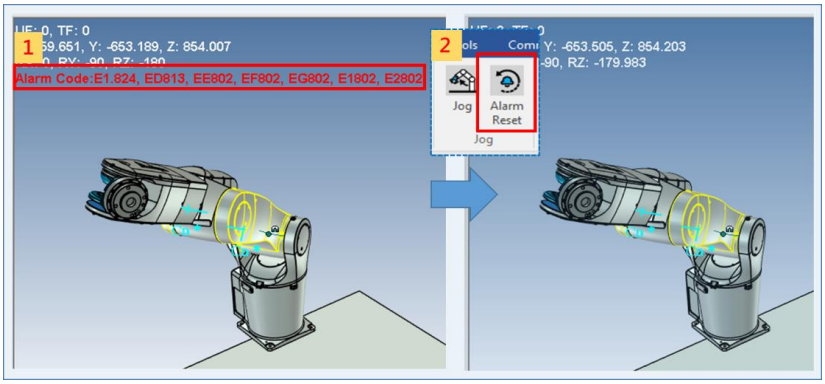
1. Turn “ON” the simulator button
2. Click on Robot
3. Click [Jog]
4. Jog page

- Speed: Select the moving speed
- Distance: Set the moving distance (inching/continuous)
- Jog Mode: Joint mode / Cartesian mode
- In Cartesian mode Home button: Robot returns to Home point

Note: Simulation button to be turned “ON” to activate robot related operation such as jog, go to point etc. In case if the user is working on 3D modelling, positioning then Simulation button to be turned “OFF”

2.4.2 Alarm Reset

During robot jogging, moving beyond the working range of the arm, over travel alarm will appear in the upper left corner. Robot movement is not possible when the alarm is active and need reset to resume jogging. When the alarm appears, user can acknowledge the current alarm with “alarm reset” button.



Description

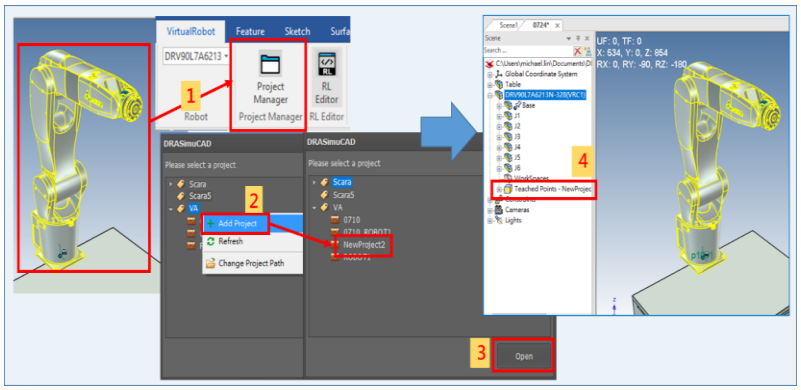
1. Alarm appears in red font when robot is out of working range
2. Press [Alarm Reset] to acknowledge alarm.

2.5 Project Management

Project Manager Menu support in creating a new Project and allows user to execute project management functions like delete, rename and export project to target folders. User can teach and save the points under the selected project.

■ Add/Import projects

• Operation



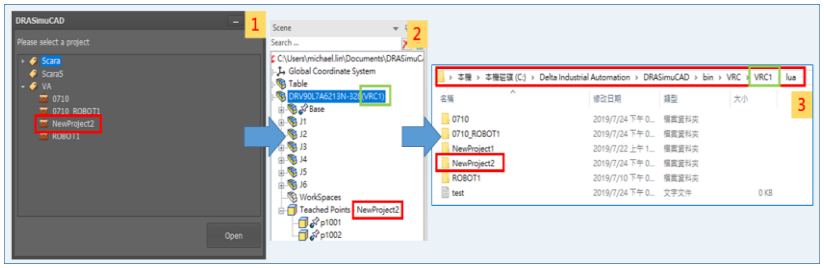
Description

1. Select Robot → Click Project Manager.
2. Click on the Robot type → Right-click to add a new project (Format within 26 English characters)→ Select the project.
3. Open project.
4. The teach points of this particular project will get saved under the selected project

■ Export Project to MS

DRASimuCAD support direct export of project to DRA Studio to execute the project with actual robot. Upon completion of simulation user can save the project and close RL editor.

■ Operation



Description

1. DRASimuCAD project
2. Project name location in **Scene** browser
3. Project path: Project is saved in default path **"C:\Delta Industrial Automation\DRASimuCAD\bin\VRC\VRC1\lua"**

■ Project Folder Includes

- RL program
- Point information of teach points
- UF, TF, Workspace information :File path "C:\Delta Industrial Automation\DRASimuCAD\bin\VRC\VRC1\VRC Parameter"

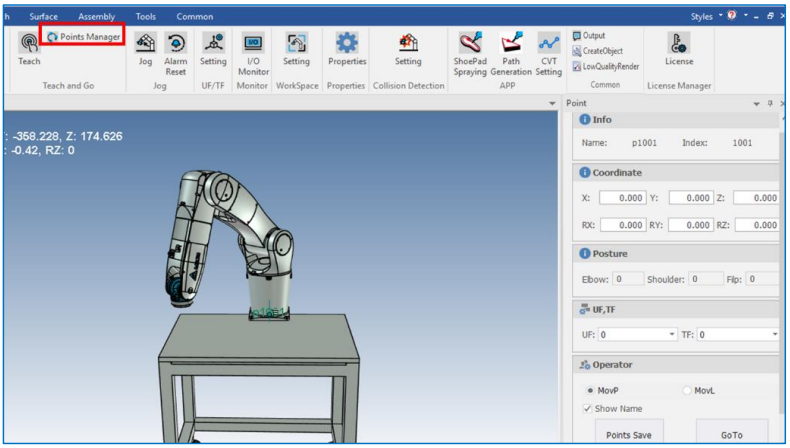
2.6 Teach And Go

The Point manager displays information related to the teach point, such as coordinate name, index posture, UF, TF ,coordinate information “X”,”Y”,”Z”,”RX”,“RY”,”RZ” and information pertaining to posture .User to teach points initially and access points tab to use go to point option during simulation .

■ Point Manager

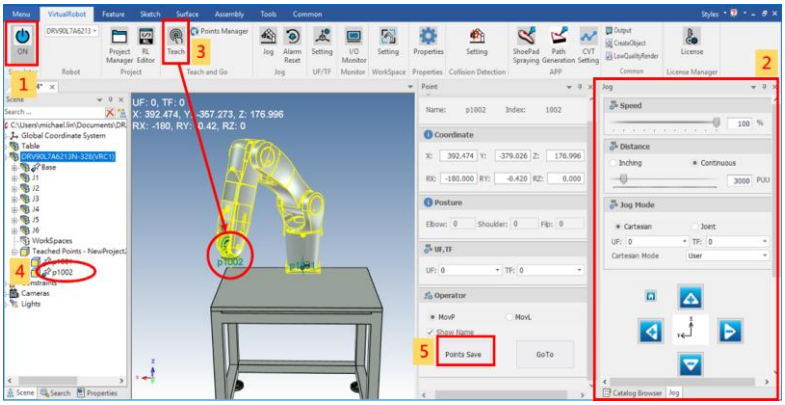
Display the Point window to share information about the selected point.

- Action: Click **Points Manager**.



■ Teach points

Teach will record the robot current coordinates values, posture with the active UF &TF details



- Operation

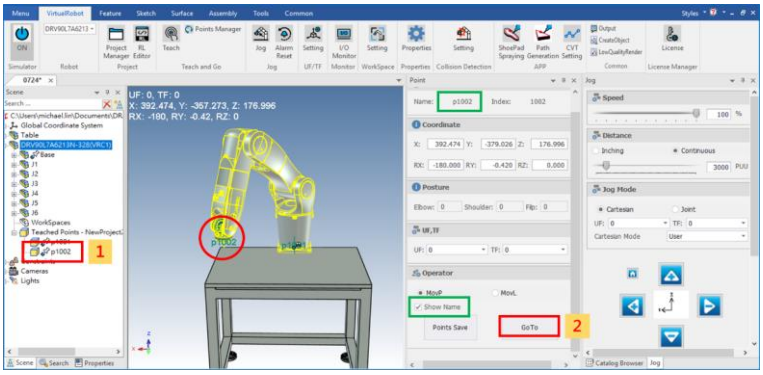
Description

1. Turn “ON” simulator
2. User can use jog option to move the robot to the target position
3. User shall click “Teach” to record the current point information
4. User can edit ,check/modify the selected point information
5. Select robot and Click **Points Save** to record the point inside the project.

■ Go to point

“Go to” option in point window will help user to move the robot to the selected point position.

- Operation



Description

1. Scene browser →Robot tree→Teach points→Select point
2. Catalog browser→Point window→ click “Goto”

Note: User can check *Show Name* option to display the name of the point in the simulation screen if necessary

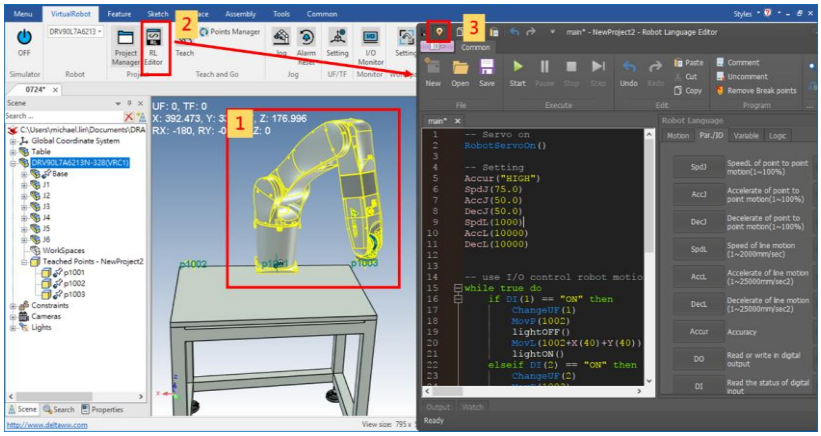
2.7 RL Editor(Robot Language Editor)

Set of Robot language instructions combined with motion command, Input/output command and logic loops. Robot simulation sequence written using the set of RL instruction and edited modified and controlled via Robot language editor.
(For details on Robot language Refer RL User Manual)

Type

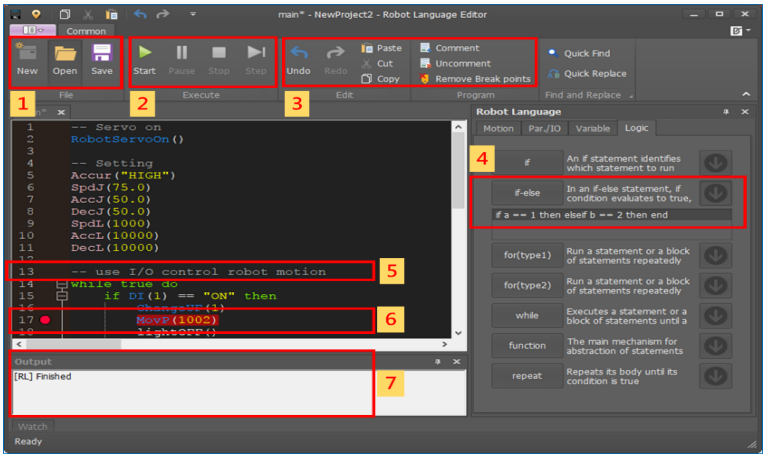
Type	Description
Motion	Instruction on robot movement command
Parameter/ IO	Input and output instruction
Variable	Instruction to edit point information
Logic	Logical instructions

Operation
Open RL



Description
Select robot.
Click RL Edit.
"***Always on top***" icon will retain the RL editor window on top of the screen even when the screen is switched

RL editor screen



Description

File Manager

Program execution- Start , Stop , Pause and continue

Program editing

Click down arrow to check the RL code hidden

Comments are written by prefix “- -“symbol. User shall include the brief description of logic and sequence for future reference.

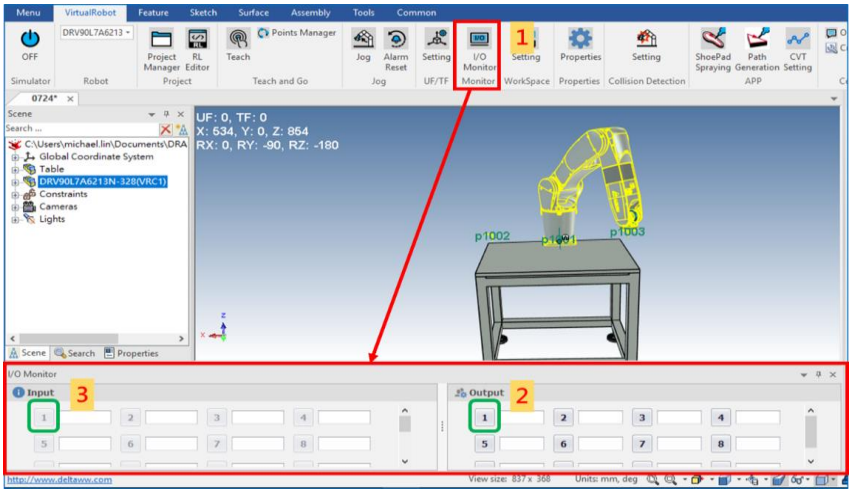
Left click on the space next to line number ,will enable Breakpoints mark (Circular red mark) to pause RL program execution in the particular line number

Output window section displays the result after the program completes execution

2.8 I/O Monitor

I/O Monitor menu will open a window, which will display all the 24 inputs and 12 outputs of the Robot. User shall check the status of the input and output as well as control the output of the robot using IO monitor

- Operation



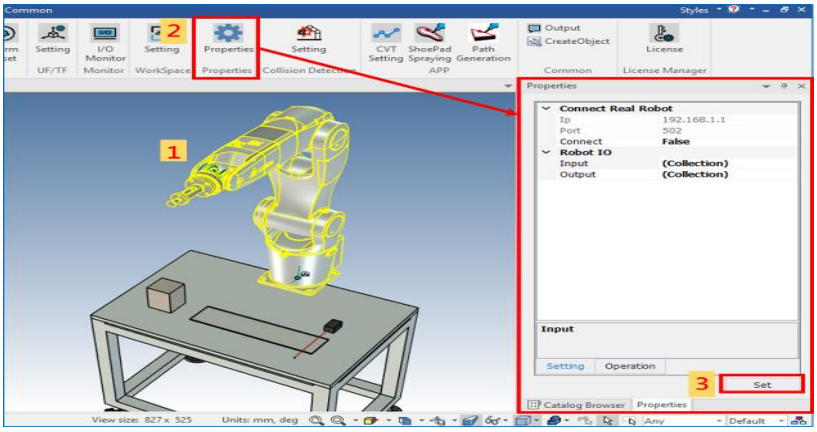
Description

1. Click on the toolbar **Virtual Robot →I/O Monitor**
2. Click the corresponding Output to control the Output status to “ON”/”OFF”
3. Simulator to be turned “ON “ to control output of robot
4. Highlighted green indicates the output is “ON”, to switch “OFF” the output user needs to toggle the same output once again.
5. If there is an input signal, the corresponding input will highlight with green.

2.9 Properties

Property menu is multi-functional and action depends on corresponding selection in scene browser. For configuration of I/O parameters properties tab will be active if at least one robot is imported and selected in the scene browser. Properties is used to configure feeder, conveyor, and sensor parameters. Corresponding features and parameters displayed when properties tab chosen during the course of simulation.

- Operation



Description

1. Select robot
2. Click **Virtual Robot → Properties**
3. Set parameters, I/O connection → Click ***Set*** to complete the setting.

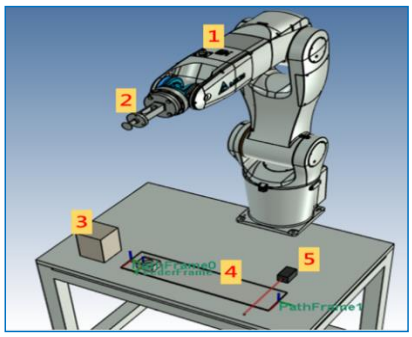
2.9.1 I/O connection settings

Devices such as robot, gripper, feeder, sensor, and conveyor controlled and configured through I/O settings

- Scenario

Robot used to control feeder to generate work piece on conveyor belt. Once the work piece moves on the conveyor and intersects with the sensor beam an input is generated. Upon reading the sensor input command, robot will move and grip the work piece.

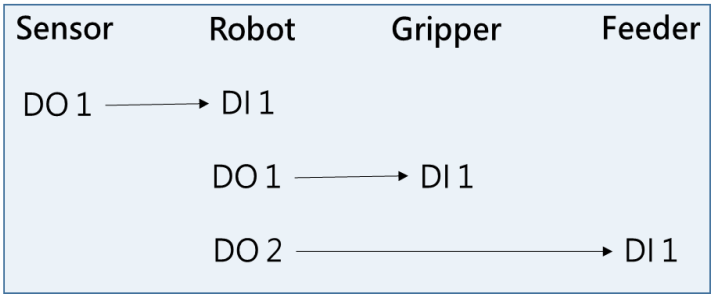
- Scenario Setup in Simulation View



Description

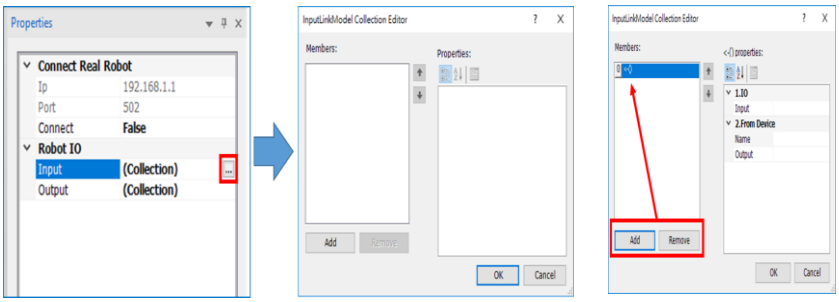
Consider a scenario with choosing the DRV Delta Vertical articulated robot attached with gripper tool, Feeder, conveyor, sensor. User to import, align and set parameters of the individual components in the simulation window.

- I/O connection setting

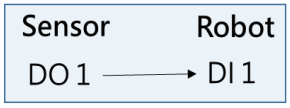


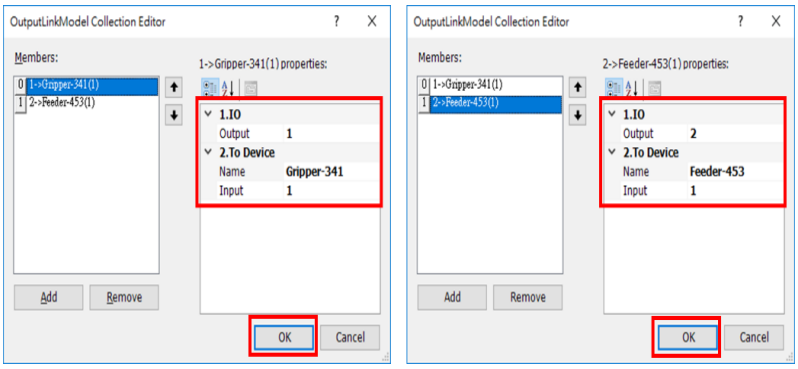
■ Setting up IO connection between robot and sensor.

1. Select robot →Properties
2. Click on ⋯ in the Input field to set up Input connection



3. Click **Add** to link device member, **Remove** to remove the device.
4. Below setting of IO Input 1 and From device Name “Sesnor-349” and output “1” will generate robot input “1” if the sensor output becomes “1”

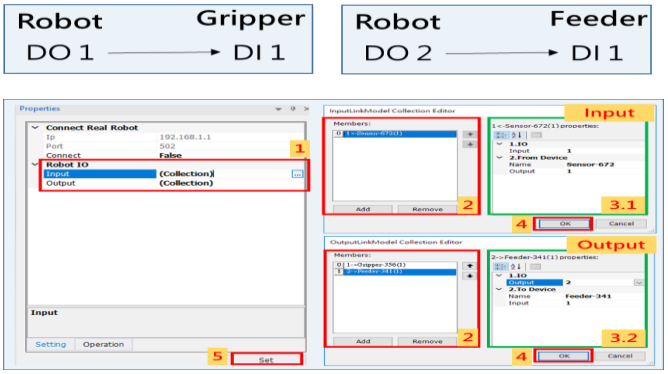




5. Click “OK” to save the settings.

■ Setting up IO connection between Gripper & Feeder with the Robot

1. Click on ... in the Output field to set up for the Output connection.



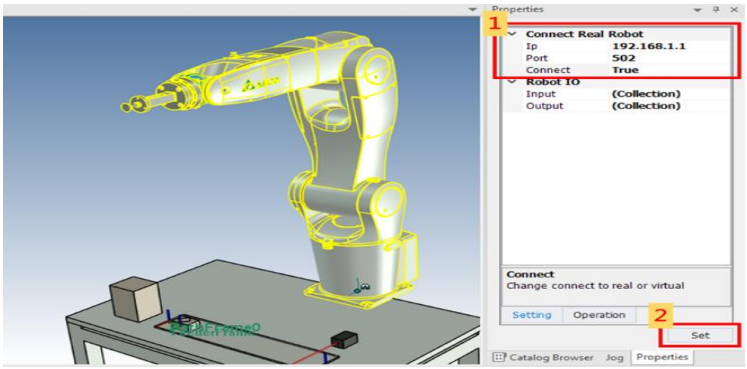
2. Click **Add** to link device member, **Remove** to remove the device.
3. Above setting of IO input 1 and from device Name “Gripper-341”, input “1” will generate gripper to close if robot DO1 switched “ON”.
4. Subsequent setting will generate the feeder to feed in component if robot digital output 2 triggered.
5. Click “**OK”** to confirm the setting.
6. Click “**Set”** to save the settings.

已註解 [S陳1]:

2.9.2 Robot Real-time Synchronization

DRASimuCAD has the feature to display and update robot movement synchronized with the actual robot running through MS. Robot movement will update real time with actual MS when “Connect real robot” made “True” with the proper IP address & port number. Alarm status, endpoint, user coordinate system, tool coordinate system, etc. synchronized and updated on real time basis with the MS.

- Operation



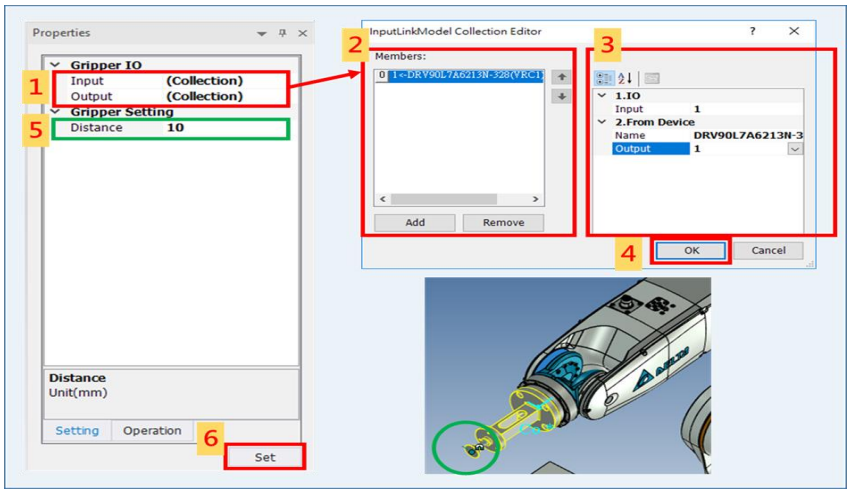
Description

1. Modify Connect to True → Set the IP and Port of the actual connected robot.
2. Click “**Set”**

2.9.3 Gripper

Virtual grippers used in simulating gripping and un-gripping operation with work pieces. To install the gripper, click on the Robot, select the gripper from the built-in library under the Tools Catalog window, drag and drop on the robot flange. (Refer Tool Catalog in Section 2.2.1).

- Gripper I/O: Gripper IO setting
- Action: Click on Gripper → **Properties**
- Description of Properties settings:



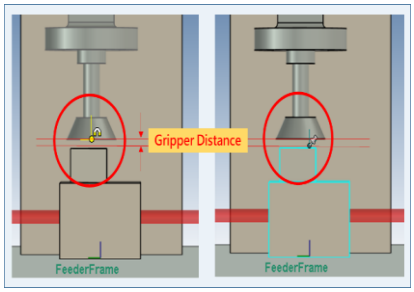
Description

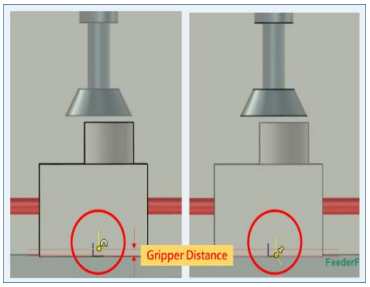
1. Click on the Input in Gripper IO to execute IO setting
2. Add or remove I/O connected devices
3. Set the details of the I/O connected devices

- Set Input: Robot DO 1 connected with Gripper DI 1

4. Click **OK** to confirm the setting.
5. Distance is the parameter between Gripper anchor and work piece anchor. Actual distance in simulation shall be less than the distance setting to grip the component. Below is the method to set the distance and anchor

- Method 1: Adjust the Anchor position of the work piece.
- Method 2: Adjust the Anchor position of the Tool endpoint.

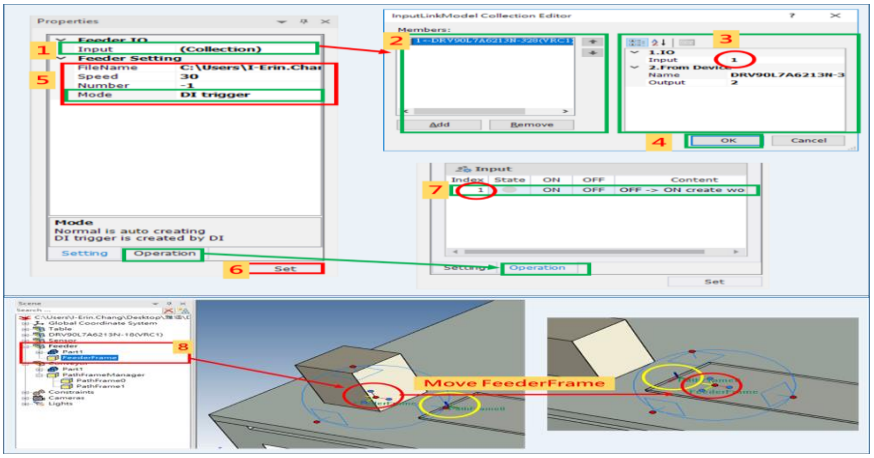




6. Click “**Set”** to save the settings.

2.9.4 Feeder

Feeder supports in generation of multiple work pieces. Feeder will automatically generate a default feeder frame, which can be modified later using TriBall.



Feeder properties can define parameters of Feeder IO control, feeding speed and quantity of work pieces etc.

- Feeder I/O: Input 1 group
- Operation: Click on Feeder → **Properties**
- Description of Properties settings

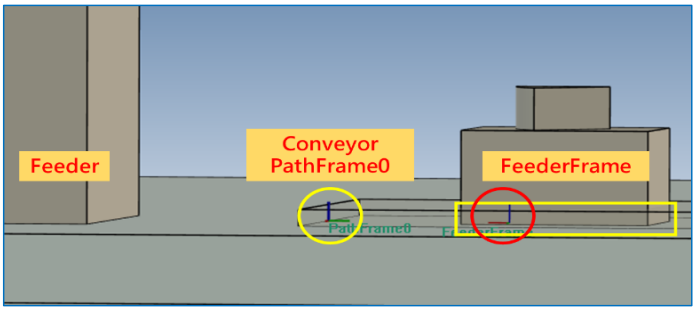
Description

1. Click on Input Feeder IO to do IO setting.
2. Add or remove I/O-connected objects.
3. Set the details of the I/O-connected object.
4. Set Input: Robot DO 2 connected with Feeder DI 1
5. Click **OK** to confirm the setting.
6. Feeder Setting
   a. File Name: Select CAD File Path. CAD File needs to be STP file.
   b. Speed: The speed at which the work piece is generated (pcs/min)
   c. Number: An amount of ***n*** produced (n is an integer greater than or equal to
      i. Zero and "-1" means infinite count)
   d. Mode:
      i. Normal: Auto generated →
      Normal mode selected; the Feeder IO **(steps "1 ~ 4"**) not necessary.

ii. DI trigger: Controlled by DI – Need to define step " 1~4 "

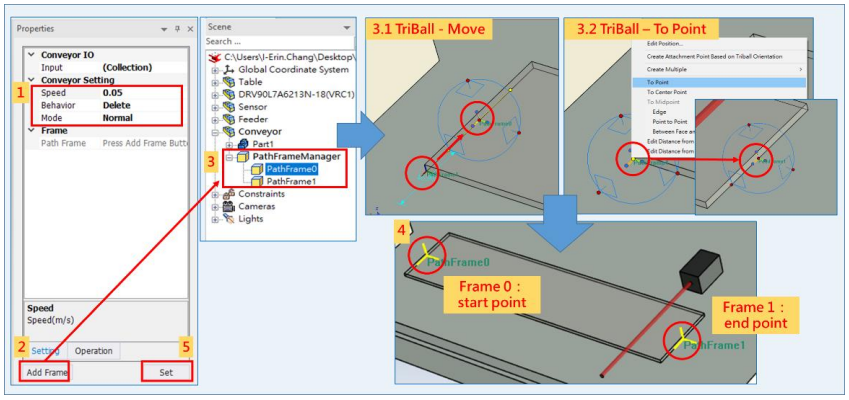
12. Click "**Set"** to save the settings.
13. Turn on the Simulator → Click **Operation**
    → Click to switch between ON and OFF (ON→OFF to generate materials)
14. Feeder Frame is the point on the workspace where the work piece will generate.
15. Note: Scenario: Work piece generated by Feeder and moved directly on conveyor.
16. Practice: Check Feeder Frame on the conveyor setting
17. The location of the Feeder Frame is after conveyor PathFrame0.
18. Ensure the work piece generation position intersects with the conveyor path frame

2.9.5 Conveyor



Conveyor supports in moving the work piece on the defined conveyor path frame. In simulation where user needs to move the work piece on a conveyor, built -in library function of conveyor used to configure.

- Conveyor I/O: 2 sets of Input (Input 1: Start/Stop; Input 2: forward/backward)
- Operation: Click Conveyor → **Properties**

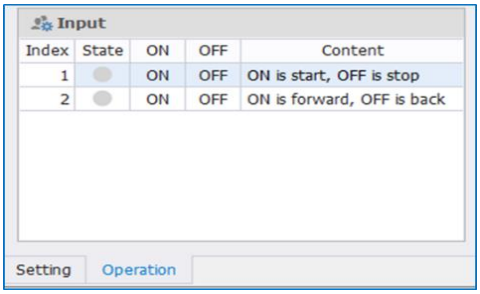


- Description of Properties settings:

Description

1. Conveyor Setting
   - Speed: Speed of conveyor belt movement (m/s)
   - Behavior
     a. STOP: Stop work piece after reaching the end point
     b. Repeated Movement: Move back and forth between the starting and ending points
     c. Delete: Delete work piece after arriving at the end point

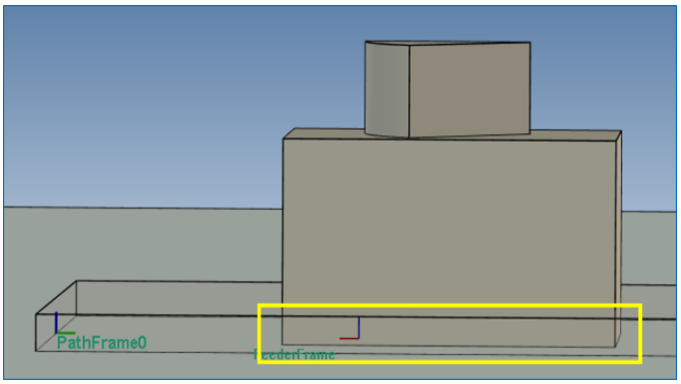
- Mode
  a. Normal: Automatic
  b. DI Trigger, controlled by DI
  → Need to set the [Input] in Conveyor IO (Similar to feeder setting steps 1-4). → After turning on the Simulator→**Operation** of Conveyor to perform IO control for the Input (Input 1: Start/ Stop; Input 2: forward/backward) control.



1. Click **Add Frame** → Add PathFrame0 (starting position) and PathFrame1 (ending position).
2. Go to the scene and select the newly added Path Frame. Use TriBall to move the position of Path Frame.
3. Method of moving:
   (3.1) Drag move to the target point.
   (3.2) Quick align: Right click → to point→Target point

- PathFrame0 Starting position; PathFrame1: Ending position
- Click "**Set"** to save the settings.

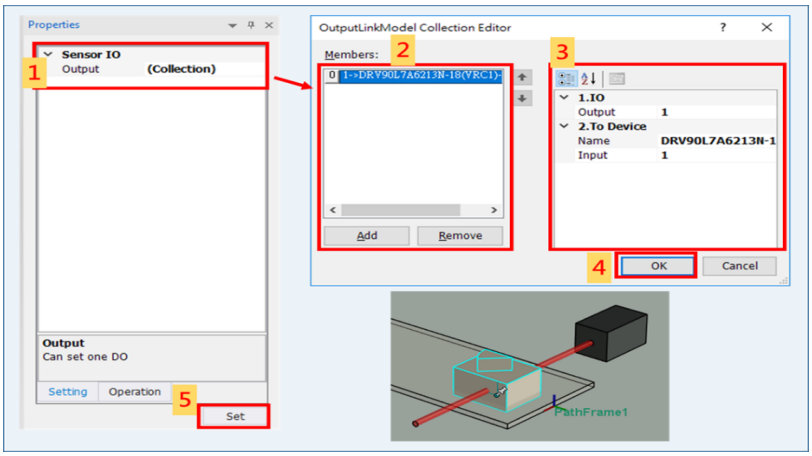
Note: Work piece generation frame needed to intersect with the conveyor frame so that the work piece moves on the conveyor.



2.9.6 Sensor

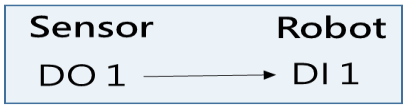
The sensor is a virtual element to trigger input when work piece intersects the sensor beam.
User to drag and drop sensor to the simulation view and configure sensor properties.
Sensor I/O: One set of Output

- Operation: Click on Sensor → **Properties**
- Description of Properties settings:



Description

1. Click on Input in Sensor IO to execute IO setting.
2. Add or remove I/O-connected objects.
3. Set the details of the I/O-connected object.
   (3.1) Set Input: Sensor DO 1 connected with Robot DI 1



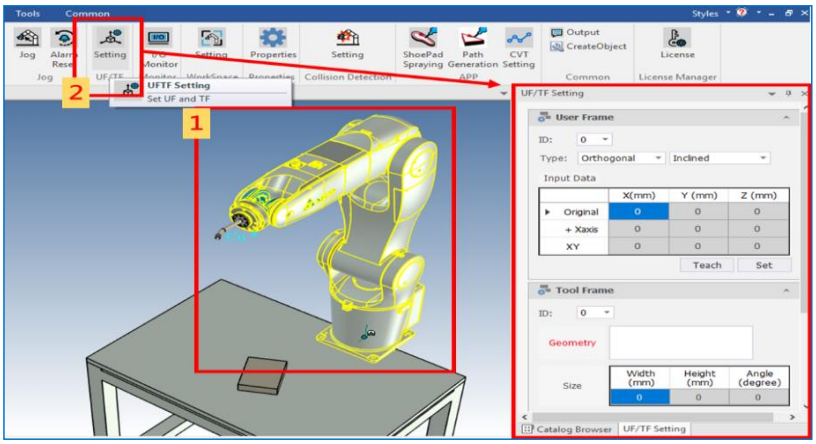
4. Click "**OK**" to confirm the setting.
5. Click "**Set**" to save the settings.

Note: Input trigger when the work piece intersects with the sensor beam.

2.10 UF/TF Definition

Menu to set the User Frame and Tool Frame for the Robot.

- Operation: Click on Robot → **Setting** (UF/TF)



Description

UF and TF will be active automatically after setting. In case, if the user needs to switch different UF/TF the same is possible in Jog screen.

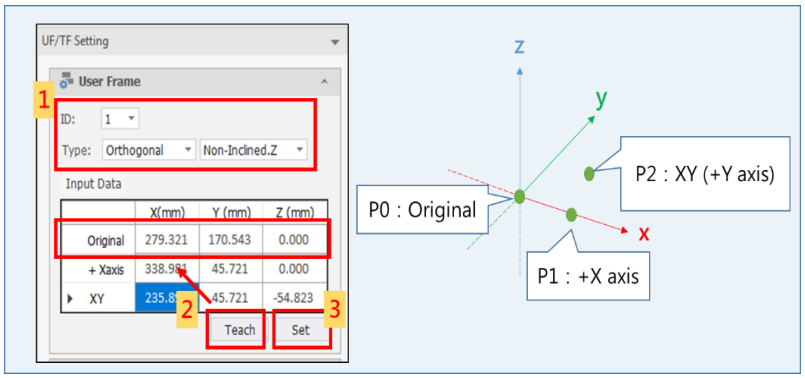
- ID: Users can set “9” sets (1~9), where default ID 0 cannot be changed
- Type:
  a. Orthogonal / Non-Orthogonal
  b. Inclined / Non-Inclined

2.10.1 User Frame (UF)

The user frame is user-defined coordinate system. User frame are 3-dimensional Cartesian coordinates defined for each operation space of work piece. The origin can be defined anywhere in the workspace. Normally work piece or workbench defined as user frame for ease of jogging and all point information saved based on user-frame origin reference

User Frame: Three points determination

■ Description of the setting:



Description

1. Set the ID and Type of the UF (orthogonal/non-Inclined)
2. Feed in details of P0 (Original), P1 (+X), P2 (XY) points

• Method 1: Directly enter information of P0 (Original), P1 (+X), P2 (XY) coordinates

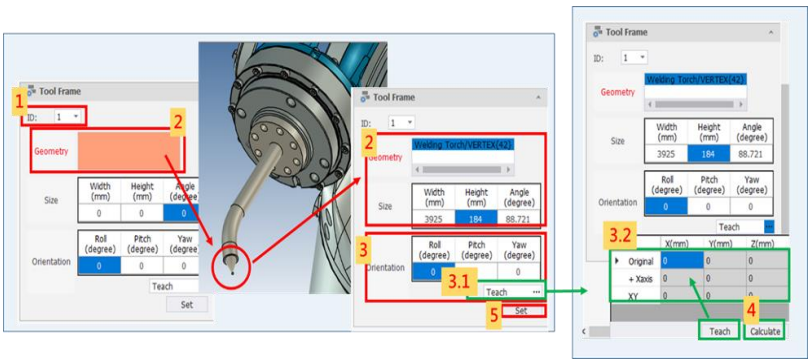
• Method 2: Teaching method

Use Jog and select Cartesian mode. Click [Teach] to teach three points.

3. Click “**Set”** to save the settings.

2.10.2 Tool Frame (TF)

A tool-mounting surface at the end of the robot is flange. Three-dimensional cartesian coordinates whose origin is at the center of the flange named TF0. User shall define the new TF data whose origin will be the end of the new tool mounted on the flange. Based on the tool dimensions offset distance components (width & height) and axis rotation angles is defined for the new tool frame.



■ Description of the setting:

Description:

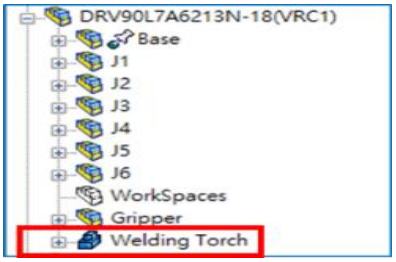
1. Use Jog and move Robot to Home.
2. Set the ID of the TF.
3. Define new tool: Click on the blank area of Geometry → Click on the endpoint of the tool.
4. Set Orientation:

- Method 1: Direct Input Method (Rotation Set). Direct input Pitch/Roll/Yaw of the tool.
- Method 2: Teaching method (Open Calibration)

(3.1) Click **Teach** in the TF.

(3.2) Teaching three points: Use JOG and select Mode Cartesian, with User Frame ID as 0 (UF: 0). Move the end point of the tool to a certain position. Select Origin (Original) / Extend the X point in direction of the positive X-axis (+X-axis) / Extend the Y-point in direction of the positive Y-axis (+Y-axis), any of the rows. Click on the **Teach** button to record the current position in the table.

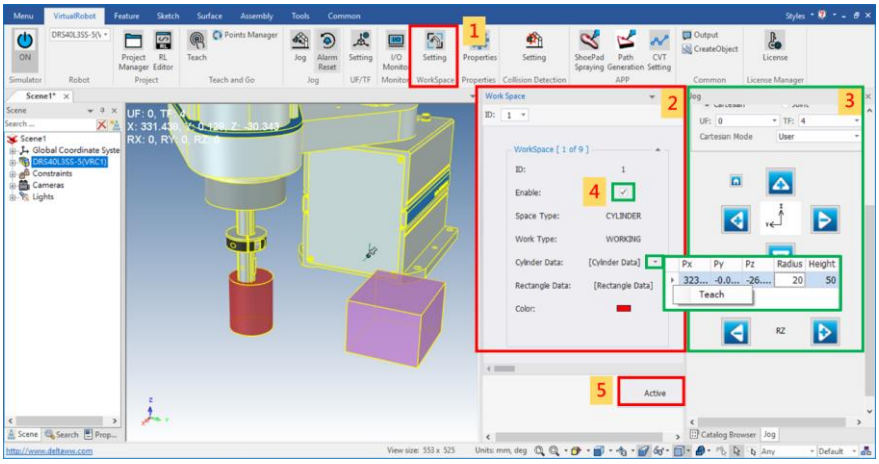
5. Click [Calculate].
6. Click [Set] to save the settings.



2.11 Work Space

Workspace supports in defining the working area and restricted area in the robot within the reach. Application where a user need to limit robot working and restricted area to monitor the robot movement to avoid peripheral equipment interference needs workspace definition. User can define nine sets of workspace by entering the position and its related parameters.

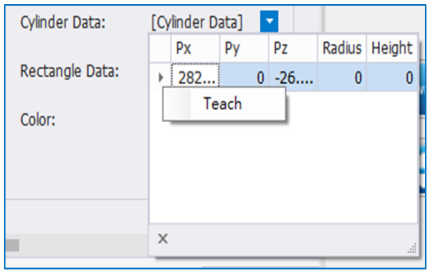
■ Operation:

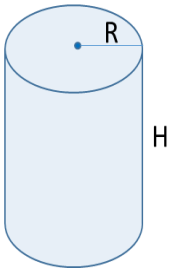


Description

1. Click **Virtual Robot** → **Setting** (Work Space)
2. Set Work Space parameters.
   - ID: There are nine sets of Work Space available
   - Enable – Activate/Deactivate this work area.
   - Space Type: Workspace shape
     a. Rectangle
     b. Cylinder
- Work Type:
  a. Working: Area where the robot can operate
  b. Restricted: Area where the robot movement is limited.
- Cylinder Data: Parameters to set the Cylinder workspace
  a. Click on the drop down arrow
  b. Jog the robot to the required position on the workspace to teach the center point of the cylinder workspace
  c. Right-click and select teach to set the current robot position as center point of Cylinder P_x, P_y, and P_z.

d. Radius: Enter the radius of the cylinder (mm)
e. Height: Enter the height of the cylinder (mm)





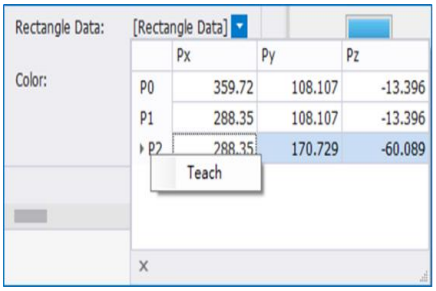
- Rectangle Data: Setting of rectangular range, with the three points of P0, P1, and P2 to determine the rectangular range.

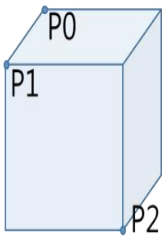
- Color: Set color

3. Use Jog option to move the Robot → Right-click to select **Teach** for teaching points.
4. Check **Enable** - Enable the list of work areas to be effective
5. Click **Active** -Open the Work Space function for the enable work areas

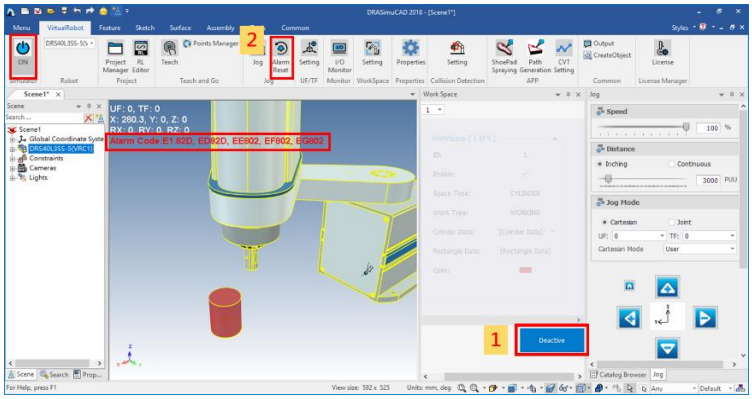
■ Alarm removal

A warning occurs when the robot moves beyond the defined work Space. User needs to de-active the Work Space function and then reset the Alarm to continue.





- Operation:



Description

1. When the Alarm appears, first click **De-active** to close the Work Space function.
2. Press **Alarm Reset** to remove the alarm.

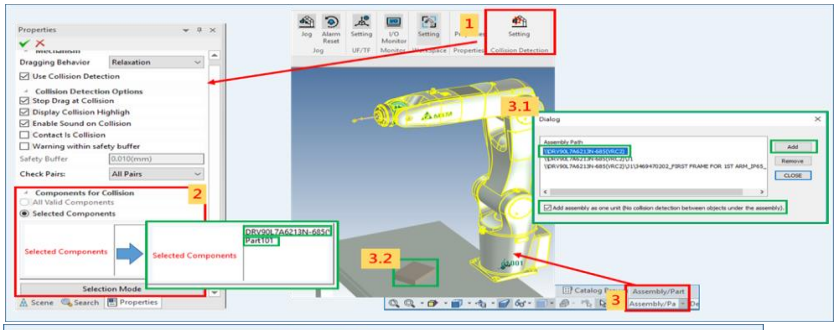
2.12 Collision Detection

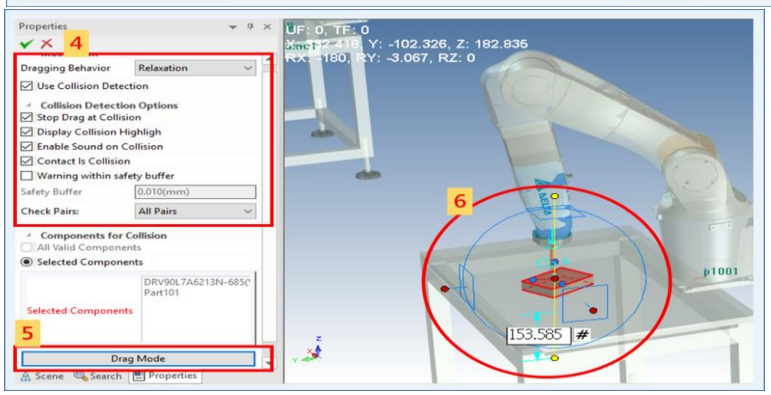
Collision detection is a function to check whether robots or other moving parts collide with peripheral equipment during simulation .A collision set contains two groups, Objects A and Objects B, in which user picks the objects to monitor collisions between selected groups . When any part in Objects A collides with parts in Objects B, collision displayed in graphical view, which will support the user to optimize the Layout.

User to define collision detection with the robot and its tool in one group and rest all parts in a different group to monitor collision detection.
Operation: Click on Robot → **Setting** (Collision Detection)

Function	Description
Use Collision Detection	Checked: Activate collision detection Unchecked: Deactivate collision detection
Stop Drag at Collision	If checked - When using TriBall to move a robot, the robot movement will be restricted when a collision takes place.
Display Collision Highlight	When the collision takes place, the color of the collided object highlighted in red.
Enable Sound on Collision	An audible beep sound will generated when a collision takes place.
Contact is Collision	Contact treated as collision.
Warning within safety buffer	Warning on the safety distance for collision detection. Detection object is less than safety distance (Safety Buffer value), the appearance of the detection object highlighted in Yellow.
Selected Components	List the objects active in collision detection
Operating mode: Selection Mode	List to add assembly as one unit (No collision detection between objects under one assembly)
Operating mode: Drag Mode	Start collision detection

- Operation:





Description

1. Import Robot, open Jog window and RL editor & Click Virtual Robot→ Collision Detection
2. Check **Selected Components** → Selection Mode → Feature to add objects for collision detection (Possible to add multiple objects as Assembly).
3. Set the method of object selection to **Assembly/Part**
   (3.1) Click Robot in the simulation window → Check [Add assembly as one unit]→**Add**
   (3.2) Select multiple object in simulation screen and add → Check [Add assembly
4. One unit] → **Add**
5. In Mechanism →Dragging Behavior, select Relaxation → set other collision detection parameters (as per description of parameter settings).
6. Switch to **Drag Mode**.

7. Move the robot for collision testing.
   (6.1) Click on the end of the Tool and use TriBall to drag the robot directly.
   (6.2) Use Jog to move the robot (Disable TriBall)
   (6.3) Use RL to control the robot (Disable TriBall)

Note:

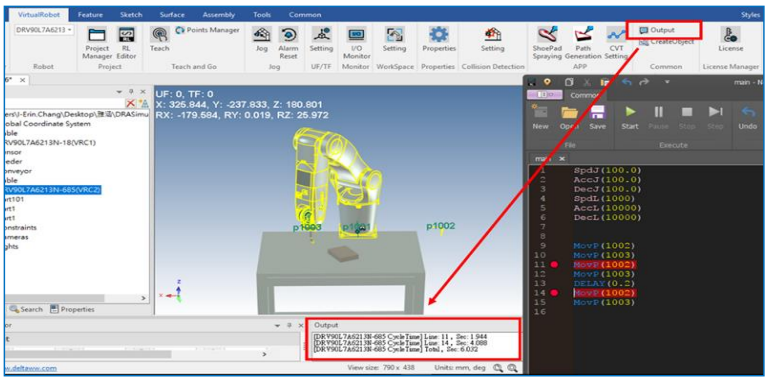
1. Switch the simulation screen to **Shaded**. The screen update will be smoother.

2. The robot position obtained by dragging the TriBall drag Mode cannot be used for teach and save
3. Click on ✔ or ✘ in the collision detection window to stop collision detection.
   ✔ Stop collision detection and maintain the current position of all objects
   ✘ Stop collision detection and restore the position of all objects
4. Closing the collision detection window is equivalent to turning OFF simulation of the collision detection.

2.13 Common

2.13.1 Output (Display Cycle Time)

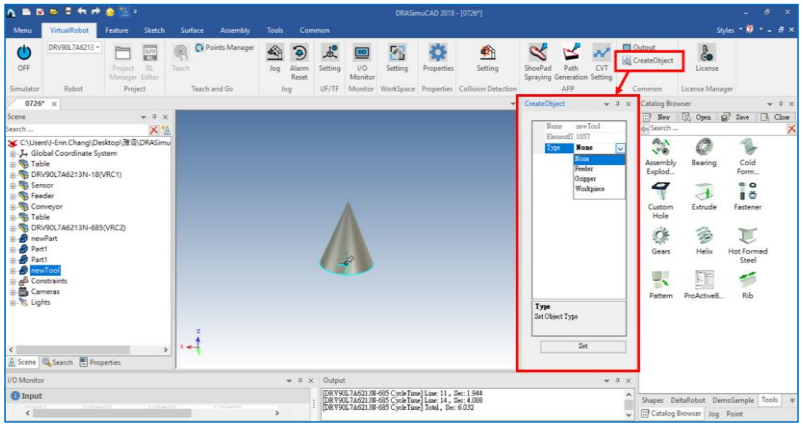
Output window will display the time taken for the robot for execution. If break point used in RL editor then the time taken to reach the breakpoint pointer shall be displayed.
Total time taken for the RL execution displayed at end of the every cycle.



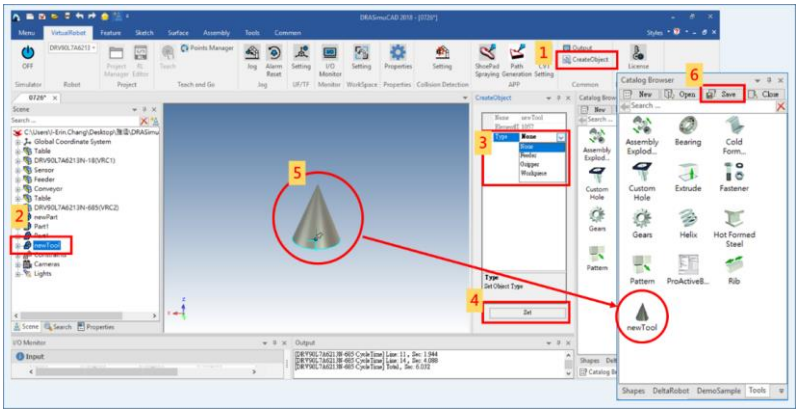
2.13.2 Create Object (User-defined Object)

Users can design customized parts/assemblies and set user defined object type like Feeder, Gripper, link devices and Work piece etc. and import within simulation environment.

- Operation: Create a component → Select the component → Virtual Robot→ Create Object



- Description of the settings:



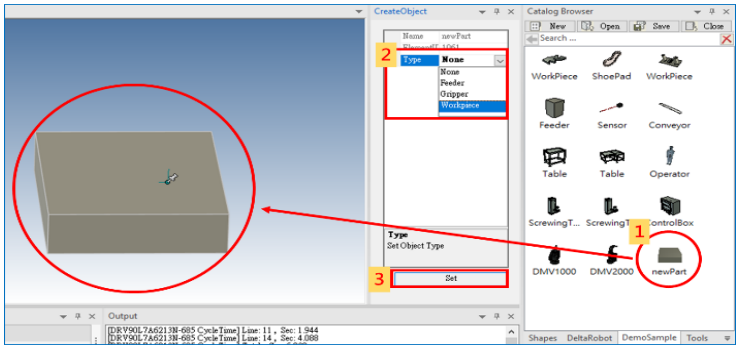
Description

1. Select component → Click **Create Object**

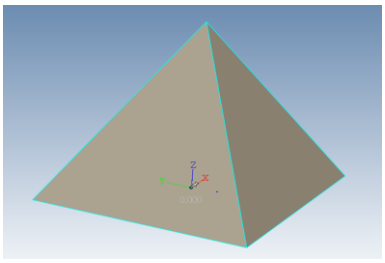
2. Change component name (Element ID cannot be changed).
3. Set the component type (Type: None, Feeder, Gripper, and Work piece).
4. Click **Set** to save the settings.
5. Drag the set component to the Catalog.
6. Click **Save** to save the Catalog.

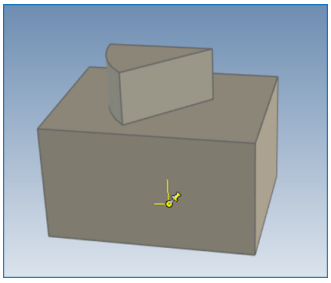
Note:

1. Feeder needs to be assembly, not as a part
2. The work piece parameters of feeder is set in Virtual Robot → Properties → File Name (Refer Feeder in Section 2.9.4)
3. Work piece can be added from Catalog browser , but default type of the new work piece when pulled to the simulation screen is none, so user need to set the type as Work piece with create object function.



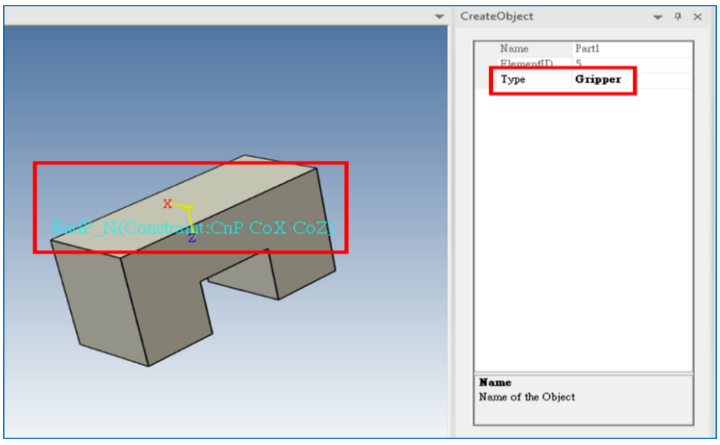
4. Work piece generation by Feeder –Work Piece anchor point to be maintained at global coordinate origin. Work piece will generate at feeder frame position added with offset distance from the global origin.





■ Example: Create Gripper

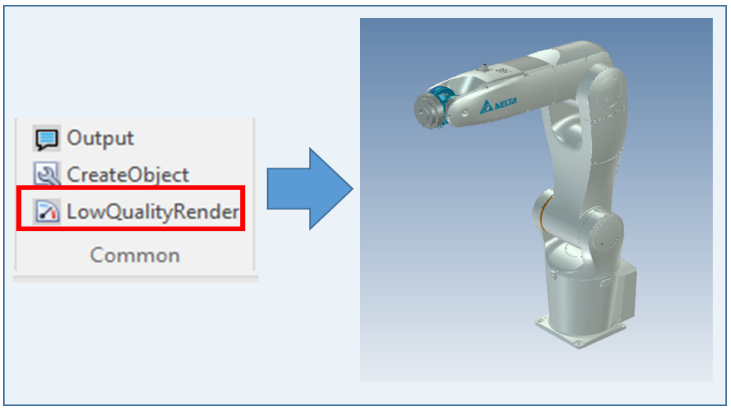
• Operation: Use the component library shapes to create Gripper (Refer Shapes Section 2.1.1) or import the Gripper Step file (Refer Gripper Import Section 2.9.3). → Create the EndP joint point (Refer Attachment Point Section 2.2.6), and verify whether the Z axis coordinate of the joint point is oriented correctly → Click on Create Object → Set component type: Gripper



2.13.3 Low Quality Render

Optimizes screen performance and simulation speed. If user works with CAD models of bigger size recommended to choose Low Quality Render to evaluate the cycle time, which shall automatically optimize the screen and the simulation performance.

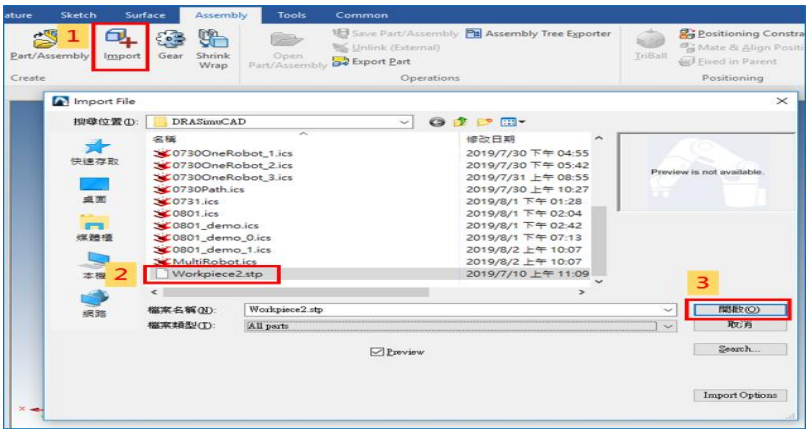
- Operation: Virtual Robot → **Low Quality Render**



2.14 Import/Export CAD files

Import/export files of equipment, geometries, reducer, jig, Work piece, robots, tools and standard libraries etc.

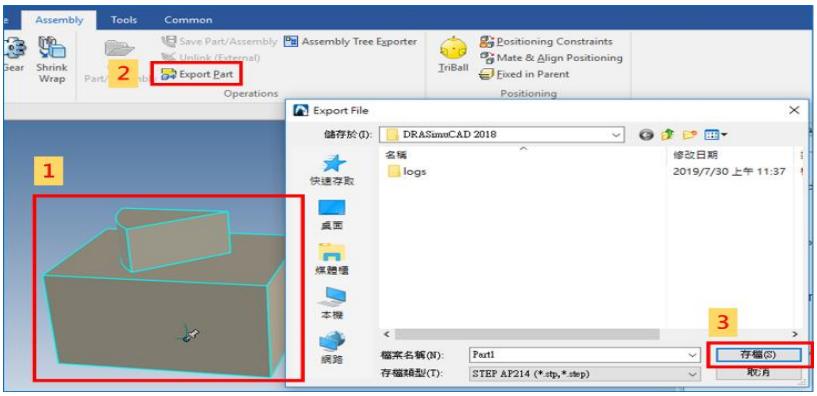
- Instructions for importing files: Click the toolbar **Assembly** → **Import** → Select the file → **OPEN**



- File format supported for import

File format	File extensions	File format	File extensions
ACIS Part	*.sat	**VRML**	*wrl
Parasolid Part	*.x_t; *.xont_txt	**SketchUp**	*.skp
STEP AP203/214	*.stp; *.step	**HOOPS OOC**	*.ooc
Romulus	*.xmt	**Point Cloud**	*.pts; *.ptx; *.xyz
IGES	*.igs; *.iges	**Pro/E Part**	*.prt
IronCAD Part	*.ics; *.ic3d	**Pro/E Assembly**	*.asm
TriModel	*.tmd	**CATIA V4**	*.model
3D Studio	*.prj; *.3ds	**CATIA V5**	*.CatPart; *.CatProduct; *.cgr
trueSpace	*.scn; *.cob	**4UG**	*.prt
AutoCAD 3D DXF	*.dxf	**Solid Works**	*.sldprt; *.sldasm; *.prt; *.asm
AutoCAD 2D File	.dxf; *.dwg	**Inventor**	*.ipt; *.iam
Wavefront	*.obj	**JT**	*.jt
Raw	*.raw	**Solid Edge**	*.par; *.asm; *.psm
Stereolithography	*.stl; *.sla		

- Instructions for exporting files: Click on the object → Click on the toolbar **Assembly** → Export Part→ **Save**



- File format supported to export

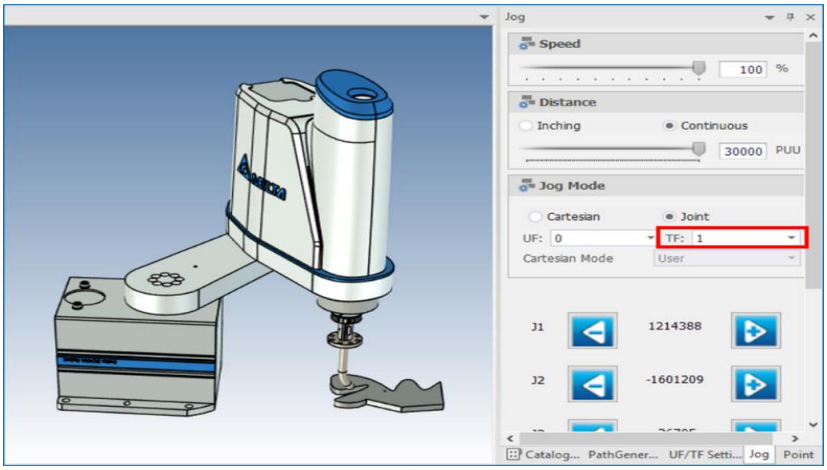
File format	File extensions	File format	File extensions
ACIS R26	*.sat	**Parasolid 29.0**	*.x_t
ACIS R24	*.sat	**Parasolid 26.1**	*.x_t
ACIS R23	*.sat	**Parasolid 25.1**	*.x_0
ACIS R21	*.sat	**Parasolid 24.0**	*.x_t
ACIS R19	*.sat	**Parasolid 22.1**	*.x_t
ACIS R18	*.sat	**Parasolid 21.0**	*.x_t
ACIS R17	*.sat	**Parasolid 19.1**	*.x_t
ACIS R16	*.sat	**Parasolid 19.0**	*.x_t
ACIS 7.0 Part	*.sat	**Parasolid 17.1**	*.x_t
STEP AP203	*.stp; *.step	**Parasolid 16.0**	*.x_t
STEP AP214	*.stp; *.step	**Parasolid 11.0**	*.x_t
IGES	*.igs; *.iges	**3D PDF File**	*.pdf
CATIA V4	*.model	**Hoops Stream File**	*.hsf
CATIA V5 Part	*.CatPart	**IronCAD Mobile File**	*.icsw
CATIA V5 Assembly	*.CatProduct		

3. Application APP

3.1 Path Generation

Path Generation helps in generating accurate paths (linear and circular) based on CAD geometry. Path generation feature can create both linear and circular paths along the selected edges of a surface. To create a path user need to select the edge using enable edge selection mode and choose multiple edges and the closest edge of the selection be picked for inclusion in the path generation.
Operation: Click directly on Virtual Robot → Path Generation

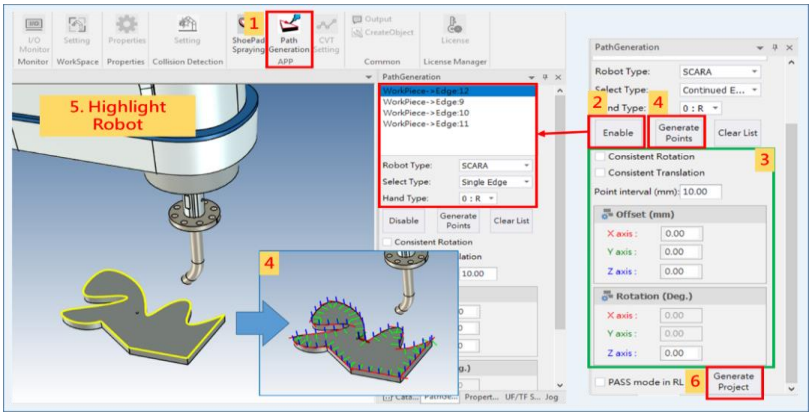
- Scenario setup:



Description

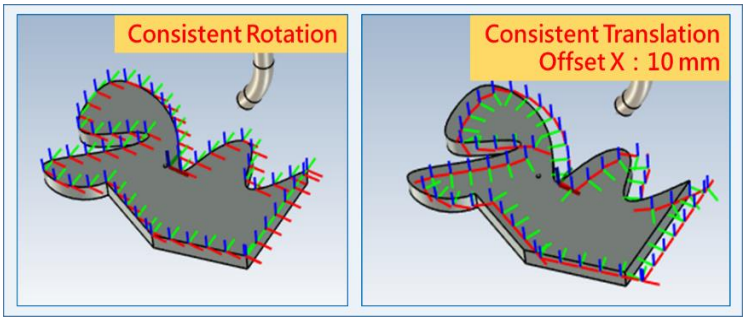
1. The robot returns to Home.
2. Combine the robot with Tool.
3. Set up Robot TF.
4. Drag in the part/component for path generation inside the simulation window

■ Description of the setting:



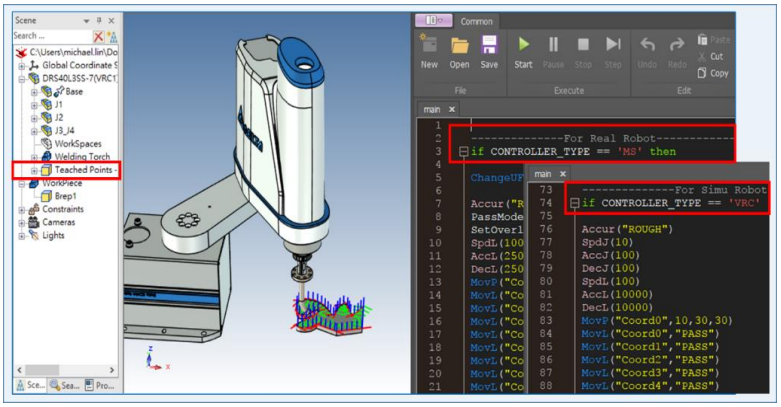
Description

1. Import the object and click Virtual Robot→ Path Generation
2. Set Robot Type, Select Type, and Hand Type. → Click **Enable** to enable the edge selection mode → Select edges in order on the part (**Clear List**: Clear all selected edges and paths).
   - Robot Type:
   a. SCARA
   b. SCARA5
   c. VA
   - Select Type (edge selection mode):
   a. Single Edge: Picks the single edge
   b. Continued Edge: Picks the continuous line connected to the edge.
   - Hand Type (hand system):
   a. 0: R (right hand)
   b. 1: L (left hand)
3. Set the parameters of the path generated
   - Consistent Rotation: Coordinates of path generated maintains the set value of RZ. The direction of rotation of RZ defined as Z-axis rotation in degree.
   - Consistent Translation: All paths translated together over a fixed distance.



- Point interval (mm): Spacing per point

4. Click **Generate Points** to generate the point and User Frame.
5. Select the Robot.
6. Click **Generate Project** to generate the project for the robot (including points and RL).

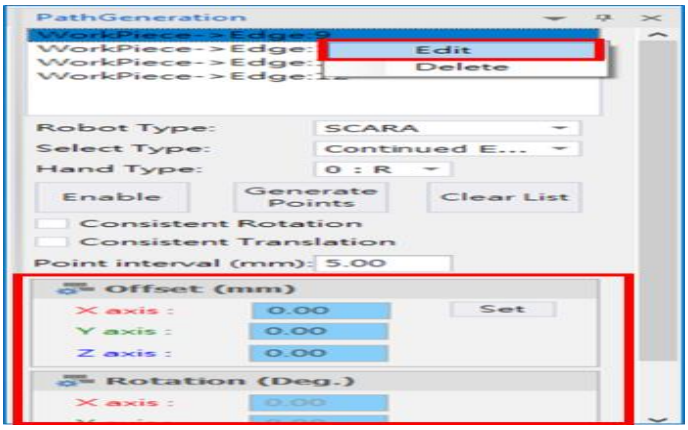


Note:

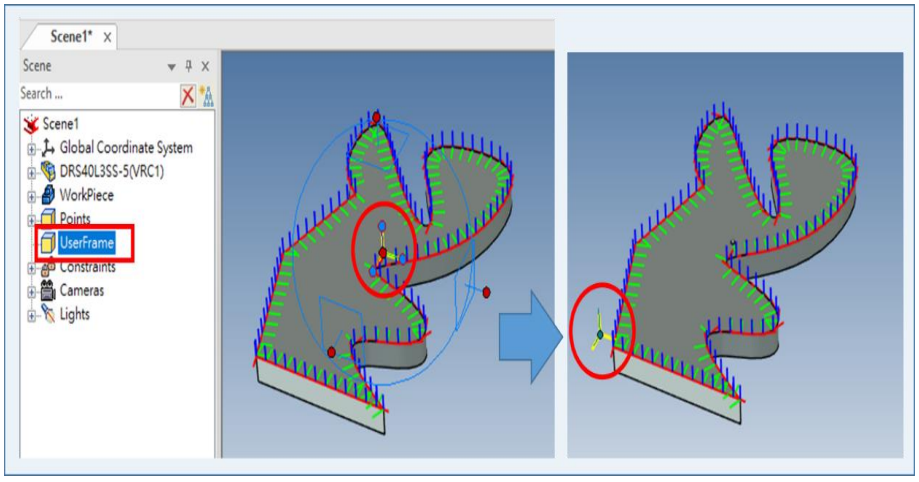
1. PASS mod in RL: If checked the RL will be generated with PASS instruction (Refer RL User manual for details)
2. Project can be exported directly to MS for program execution (Refer Project Management Section 2.5).

3. Editing and deletion of a single edge

- Operation:
  Click **Disable** to close the edge selection mode → Click the left button on the single edge to edit.
  Select **Edit** / **Delete**→ Set the Offset and Rotation of the single edge.

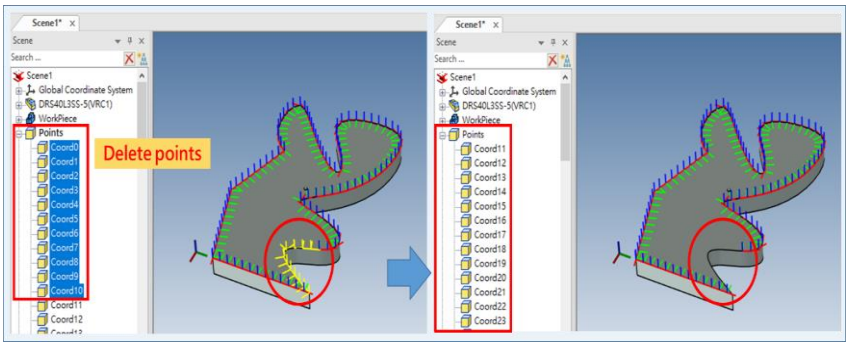


4. Setting UF origin
   Generate Points will automatically generate the path coordinates of the selected edge and the default User Frame will also be generated at the same time. Choose User Frame and activate TriBall to move the UF origin.



5. Edit/ Delete Point

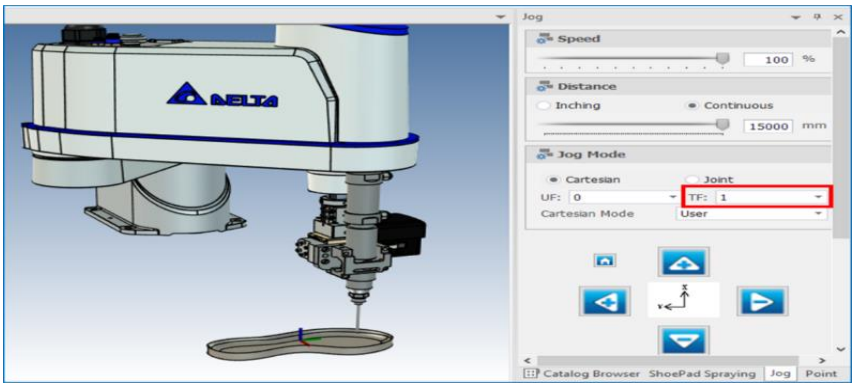
   Upon successful generation of the project user can access the coordinate points under the Scene tree/Robot/Teach points. User can selected individual points, check the reference simultaneously in the simulation window and edit / delete the points as per the application.



3.2 Shoe Pad Spraying

Shoe Pad Spraying App supports in generating accurate paths (linear and circular) based on edges selected in the Shoe Pad CAD geometry. Shoe Pad Spraying will have additional features of spray distance and inward offset which are relevant to Shoe Pad application.

- Operation: Click Virtual Robot → Shoe Pad Spraying
- Scenario setup:

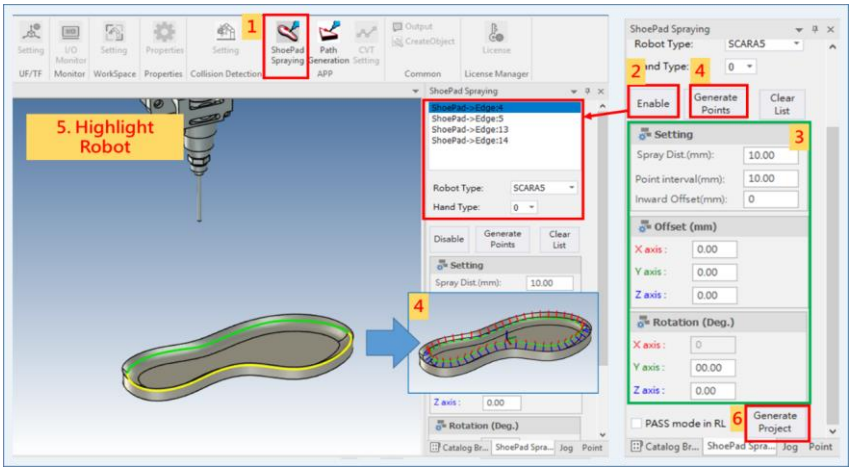


Description

(1) Robot returns to Home.

(2) Combine the robot with Tool.

(3) Set up Robot TF.

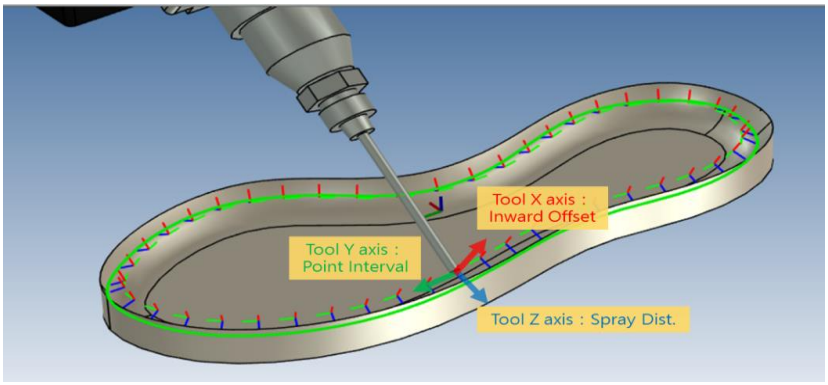


(4) Drag in the part/component for path generation inside the simulation window

■ Descriptions of the setting:

Description:

1. To import objects, click Virtual Robot→ **Shoe Pad Spraying**
2. Set Robot Type, Select Type, and Hand Type. → Click **Enable** to enable the edge selection mode → Select edges in order on the part (**Clear List**: Clear all selected edges and paths).
3. Set the parameters for the path generation
   - Spray Dist. (mm): The distance from the point along the Tool Z axis to the spray side
   - Point Interval (mm): Pitch between the point along the Tool Y axis and the subsequent point
   - Inward Offset (mm): The offset distance of the point from the spray side along the Tool X axis



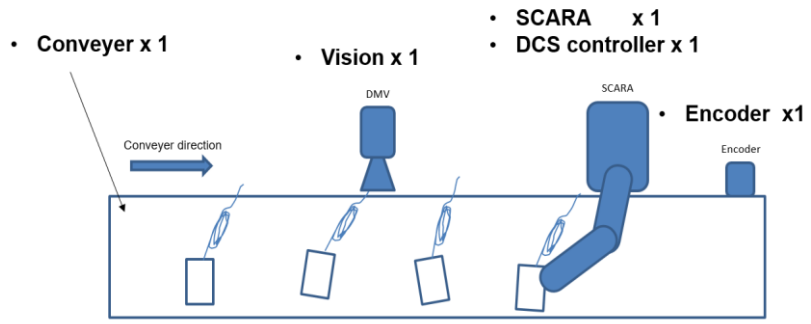
1. Click **Generate Points**.
2. Click on Robot.
3. Click **Generate Project** to generate the project for this robot (including points and RL).

Note:

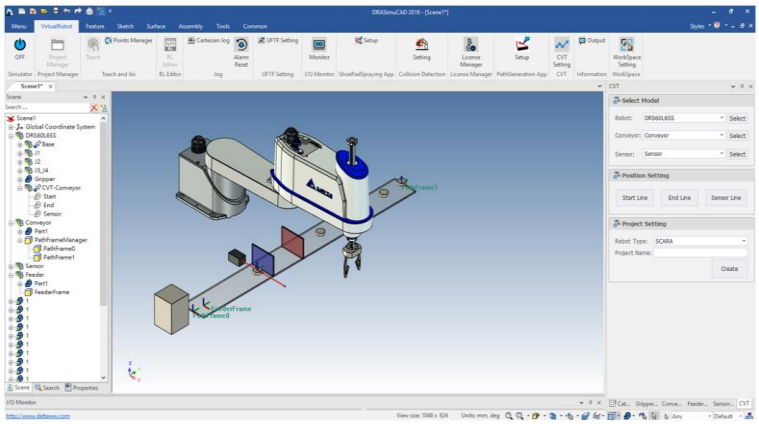
1. PASS mod in RL: If checked the RL will be generated with PASS instruction (Refer RL User Manual)
2. Project can be exported directly to MS for program execution (Refer Project Management Section 2.5)

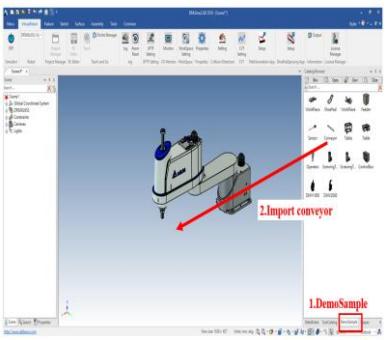
3.3 Conveyor Tracking – CVT

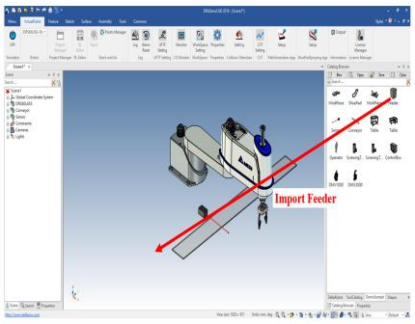
Conveyor tracking, robot Tool Frame (TF) will automatically follow a User Frame defined on the moving conveyor. While tracking the conveyor the robot will maintain the programmed TF speed relative to the user frame even if the conveyor runs at different speeds.
Architecture of Conveyor Tracking – Refer below Picture (Refer Delta Conveyor tracking User manual)



- Simulation Scenario setup:



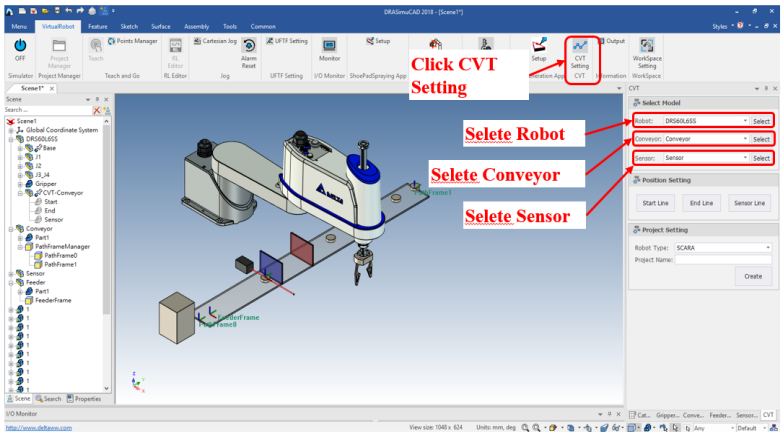




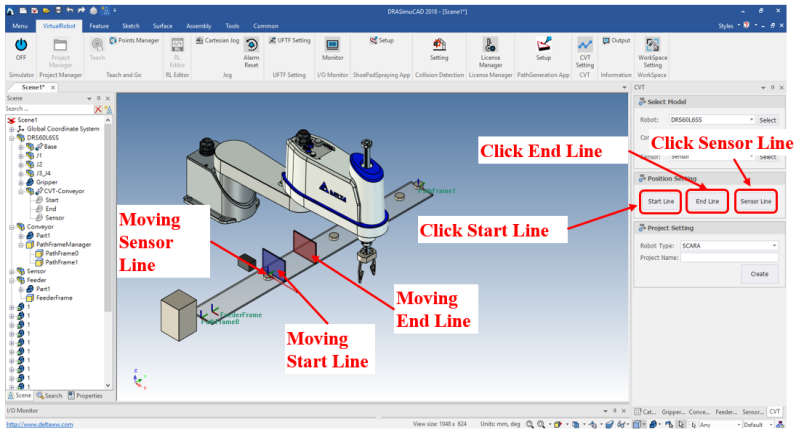
■ Description of the setting:

Description

1. Import robot from Catalog Browser Virtual Robot → Delta Robot →DRS/VA
2. Attach gripper from Catalog Browser Virtual Robot → Tools Catalog →Gripper
3. Define TF data (Refer Tool Frame Section 2.10.2)
4. Import conveyor from Catalog Browse Virtual Robot → Demo Sample →Conveyor
5. Set conveyor parameter (Refer Conveyor Section 2.9.5)Virtual Robot → Properties
6. Import Feeder from Catalog Browse Virtual Robot→ Demo Sample→Feeder
7. Set Feeder parameter (Refer Feeder Section 2.9.4) Virtual Robot→ Properties
8. Import sensor from Catalog Browse Virtual Robot → Demo Sample→Sensor
9. Set sensor parameter (Refer Sensor Section 2.9.6) Virtual Robot→ Properties
10. Configure Sensor DI/DO and sensor DI/DO) Virtual Robot → Properties
11. Enter CVT Setting Virtual Robot → CVT Setting
    i. In select model /Robot – Click select and highlight the robot in simulation window
    ii. In select model /Conveyor – Click select and highlight the conveyor in simulation window
    iii. In select model /Sensor – Click select and highlight the sensor in simulation window
    iv. Upon confirmation that the robot model , conveyor and sensor name appears in the select model click “**Set**”

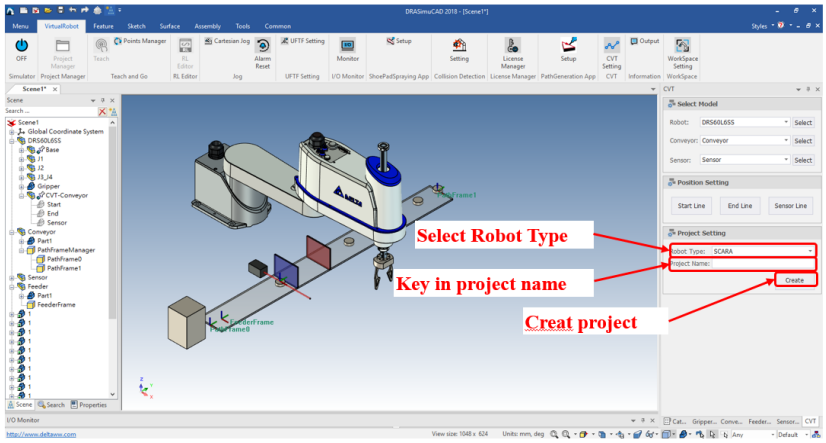


1. Position setting
   i. Click Start line , End Line and Sensor line
   ii. User can identify that a rectangular box indicating sensor line , start line and sensor line will be appearing in the simulation window



   iii. Under scene browser – User can identify the CVT Conveyor line added
   iv. Expand CVT conveyor and using TriBall locate the start line , end line and sensor line on the simulation window
   v. Ideally start line and End line should be within the robot reach and sensor line to be located at the sensor intersection point with the conveyor direction

2. Project Setting
   i. Select robot type SCARA / VA as per the application
   ii. Key in the project Name
   iii. Highlight the robot and create the project



3. Open Project Manager and edit the project
4. Set the UF and TF data (Refer Tool Frame Section 2.10.2)
5. Teach point “P0” Standby point
6. Teach point “P1” UF point for tracking
7. Optimize trans_ccd_x & trans_ccd_y values such that the Robot tracks the work piece on the moving conveyor
8. Execute the project

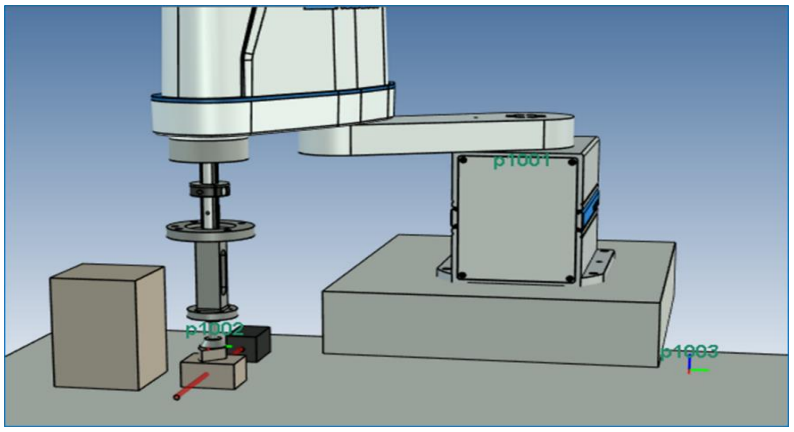
Note:

a. Conveyor, feeder and sensor position needs optimization suiting the application requirement.
b. Its recommended to check the conveyor feeder and sensor function individually before doing CVT setting
c. Conveyor speed and feeder speed to be optimized for the tracking time and distance, if not robot will drop the user frame if the connected user frame goes beyond the end line.
d. Monitor window for IO updates to be opened simultaneously to ensure the cross connection of input with sensor and output trigger
e. PASS mod in RL: If checked the RL will be generated with PASS instruction (Refer RL User Manual)

4. Example of application scenario setup

4.1 One Robot Pick and Place

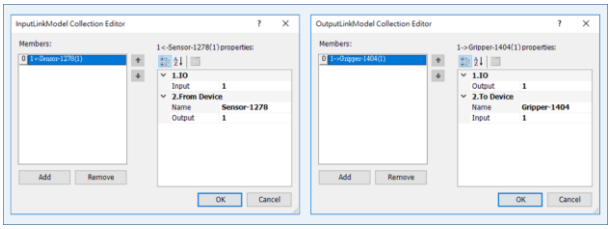
- Reference- Tutorial video "Tutorial1_OneRobotPickAndPlace".
- Scenario setup: Once the sensor detects the feeder-generated object, the robot starts to pick up and place the objects.



Description

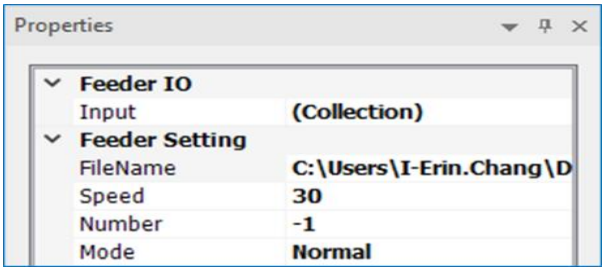
1. Switch to screen-viewing angle TFR.
2. Import the table and riser into the simulation screen (Riser used to elevate the robot).
3. Attach the robot with the tool→ **UF/TF** to set Robot TF.
4. Click on Robot → Project Manager to add a project.
5. Make sure the TF change is successful: **Jog** → Switch TF ID → Jog the Robot → **Teach** point.(Cross check the TF data)
6. Set Robot **Properties** → Robot IO.
7. Input: Sensor

- Output: Gripper



1. Set up Feeder

   1.1 Properties



   1.2 Turn ON simulation button → Generate a work piece → Turn off simulation switch.

   1.3 Hide the Feeder → Delete the work piece other than the source work piece, leaving the source work piece → Change the Anchor of the source work piece.

   1.4 Display the Feeder → Adjust the Feeder Frame to the target position where the work piece to be generated.

   1.5 Turn ON simulation button → Generate a new work piece and confirm that the anchor position changed successfully →close the simulation button.

2. Set the number of the Feeder **Properties** to zero (stop generating work piece).
3. Select Robot → **Jog** to the grip position → **Teach** point → **Jog** to the placement position → **Teach** point.
4. The number of Feeder **Properties** is set to -1 (infinite number of work pieces generated)

5. Open RL editor and edit RL
6. Turn ON the simulation execute the RL to run the simulation.

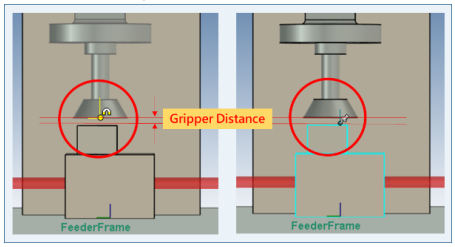
```
main*
--Start To Write RL
RobotServoOn()

SpdJ(10.0)
AccJ(25.0)
DecJ(25.0)
SpdL(1000)
AccL(10000)
DecL(10000)


while true do
    if DI(1) == "ON" then
        -- sensor ON --
        MovP(1002)   -- move to p1002
        DELAY(0.05)
        DO(1,"ON")   -- gripper ON: pick up
        MovP(1003)   -- move to p1003
        DELAY(0.05)
        DO(1,"OFF")  -- gripper OFF: place

    elseif DI(1) == "OFF" then
        MovP(1002)
    end
end
```

Note:

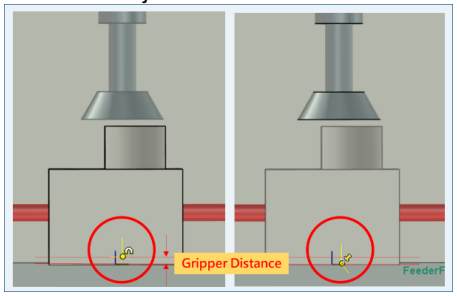
Work Piece and Gripper anchor:

The distance between the anchor position of the gripper and work piece to be ensured within the range of the gripper setting distance.

- Method 1: Adjust anchor position of the work piece

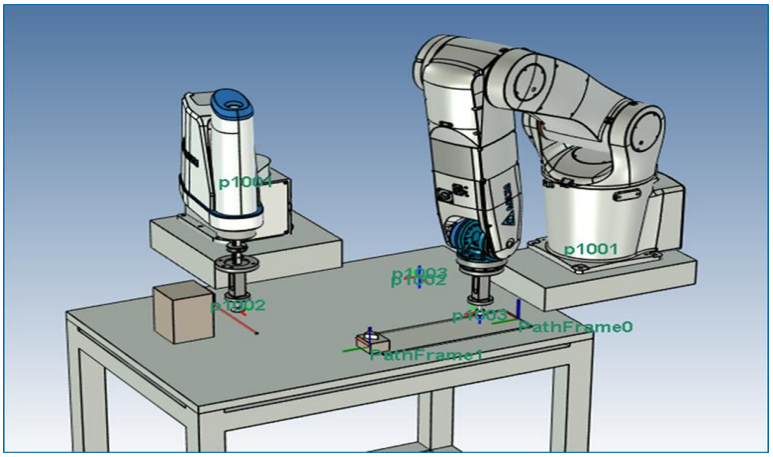


- Method 2: Adjust anchor of the End Point of the tool



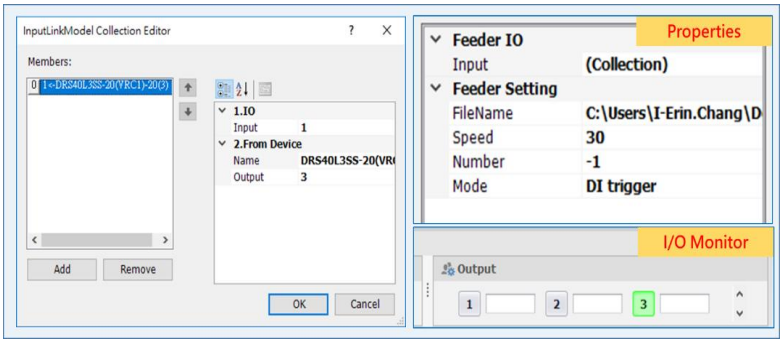
4.2 Multi Robot Demo

- Reference-Tutorial video "Tutorial2_MultiRobot".
- Scenario setup: Continuation of the scenario in chapter 4.1 of object pickup and place with six-axis robots added additionally. Complete IO communication between two arms, and combine Conveyor for moving objects.



Description

1. Open "Object Pickup and Placement Scenario" (section 4.1).
2. Change the Mode of the Feeder to DI Trigger Controlled → With control by SCARA Output 3, generate a new work piece → Change and confirm that the anchor of the source work piece is within the range of gripper Tool.



3. Import the old SCARA project → Grip the work piece → Jog to move it to the placement position.

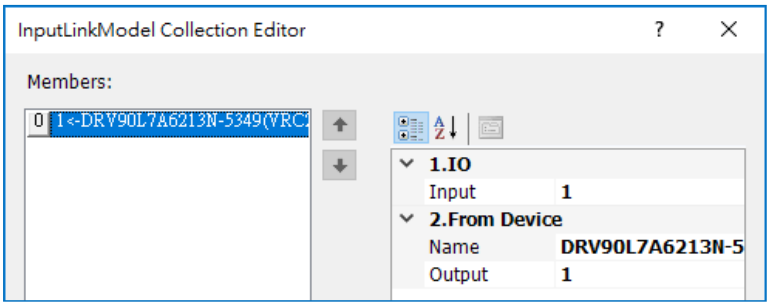
4. Drag and drop six-axis VA robot from the catalog.

   (4.1) Attach the tool on a six-axis robot.
   (4.2) Setting up a six-axis Robot TF.
   (4.3) Adding a six-axis robot project.
   (4.4) **Teach** test point to confirm that the TF setting is successful.

5. Drag conveyor from the catalog to adjust position and size.

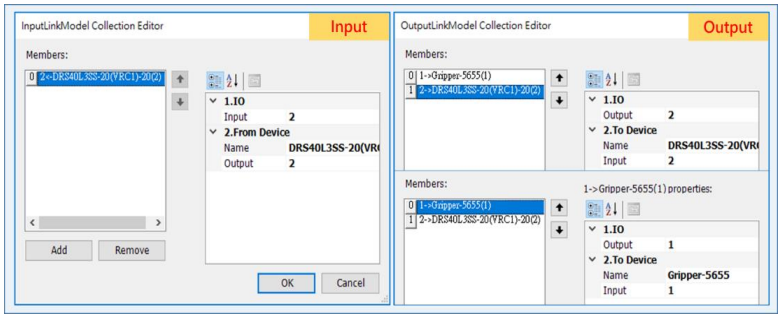
6. Set Gripper **Properties** → Gripper IO.

   - Input: Six-axis Robot



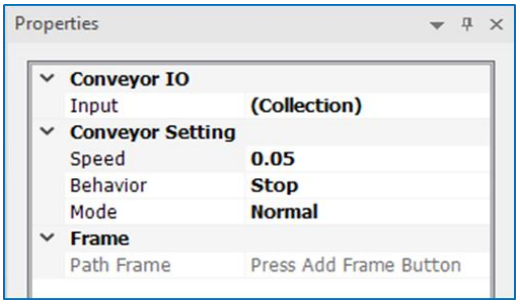
7. Set Robot **Properties** → Robot IO

   - Input: SCARA
   - Output: (1) Gripper, (2) SCARA



8. Set Conveyor Properties

   (8.1) Properties

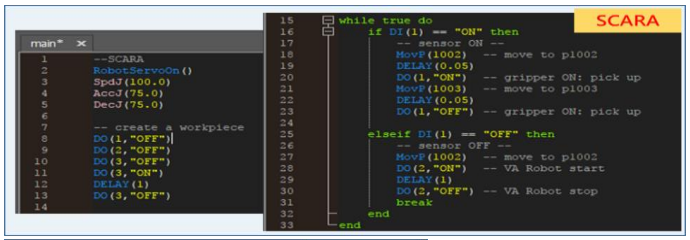


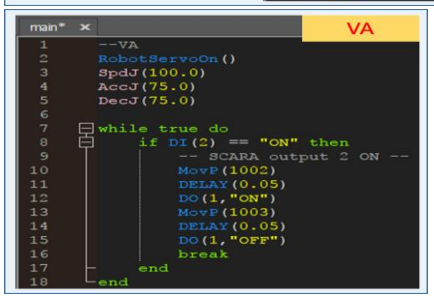
   (8.2) Click **Add Frame** → Add PathFrame0 (starting position) and PathFrame1 (end position) → Use TriBall to move PathFrame0 and PathFrame1 positions.

9. Select the six-axis Robot → Grip the work piece → **Jog** to the gripping position → **Teach** Point of placement position→ **Jog** to the placement position → Place the work piece and ensure that the part will be moved by the conveyor → **Teach** Place point.

   Note: The work piece anchor needed to overlap with the conveyor plane, so that the work piece can move once the conveyor switched ON.

10. User to edit RL.

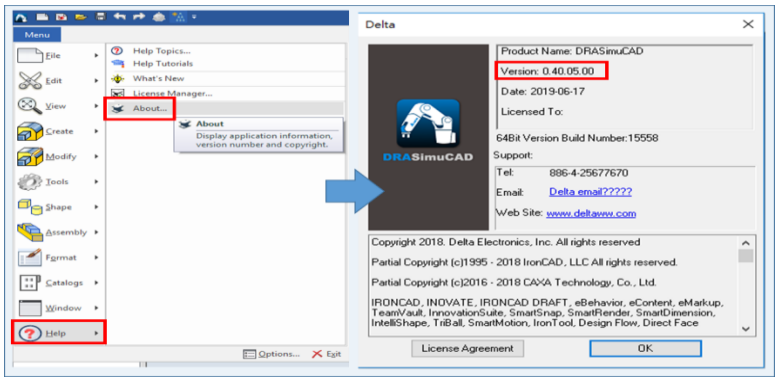




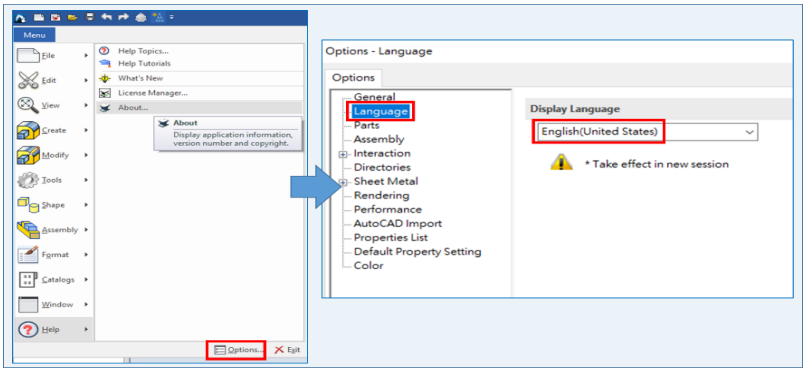
11. Turn ON the simulation button and execute the RL to run the simulation.

5. Frequently Asked Questions - User FAQ

1. How to check the DRASimuCAD version installed?
2. Click Menu→ Help→ About.

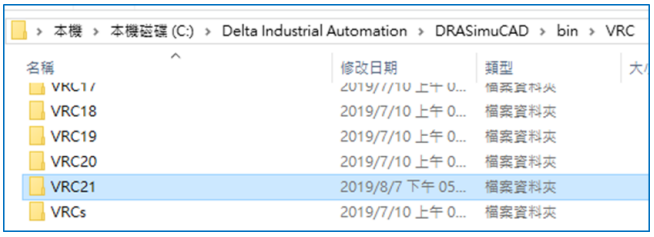


3. How to change the language of the User Interface?
   Click Menu→Options → Language. After changing the settings, close and reopen DRASimuCAD.



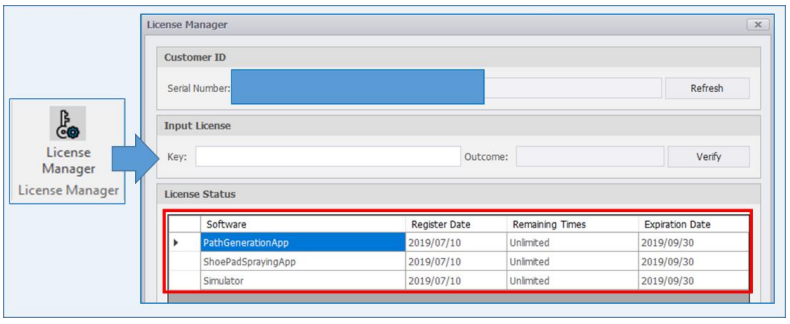
4. What will be stored in the project archive?
   C:\Delta Industrial Automation\DRASimuCAD\bin\VRC\VRC1\lua ➔ RL project, point data
   C:\Delta Industrial Automation\DRASimuCAD\bin\VRC\ VRC1\VRC Parameter ➔ UF, TF, Workspace

5. Where is the folder location to execute the MS controller project backup of the MS in DRASimuCAD?
   C:\Delta Industrial Automation\DRASimuCAD\bin\VRC\VRC1\lua
   See section 2.4 for details.
6. How many virtual Robot can be imported and used to make simulations in the current version?
   Maximum of Twenty Virtual robots, however, the performance based on the PC configuration with independent graphic card, CPU i7, and RAM 16g to support an operation with 20 virtual robots.
   How do we increase the number of virtual robots by user?
   Copy paste and re-name the VRC20 folder under the below path (C:\Delta Industrial Automation\DRASimuCAD\bin\VRC folder) and re name it to VRC21.



7. What is the location for TF and UF parameter files?
   C:\Delta Industrial Automation\DRASimuCAD\bin\VRC\VRC1\VRC Parameter
8. How much length can the project name be?
   “26” English characters maximum
9. How to create a new tool?
   Refer Gripper Section 2.9.3 and Tool Frame Section 2.10.2
10. Draw a tool (Refer Shapes Section 2.1.1) → Create an attachment point (Refer Attachment Point Section 2.2.6) → [Create Object] (Refer Gripper Section 2.9.3) → Component Type: Gripper.
11. How to create a user defined object?
    Draw objects (Refer Gripper Section 2.9.3) → [Create Object] (Refer User defined Object Section 2.13.2) → Component Type: Work piece.
12. How to reorient the robot on the window? How to pan? How to drag to the desired position?
    Refer TriBall Section 2.2.2

13. Jog operation is not working. How to trouble shoot?
    Click on the arm. JOG parameter setting, such as Speed. Check for the presence of any alarm, need to reset before Jog operation.
14. What should we do when the table becomes a sub-item for the Robot?
    Recommended to delete the table and add it again. User needs to take care that while adding a new part robot is not highlighted or selected. In case the robot is highlighted /selected then the new part created will become sub-item of parent robot.
15. How is User IO set? How to handshake with another IO?
    Refer IO Connection Setting Section 2.9.1 Properties Settings and Refer Multi Robot Demo Section 4.2
16. What should the user do if the simulator button turns gray/dull?
    Restart DRASimuCAD, since the problem is with connecting virtual robot VRC
17. What should user do if the RL program is not executing after clicking start?
    Check if the simulator is in ON condition and system has no alarm. If still not responding after few seconds, restart DRASimuCAD.
18. What should user do if the simulation motion is slow with multiple robots running at the same time?
    Click Virtual Robot → Low Quality Render (Refer Low Quality Render Section 2.13.3).
19. What should user do if there is license error upon launching DRASimuCAD?
    Click Virtual Robot → License Manager → Check whether the license has expired. If so, please contact Delta Electronics, Inc.



20. How to set up multiple tables on the same plane? How to align them?
    Refer TriBall Section 2.2.2 illustration to align multiple tables.

21. How to command GO HOME?
    In jog window, choose Cartesian jog mode and Click (Home) button
22. What should user do when the “lua server” is disconnected?
    Method 1: Delete the current robot and add new robot again from the catalog.
    Method 2: Do not delete the robot, close and restart DRASimuCAD.