

Machine Tending using Feeler Machines

Visual Components 4.1 | Version: November 19, 2018



The Visual Components Machine Tending library allows you to quickly build and simulate machine tending applications using different resources and machines. The library is flexible and can be used with other component libraries, for example Works and Conveyors.

In this tutorial, you will learn how to:

- Build a conveyor line that transports the inputs and outputs of a machine tending process.
- Remotely connect inputs, outputs, machines, and resources used in a machine tending process.
- Define the stages of a machine tending process and automate their execution.

This tutorial assumes you have a basic understanding of layout configuration and have completed the "Basics of Simulation" and "Machine Tending Operations Using Robots" lessons in the Visual Components Academy.

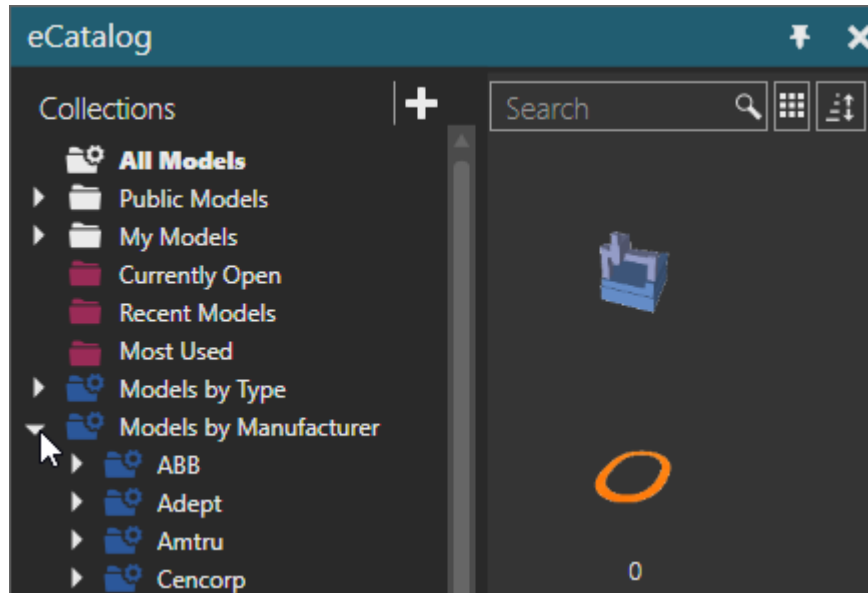
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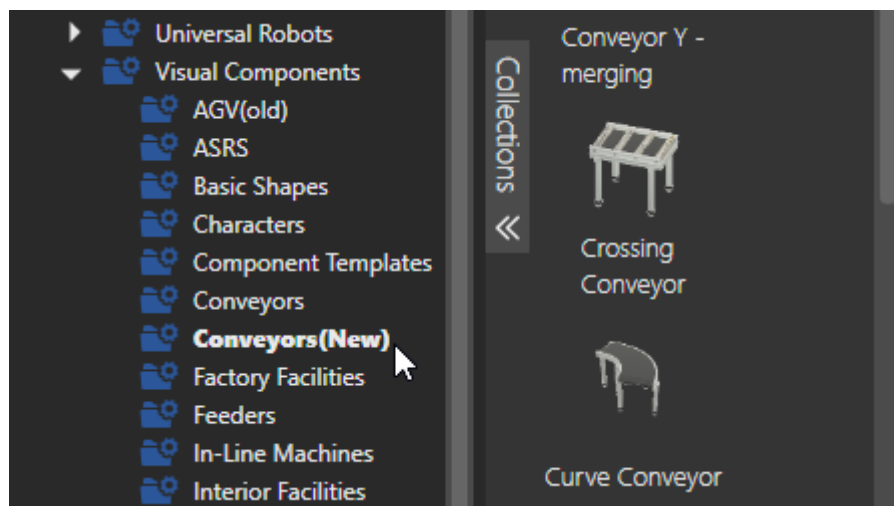
Find Conveyors Library

Components in the Conveyors library allow you to transport components and simulate material flow. You can also use these components as templates for modeling your own conveyors from imported CAD files.

1. In the eCatalog panel, Collections view, expand **Models by Manufacturer**.

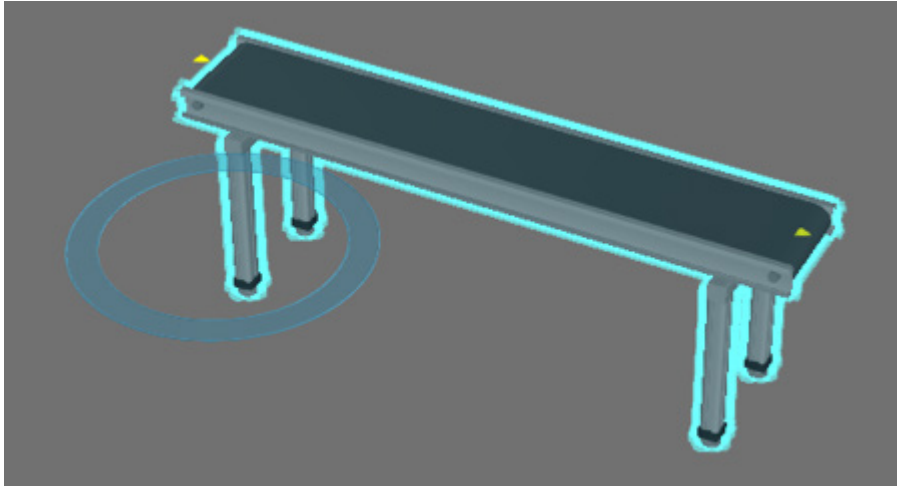


2. Scroll down and then expand **Visual Components**.
3. Click **Conveyors (New)**. This displays a collection of conveyor components.

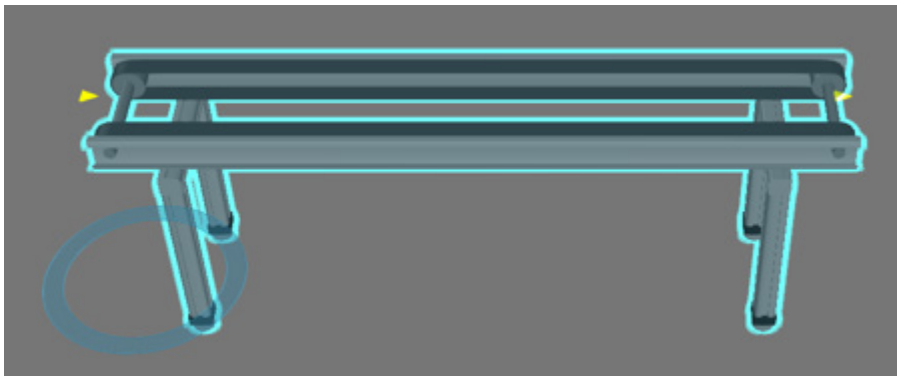


Add Conveyor

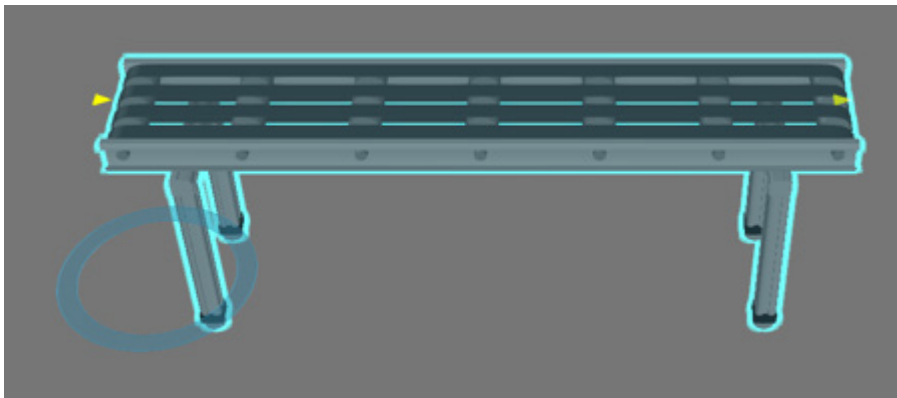
1. Drag and drop a **Conveyor** in the 3D world. This adds the component to your layout.
2. In the Component Properties panel, set ConveyorLength to **2000** and ConveyorWidth to **300**. The geometry of the conveyor is automatically updated based on the new length and width.



3. In the Presets property, select **TwinBelt Conveyor**. The geometry of the conveyor is automatically changed to represent its new type.

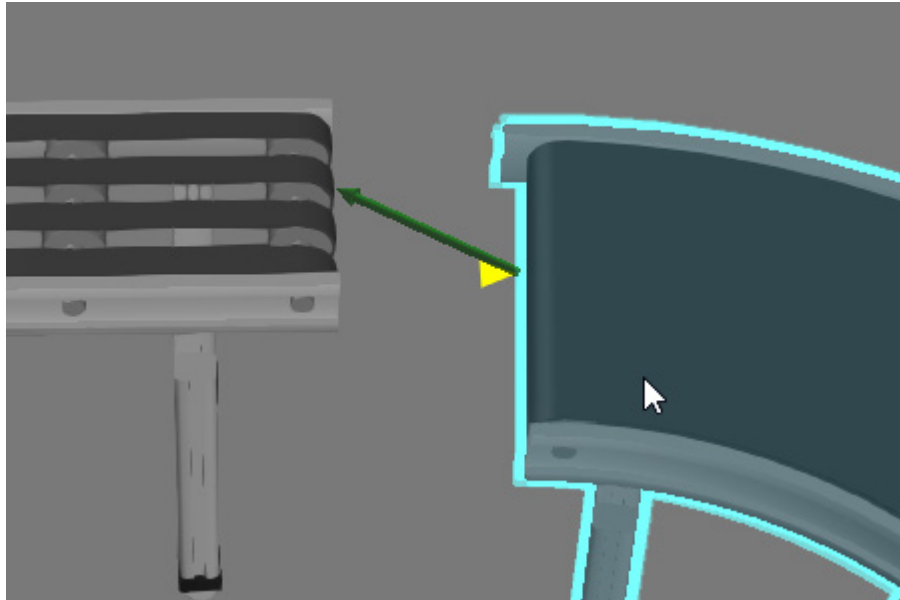


4. In Presets, select **Multibelt Conveyor**.



Add Curve Conveyor

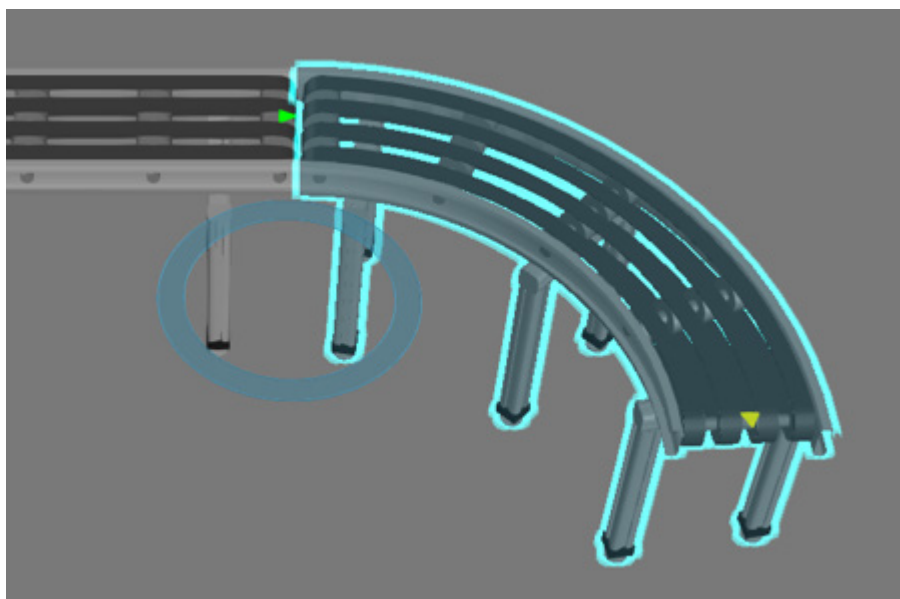
1. Drag and drop a **Curve Conveyor** in the 3D world.
2. Use the PnP command to drag the curve conveyor toward the end of the other conveyor until you see a green arrow.



The yellow arrows on the curve conveyor are its connection points or interfaces. One is input to its path, and the other is output from its path.

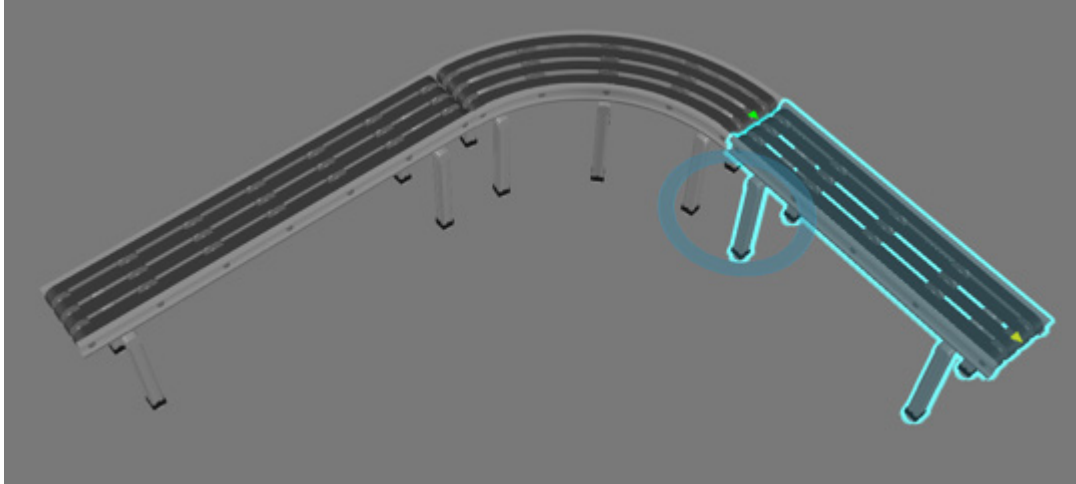
The green arrow points to a compatible interface in another component. The green arrow appears when compatible interfaces are moved close to one another.

3. Continue dragging the curve conveyor in the direction of the green arrow until the conveyors snap together. They are now connected, and the curve conveyor inherits certain property values because its "AutoProperties" property is enabled by default.



Add Another Conveyor

1. Drag and drop another **Conveyor** in the 3D world.
2. Use the PnP command to connect that conveyor to the end of the curve conveyor.



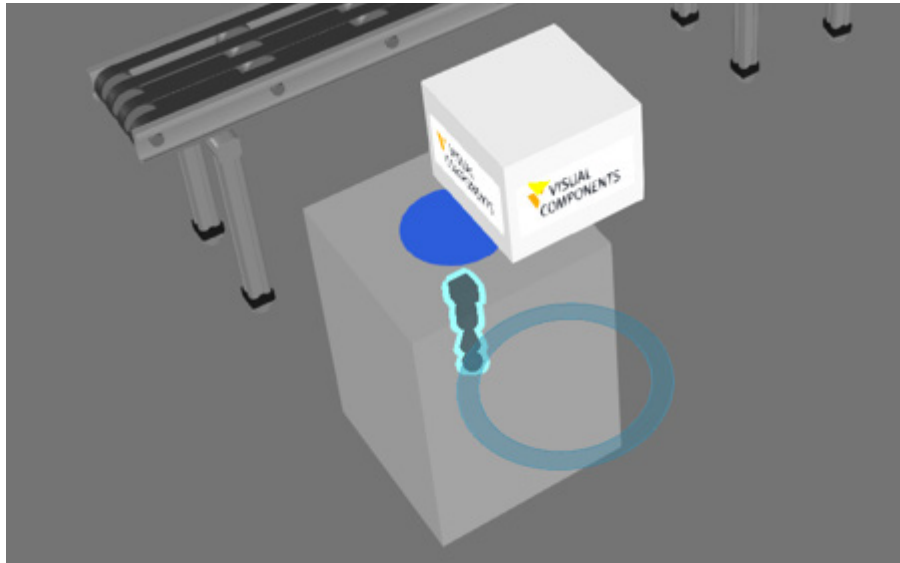
3. Hold down CTRL and then click the other two conveyors to add them to the selection. These components have common properties for their length, width and height.
4. In the Component Properties panel, set ConveyorWidth to **250**. This updates the width for each conveyor in the selection.

Component Properties	
3 Objects Selected	
Coordinates <input checked="" type="radio"/> World <input type="radio"/> Parent <input type="radio"/> Object	
X -941.51	Y -841.155
Rx 0	Ry 0
Z 0	Rz 0
Default	Advanced
Materials	
Name	<multiple values>
Material	black_matte
Visible	<input checked="" type="checkbox"/>
BOM	<input checked="" type="checkbox"/>
BOM Descripti...	<multiple values>
BOM Name	<multiple values>
Category	Conveyors
PDF Exportlevel	Complete
Simulation Level	Detailed
Backface Mode	Feature
ConveyorWidth	250 mm

Add Shape Feeder

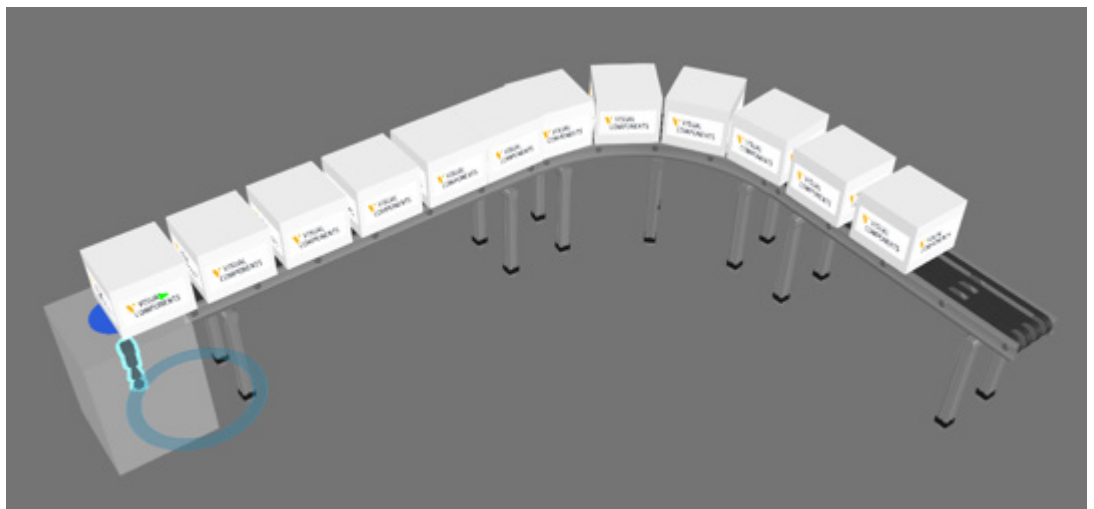
A feeder allows you to create components during a simulation and then transfer them onto other components, for example a connected conveyor.

1. In the eCatalog panel, under Visual Components, click **Feeders**.
2. Drag and drop a **Shape Feeder** in the 3D world.
3. Run the simulation, verify boxes are created, and then reset the simulation.



When a box leaves the feeder, it is not transferred to another component or container. The box is released to the 3D world, and then removed from the layout to save memory. Be aware that all dynamic components are removed when you reset a simulation.

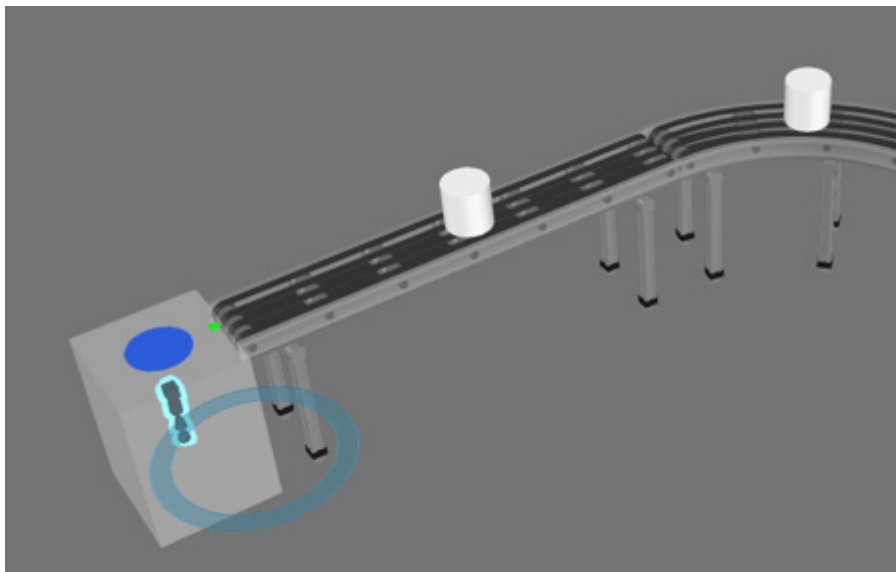
4. Use the PnP command to connect the feeder to the beginning of the conveyor line.
5. Run the simulation, verify boxes flow onto the conveyor line, and then reset the simulation.



6. In the Component Properties panel, set Product to **Cylinder** and CreationInterval to 8.

Backface Mode	Feature
Product	Cylinder
ConveyorLength	500
ConveyorWidth	500
ConveyorHeight	700
CreationInterval	8.000 s +
WarmUpDelay	0.000 s +

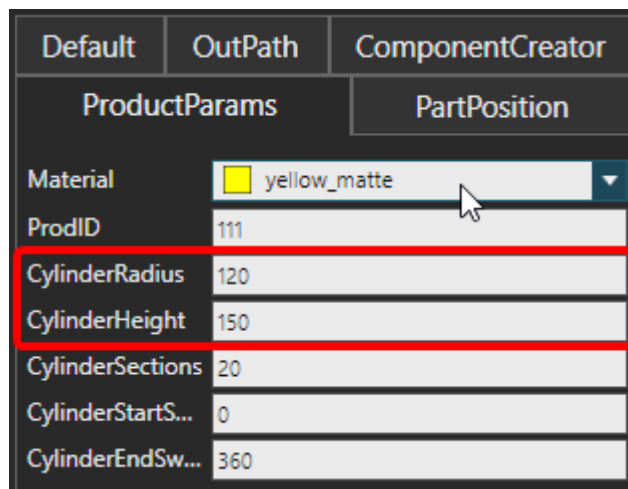
7. Run the simulation, verify the feeder creates a cylinder every eight seconds, and then reset the simulation.



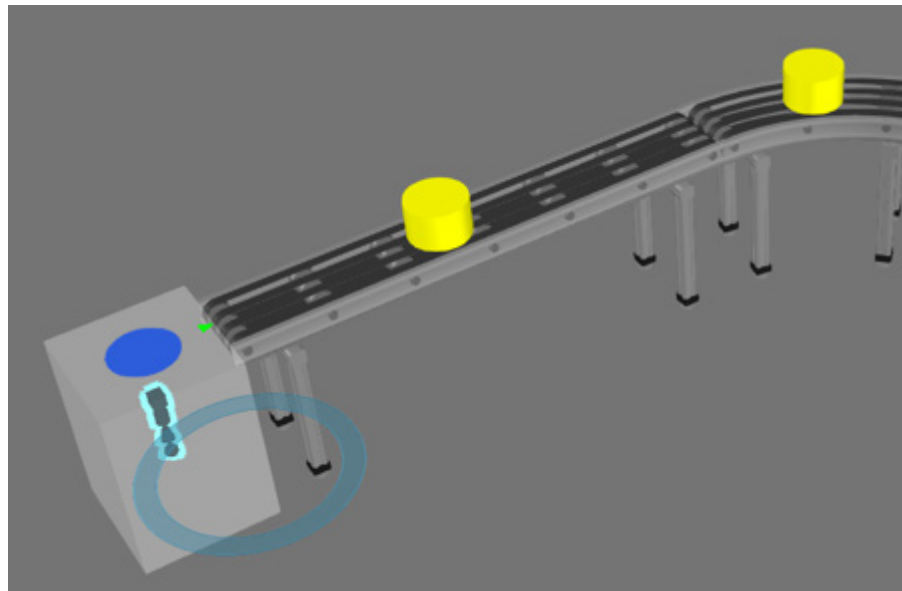
Change Product

A Shape Feeder allows you to create different types of components known as products and customize their properties.

1. In the Component Properties panel, click the **ProductParams** tab to access that group of properties.
2. Set Material to **yellow_matte**, CylinderRadius to **120**, and CylinderHeight to **150**.



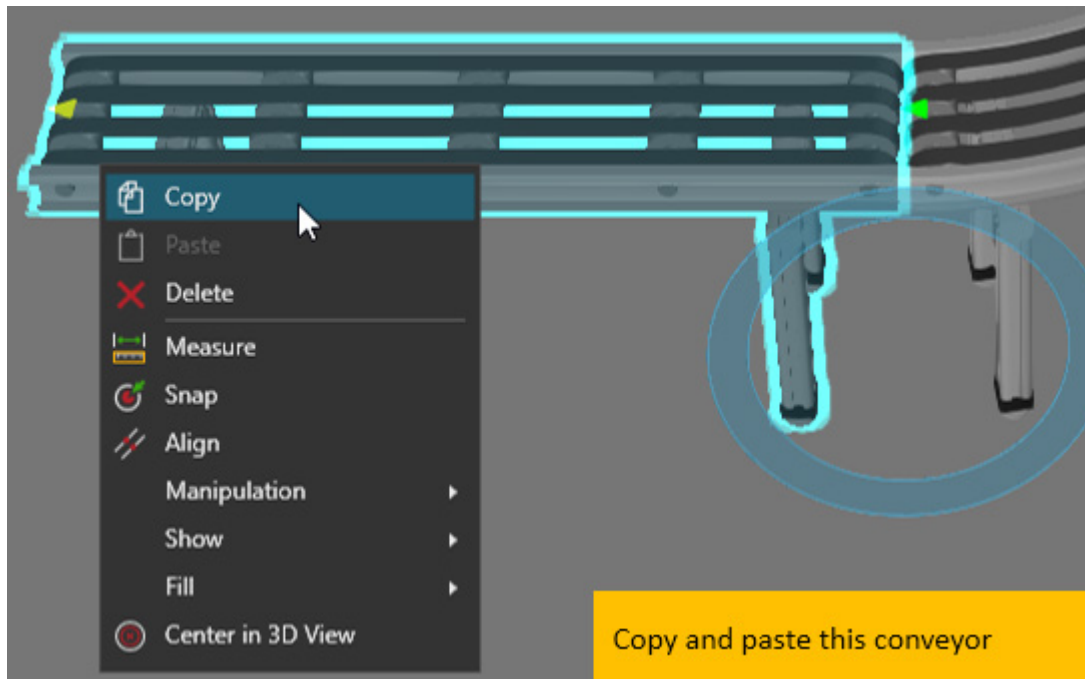
3. Run the simulation, verify yellow matte cylinders are created, and then reset the simulation.



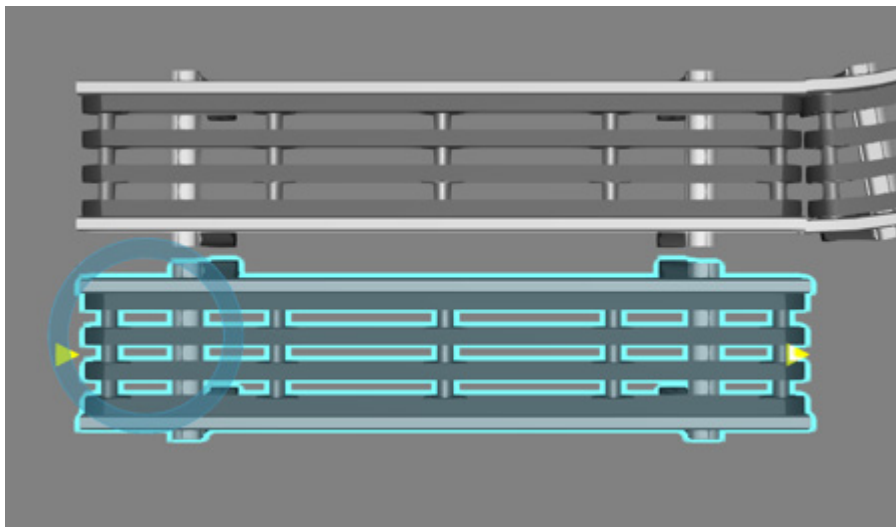
Add More Conveyors

Another conveyor line can be made to transport cylinders after they have been through a machining process.

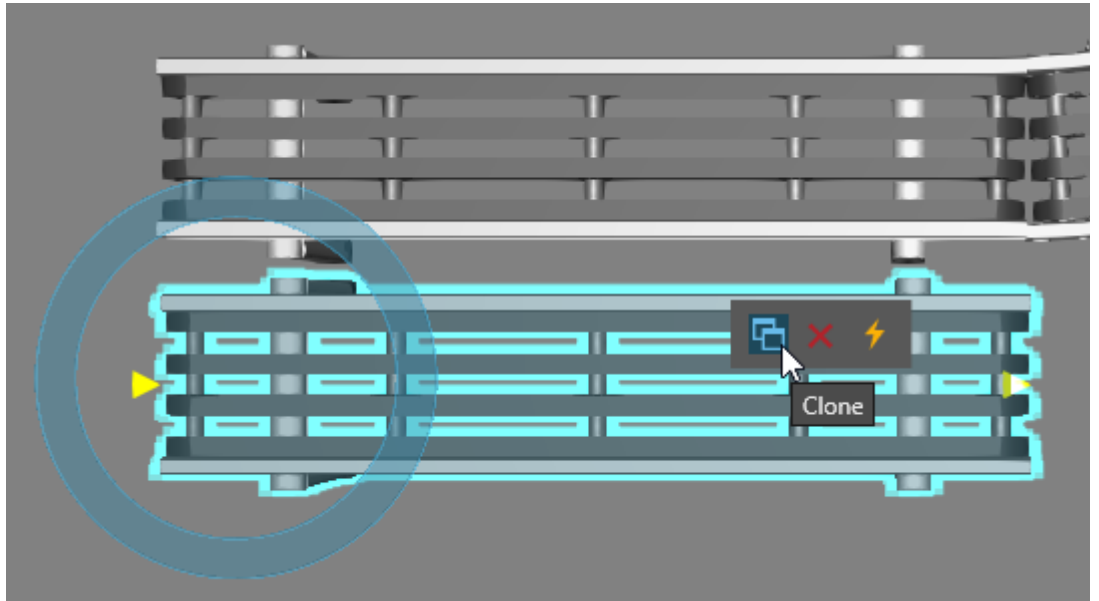
1. In the 3D world, copy and paste the last conveyor in the line. This adds a copy of that conveyor to your layout. Note that a pasted component is automatically selected for you.



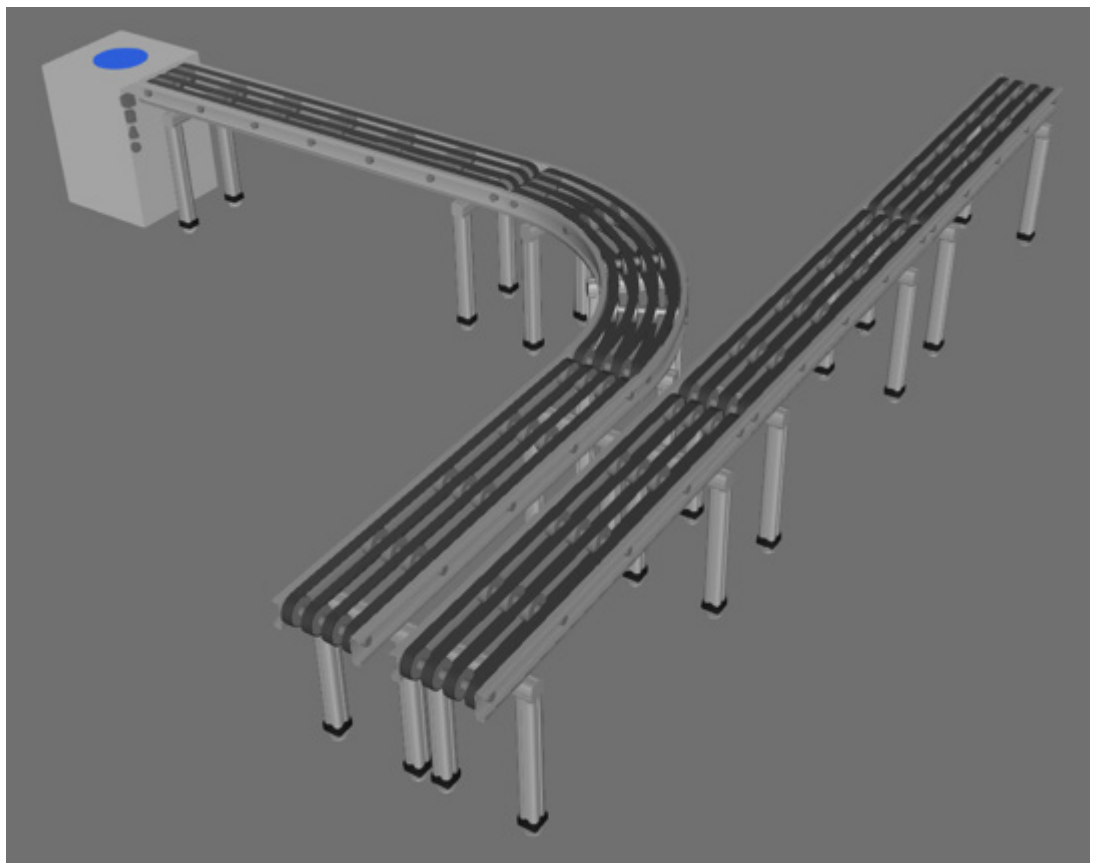
2. Use the ring of the PnP command to rotate the copied conveyor **180** degrees. The copied conveyor should flow in the opposite direction of the original conveyor.
3. Drag the copied conveyor to the side of the original conveyor. This allows a resource, for example a robot, to easily reach both conveyor lines.



4. Click the **copied conveyor** to select it, and then on the Mini toolbar, click **Clone**. This quickly creates a duplicate of the selected conveyor. The duplicate is also connected to the end of that conveyor because of the automatic Plug-n-Play feature.



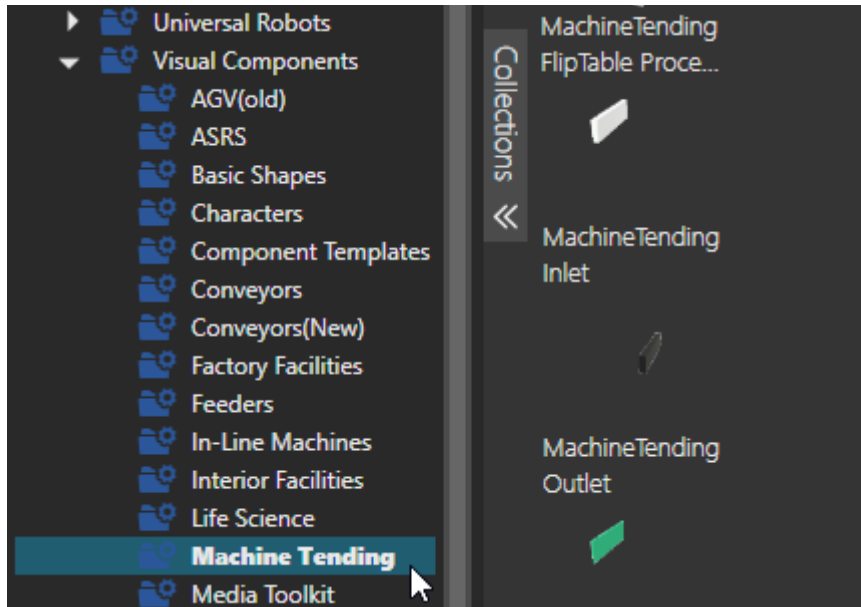
5. Repeat step 4. The other conveyor line should now consist of three conveyors.



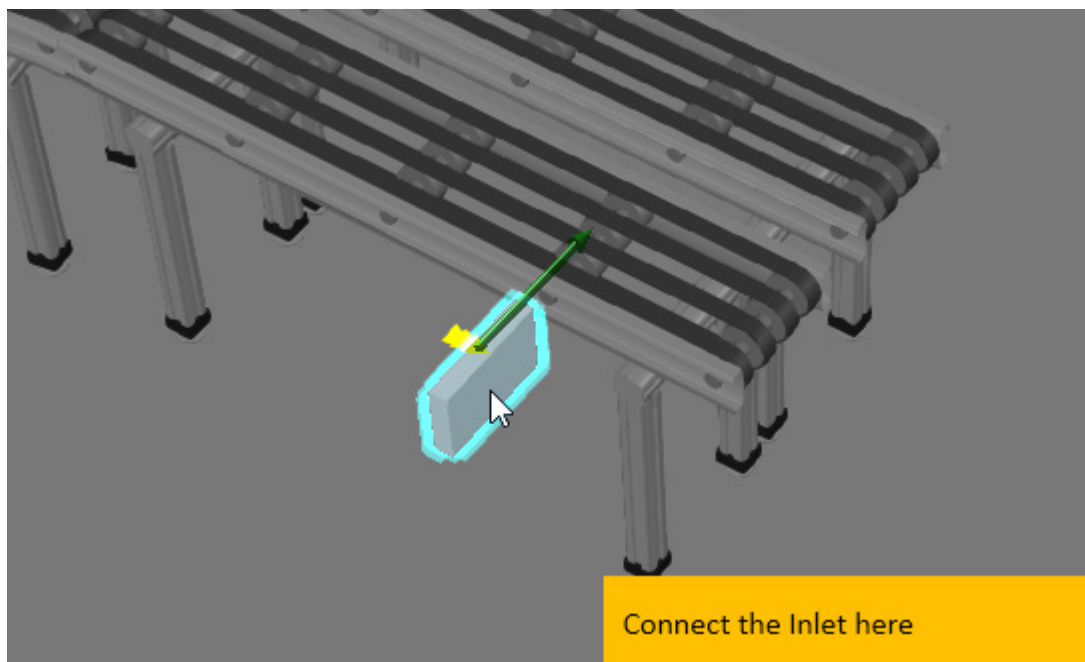
Add Inlet

A Machine Tending Inlet acts as an input or location for picking up products. The Inlet can be connected to the end of a conveyor or to its path.

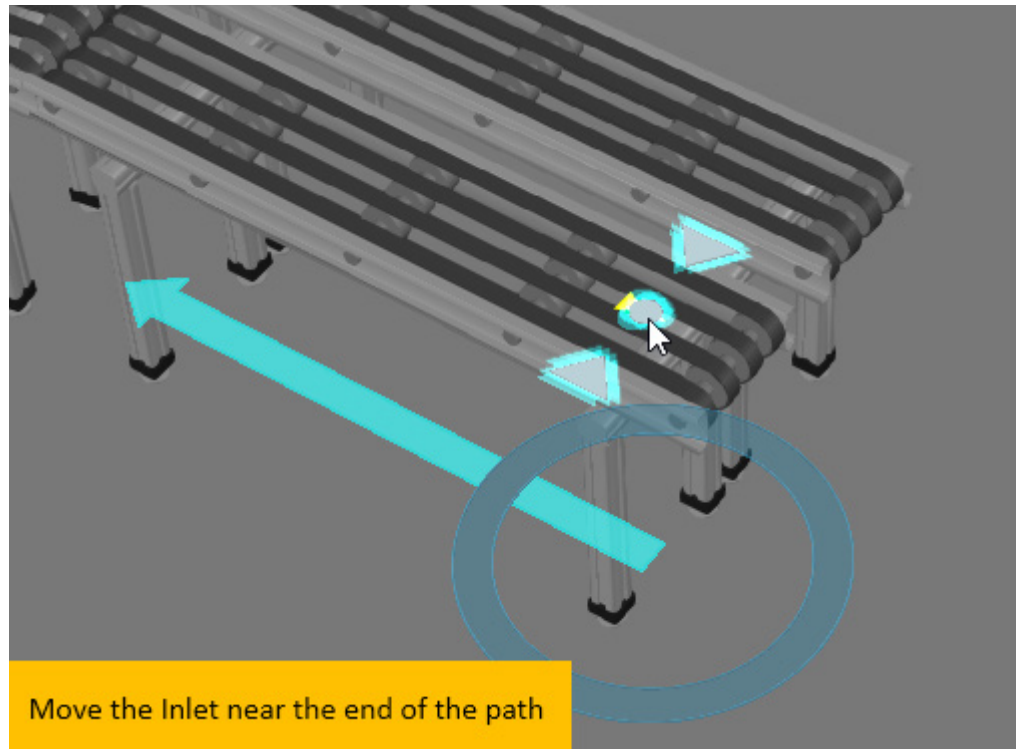
1. In the eCatalog panel, under Visual Components, click **Machine Tending**. This displays components in the Machine Tending library.



2. Drag and drop a **Machine Tending Inlet** in the 3D world.
3. Use the PnP command to connect the Inlet to the path of the last conveyor receiving a cylinder. The geometry of the Inlet should change to indicate it will act as a component path sensor.



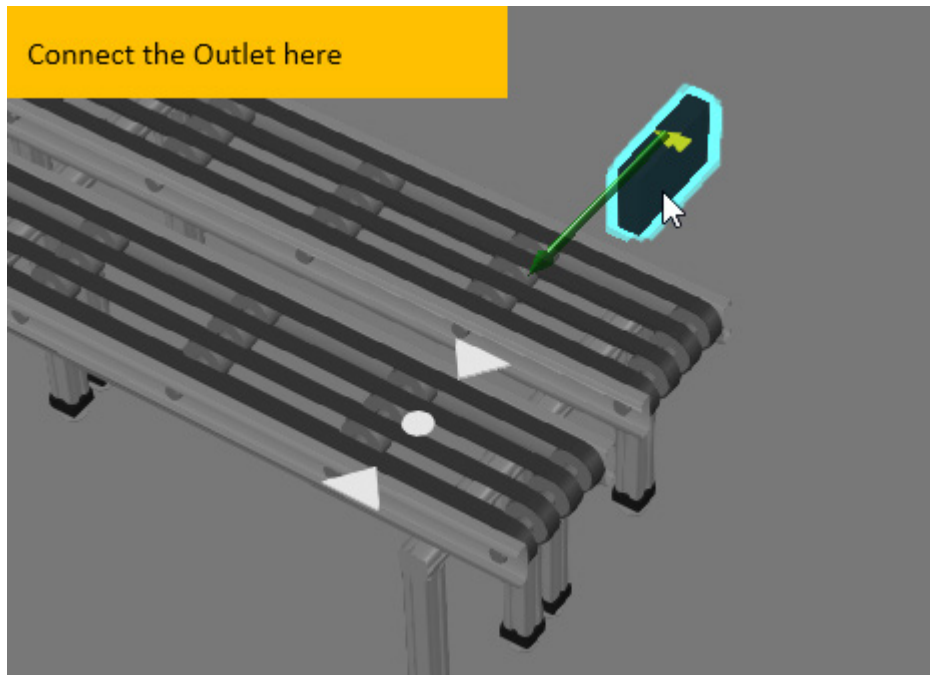
4. Use the PnP command to drag the Inlet near the end of the path.



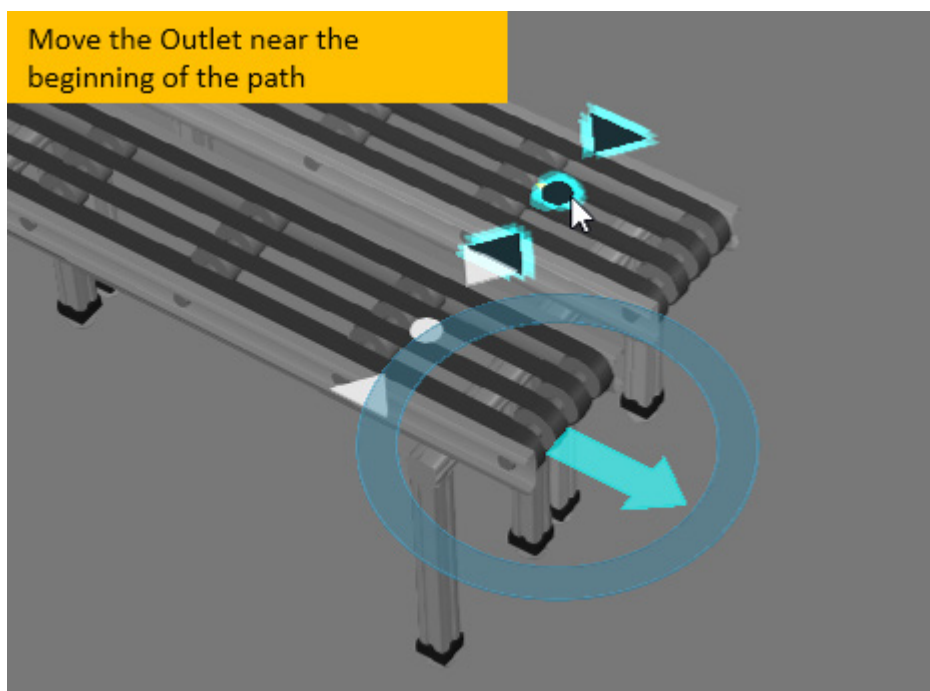
Add Outlet

A Machine Tending Outlet acts as an output or location for placing products. The Outlet can be connected to the beginning of a conveyor or its path.

1. Drag and drop a **Machine Tending Outlet** in the 3D world.
2. Use the PnP command to connect the Outlet to the path of the conveyor that is next to the other conveyor containing the Inlet.



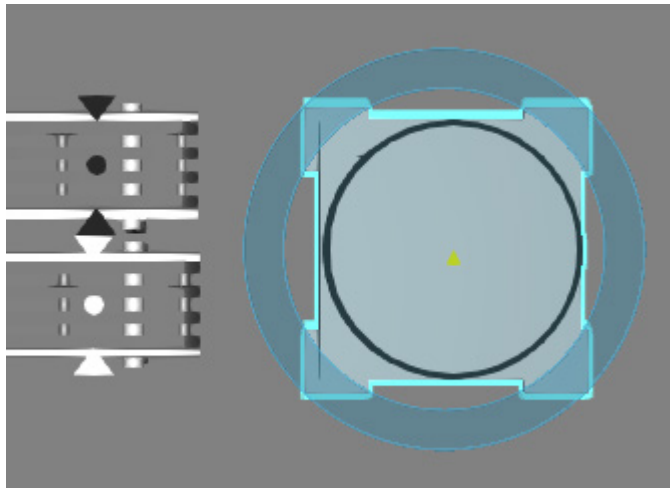
3. Use the PnP command to drag the Outlet near the beginning of the path.



Add Robot Manager

A Machine Tending Robot Manager is a controller for a robot. It is responsible for remotely connecting process stages and telling a connected robot what to do during a simulation.

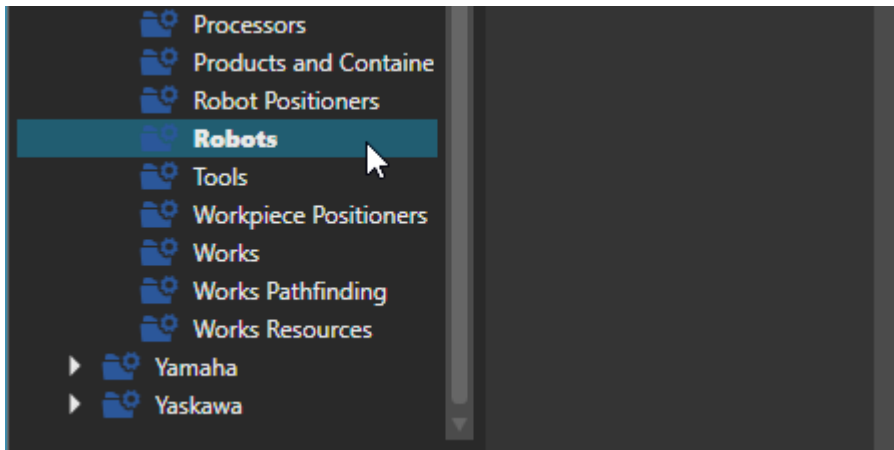
1. Drag and drop a **Machine Tending Robot Manager** in the 3D world.
2. Move the manager near the conveyor lines where one ends and the other begins.



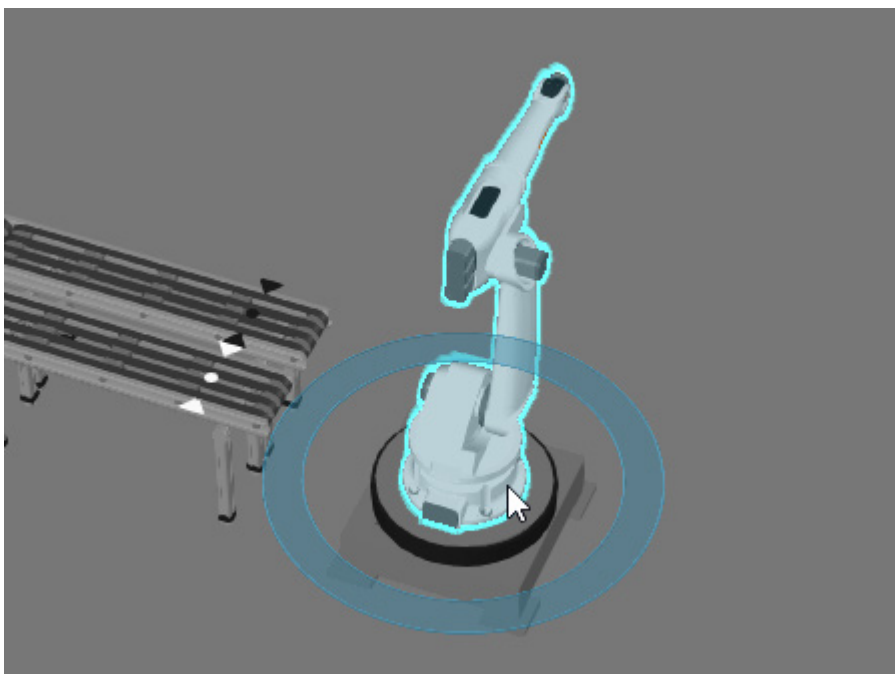
Add Robot

This tutorial uses a Generic Articulated Robot, but you can use your own robot or a similar one found in the eCatalog panel. The robot needs to be connected to the manager because the manager will tell the robot what to do, for example what and where to pick a product.

1. In the eCatalog panel, under Visual Components, click **Robots**. This displays generic robot components that can be used in layouts and as templates for modeling new robots. In fact, any robot in the eCatalog panel can be used as a template.



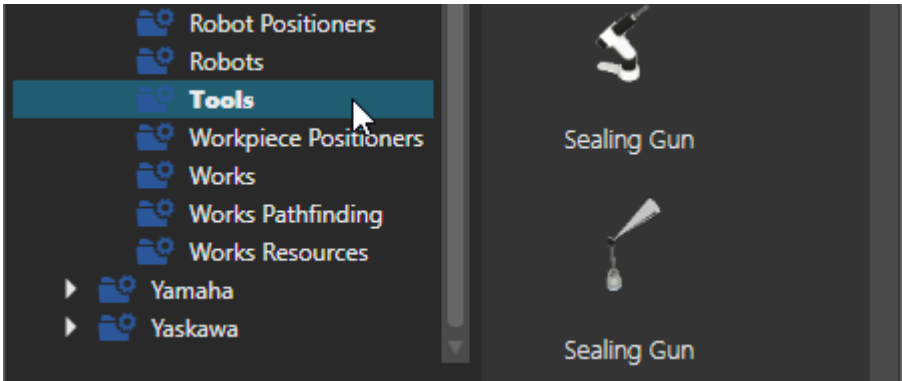
2. Drag and drop a **Generic Articulated Robot** in the 3D world.
3. Use the PnP command to connect the robot to the manager.



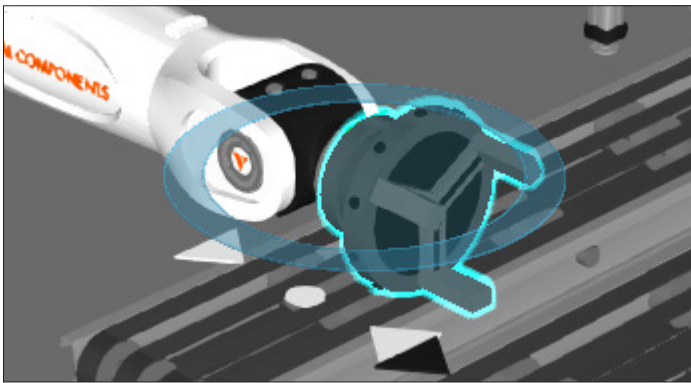
Add Gripper

You can connect an end-of-arm tool (EOAT) to the robot. The manager will know to use that tool with the robot.

- 1. In the eCatalog panel, under Visual Components, click **Tools**.



- 2. Drag and drop a **Simple Gripper** in the 3D world.
- 3. Use the PnP command to connect the gripper to the end of the robot arm.



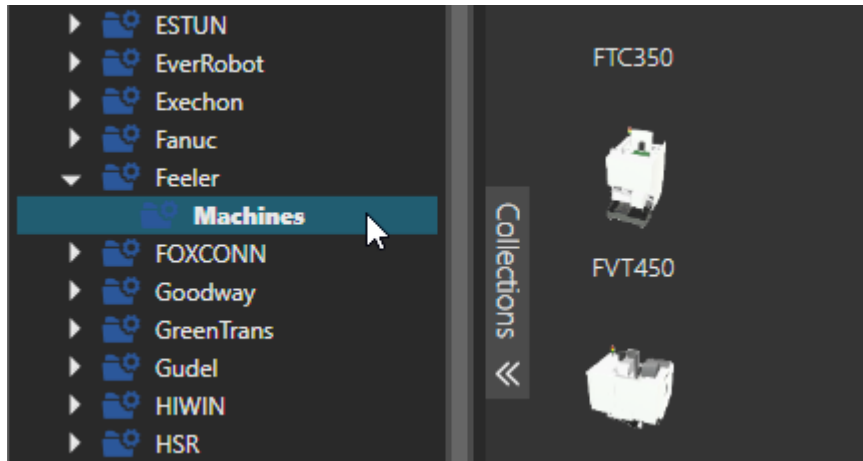
- 4. In the Component Properties panel, set GrippingDia to **240**. This makes the claws of the gripper able to fit around the workpiece.

J2	0	
GrippingDia	240	mm
BodyDia	150	mm
BodyHeight	70	
FingerLength	50	

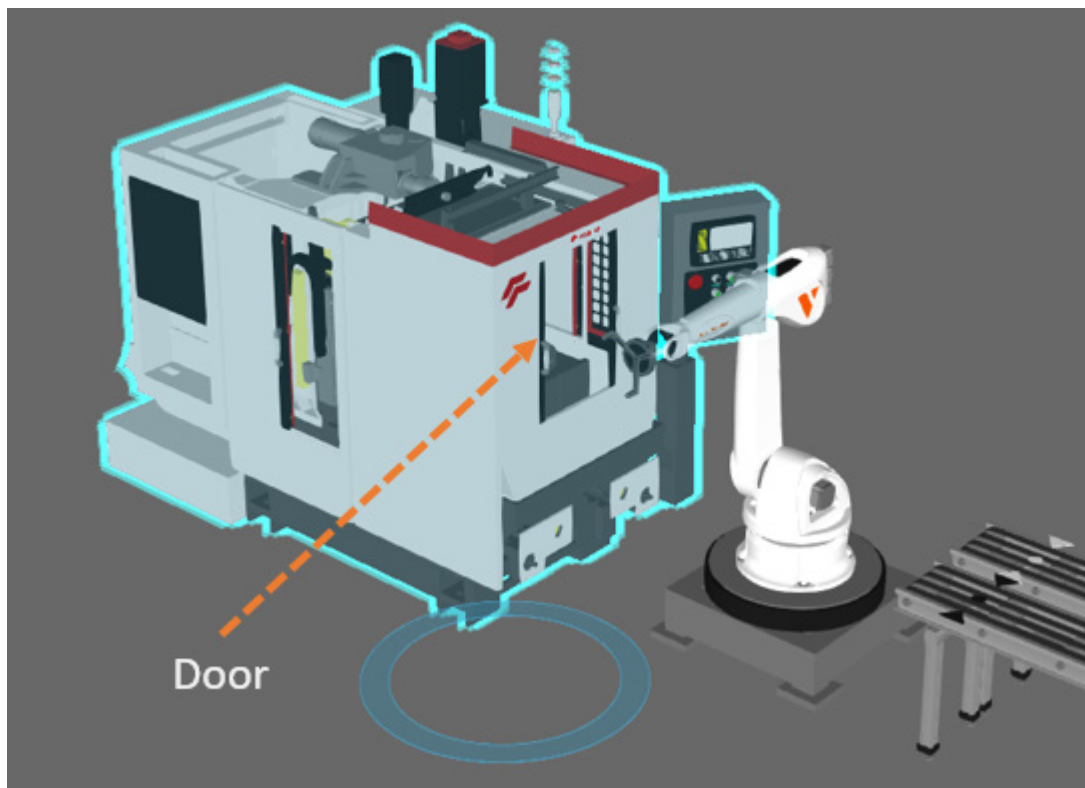
Add Feeler Machine

The [Feeler](#) machine components in the eCatalog panel can be used with the Machine Tending library as well as the Works library.

1. In the eCatalog panel, under Models by Manufacturer, expand **Feeler** and then click **Machines**.



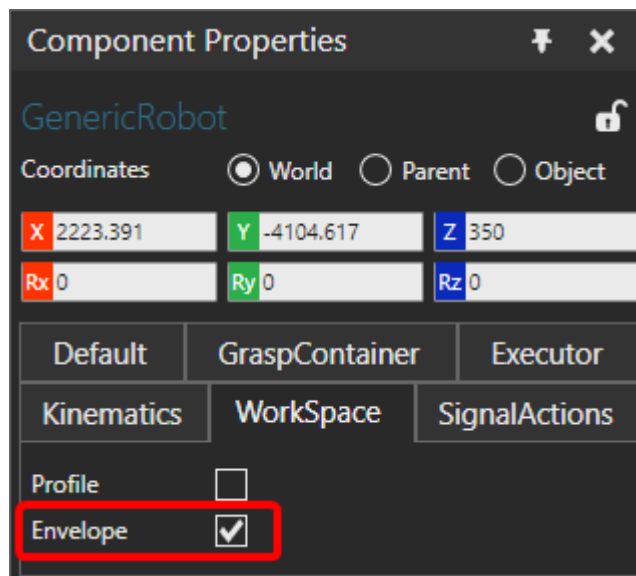
2. Drag and drop an **EH-320** in the 3D world.
3. Use the PnP command to move the door of the machine closer to the robot.



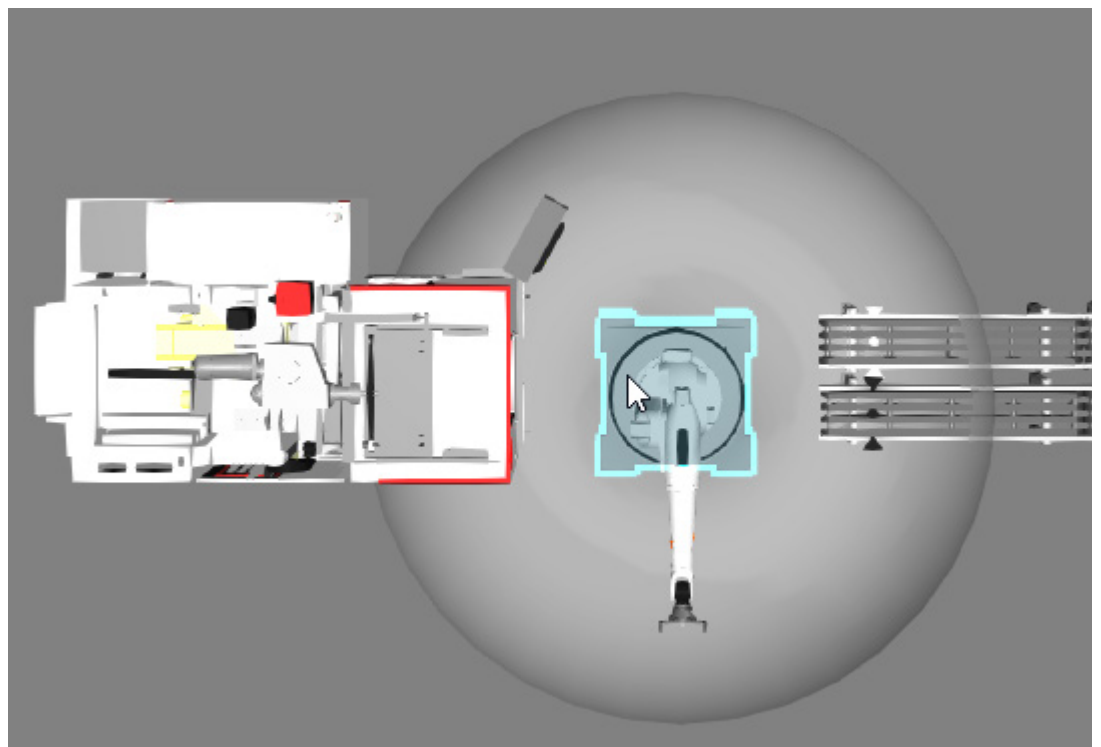
Reposition Components

The robot must be able to reach the Inlet, Feeler machine, and Outlet. Generally, a robot has a property that displays its workspace or area of reachability.

1. In the 3D world, select the **robot**.
2. In the Component Properties panel, WorkSpace tab, select **Envelope**.



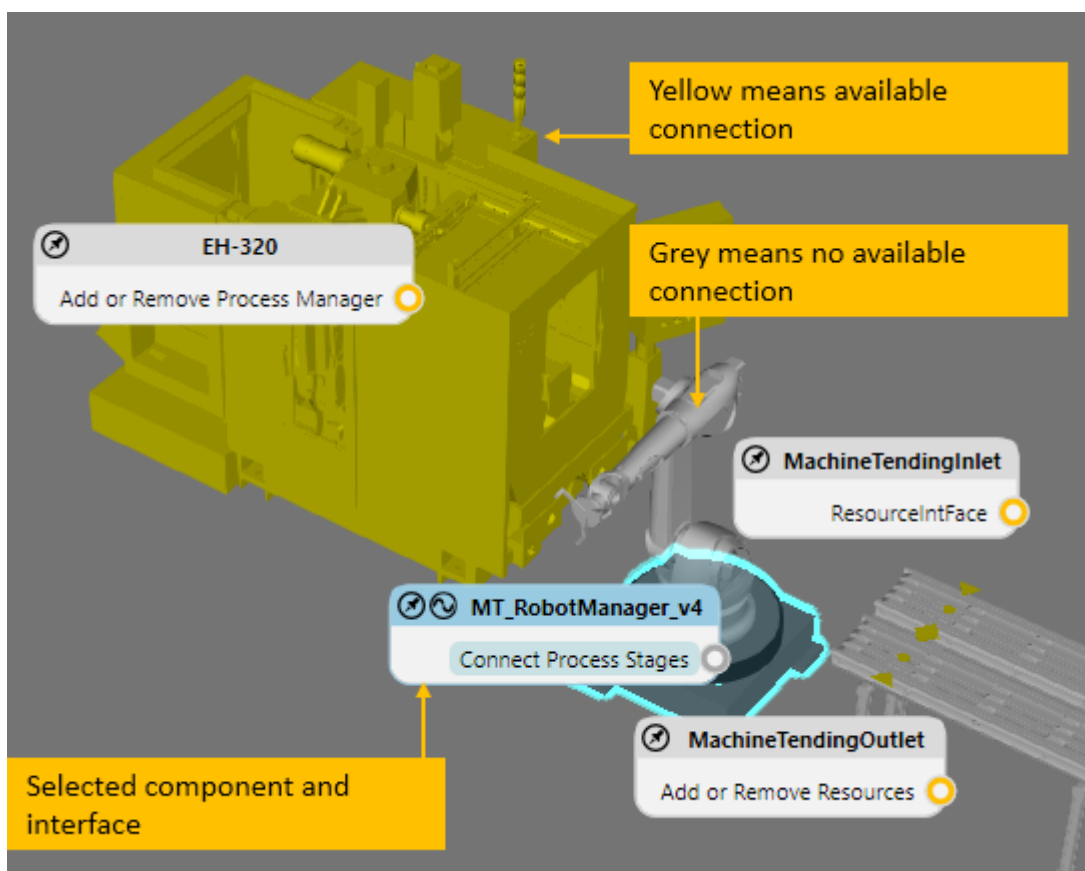
3. Use the View Selector to go to a top-down view, and then use the PnP command to reposition the robot manager and Feeler machine. The robot is attached to the manager, so the robot will move with it. Note that you do not need to move the conveyor lines.



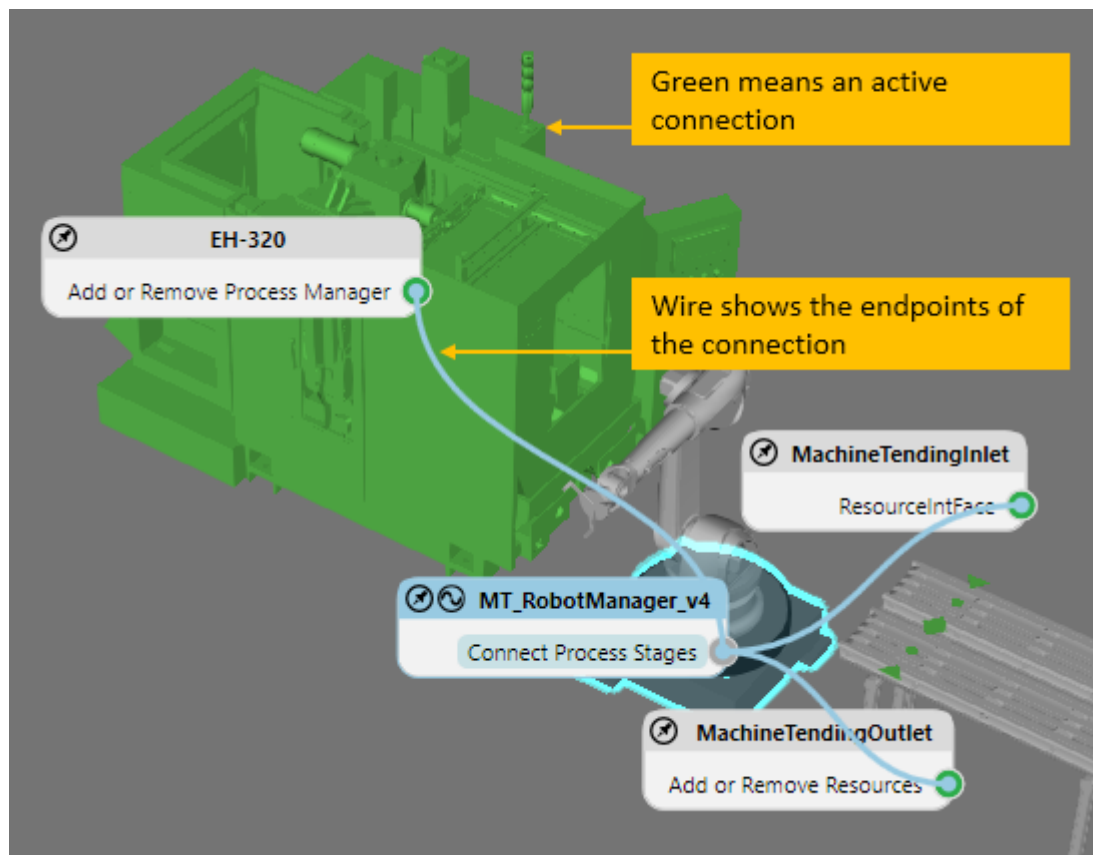
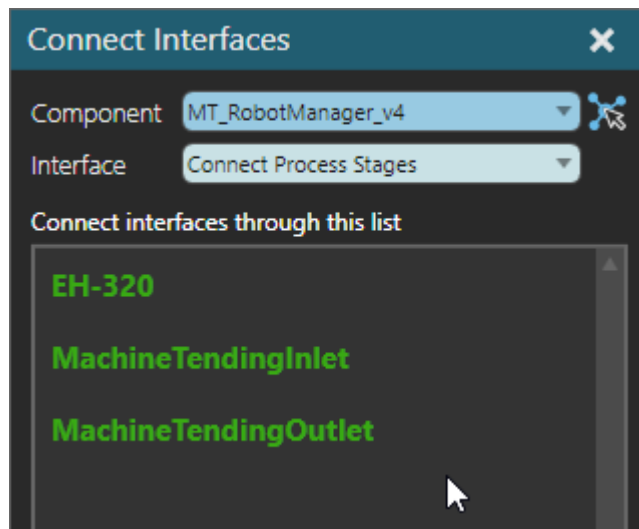
Remotely Connect Components

The robot manager supports multiple connections, including Inlets, Outlets, and machines that support the Machine Tending library, such as the Feeler machine. The robot is physically connected to the manager, but the other process stages need to be remotely connected to the manager.

1. Turn off the **Envelope** of the robot.
2. In the 3D world, select the **robot manager**.
3. On the Home tab, in the Connect group, click **Interfaces**. This displays a task pane along with connection editors in the 3D world for wiring connections.

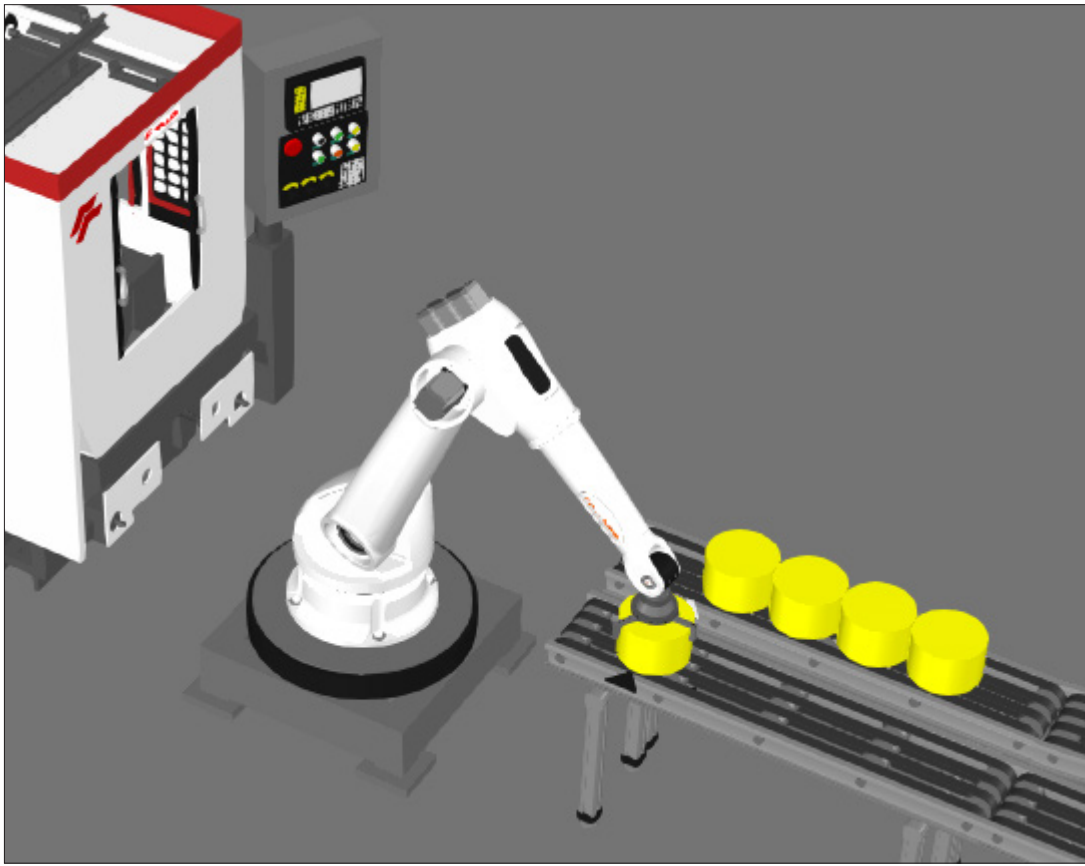


4. In the Connect Interfaces task pane, click each **interface** in the list to add it as a connection.



5. Press ESC or click **Close** in the Connect Interfaces task pane to exit the command. You have now connected the stages for a machine tending process.

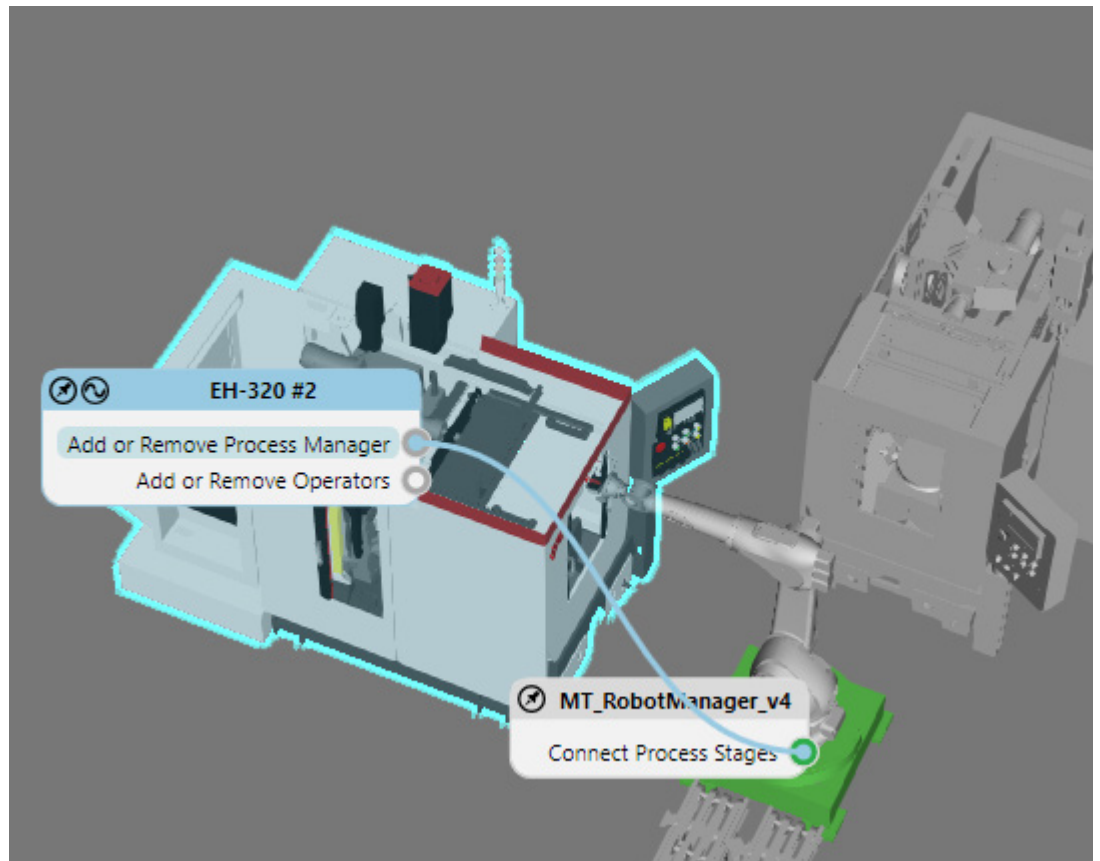
6. Run the simulation, verify the robot loads and unloads the machine, and then reset the simulation.



Add Another Machine

You can have more than one machine in a process. For example, you can use two machines to increase output.

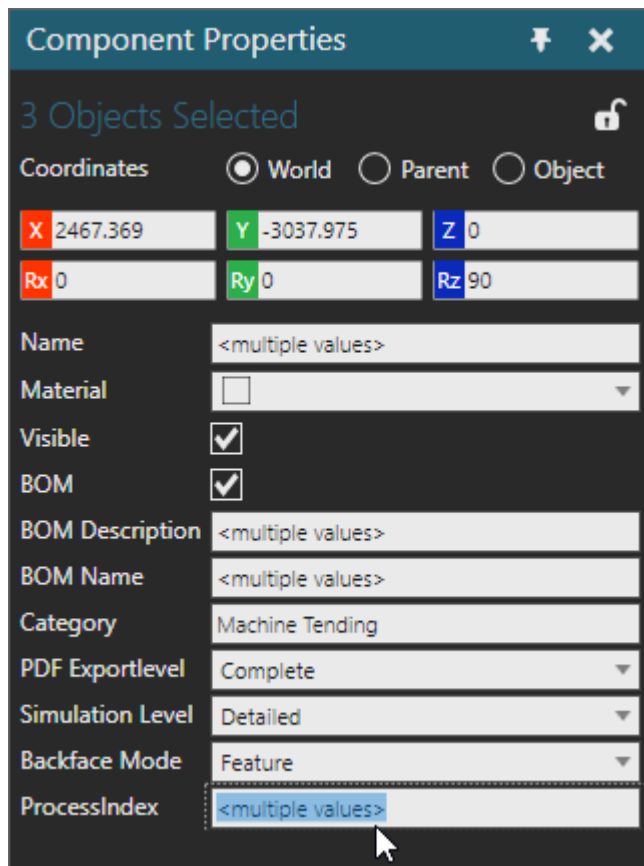
1. In the 3D world, copy and paste the **Feeler machine**, and then move the copied machine within reach of the robot.
2. Remotely connect the copied machine to the robot manager.



3. Run the simulation, verify the robot loads and unloads parts from both machines, and then reset the simulation.

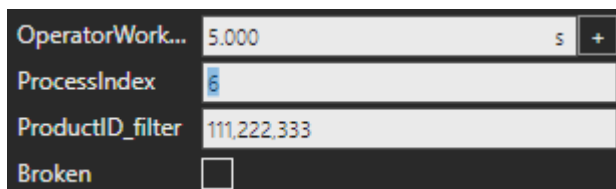
Change Process Index

Every component that acts as a process stage has a ProcessIndex property. This defines its order in the process.



For example, an Inlet has a default ProcessIndex value of zero, and an Outlet has a default value of 99999. That is, Inlets start at the beginning of the process, and Outlets come at the end. Components with the same ProcessIndex value mean they are concurrent and associated with the same process stage. For example, both Feeler machines have a ProcessIndex of 5.

1. In the 3D world, select the second Feeler machine, **EH-320 #2**.
2. In the Component Properties panel, set ProcessIndex to **6**. This means a part will go from one machine to the other before it is transported to the Outlet.

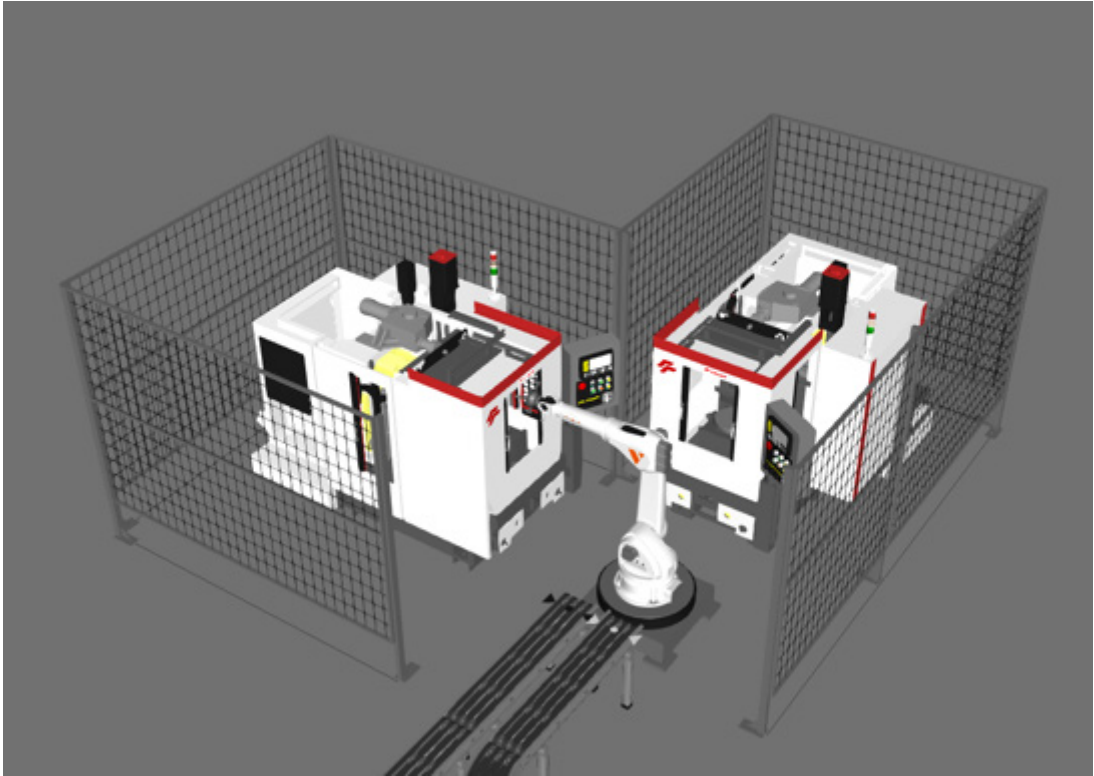


3. Run the simulation, verify a part visits both machines, and then reset the simulation.

Exercises

Refer to the lesson files, Help file, and other Academy lessons as needed to complete these exercises.

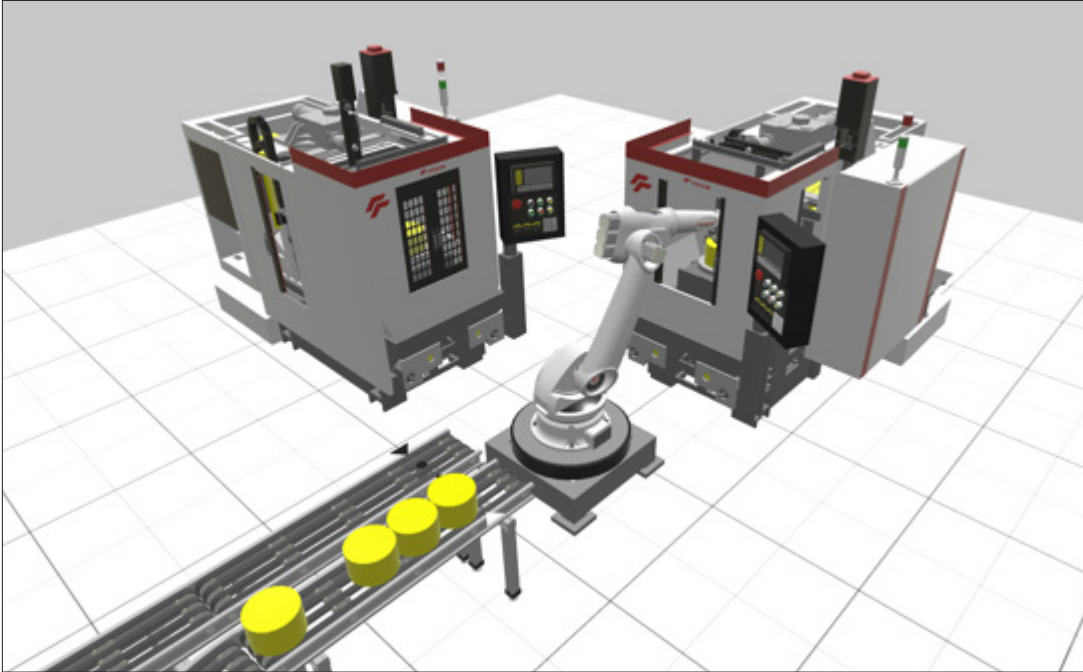
Add Fence



This exercise is optional. You can find the required component in the Visual Components Factory Facilities library.

- Add a **Fence Builder** to the 3D world, and then use the Interact command to create a fenced-off area around the machines and robot.

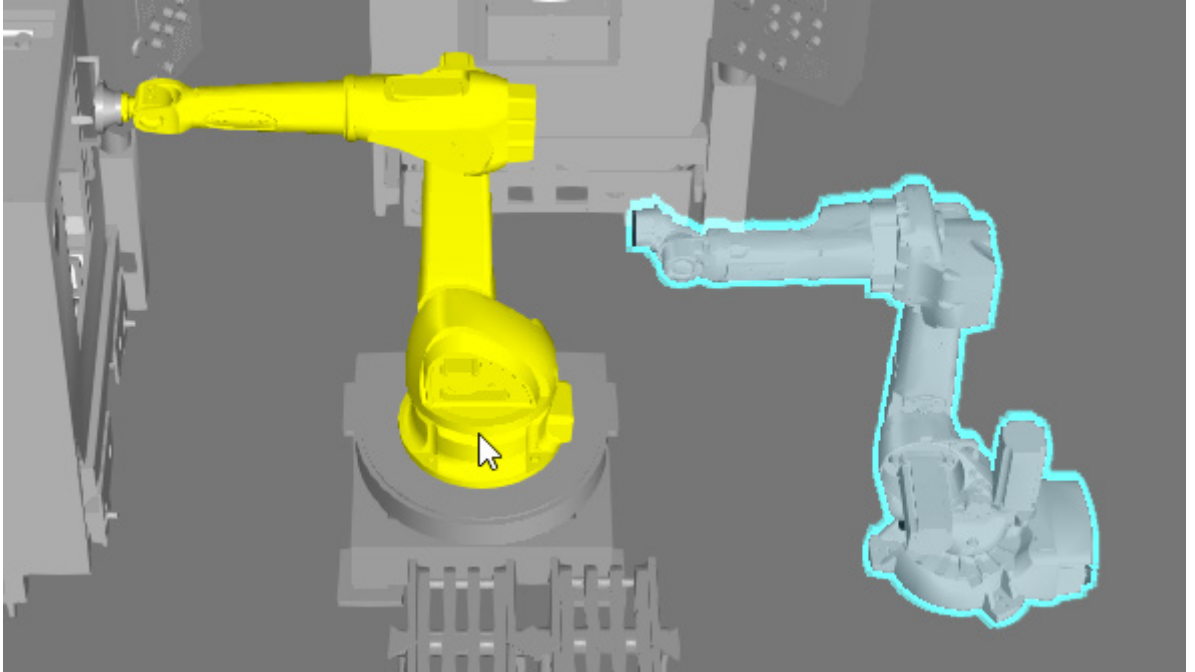
Record Simulation



This exercise is optional.

1. Record the simulation as a **3D PDF** and then view the file with a PDF reader.
2. Record the simulation as an **animation** and then view the file with Visual Components Experience.
3. Use the **Camera Animator** command to move the camera to specific views. Next, record the simulation as a video and then playback the video.
4. Create a **2D drawing** of the layout along with a parts list and dimensions.

Exchange Robots



This exercise is optional.

- Use the **Exchange Robots** command in the Program tab to test the machine tending process with different robots. Remember that you cannot exchange robots with different numbers of joints/axes.

Use Human Resources



This exercise is optional. You can find the required components in the Visual Components Machine Tending library.

1. In the 3D world, delete the **robot manager**. This should also delete the robot and its gripper since the robot was attached to the manager, and the gripper was attached to the robot.
2. Add a **Machine Tending Resource Manager** to the 3D world.
3. Add an **Anna (Machine Tending)** component to the 3D world.
4. Add a **Machine Tending Pathway** to the 3D world, and then use the Interact command to resize its boundaries to cover the work area.
5. In the 3D world, select the **manager**, and then connect the machines, Inlet and Outlet as process stages. Next, connect the human as a resource. Finally, connect the pathway, which allows the human to use it for walking to and from locations.
6. Run the simulation, verify the human operates the machines, and then reset the simulation.

Review

In this tutorial you learned how to configure a machine tending layout. You know how to create products and transport them using different conveyor lines. You know how to use robot resources and machines to process parts. You also know how to remotely connect components and change the order of process stages.

If you completed the exercises, you know how to make a layout and modify it for different use cases. For example, you know how to create different types of media to visualize a manufacturing process, use different robots, and incorporate the use of factory workers.