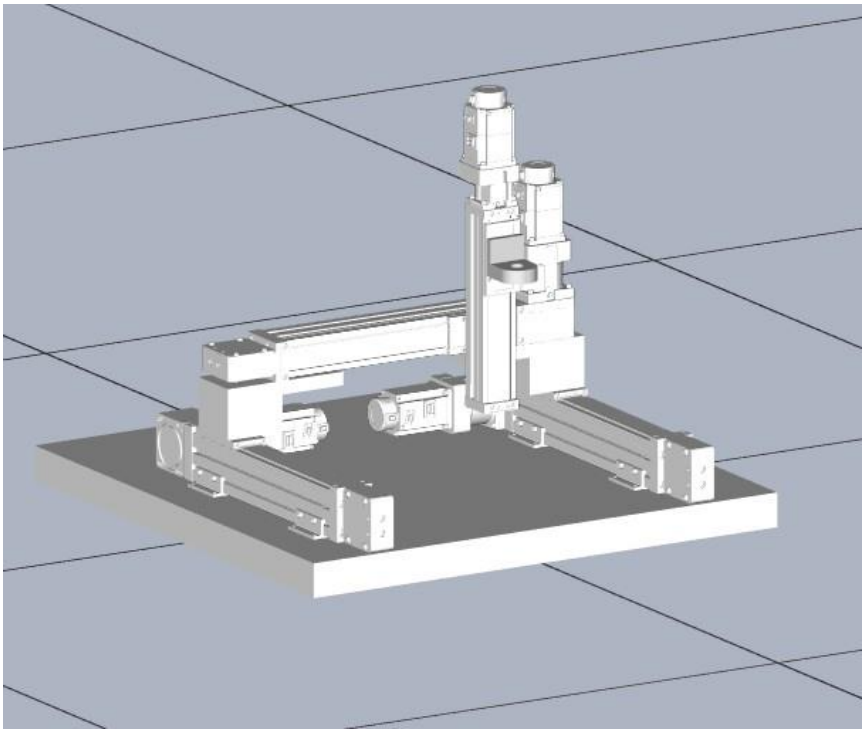
OMRON TECHNOLOGY NOTE

Sysmac Simulator Example – XYZ Machine

This document explains how to:

- Use the Mechanical Component Wizard to create a simulated XYZ Machine
- Setup the link between the Ladder Logic and the Simulated XZY Machine
- Run the Simulation to verify functionality



Product(s):

Sysmac Studio

Sysmac Studio Version: 1.40.0.64008 with 3D Simulation Option License

Date:

5/15/2020

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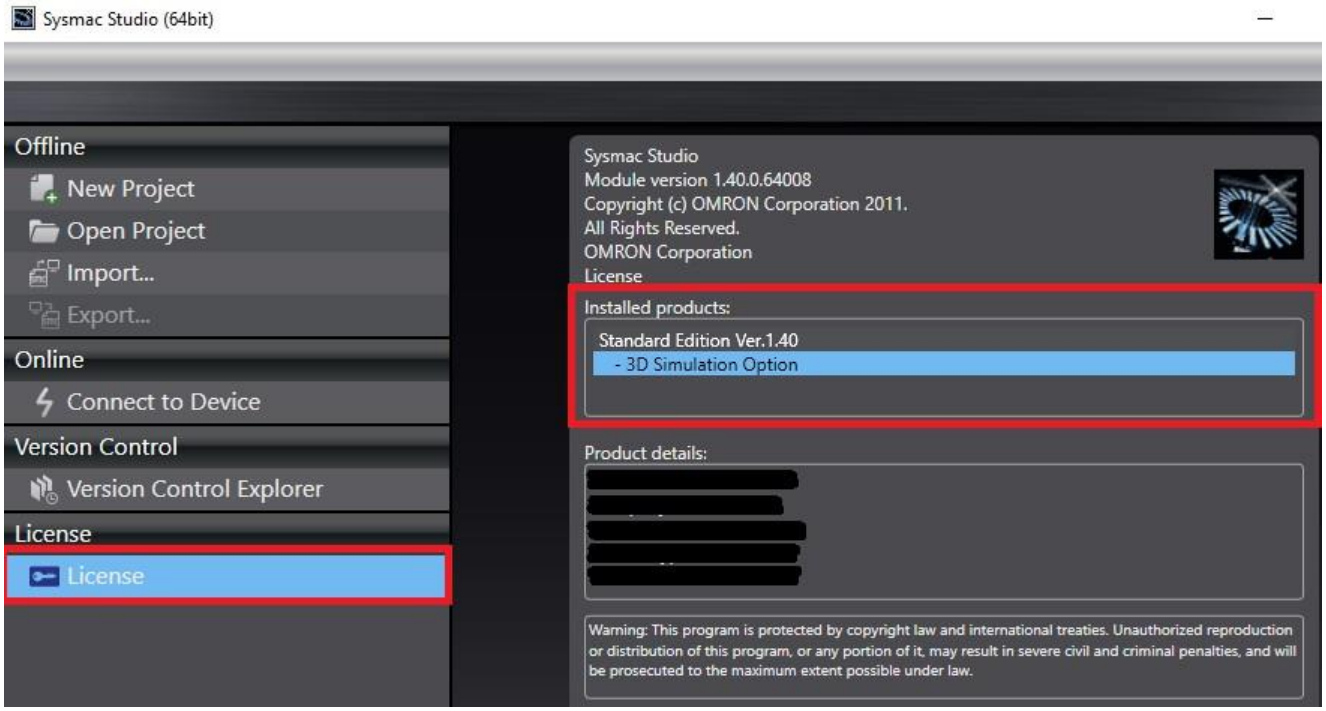
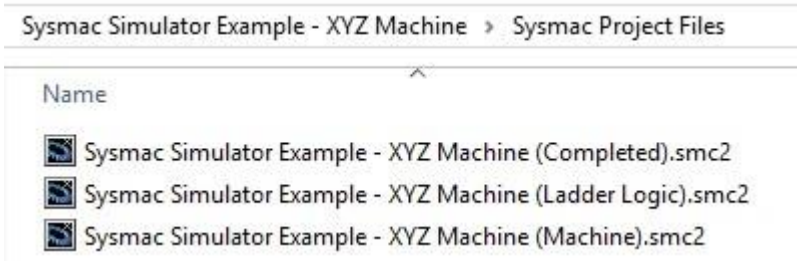
1. Sysmac Studio Example Projects

1.1 Simulation License Registration

In order to use the following project files you will need to have the 3D Simulation Option enabled in the License section of Sysmac Studio. If you do not have this license please contact your local Omron Representative.



1.2 Project List



1.3 Sysmac Simulator Example – XYZ Machine (Ladder Logic)

This file only has the ladder logic portion of the example and can be used to go through the process of making a simulated machine and linking it to existing ladder logic. This is the example project file that the guide will focus on.

1.4 Sysmac Simulator Example – XYZ Machine (Machine)

This file only has the simulated machine and can be used to show how to write the ladder logic to control an existing machine with Sysmac Studio.

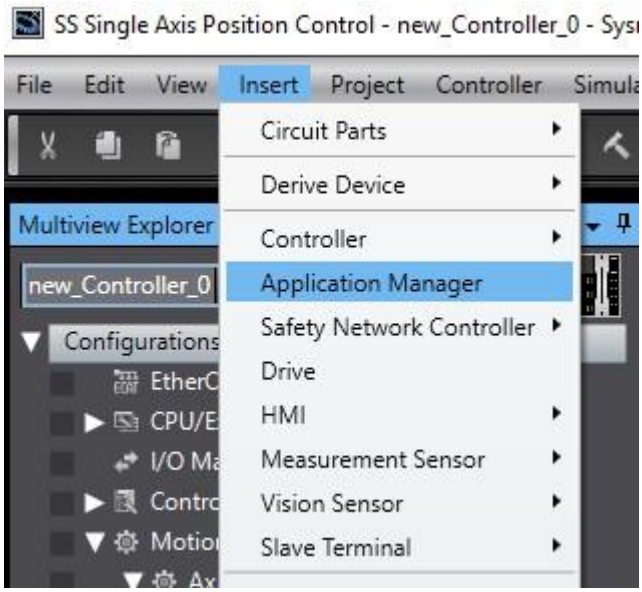
1.5 Sysmac Simulator Example – XYZ Machine (Completed)

This file has both the ladder logic and simulated machine portions of the example and can be used as a reference.

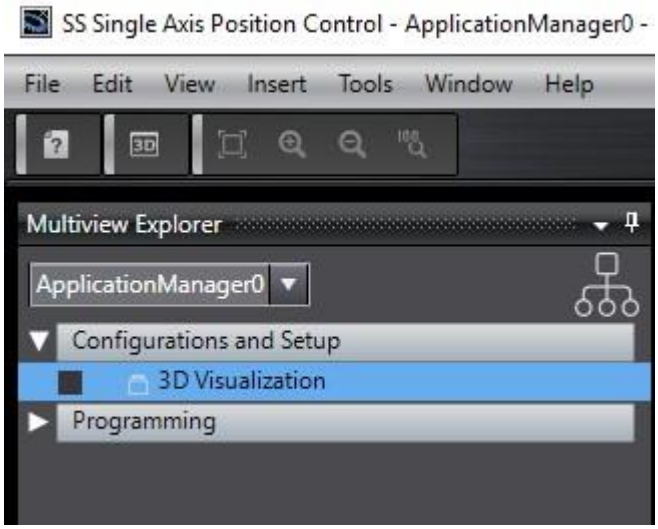
2. Application Manager

2.1 Insert Application Manager

From the top menus, select Insert and then navigate to the Application Manager from the drop down menu.

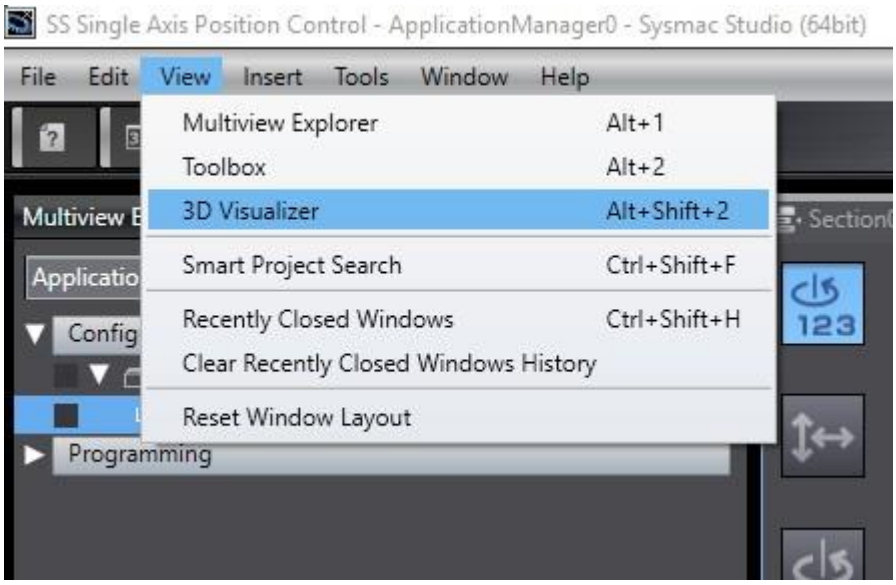


This will add a new device in the Multiview Explorer window which can be selected by using the drop down arrow next to new_Controller_0.

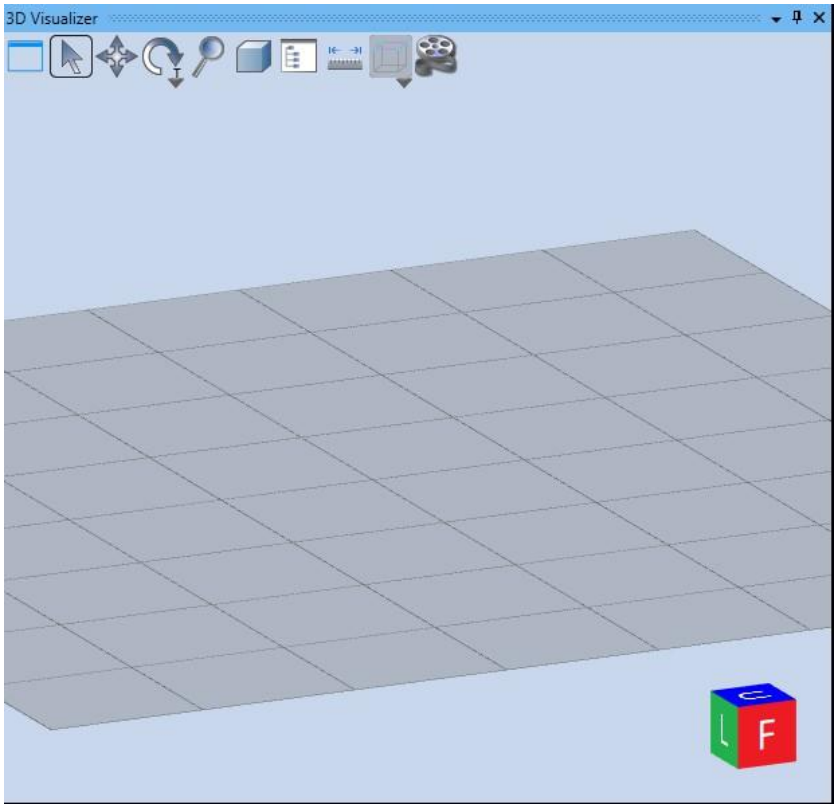


2.2 View the 3D Visualizer

Navigate to the top menu, and select View -> 3D Visualizer.



This is the environment that the machine will be created in.



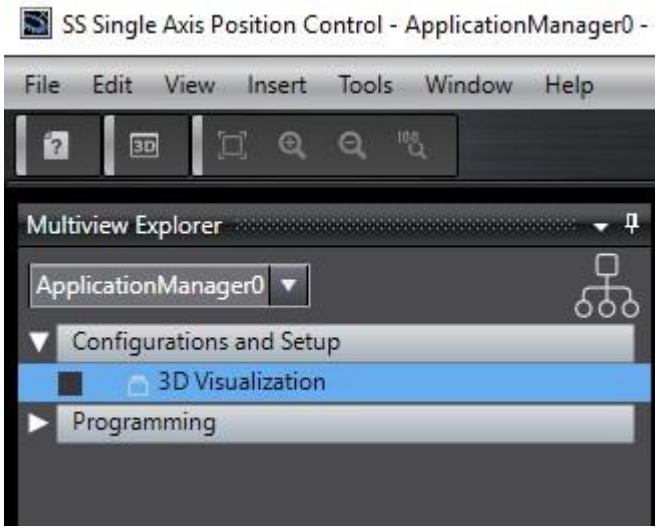
2.2.1 3D Visualizer Controls

- **Left Click** in this environment allows you to select an item in the 3D Visualizer.
- **Right Click and Hold** in this environment allows you to rotate the view in the 3D Visualizer.
- **Middle Mouse Button Click and Hold** allows you to keep the same rotation but shift the position of the view in the 3D Visualizer.

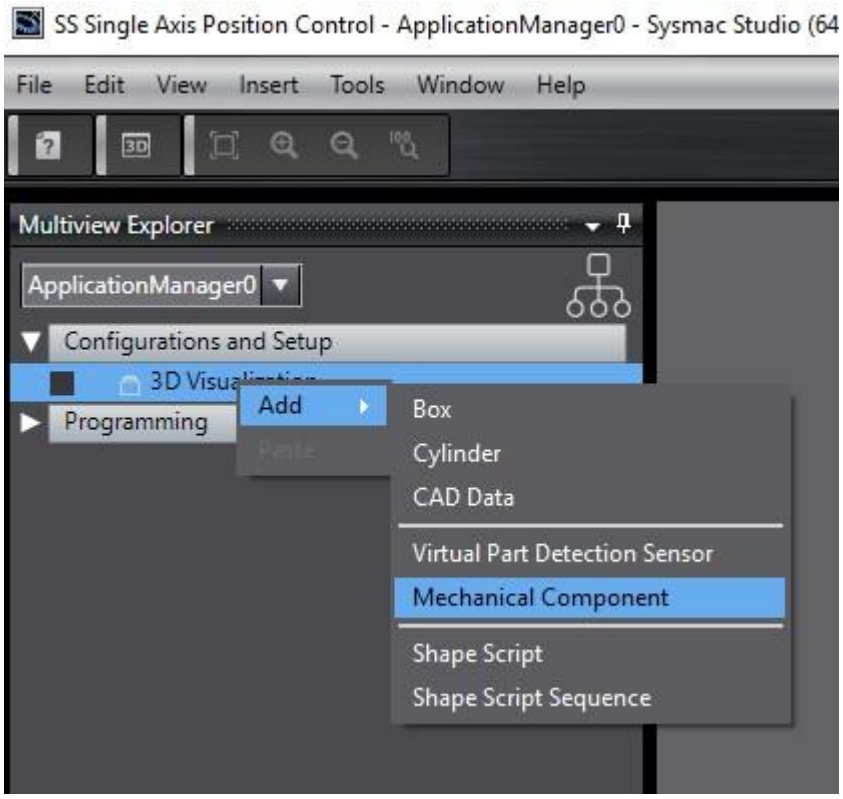
3. Creating a 3D Visualization

3.1 Add Mechanical Component

Make sure the ApplicationManager0 is selected in the Multiview Explorer window.



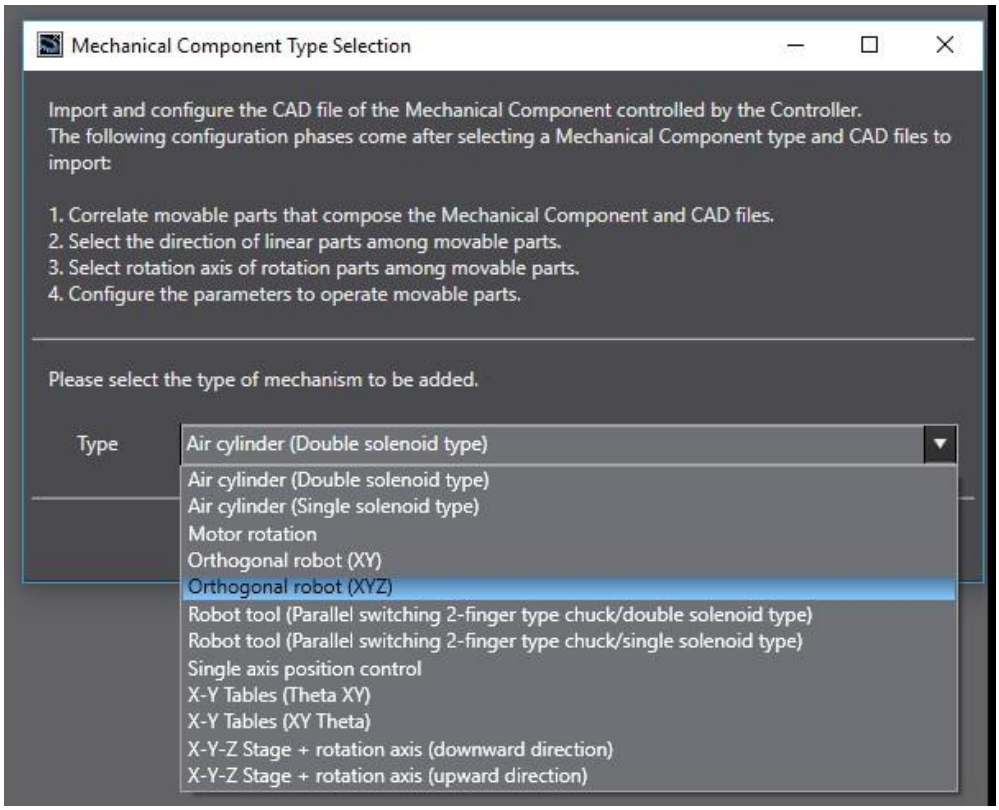
Right click on the 3D Visualization option from the Configurations and Setup drop down in the Multiview Explorer Window and select Add - Mechanical Component.



3.2 Mechanical Component Selection

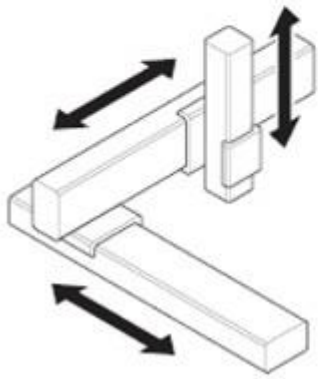
Below are the options of common machines that you can select from. If your machine or motion type does not fit into one of these categories, you are able to make your machine by combining multiple Motor Rotation and Single Axis Position Control examples. This material will be covered in another document.

The machine type we are focusing on in this example will be the Orthogonal Robot (XYZ).



Orthogonal Robot (XYZ)

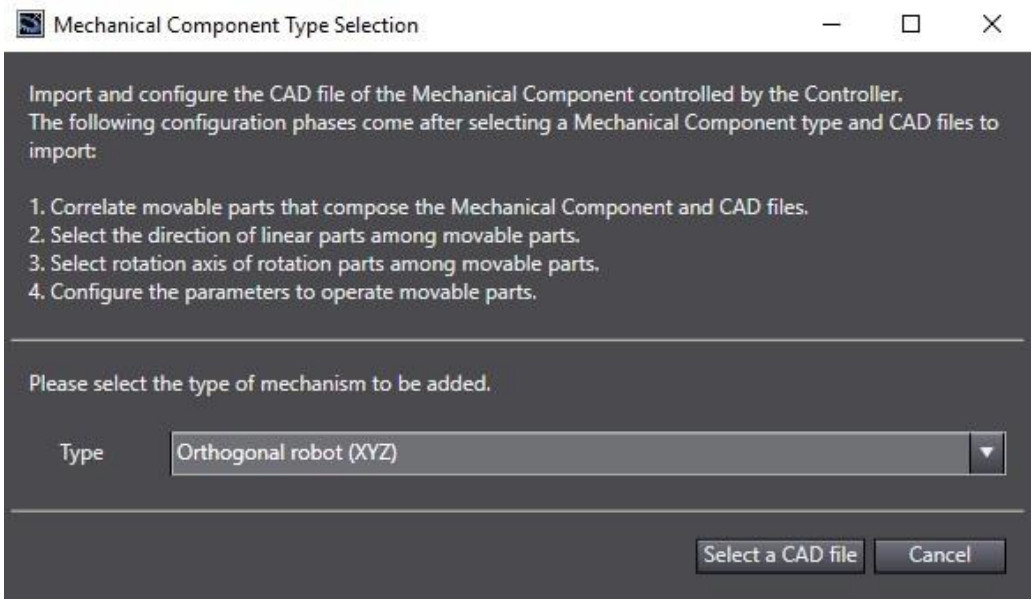
Orthogonal robot (XYZ) refers to a component that can move to any position in a 3D space.



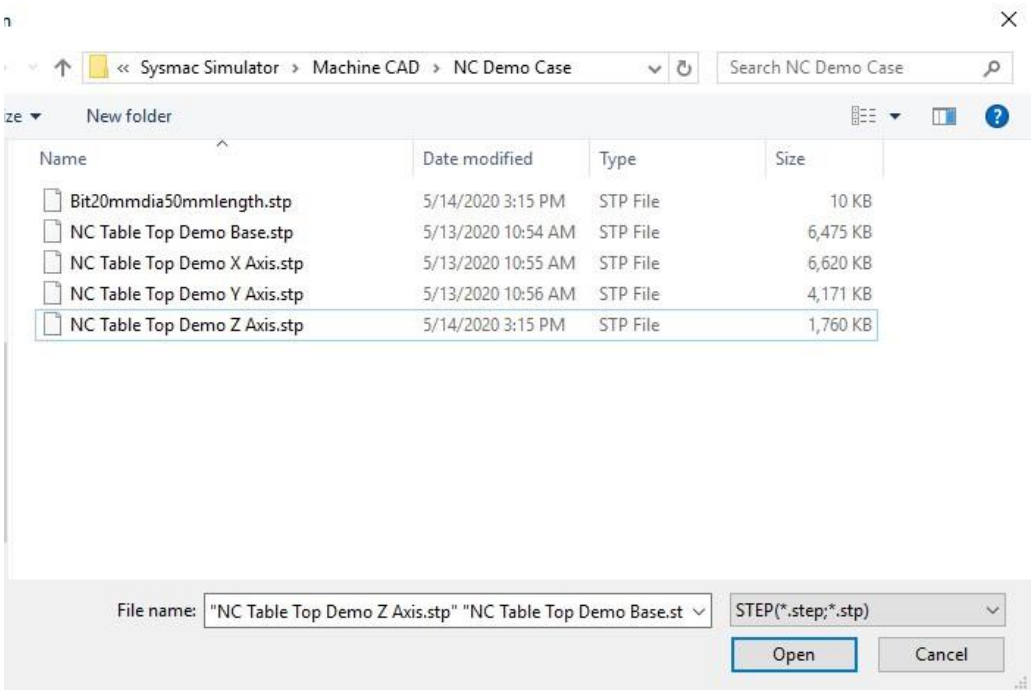
4. Mechanical Model Wizard: Orthogonal Robot (XYZ)

4.1 Import CAD Files (.STEP / .STP Format)

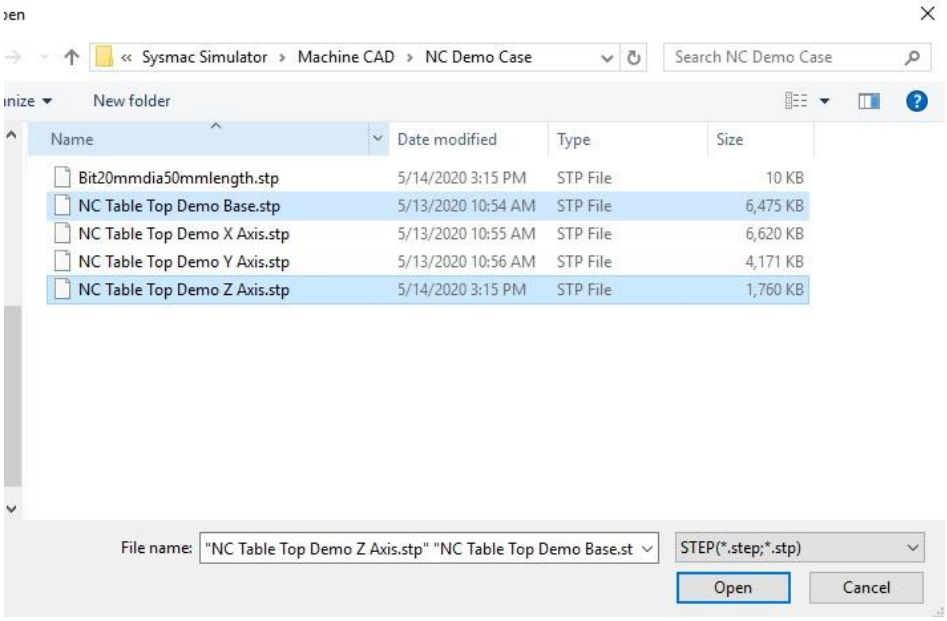
Make sure the Orthogonal Robot (XYZ) is selected from the Type drop down menu and then press the “Select a CAD file” button.



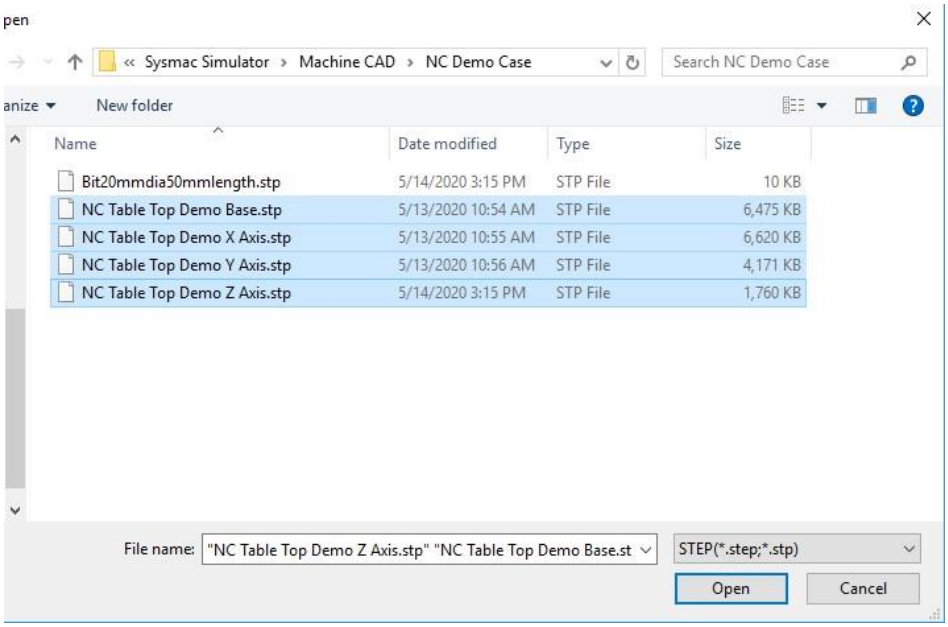
Navigate to the file location where your machine CAD data is located.



This file selection window supports **CTRL + CLICK** to select individual files if the files you need are not in order:



It also supports the **SHIFT + CLICK** to select the files that are grouped together:

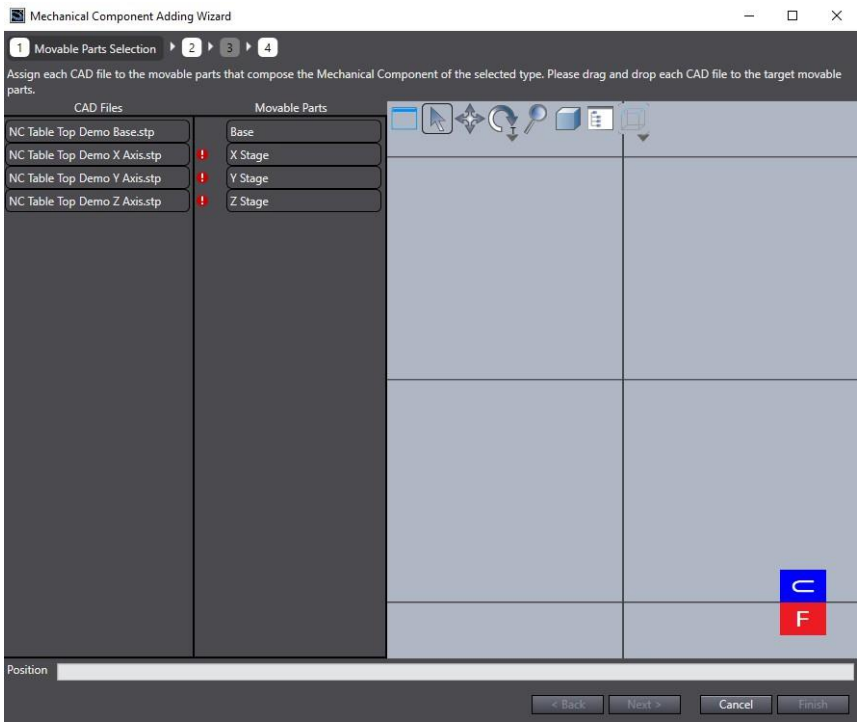


The files needed for this example are:

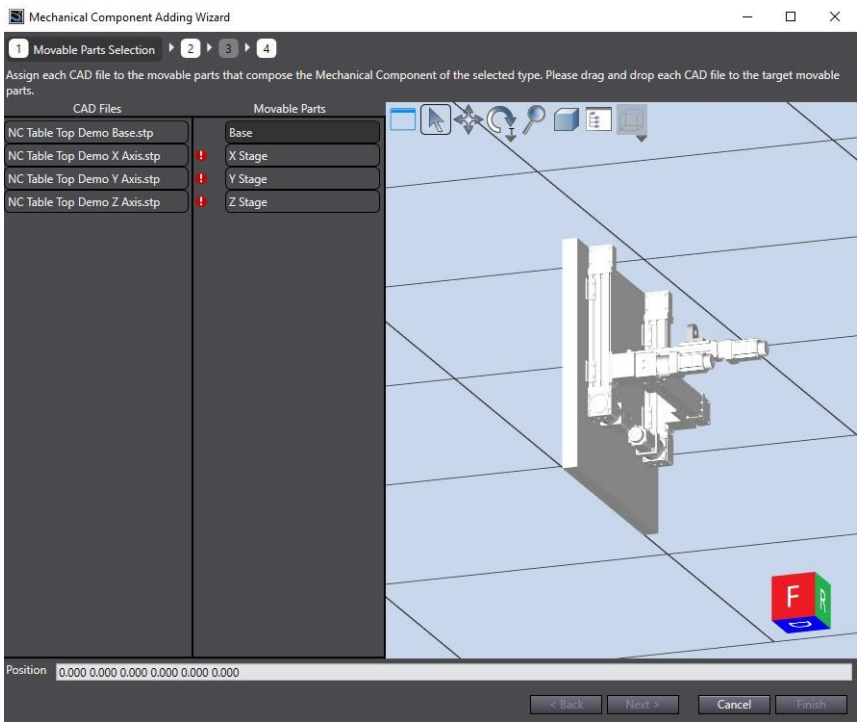
- NC Table Top Demo Base
- NC Table Top Demo X Axis
- NC Table Top Demo Y Axis
- NC Table Top Demo Z Axis

4.2 Assign CAD Files to Machine Components and Adjust Offsets

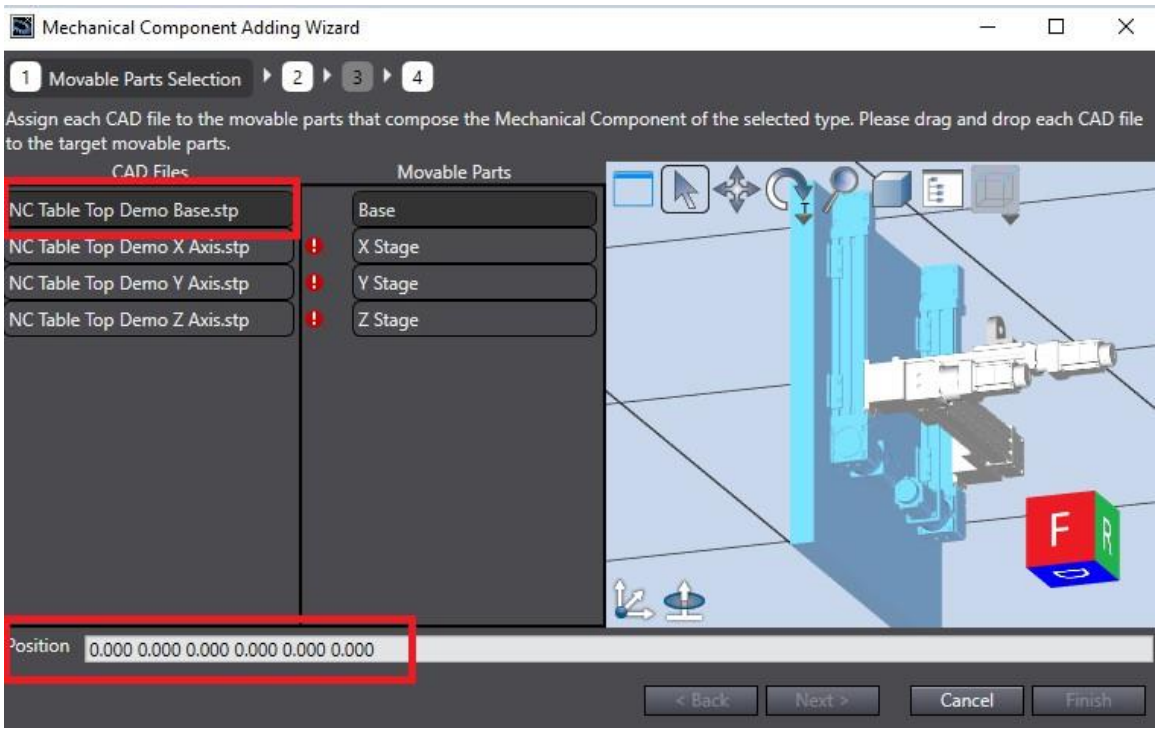
When the files are done being imported into the Mechanical Component Wizard, you might end up with a screen like the one below where you are not able to see your model.



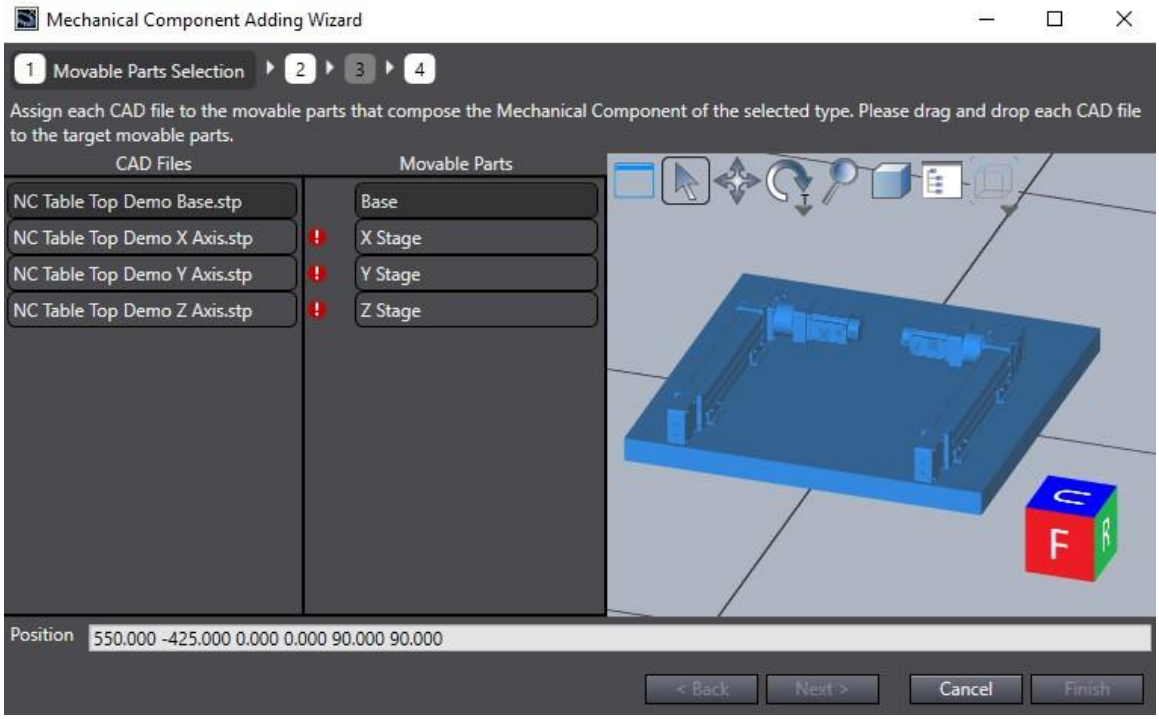
If you right click and hold in the 3D Visualizer portion of this window you are able to rotate the view of the window.



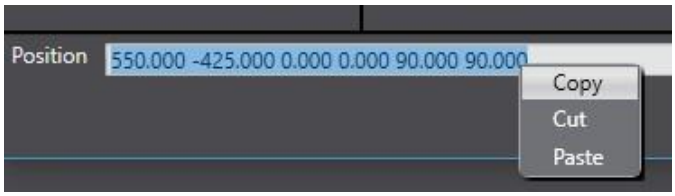
To change the position and orientation of the machine you can select the CAD file part that you want to adjust and enter in a new position for the part.



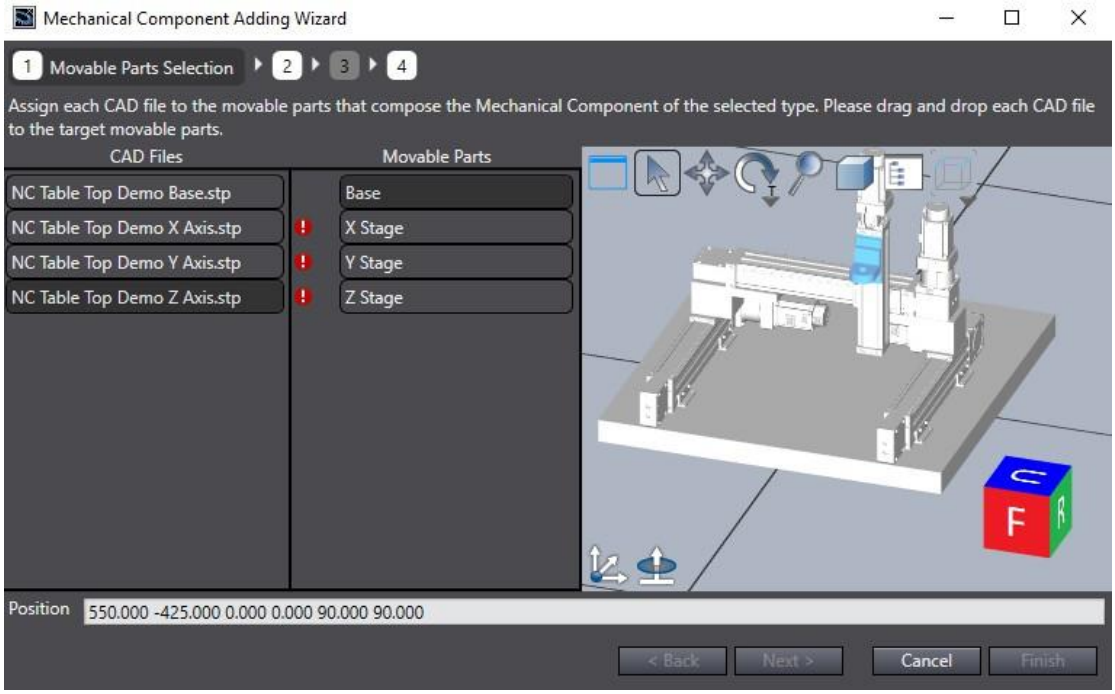
The Position values that were used in this example are: 550.00 / -425.00 / 0.00 / 0.00 / 90.00 / 90.00.



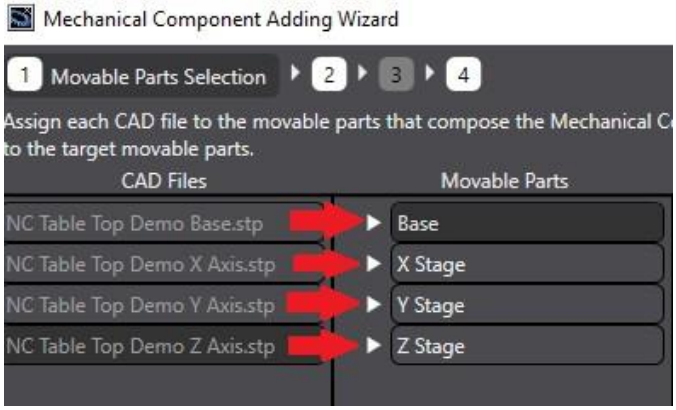
Adjust the positions for all the CAD Files for this machine. An easy way to do this is to copy the position section from the base and then paste it into the position section for the other files



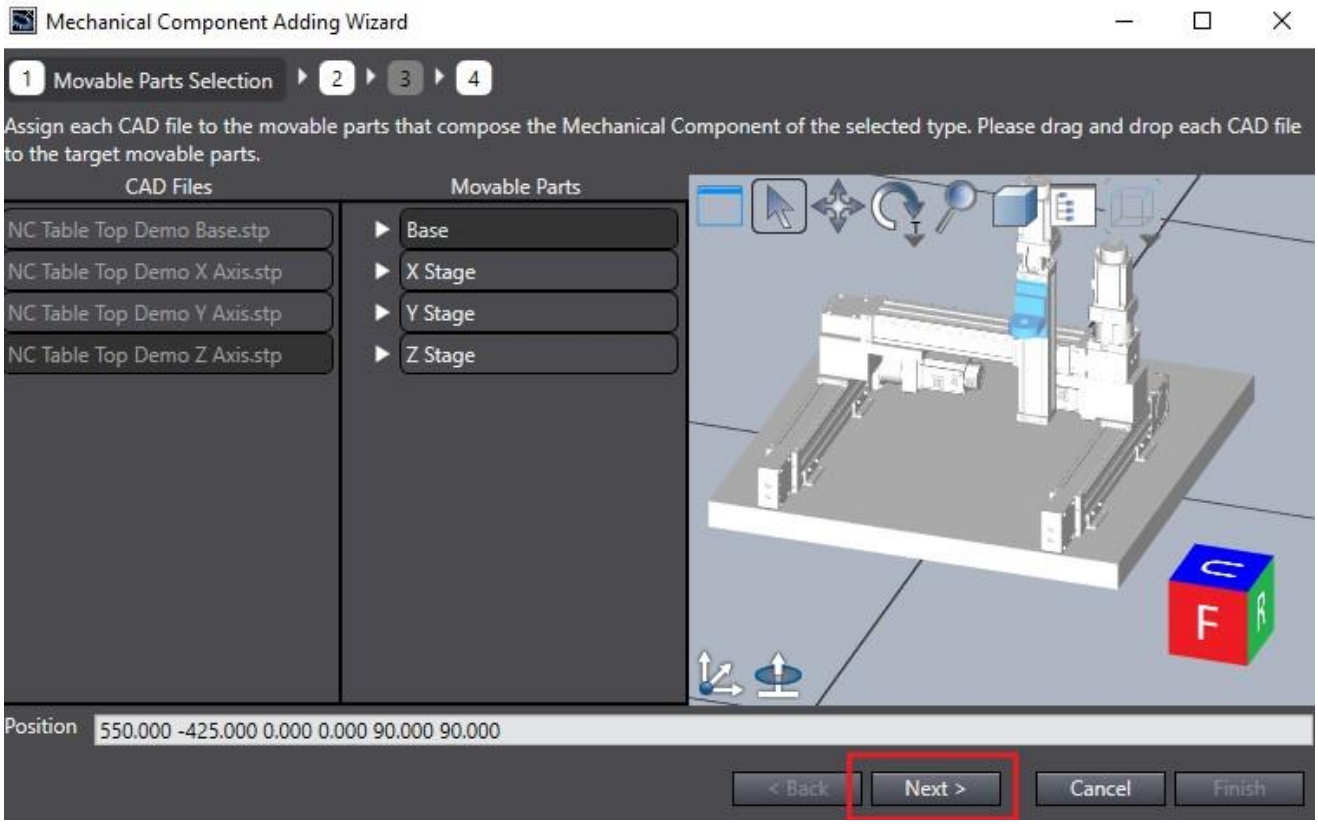
The machine should end up looking like this:



The last portion of this section will be to assign the CAD Files to the Movable Parts. This can be done by dragging and dropping the files to their assignments.

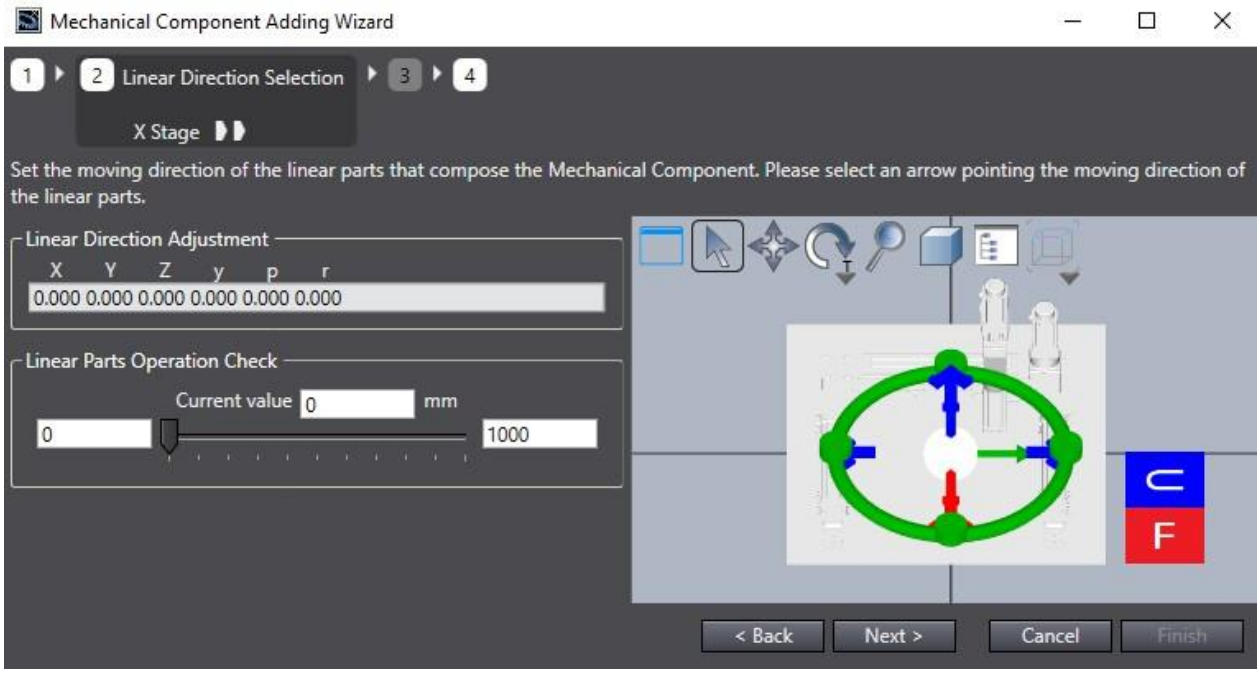


Press Next to continue to the next part of the wizard.

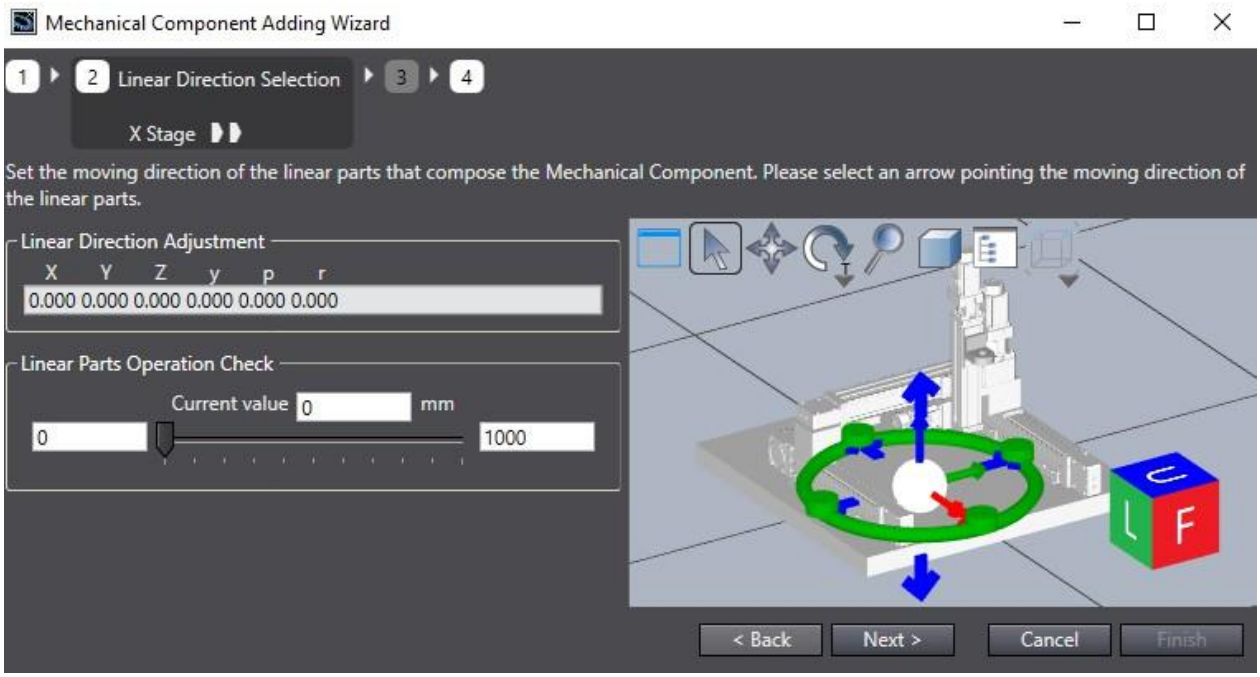


4.3 Linear Direction Selection: X Axis

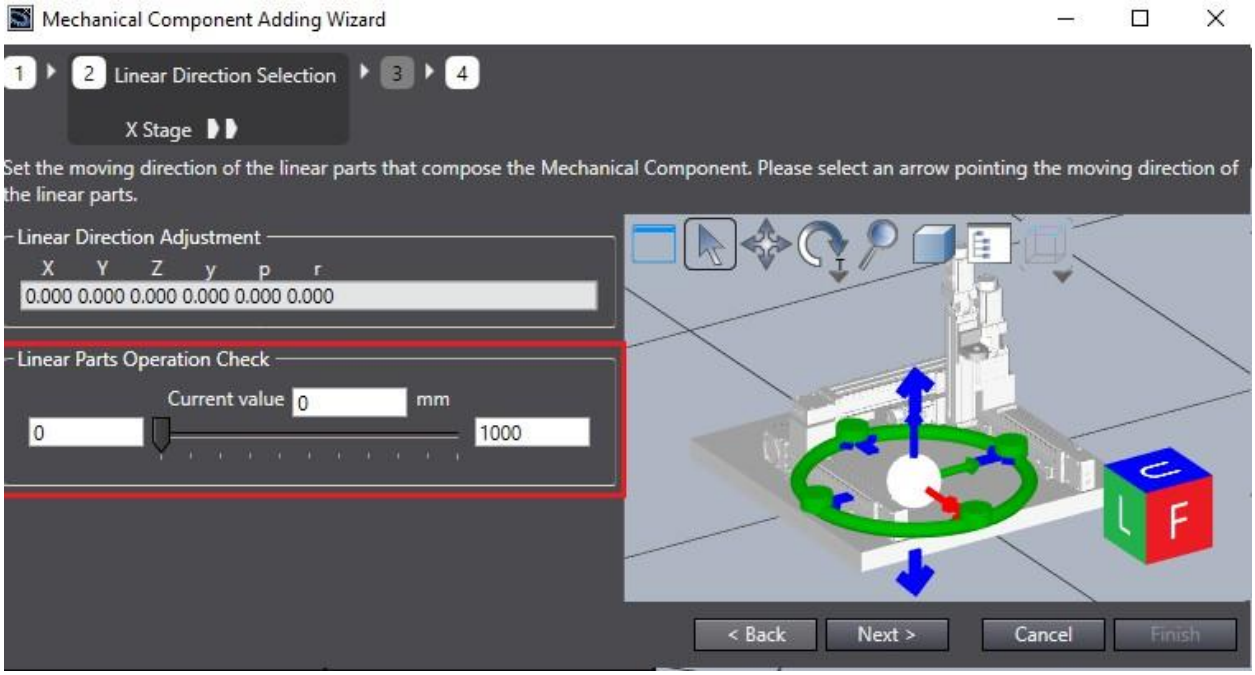
Below is the starting point for the next window in the wizard. This portion lets you select the direction that you want the X Axis portion of the machine to travel in.



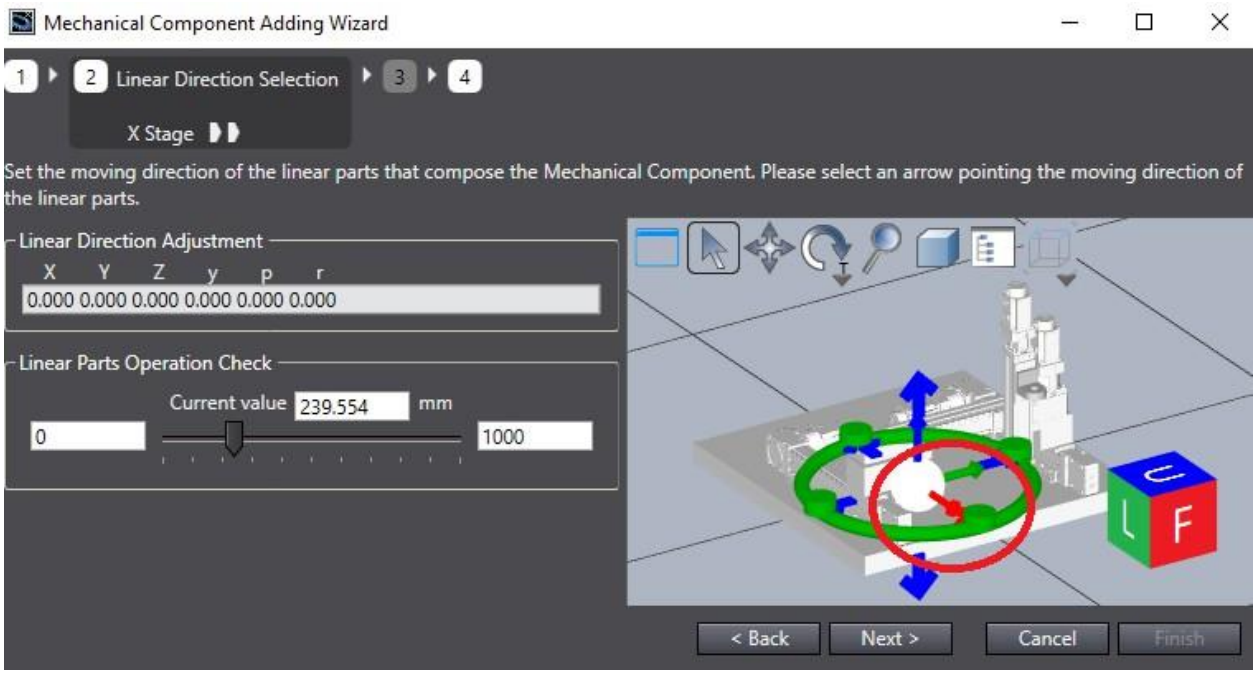
You can adjust the view of the demo by right clicking and holding in the visualization window to get a better view of the machine.



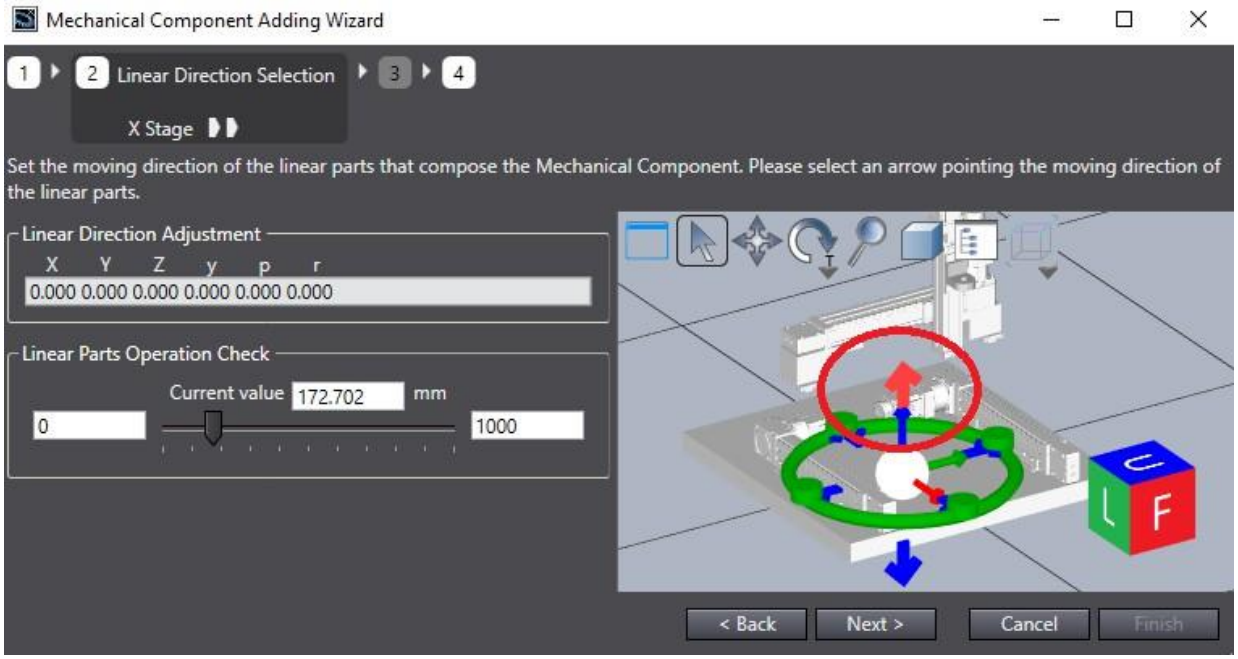
The X Axis can be moved by adjusting the slider in the Linear Parts Operation Check section of the window.



The X Axis will move in the direction designated by the RED ARROW in the 3D Visualizer.

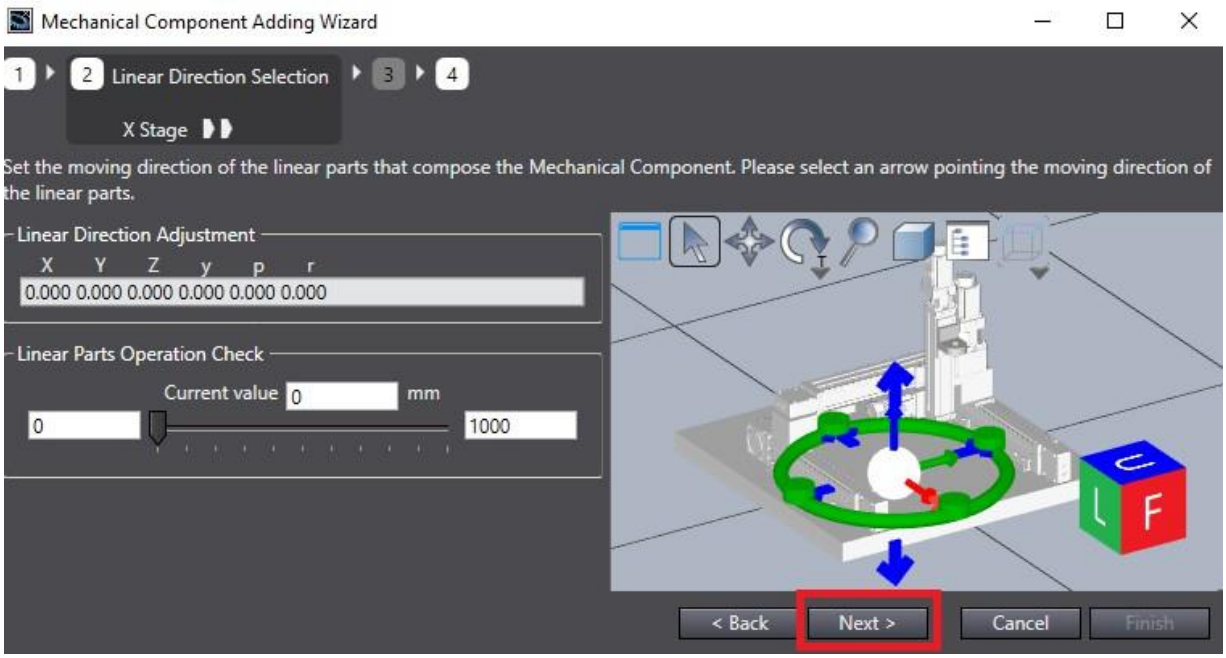


If you wanted to change the direction of the X Axis, you can select the BLUE ARROW in the 3D Visualizer and adjust the slider.



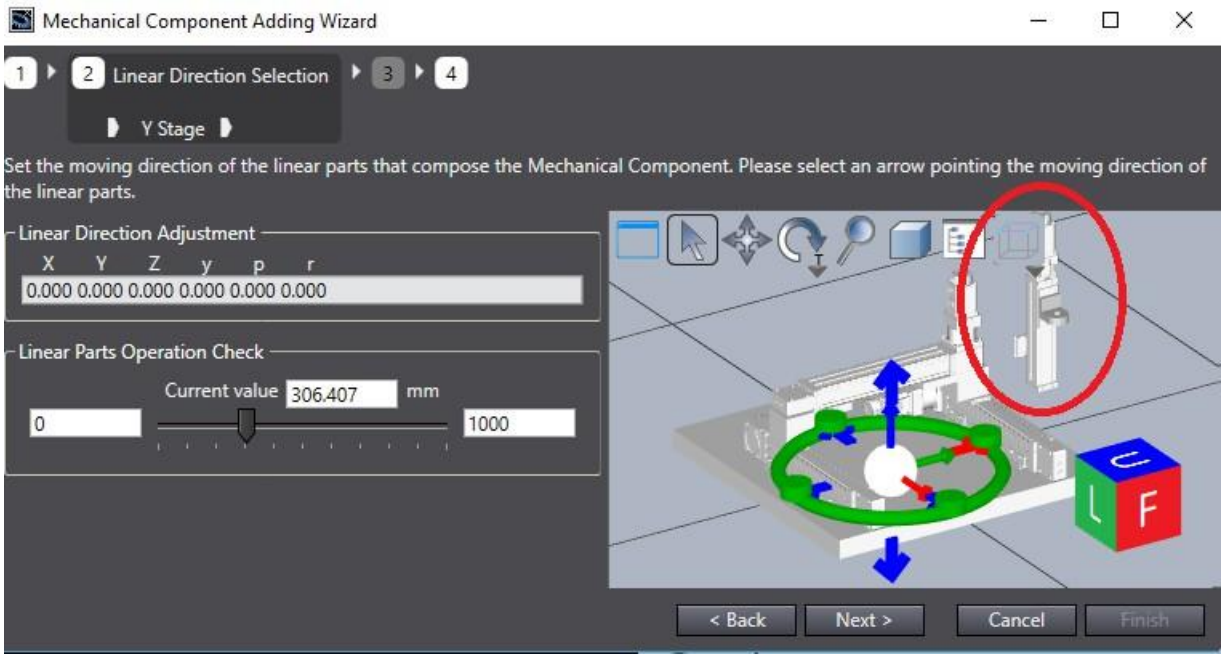
The Linear Parts Operation Check slider does not set the limits of motion for the machine for the final example. This is done in the Axis Setup on the Ladder Logic side of Sysmac Studio.

We want to use the default direction for the X Axis on this machine. Hit Next to continue.

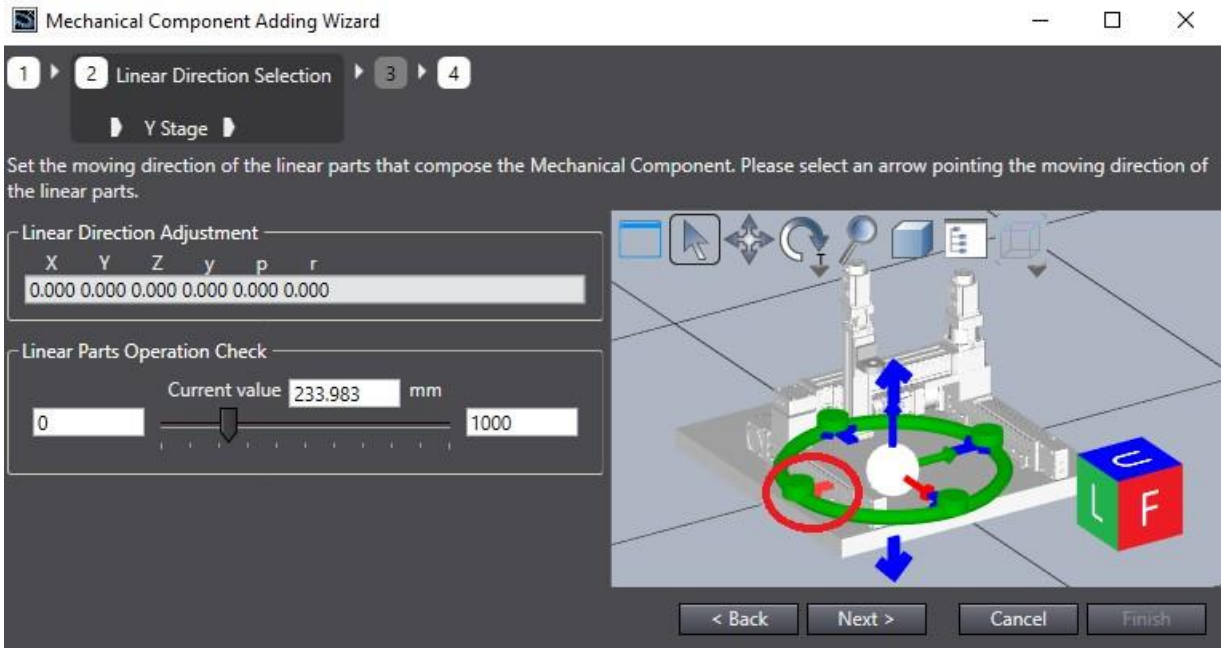


4.4 Linear Direction Selection: Y Axis

For the Y Axis we will do the same as the X Axis. Use the slider to test the direction of travel for the Y Axis. By default, it will be in the opposite direction than what we want.



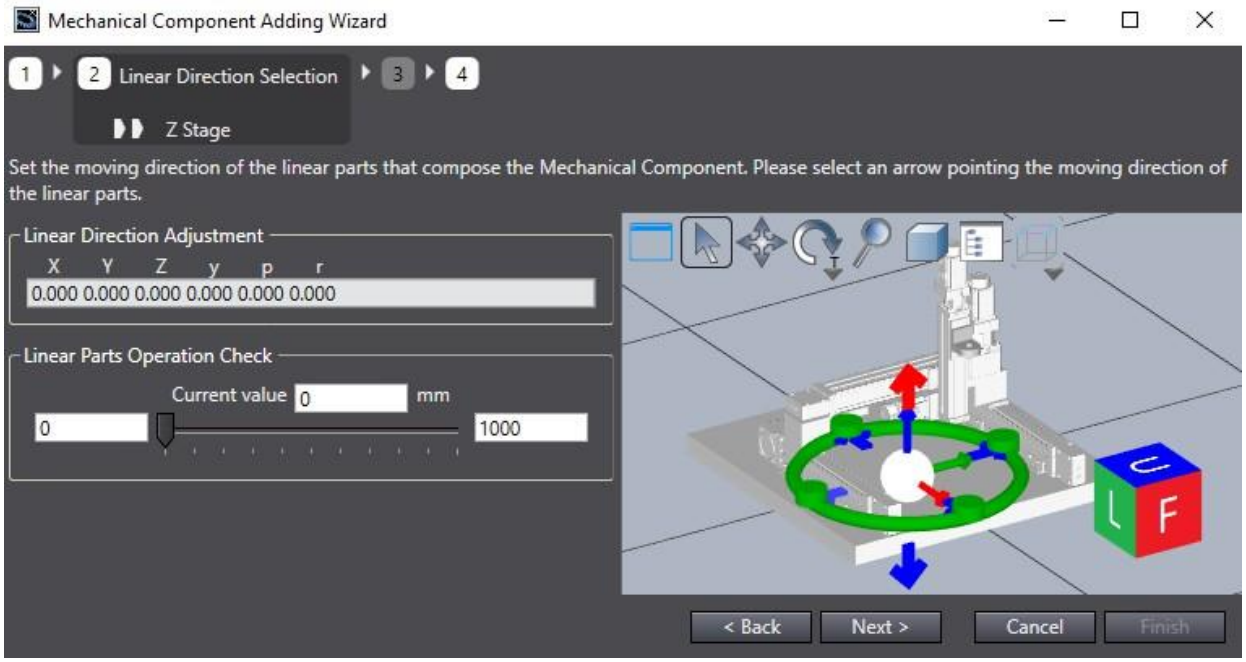
Change the direction by selecting the BLUE ARROW and confirm the motion with the slider.



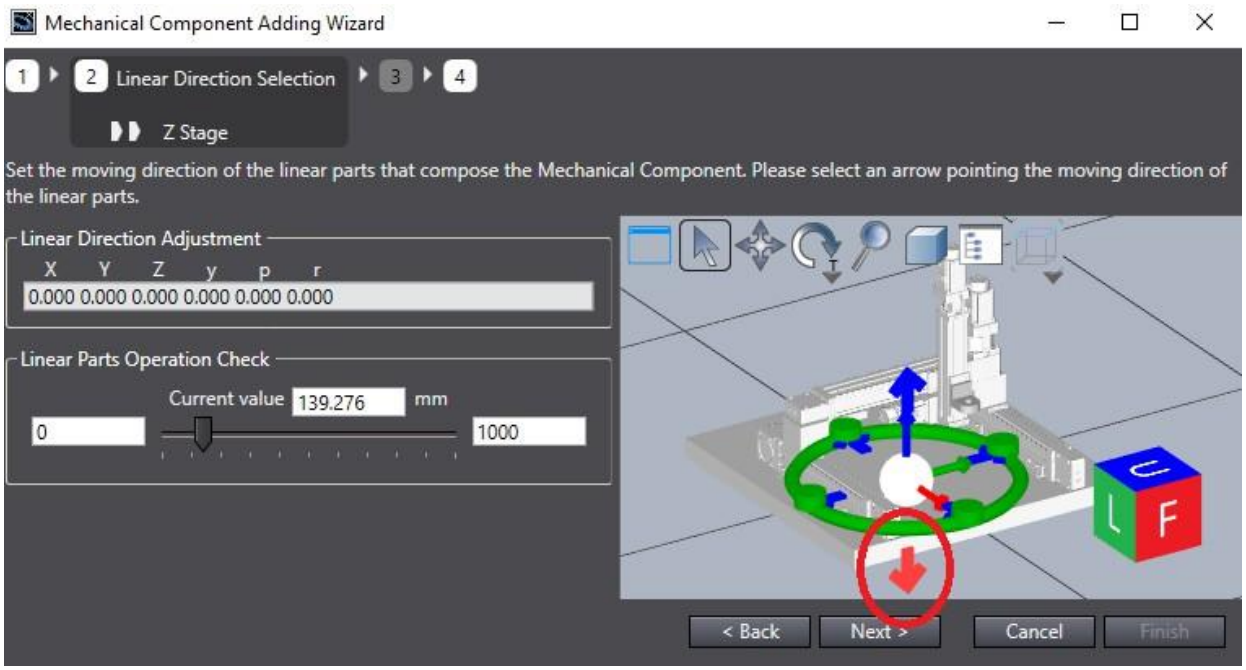
Hit Next to continue to the Z Axis.

4.5 Linear Direction Selection: Z Axis

Next, we will adjust the Z Axis direction of this machine. The default direction is opposite of what we need for this machine example.



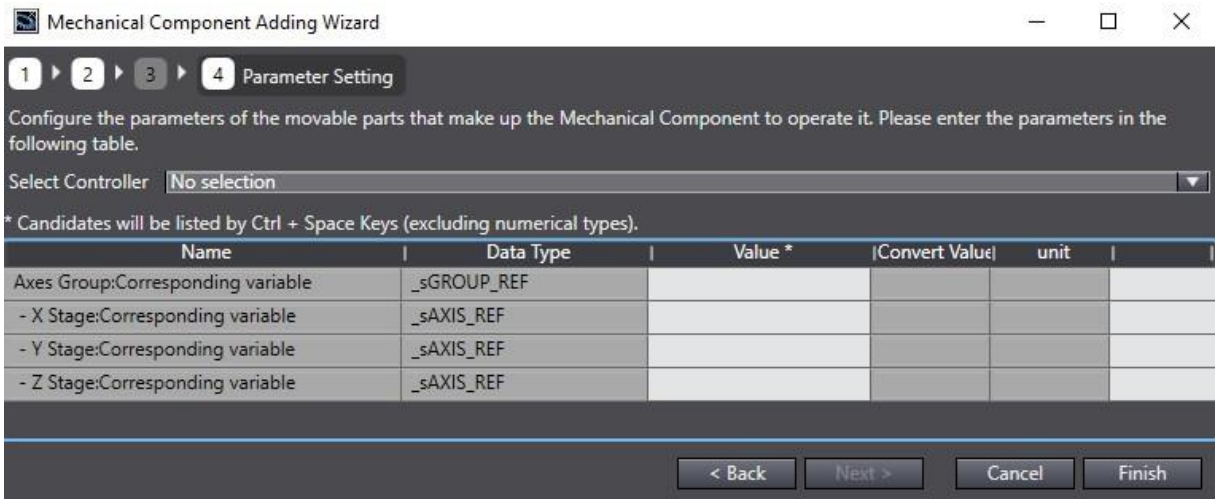
Click the bottom BLUE ARROW to adjust the direction of the Z axis. Confirm the motion with the slider.



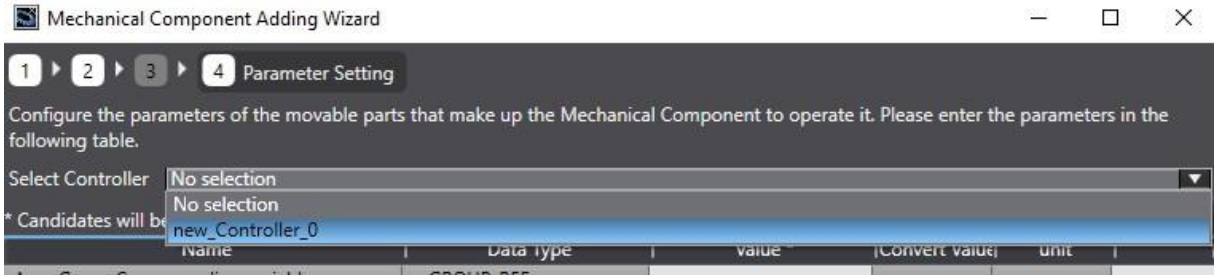
4.6 Parameter Setting (Linking to Motion Axes)

The final section of the wizard will have you assign the Motion Axes that are configured on the Machine Controller (PLC) to the Mechanical Model.

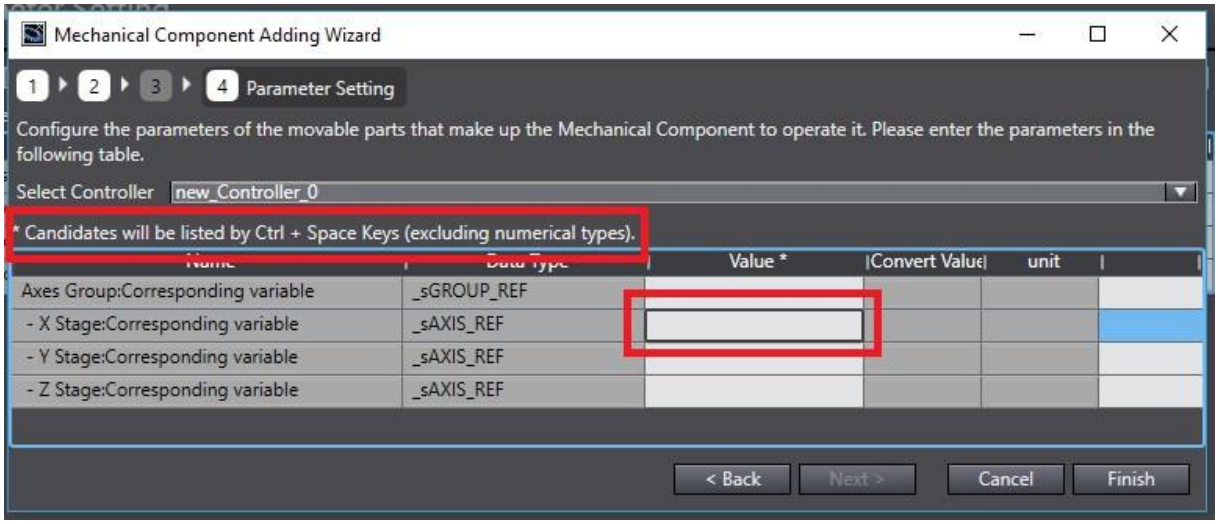
If you do not have the Machine Controller / Ladder Logic portion finished at the time of creating this Mechanical Model then you can select “Finish” and exit the wizard and edit the properties of the machine later.



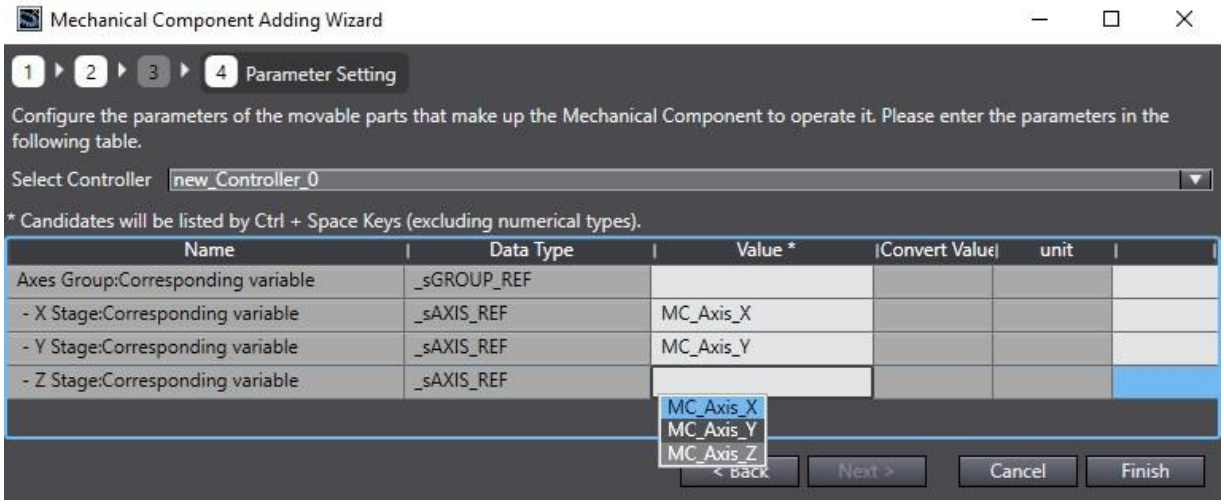
Select the Machine Controller used in the project from the drop down “Select Controller Option”



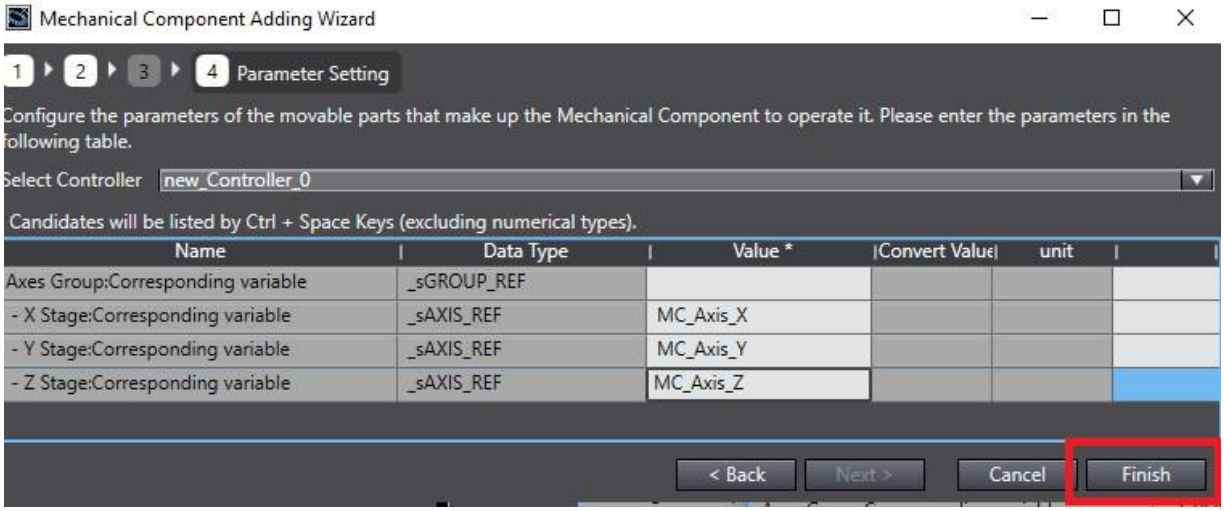
Next, double click in the Value cell for the Axis that you want to assign a variable to. If you can see the cursor you are able to use the shortcut command **CTRL + SPACE** to have a list of available axes to assign to this axis.



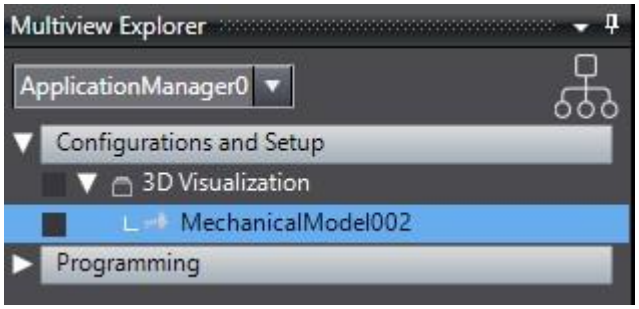
Assign the correct Axis Variables to the X Stage, Y Stage, and Z Stage components of this machine.



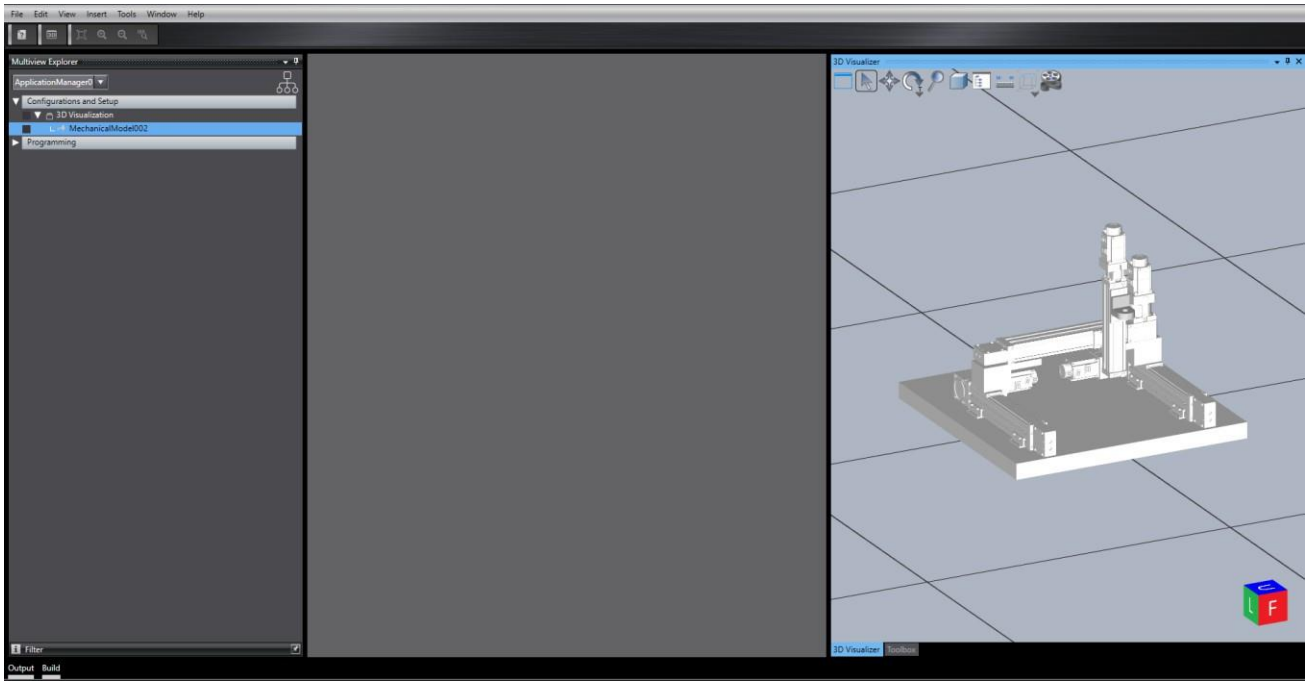
Press Finish to exit the wizard.



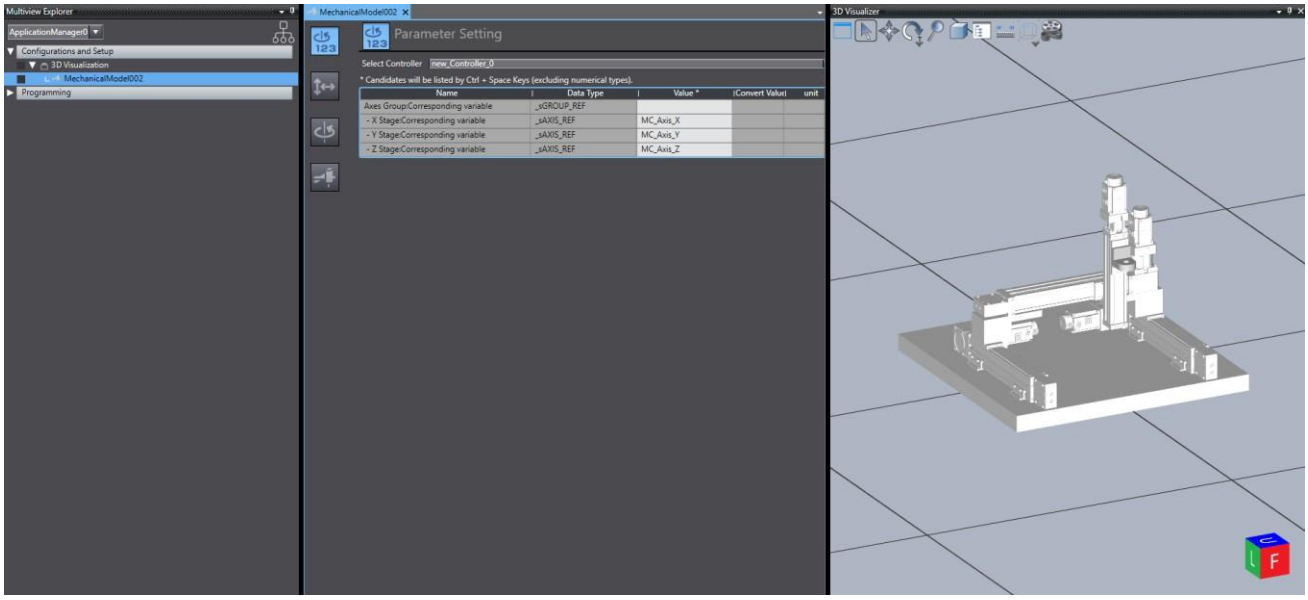
After you have exited the wizard after pressing “Finish”, you should see your machine in the 3D Visualization in the Multiview Explorer.



You will also now see the machine in the 3D Visualizer Window.



If you wanted to edit some of the properties of the machine, you can double click the machine in the Multiview Explorer to bring up the parameters window.

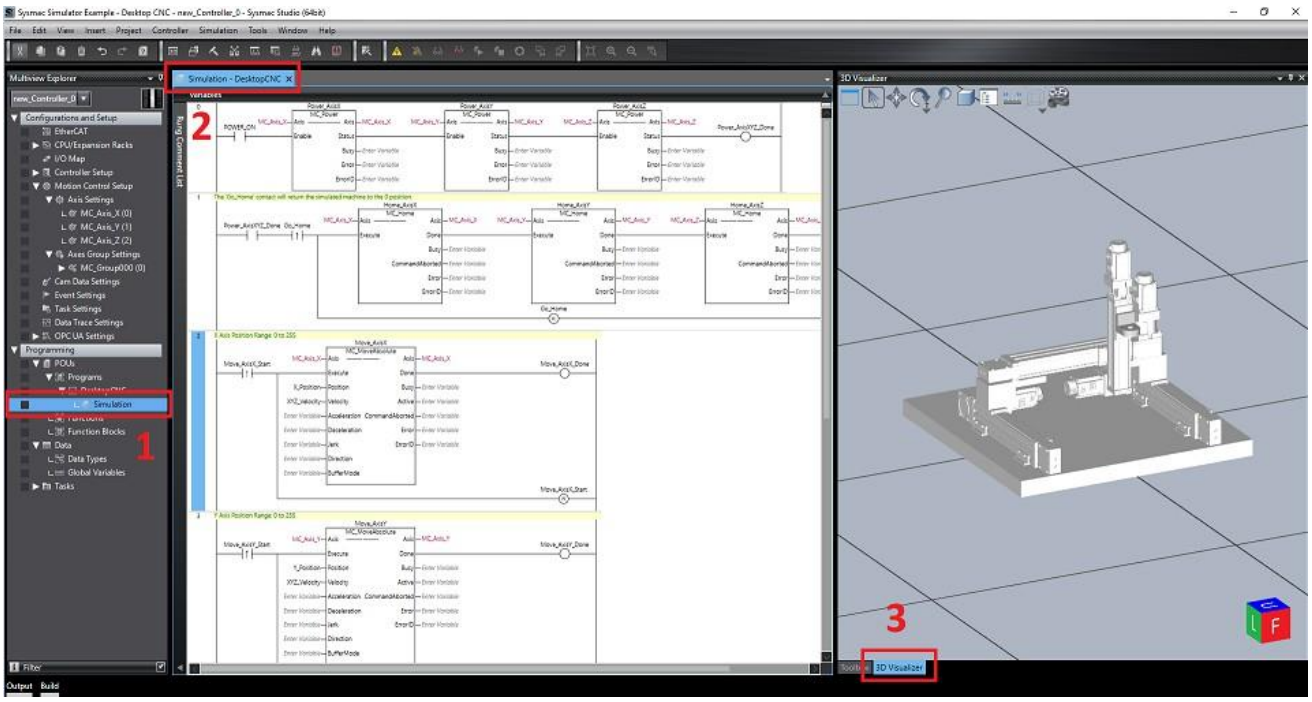


5. Starting the Simulation

5.1 Adjusting Sysmac Studio's Layout

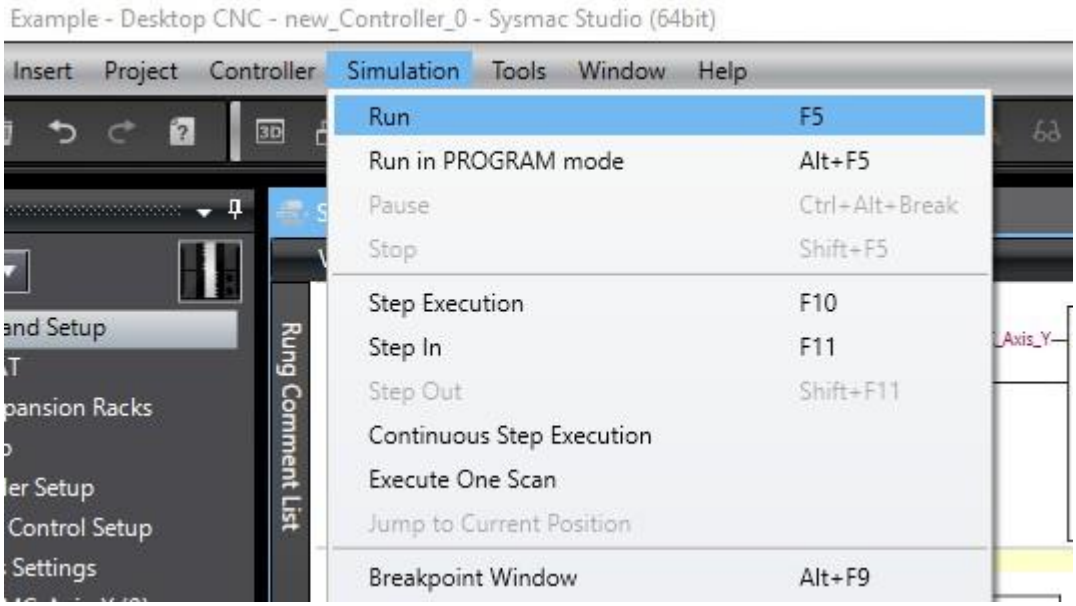
To make it easier to view the ladder logic with the simulated machine, it is recommended to adjust Sysmac Studio's window layout so that it looks like the image below.

Double click on the project in the Multiview Explorer **(1)** and the project will appear in the middle window **(2)** by default. The 3D Visualizer can be displayed by pressing the 3D Visualizer button **(3)** where the toolbox normally appears.

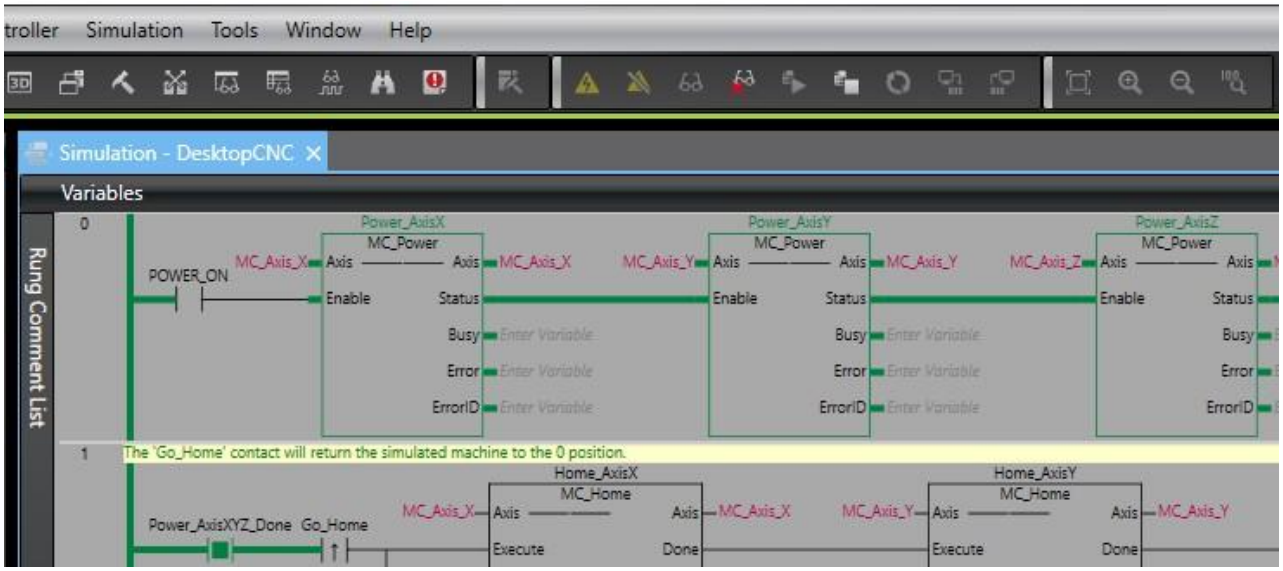


5.2 Starting the Simulation

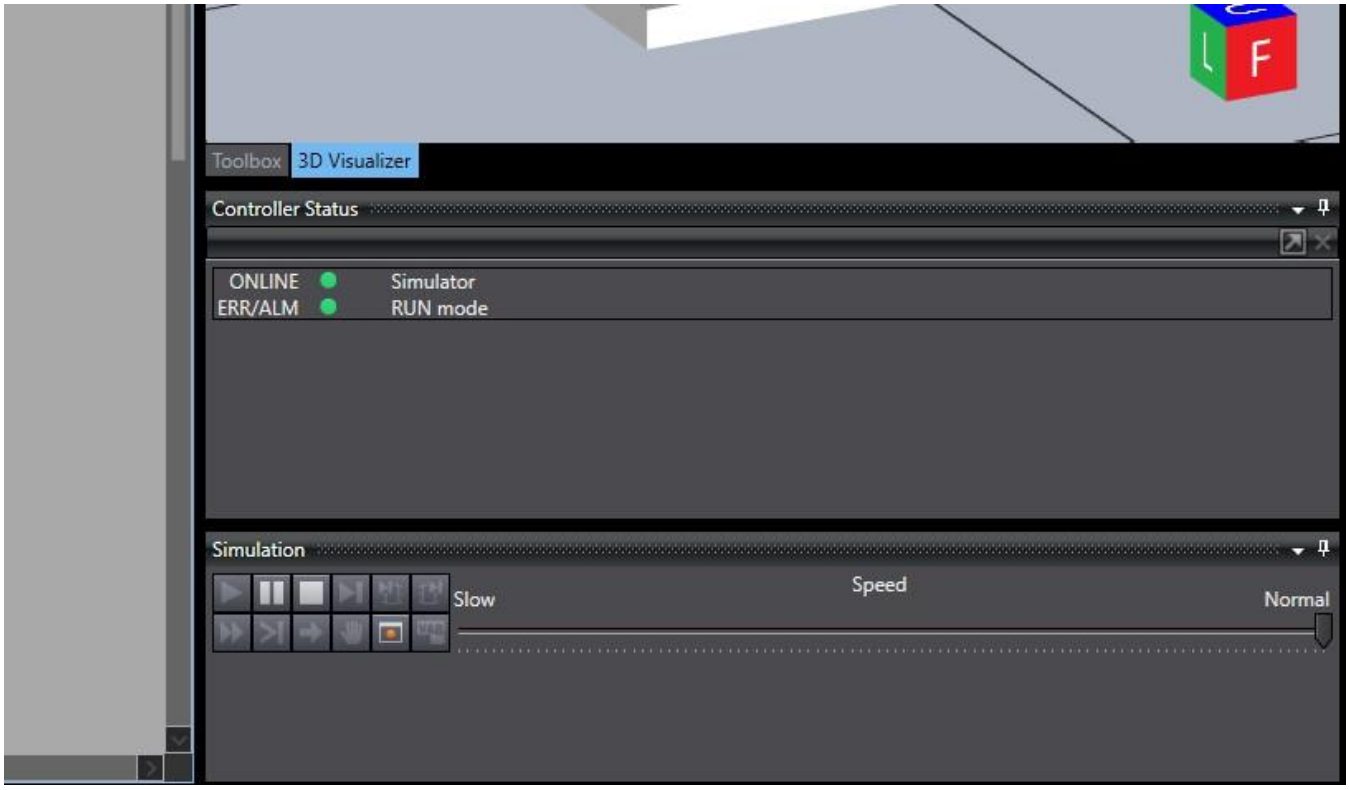
Navigate to the top menus of Sysmac Studio, select the Simulation drop down, and press Run to start the simulation.



When the simulation is running, you will see a lime-green bar at the top of the screen and the program background will change from white to gray.



Below the 3D Visualizer window, a two windows should appear.



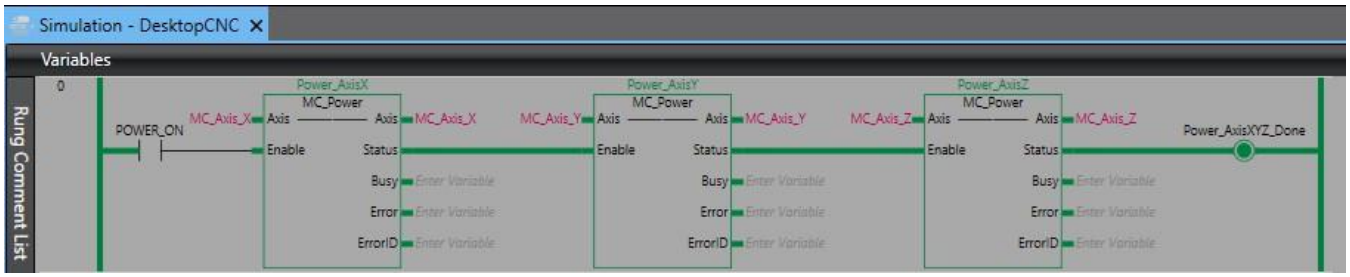
The Controller Status window shows the status of the simulation and the ERR/ALM will turn from Green to Red when an error occurs. The most common error that occurs during this simulation will be when you command the machine axis to move past the limits that are configured in the axis settings.

The Simulation window allows you to Pause, Stop, and Play the simulation.

5.3 Machine Simulation Operation

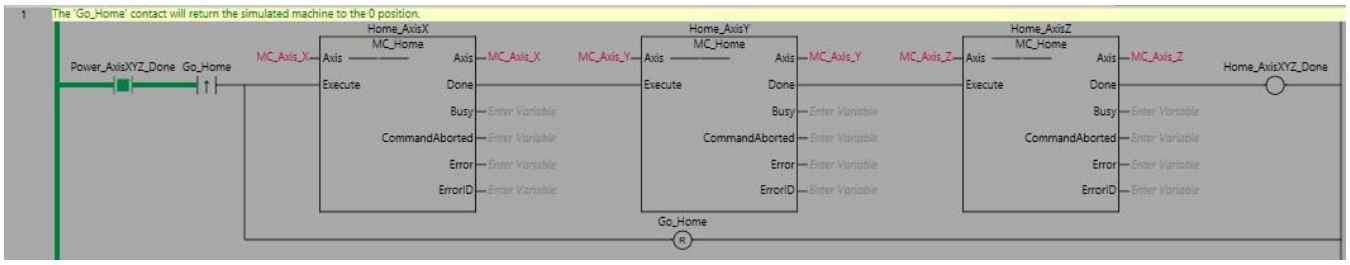
If you are using the project examples where the ladder logic is provided, then below will be a short description of how to operate the simulated machine.

5.3.1 Rung 0



Rung 0 shows a sequence to power the axes for the machine if this was a physical machine and not a simulation. This rung is mostly for completeness more than function and when you start the simulation it will automatically provide power to the axes.

5.3.2 Rung 1

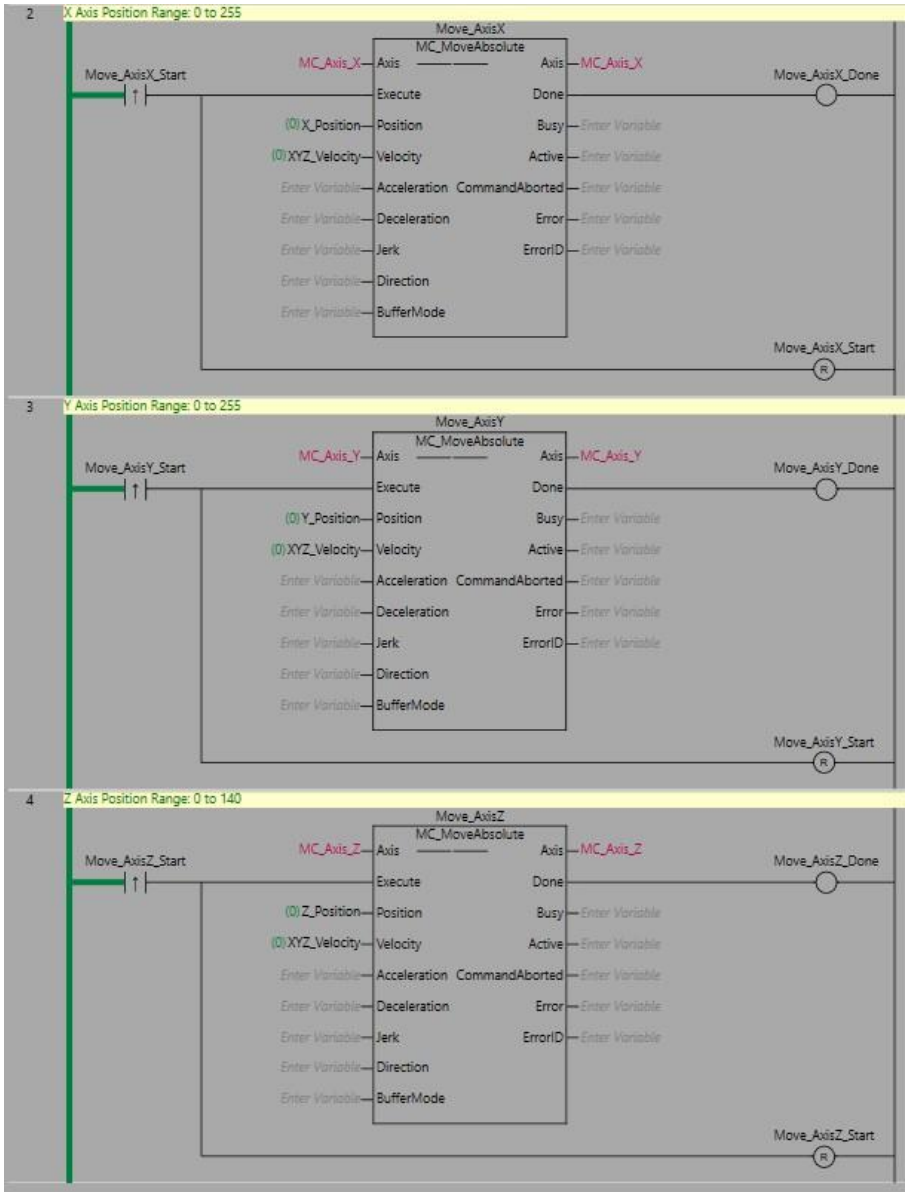


Rung 1 will return the simulated machine to the 0 positions for all of the axes when you set the Go_Home contact to TRUE. This can be done by double clicking on the Go_Home and selecting the TRUE option.

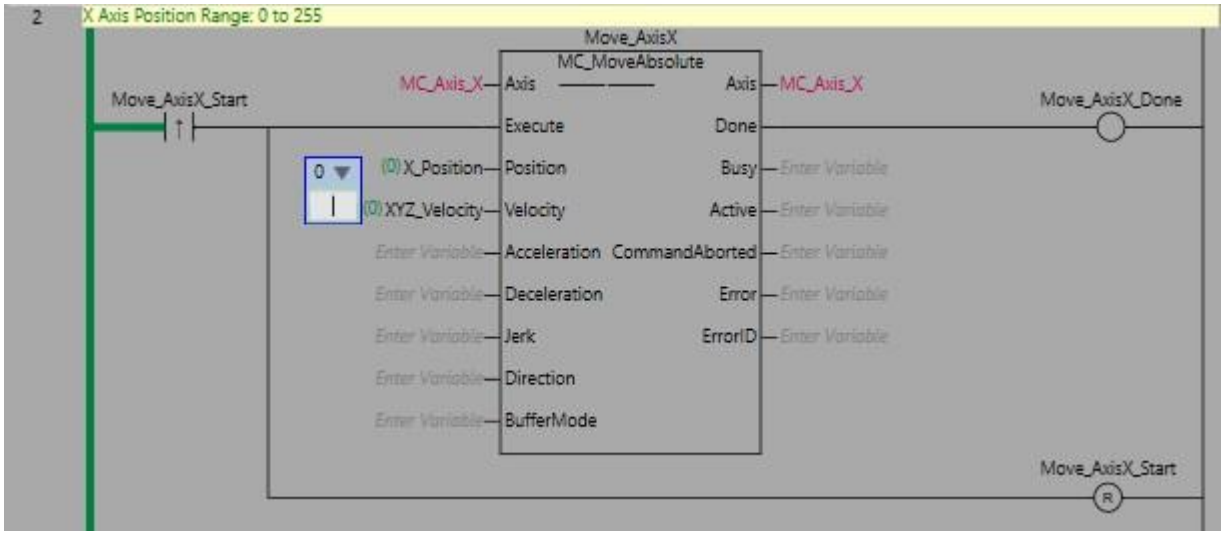
The Go_Home output with the R will reset the TRUE status when the command is sent so that you don't have to manually do this each time.

5.3.3 Rungs 2 - 4

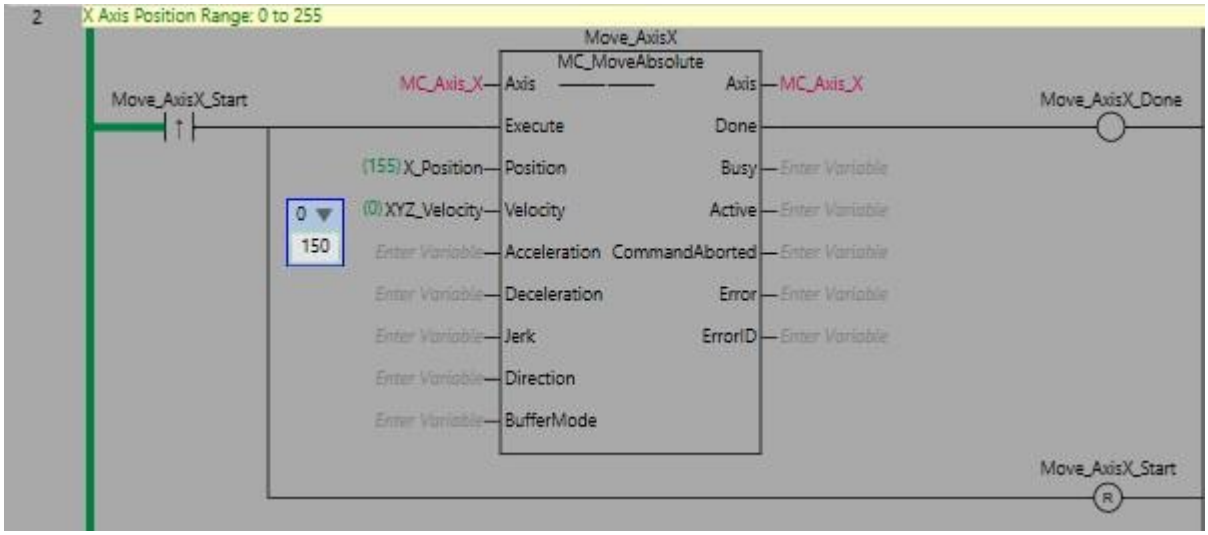
Rungs 2 – 4 will command the simulated machine axes to move to different target locations.



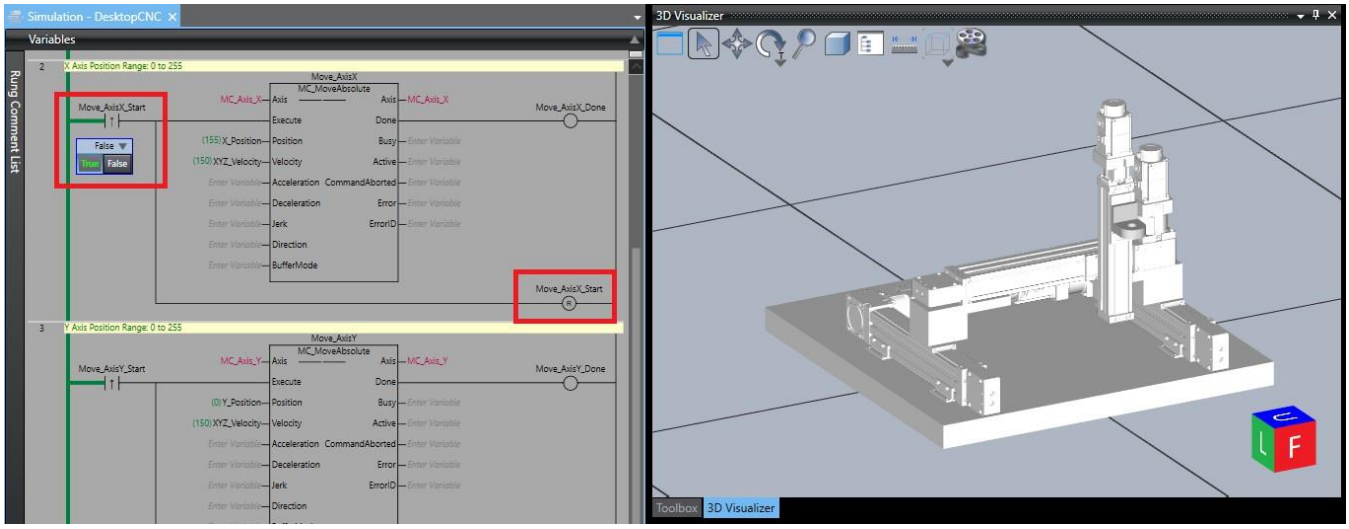
To change the target location while the simulation is running, you can double click on the X_Position, Y_Position, or Z_Position variables and you can enter in a new value. Note the Axis Ranges in the comments section of the rung. Press Enter to push the value into the variable.



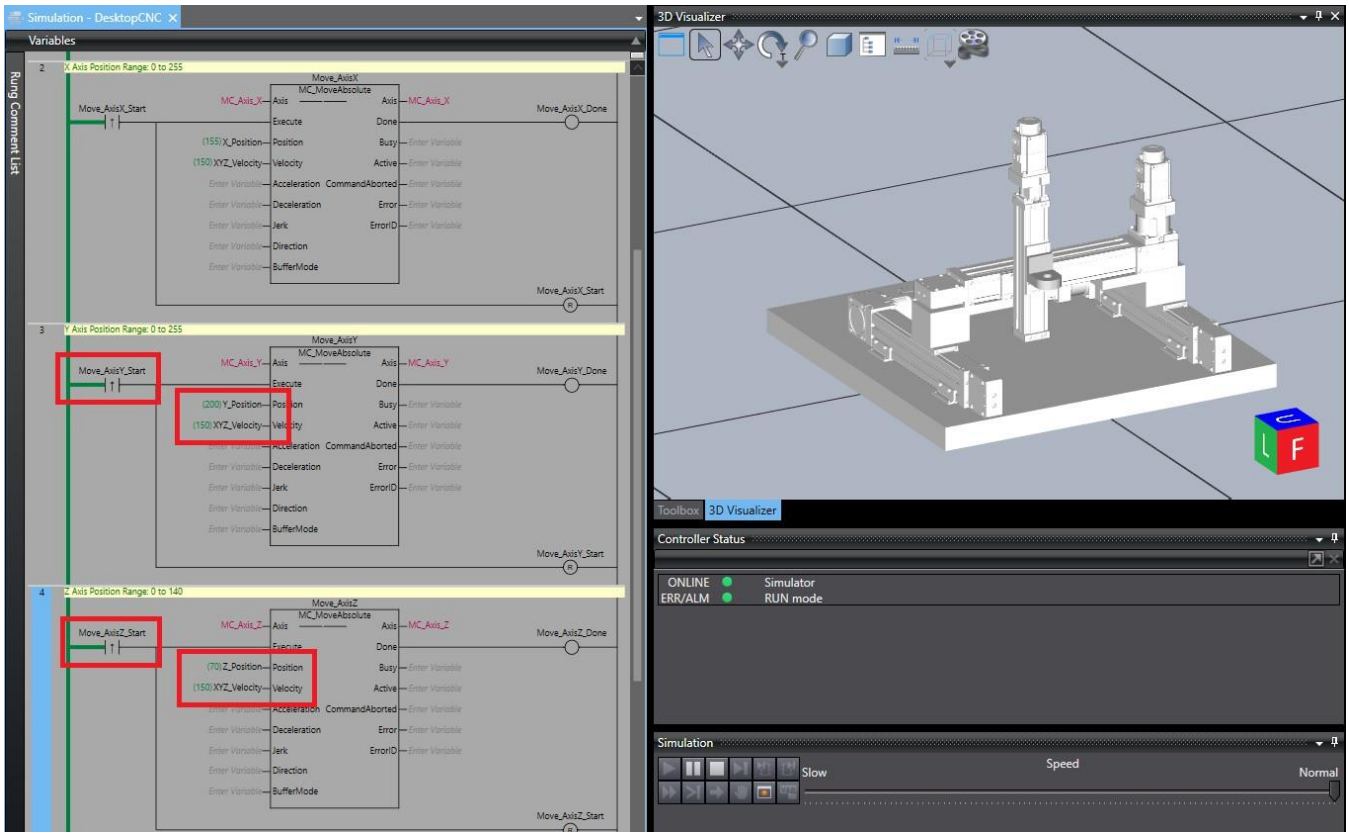
You can also change the velocity value by double clicking on the XYZ_Velocity variable. The same variable is used for all three axes so when you change it for one axis it will adjust it for all of the axes.



Double click on the Move_AxisX_Start contact and select TRUE to command the machine to move. Move_AxisX_Start will reset back to FALSE because of the Move_AxisX_Start Reset output contact. This Reset command is so that you don't have to manually set Move_AxisX_Start to FALSE after each commanded move.



You can repeat this for the other axes of this machine by repeating the procedure.

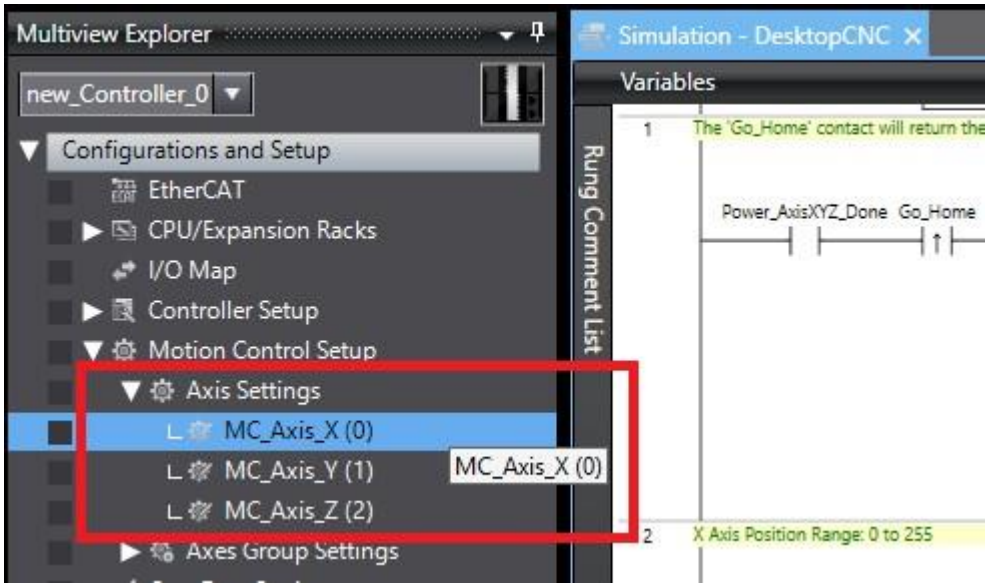


5.4 Machine Simulation Operation

Press Stop to end the simulation.

5.5 Motion Axis Limits

To change or set up the axis limits of your simulated machine you can go to the Axis Settings under Motion Control Setup in the Configurations and Setup menu in the Multiview Explorer.



You can change the behavior of the software limits and set the Positive and Negative software limits depending on the machine type that you are using. If there are no limits for the axis then the axis of that machine can continue outside of the bounds of what you would expect a machine to be able to do.