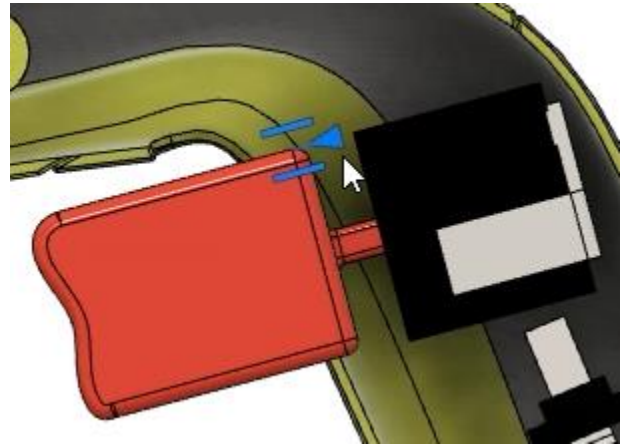


Introduction to assembly modeling

In this module, you'll learn the difference between bodies and components, then apply and modify a joint to replicate mechanical motion.

Learning objectives:

- Create a component.
- Create a joint.
- Edit a joint limit.
- Drive a joint.



The completed exercise

1. Upload and open the supplied *reciprocating saw motion.f3d* file. Explore the file's various components and bodies.

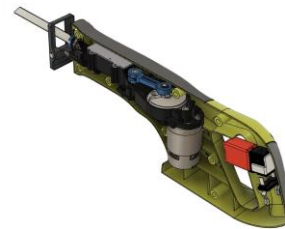


Figure 1. Open the supplied file

2. Since components in Fusion 360 each have their own origin location, their location in reference to the file's origin can be tracked; this means that components can have mechanical motion applied. In the image on the right, the Internal_Mechanics component's origin and the Gear Housing component's origin are visible. Fusion 360 can track the difference between the two origins in order to simulate motion. Bodies do not have an origin which means they cannot replicate motion.

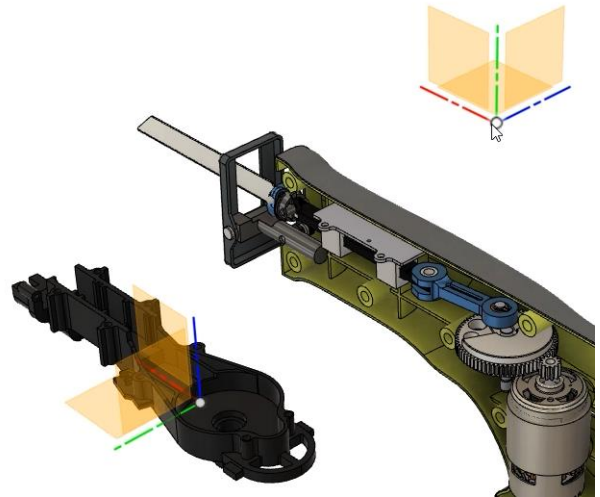


Figure 2. Note the components' origin

3. If you moved any components, click Position > Revert Position to return them to their original location.

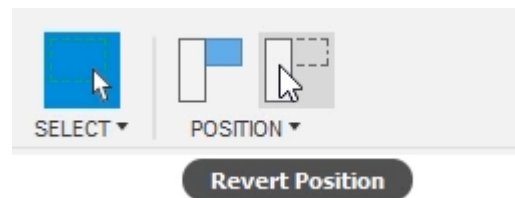


Figure 3. Revert a component's position

4. Expand the Browser's Bodies folder and notice that there is only one body inside of it: the Trigger body. The Trigger body has a cylinder icon to indicate that it is a body. Right-click the Trigger body and choose Create Components From Bodies.

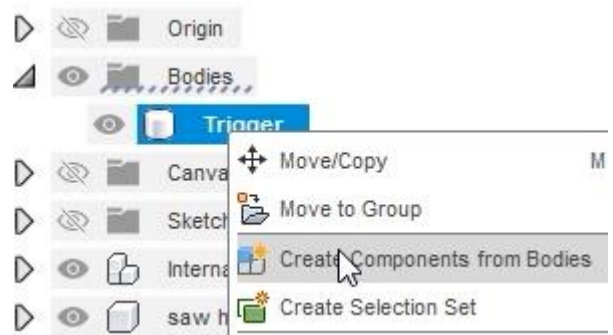


Figure 4. Convert a body to a component

5. An alternate way to convert a body into a component is to select the body and click Assemble> New Component. Make sure the Internal and From Bodies options inside the New Component dialog are activated, then OK the dialog.

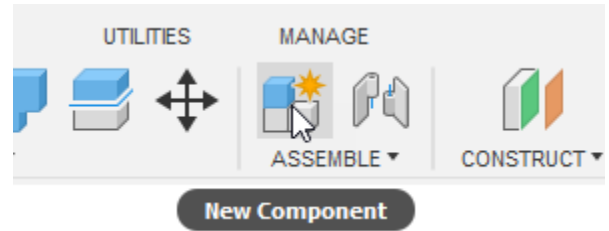


Figure 5. Convert a body to a component

6. The Trigger has been removed from the Bodies folder and the icon is changed to a cube to indicate it is now a component.



Figure 6. Inspect the new component

7. Now that the Trigger is a component, it can be moved to a new location. Click Position> Revert Position to return it to its original location.

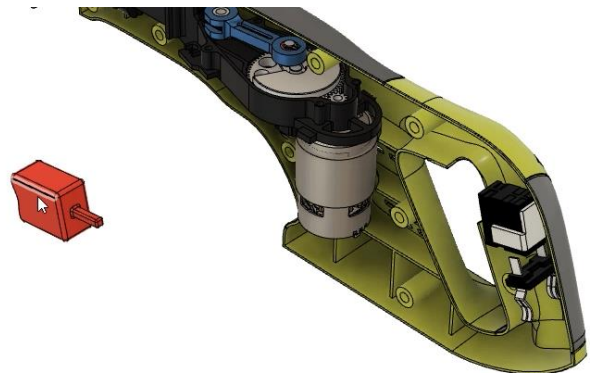


Figure 7. Move the new component

- The Browser also has a second component named Trigger. This component is an assembly, so it uses the three stacked cubes icon. Right-click this component assembly and choose Ground from the menu. An orange pin is added to the component's icon to indicate that it is grounded. Grounding a component fixes the origin in space so that the component cannot move.



Figure 8. Ground the component assembly

- Notice that the Trigger component has two subcomponents: a Trigger Box and Trigger Box Collar component. Since these are also components that have their own origin, they can be dragged to a new location even though the Trigger component is grounded. If you want to restrict these from moving, each of these subcomponents needs to be grounded. Click Position > Revert Position to return all the components to their original location.

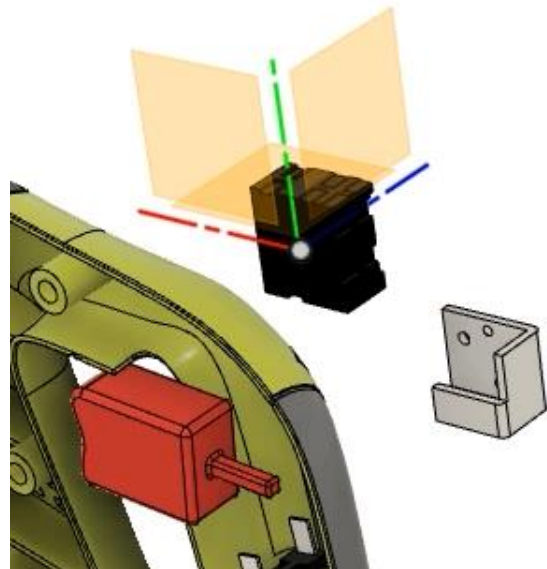


Figure 9. Move the subcomponents

10. An alternate way to restrict the subcomponents from moving is to create a rigid group. Select the Trigger component and click Assemble> Rigid Group. The component and subcomponents are all rigidly grouped together which means they are all grounded because one of them is grounded.

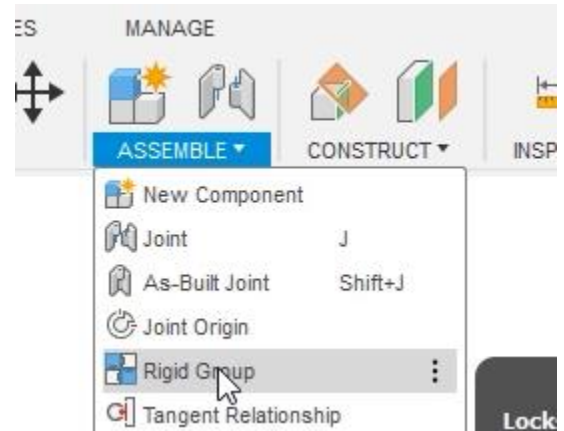


Figure 10. Create a Rigid Group

11. Select the Browser's two Trigger components, right-click them, then choose Isolate.

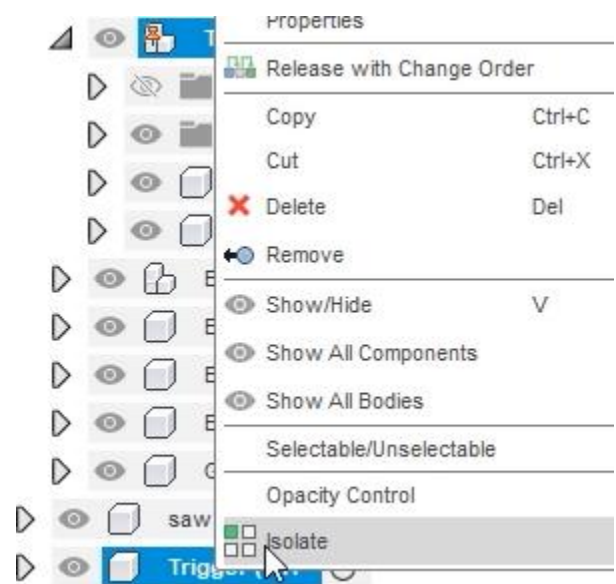


Figure 11. Isolate two components

12. All the components are hidden except for the two you selected.

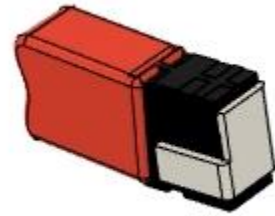


Figure 12. Inspect the result

13. Click and drag the trigger away from the housing and notice that it is not parallel with the housing.

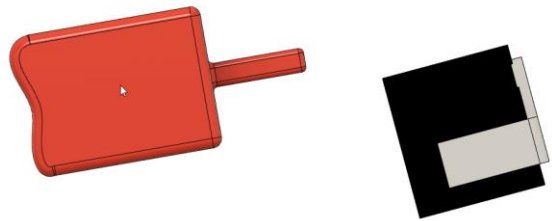


Figure 13. Move the trigger

14. Click Position> Capture Position to record the trigger's new position. Capturing the position adds a feature to the timeline which can be suppressed if you need to return the trigger to its original position.

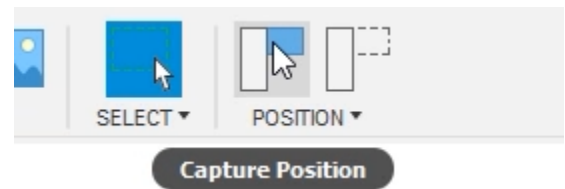


Figure 14. Capture the component's position

15. Click Modify> Align.

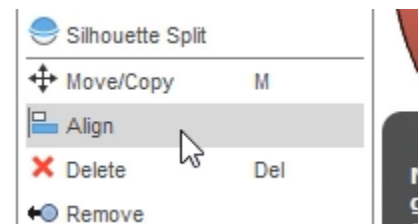


Figure 15. Open the Align tool

16. Make sure the Components option is selected in the dialog's Object menu, then choose the face shown in the image on the right as the From selection. When selecting this face, avoid selecting any of the face's small white icons.

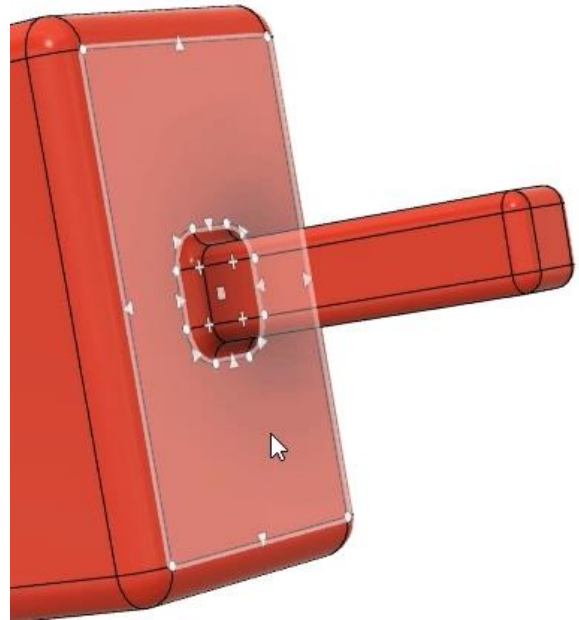


Figure 16. Choose the From selection

17. Choose the face shown in the image on the right as the dialog's To selection. Again, avoid selecting any of the face's small white icons.

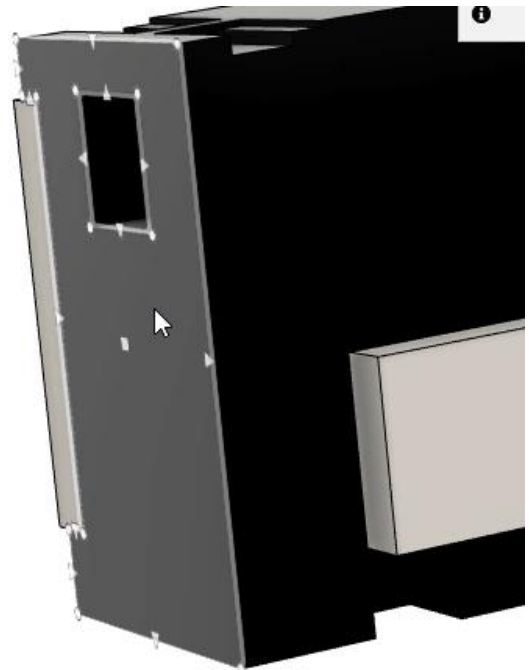


Figure 17. Choose the To selection

18. The two faces you selected are now aligned to each other, but the components might not be touching each other. Activate the dialog's Capture Position option, then OK the dialog.

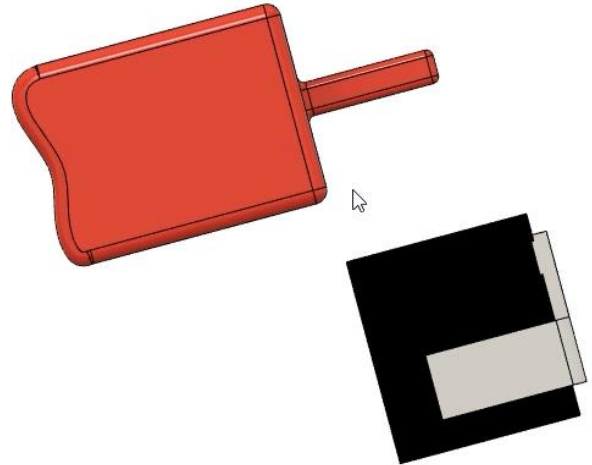


Figure 18. Inspect the result

19. Open the Align tool by clicking Modify> Align and choose the trigger's top face shown in the image on the right as the From selection.

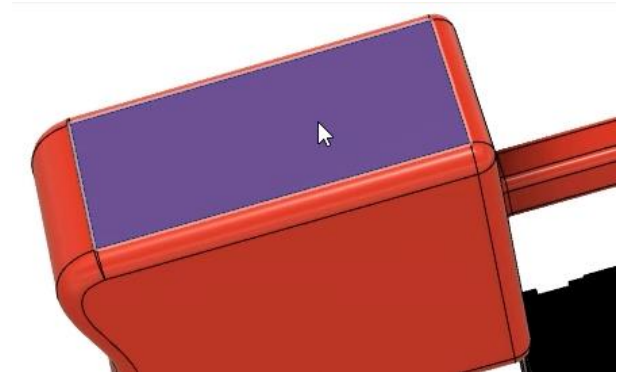


Figure 19. Open the Align tool and choose the From selection

20. Choose the housing's top face shown in the image on the right as the To selection. Again, avoid selecting any of the face's small white icons. Activate the dialog's Capture Position option, then OK the dialog. The components are now aligned correctly.

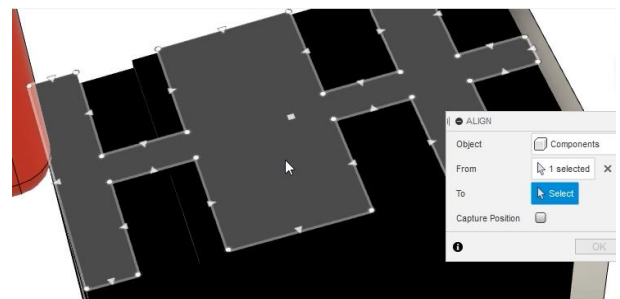


Figure 20. Choose the To selection

21. A joint needs to be added between the two components to replicate mechanical motion. Since the components are now aligned to each other, and As-Built Joint can be used. If the components were not properly aligned, the Joint tool would need to be used.

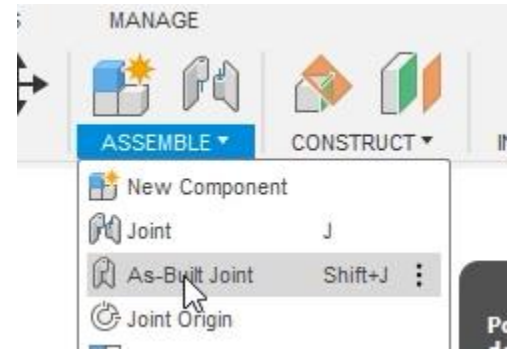


Figure 21. Open the As-Built Joint tool

22. Choose the Slider option from the dialog's Joint Type menu. For the dialog's Components selection, choose the housing and trigger components.

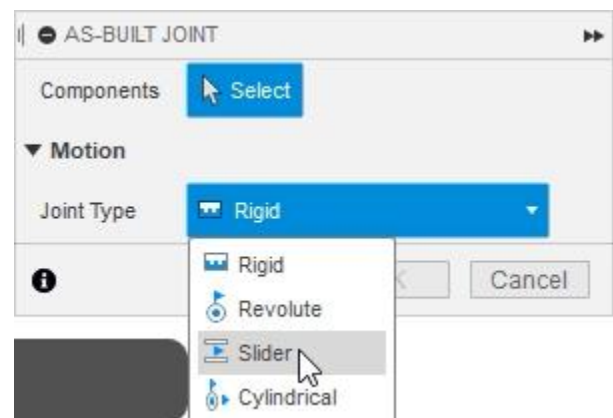


Figure 22. Choose the joint type

23. For the dialog's Snap selection, choose a linear edge aligned with the direction you want the component to slide. After making the selection, one of the components will animate to illustrate the degrees of freedom. The second component you select will always be the component that animates. It is important to note that the animation does not respect any other joints that might be applied to the component. OK the dialog to apply the joint.



Figure 23. Choose the Snap selection

24. Click and drag the trigger and note that it is allowed to move in the appropriate direction. However, the trigger is allowed to move much too far in either direction. Click Position> Revert Position to return it to its original position.

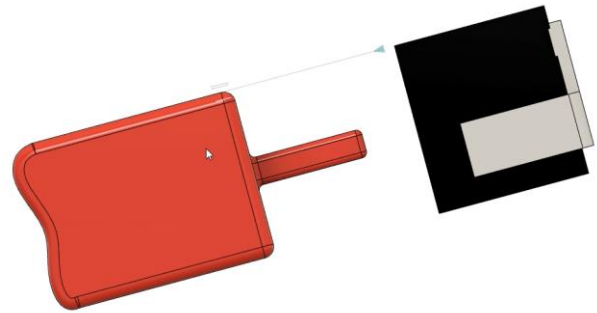


Figure 24. Move the trigger

25. Expand the Browser's Joints folder and rename the new joint as **Trigger Slider**. Right-click the Trigger Slider joint and choose Edit Joint Limits.

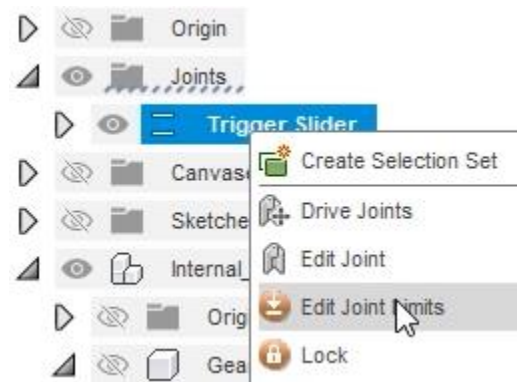


Figure 25. Edit a joint's limits

- 26.** Drag the slider icon's handle to determine how far the trigger should be allowed to move.



Figure 26. Drag the icon's handles

- 27.** Enter the values that you found in the previous step to limit the trigger's travel. Activate the Rest option and make sure the Rest value is set to 0 mm.

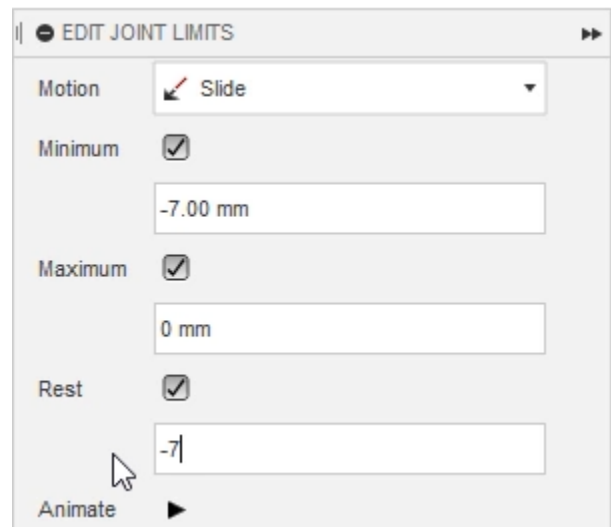


Figure 27. Configure the joint's limits

28. Click and drag the trigger, then let go. Notice the trigger snaps back into the resting position. Capture the trigger's new position by clicking Position> Capture Position. Notice that the trigger housing cannot move because you grounded it in the Browser.

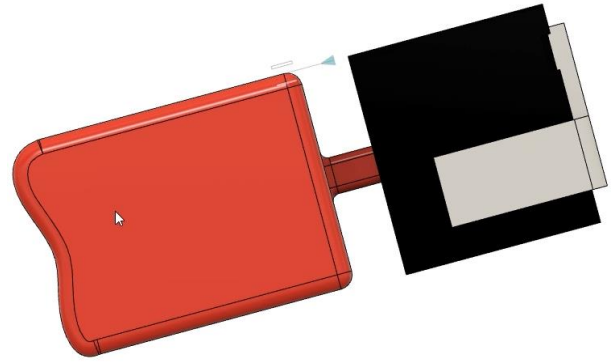


Figure 28. Explore the new joint

29. Right-click the Browser's top level and choose Unisolate All.

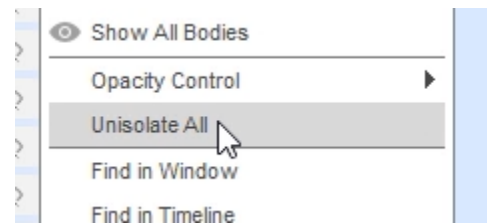


Figure 29. Unisolate all the components

30. Right-click the Trigger Slider joint and notice the options in the menu. The Animate Model option will respect all the joints applied to the assembly. The Animate Joint option will animate only the selected joint which will not respect any other joints applied to the model. Animating only this selected joint might mean the trigger housing moves instead of the trigger depending on the order you selected the components when creating the slider joint. If you have animated the joint or the model, press Esc to end the animation. Save the file and continue to the next module.

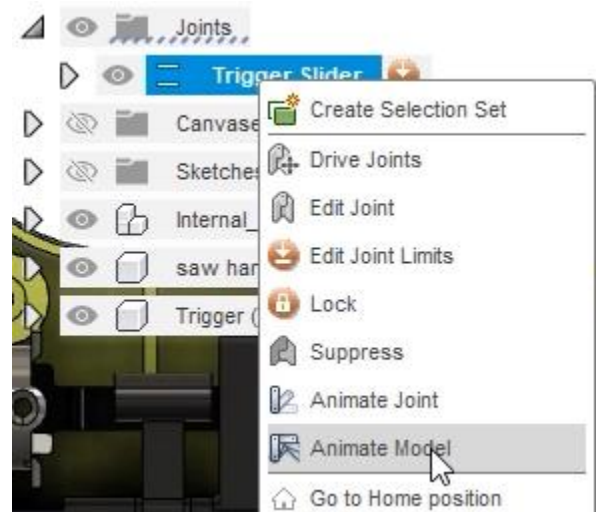


Figure 30. Explore the joint's options