

Pro/ENGINEER[®] 2001

**Design Animation
Topic Collection**

Parametric Technology Corporation

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About Animation

Use the **Application > Animation** command to invoke the Design Animation option. With Design Animation, you can coordinate the components of an animation sequence and play back an animation.

When you select this command, a timeline window appears below the graphics window, and a toolbar appears below the Pro/ENGINEER toolbar. You can run, create, and manage your animation using the menu commands, the toolbar buttons, or the timeline window.

You can use Design Animation to do the following:


- Visualize your assembly's operation. If you have the concept, but have not defined the mechanics, you can drag bodies to different positions and take snapshots to create an animation.
- Create an assembly or disassembly sequence animation of your model.
- Create a maintenance sequence, a short animation of steps to take to instruct a user in how to repair or build a product.

For an introduction and overview of the Design Animation module, and for typical steps to take to create an animation, see the Design Animation Concepts Guide online document.

To Define an Animation

You can create an animation to do many different things. Depending on your objective, you may use different steps to create your animation.

Following are the typical steps you might take to create an animation:












1. Open an assembly in Pro/ENGINEER.
2. Open Design Animation by clicking **Applications > Animation**.
The Design Animation toolbar and timeline appear. An **Animation** menu is added to the Pro/ENGINEER menu bar. You can create your animation either by selecting commands from the **Animation** menu or by clicking the toolbar buttons.
3. Create a new animation by clicking **Animation > Animation** or click  (**Animation**) on the Design Animation toolbar. The **Animation** dialog box opens with a default name for your animation. Use the **Rename** command to give your animation a meaningful name.
4. Check your body definitions:
 - For a Pro/ENGINEER assembly, you probably want to select **One Part per Body** and then edit the body to put the parts into the appropriate moving groups.
 - **One Part per Body** will empty the ground body of parts. You should edit the body named ground and reassign ground parts to it.
 - For a Mechanism Design assembly, you should check that the body definitions are as desired.
5. Define animation components that create movement.
 - To specify general movement, create key frame sequences. To create key frame sequences, take snapshots of your assembly at specific positions, using the drag functionality to move bodies to new positions. Design Animation will interpolate between these key frames to produce a smooth animation.
 - To create specific movement between bodies connected by joints or between geometric entities, define drivers on joints or geometric entities.
6. If not already on the timeline, include the drivers and key frame sequences on the timeline. Any components included on the timeline form the basis for your animation. You can edit the timeline length and increments, the length of the driver or key frame sequence in the animation, and the relative timing of all components in the timeline.
7. Optional: If you have not already included body locking, events, or connection status in the timeline, you can add them now.
 - If you want a group of bodies to be fixed relative to each other for a part of the animation, you may want to set up body locking for that time period.
 - Changing the connection status is useful for assembling and disassembling your model. If you are















working with key frame sequences, you can change the connection status on the **Drag** dialog box while dragging bodies to position them in snapshots. If you are working with drivers, you want to use the **Animation > Connection Status** command.

- If you need to have animation components sequenced in a particular order, you can specify a system-defined or user-defined event as a reference, or you can group them together in a subanimation.
8. Start your animation by clicking **Animation > Start**.
The **Run** dialog box opens. The model moves as specified by the animation components in the timeline, and the timeline shows the progress of the animation.
If you have problems, try one of the following:
 - Make sure your mechanism is not overconstrained. For example, check that a driver and key frame sequence are not requiring conflicting positions.
 - Increase the number of time steps (**Utilities > Time domain**).
 9. If you want to view the animation again, or to change the speed or direction, click **Animation > Playback**. If desired, you can check for interference and other results.
 10. Define views along your animation to view orientations and magnification of your model. You can also choose an interpolation method for your views.
 11. Specify component displays along the animation for your assembly components.
 12. Rerun the animation and view results.
 13. Save your animation and results. You save your results using the **Save** button on the **Results Playback** dialog box. Design Animation saves your playback results to a .pba file. You can also export to a .fra file for use in Pro/FLY-THROUGH. Save your animation using the **File > Save** command. Design Animation saves your animation to the .asm file with your model.

Design Animation Toolbar Buttons

When you click **Application > Animation**, the Design Animation toolbar opens with a set of default buttons. You can select which buttons appear on your toolbar by using the **Utilities > Customize Screen** command. For more information on this command, search for information on customizing screen commands in the Core area of the PTC Help system.

Button	Action/Name	Comments
	Control the display of icons on your model.	The Display Entities Dialog Box opens.
	Create a new animation.	The Animate dialog box opens.
	Define bodies in your assembly.	The Body Definition dialog box opens.
	Drag model and create snapshots.	The Drag dialog box opens.
	Create a key frame sequence.	The Key Frame Sequence dialog box opens.
	Create body–body locking.	The Lock Bodies dialog box opens.
	Create a driver.	The Driver Editor dialog box opens.
	Create a new view at time.	The View @ Time dialog box opens.
	Define component display at time.	The Display @ Time dialog box opens.
	Edit the selected entity in the timeline.	A dialog box opens that corresponds to the selected entity.
	Undo.	

	Redo.	
	Remove the selected entity from the animation timeline.	
	Generate the animation.	The Run dialog box opens and the animation starts.
	Play back the animation.	The Animate dialog box opens.
	Export the animation.	The current animation is exported as a .fra file.
	Change the connection status.	The Connection Status dialog box opens.
	Create an event.	The Event Definition dialog box opens.
	Include a subanimation.	The About Subanimations dialog box opens.
	Define the interpolation settings.	The View Interpolation dialog box opens.
	Zoom in on time scale.	The time scale decreases to the selected size. Click and drag a rectangle around the part of the time scale you want to see.
	Zoom out time scale.	The time scale increases incrementally until it reaches the original setting.
	Zoom to refit time scale.	The time scale returns to the original setting.
	Change the animation time domain.	The Animation Time Domain dialog box opens.
	Change the animation tolerance setting.	The Assembly Setting dialog box opens. You can set the tolerance level for the assembly.

Animation Dialog Box

Use this dialog box to create a new animation, or to open or delete an existing animation. When you click **Animation > Animation**, or the **Animation** button, this dialog box opens.

This dialog box contains the following items:

- **New**—Create a new animation. Design Animation gives it a default name. You can now define the components that make up your animation, including key frame sequences and drivers.
Warning: This command clears the current animation from the timeline. If you do not save your model before selecting this command, you will lose your animation data.
- **Open**—Select an animation from the list.
- **Delete**—Remove the selected animation from the list.
- **Rename**—Rename an animation. Select one of the animations from the list. Edit the name in the entry box. Click **Rename**. The new name appears in the list.

About Connection Status

If you created your assembly in Mechanism Design, use connection status to manage the connections defined for your assembly.

When you click **Animation > Connection Status**, the **Connection Status** dialog box opens. You can also change the status of a connection within the **Drag** dialog box for use when you are taking snapshots to use in a

key frame sequence.


Note: If you define a connection status using this dialog box, an icon will appear in the timeline. This connection status takes precedence over any defined in the **Drag** dialog box and included in a key frame sequence.

After you select a connection, you need to specify the following:

- **Time**
 - **Value**—Set the time value. The connection state and locking status will take effect by the specified amount of time after the selected event.
 - **After**—Select the event after which you want the connection to take effect.
- **State**
 - **Enable**—Enable the connection. When you click **Apply**, a connection icon on the timeline will reflect the connection status.
 - **Disable**—Disable the connection. When you click **Apply**, a connection icon on the timeline will reflect the connection status.
- **Lock/Unlock**
 - **Lock**—Lock the connection. This has the effect of gluing the two bodies together, allowing no movement between the bodies.
 - **Unlock**—Unlock the connection. This is only available after you have locked the body.
- **Reset** — Reset the dialog box information to its original state.




To Define Connection Status

You can specify that any of your connections remain inactive, or become disabled, during a period of time in the animation. Use the **Connection Status** command when you define motion using drivers rather than key frame sequences. Use this command, for example, to illustrate disassembly of your model, or to focus on the movement of one connection at the expense of others.

1. Click **Animation > Connection Status** or click  (Create new connection status) on the toolbar. The **Connection Status** dialog box opens.
2. Select a connection.
3. Enter a time and select a reference event from the **After** list. The connection status begins after the reference event and entered time. The time you enter can be negative with respect to the selected event, but cannot occur before the start time of the animation.
4. Select **State Enable** or **State Disable**.
5. Select **Unlock** or **Lock**.
6. Click **Apply**. The appropriate connection icon appears in the timeline.

Connection Icons

When you change the status of a connection, the timeline reflects the change with an icon. Following are the connection icons and what they represent:

Icon	Connection Status
 Connection_1.2	Disabled connection
 Connection_1.1	Enabled, unlocked connection
 Connection_1.3	Enabled, locked connection

About Events

Use events to maintain an associative relationship between animation elements.

For example, if you tie one timeline component to start when another one ends, then if the end time of one component in the animation changes, any subsequent elements that are defined to start after that end time are shifted automatically.

Design Animation automatically creates events for the beginning and end of any animation component included in the current animation. In most cases, you will be able to use one of these system-defined events and not have to create one yourself.

When you click **Animation > Event**, the **Event Definition** dialog box opens. In this dialog box, you can do the following:

- Name the event.
- Specify the time after your reference event that you want this event to start.
- Select a reference event. Select the down arrow to display the list of available reference events.


The event you are creating will take place by the specified amount of time after the reference event.

When you create a new event, a symbol with the name of the event appears in the timeline.

When you define an animation element to start after an event, Design Animation defines a relationship between the element and event and draws a dashed line between them. To control the visibility of this dashed line, use the **View > Display Settings > Animation Display** command.

To Define an Event

Use events as markers in the timeline to order the timing of animation components. The default event, which specifies the time at the beginning of the animation, is *Start*, and is always listed. Use these steps to define other events.

1. Click **Animation > Event** or click  (Create new event) on the toolbar. The **Event Definition** dialog box opens.
2. Enter a name for the event in the **Name** entry box.
3. Enter a time and select a reference event from the **After** list.
The new event begins after the reference event and time. The time you enter can be negative with respect to the selected event, but cannot occur before the start time of the animation.
4. Click **OK**.
An event symbol, with the name of the new event, appears in the animation timeline. If the event is referenced to an existing component in the timeline, a dotted line leads from the reference event to the new event.

About Subanimations

Use the **Subanimation** command to include an animation created with your assembly or any of its subassemblies in the current animation. This included animation becomes a subanimation. By default, a subanimation references Ground. If your subanimation moves relative to another body, you must reference the other body. You can specify the reference body through the **Subanimation** dialog box.

You should note the following points about subanimations:

- Make sure that the reference body is not part of the subanimation. If the reference body movement is defined in the subanimation, the animation may be erratic due to the conflicting body specifications.
- When inserting a key frame sequence in a subanimation, make sure that only the bodies you want to move are defined with **Desired** (the default) or **Required**. Any bodies defined with **Unspecified** will not move with the reference body. You can change how the bodies are defined through the **Key Frame Sequence** dialog box.

- Only those bodies that are actively defined in a subanimation will move with reference to the specified body. As soon as a body is not specified, it will not move. For example, a door that is opening on a moving car will stop moving with the car if it is specified for only half of the animation.

When you click this command, a dialog box opens, listing the animations for the current assembly. Select the animation you want to include in the current animation and click **Include**. By default, the included animation starts at time 0.0 in the current animation.

This subanimation will appear on the timeline with no details of its animation elements. To view details of the subanimation, click + , which appears at the start of the subanimation in the timeline.

Subanimation Dialog Box

When you create a subanimation, it references Ground by default. If you need to change the reference body, or the timeframe for the subanimation, use the **Subanimation** dialog box. You can access this dialog box by selecting the subanimation in the timeline window and doing the following:

- Click **Edit > Selected**.
- Right-click on the subanimation in the timeline and click **Edit** from the pop-up menu.
- Click the **Edit The Selected Animation Object** button on the Design Animation toolbar.

You can choose from the following items:

- **Reference Body**—Select the new reference body.
- **Start Time**—Enter the relative time you want the animation to start after the event you select. The time you enter can be negative with respect to the selected event, but cannot occur before the start time of the animation.
- **End Time**—Displays how long the subanimation will run. If you want to change the duration of a subanimation, you must open that animation and edit its timeframe.

To Run the Animation

1. Click **Animation > Start** to start running the animation. The **Run** dialog box opens.
2. If the animation runs into any problems, you can use the dialog box to specify how to proceed. You can use the following items:
 - **Failure Options**
 - Pause**—Click to pause the animation. You can then choose to continue or cancel the animation. If you continue, Design Animation will skip to the next frame and try to continue.
 - Continue**—Click to continue running.
 - **Graphical Feedback**—Click to have the assembly move on the screen as it runs the animation.
3. After you run your animation, you can use **Animation > Playback** to view the results.

About Playback

After you run your animation (using **Animation > Start**), use the **Playback** command to review, save, remove, or export the information.

Click **Animation > Playback** to display the **Results Playback** dialog box with these items:

- **Result Set** — Select the animation you want to play back.
- **Description**—View or update a description for your animation.
- **Play**—Play back the animation. The **Animate** dialog box opens, enabling you to rewind, fast-forward, play, and repeat the animation. Design Animation plays the animation on the display screen and scrolls across the timeline. If you play an animation, then select another animation and click **Play**, Design Animation plays the animation on the display screen but does not update or change the information in the timeline window.
- **Save**—Save the current animation results to disk with a .pba extension. Each animation can save only one file.

- **Restore**—Restore animation results. This option enables you to select a results file from disk. You can then select it from the **Results Set** scroll box and click **Play** to view the animation. You can restore animation results only for the current assembly.
- **Remove**—Remove the current animation results from the current session.
- **Export**—Export the animation playback to a .fra file. You can use this file in Pro/FLY-THROUGH.
- **Interference Mode**
 - **No Interference**—Will not check your assembly for interference.
 - **Quick Check**—Do a low-level check for interference. Automatically selects **Stop Playback** as an option.
 - **Two Parts**—Specify two parts for which to check the interference. Design Animation highlights the area on the model where interference occurs.
 - **Global Interference**—Check for any kind of interference in the entire assembly. Design Animation highlights the area on the model where interference occurs.
- **Interference Options**
 - **Include Quilts**—Include surfaces as part of the interference check.
 - **Stop Playback**—Stop the playback if any interference is detected.
- **Movie Generation Schedule**

To Play Back the Animation

Use the **Playback** command to change the rate or beginning frame of your animation easily. You can also set up the animation to run in a continuous loop, or to reverse and run backwards. This is a convenient way to control your animation for a presentation.



You must run your animation at least once using the **Animation > Start** command before using the **Playback** command.


1. Click **Animation > Playback**.
The **Results Playback** dialog box opens.
2. Select an animation from the **Result Set** list.
3. If you want to change the description, type your text in the entry box and click **Update**.
4. Select an **Interference Mode**.
5. Select an **Option**.
6. If you want to specify which portions of the results to view during playback, click **Movie Generation Schedule**.
7. Click **Play**.
The **Animate** dialog box opens.

Movie Generation Schedule

When you play back the results of your animation, you can specify which portion of the run you would like to view. If you want to see the entire run, click **Default** on the **Results Playback** dialog box.










If you want to see a specific portion of the run, clear the **Default** check box. You can now choose from the following options:

- **Start Time**—Specify the start time of the segment you want to view.
- **End Time**—Specify the end time of the segment you want to view.
Note: If the start time is greater than the end time, the movie will run in reverse.
-  **(Add a movie segment)**—After you specify a start and end time, click this button to add the segment to the list for playback. You can replay this segment multiple times by adding it to the list multiple times.
-  **(Update a movie segment)**—To change the start or end time of a playback segment, highlight that segment and click this button. You can now update the start and end time.

-  (**Delete a movie segment**)—To delete the movie segment, highlight that segment and click this button.

Animate Dialog Box

Use this dialog box to play back the results of your animation. The dialog box contains the following items:

Button	Function
Frame sliding bar	List the frame that is currently displayed.
	Play backwards.
	Stop.
	Play.
	Reset the animation to the beginning.
	Display the previous frame.
	Display the next frame.
	Advance the animation to the end.
	Repeat the animation.
	Reverse directions at ends.
Speed sliding bar	Change the speed of the animation.
Capture	Record the animation to JPEG or MPEG.

When you play back the animation, Design Animation plays the animation results on the display screen while scrolling across the timeline window.

Capture Dialog Box

When you click **Capture** on the **Animate** dialog box, the **Capture** dialog box opens. You can record your animation as a series of JPEG files or an MPEG file, and use the recorded animation for your presentation.

Use the following items to record your animation:

- **Output filename**—Enter a name. The file will be saved in the current working directory. If you want to select an existing file, click **Browse** and select a directory and file.
- **MPEG or JPEG**—Select the format you want.
- **Photorender frame**—Select this option if you want to use Pro/ENGINEER's PHOTORENDER to record your animation. Set the options for the photorendering before capturing the animation. Use the Pro/ENGINEER **View > Advanced > Photorendering** command. For more information, search for photorender in the Visualization area of the PTC Help system.
- **Image size**—Enter the width and height of the output file in pixels.

When you click **OK**, the animation begins and runs for 100 frames. If you select **JPEG**, the program records one file per frame.

About Time Domain

Use the **Time Domain** command to create a timeframe for the current animation.


When you click **Utilities > Time Domain**, the **Animation Time Domain** dialog box opens. You supply different information for the dialog box, depending on which of the following you select for the time domain:

- **Length and Rate**—Enter the end time (in seconds) and the frame rate (the number of frames per second) for the animation. The system calculates the total number of frames and the length of the run.
- **Length and Frame Count**—Enter the end time (in seconds) and total frame count for the animation. The system calculates the frame rate and the length of the run.
- **Rate and Frame Count**—Enter the total frame count and the frame rate or interval of the animation. The system calculates the end time.

After you select one of these time options, fill in the appropriate fields on the rest of the dialog box.

To Change the Time Domain

Follow these steps to alter the rate and duration of your animation. You can use time domain factors to alter your time scale, or to increase or decrease the smoothness of the interpolation between frames.

1. Click **Utilities > Time Domain** or click  (Animation time domain). The **Animation Time Domain** dialog box opens with the name of your animation.
2. Select one of the methods to control the animation. Change the duration to fit your animation. To have a smoother transition between key frames, you may want to increase your frame count.
3. If you want to change the timeline scale, deselect the **Display Interval Default** box, and enter a new value for the interval. When you click **Apply**, the timeline displays your changes.
Note: A smaller display interval results in more divisions on the timeline scale, and allows you to make finer movements when using the mouse to move timeline elements.

Time Domain Rate and Frame Count

Use this method to control the number of frames and the interval between them in your animation. Enter information in any of these fields. The default time unit is seconds. Increase the frame count to make the transition between frames smoother, or to see more details in the animation movement.

When you click **Apply**, the program updates other fields. Click **OK** to accept the values and exit the dialog box.

- **Start Time**—Enter the time you want the animation to start running. The animation starts at the time you enter, but the timeline does not display the new start time.
- **Frame Count**—Enter the total number of frames for the entire animation. The program updates the end time on the dialog box and on the timeline.
- **Rate**—Enter the rate in frames per second. The program updates the frame interval and end time.
- **Interval**—Enter the interval between frames. The program updates the end time and frame rate. The timeline displays the new duration.

Change either the frame rate or interval. The frame count, interval, frame rate, start, and end times are related by the following formulas:

$$\text{Frame Rate} = 1/\text{Interval}$$

$$\text{Frames Used} = [\text{Frame Rate} * (\text{End Time} - \text{Start Time})] + 1$$

Note: The **Frame Count** value on the dialog box does not change if you increase the **Start Time**. This is the number of frames available for the entire animation, and is used to calculate the **Frame Rate** and **Interval**. When you run or play back the animation, however, the number of frames is that determined by **Frames Used**.

For example:

Start Time	0	5
End Time	10	10
Frame Count	101	101
Frames Used	101	51

Time Domain Length and Frame Count

Use this method to control the number of frames in your animation, and the length of the animation run. Decrease the length if your animation is shorter than the default value. Increase it to make room for more components in the animation. Increase the frame count to make the transition between key frames smoother, or to see more details.

Enter information in any of these fields. The default time unit is seconds.

When you click **Apply**, the program updates other fields. Click **OK** to accept the values and exit the dialog box.

- **Start Time**—Enter the time that you want the animation to start running. The animation starts at the time you enter, but the timeline does not display the new start time.
- **End Time**—Enter the time that the animation ends. The timeline displays the new duration, and the program updates the interval and frame rate in the dialog box.
- **Frame Count**—Enter the total number of frames for the animation. The program updates the interval and frame rate in the dialog box.

The frame count, interval, frame rate, start, and end times are related by the following formulas:

$$\text{Frame Rate} = 1/\text{Interval}$$

$$\text{Frames Used} = [\text{Frame Rate} * (\text{End Time} - \text{Start Time})] + 1$$

Note: The **Frame Count** value on the dialog box does not change if you increase the **Start Time**. This is the number of frames available for the entire animation, and is used to calculate the **Frame Rate** and **Interval**. When you run or play back the animation, however, the number of frames is that determined by **Frames Used**.

For example:

Start Time	0	5
End Time	10	10
Frame Count	101	101
Frames Used	101	51

Time Domain Length and Rate

Use this method to control the duration of your animation and the time between frames. Enter information in any of these fields. The default time unit is seconds. Decrease the duration if your animation is shorter than the default value. Increase it if your animation is greater than the default value, for example, to follow the animation with a new component. Decrease the frame rate to see more details in the animation.

When you click **Apply**, the program updates other fields. Click **OK** to accept the values and exit the dialog box.

- **Start Time**—Enter the time that you want the animation to start running. The animation starts at the time you enter, but the timeline does not display the new start time.
- **End Time**—Enter the time that you want the animation to end. The program updates the frame count.
- **Rate**—Enter a frame rate in frames per second. The program updates the interval and the frame count.
- **Interval**—Enter the interval between frames. The program updates the frame count and rate.

Change either the frame rate or interval. The start time, end time, frame count, interval, and frame rate are related by the following formulas:

$$\text{Frame Rate} = 1/\text{Interval}$$

$$\text{Frames Used} = [\text{Frame Rate} * (\text{End Time} - \text{Start Time})] + 1$$

Note: The **Frame Count** value on the dialog box does not change if you increase the **Start Time**. This is the number of frames available for the entire animation, and is used to calculate the **Frame Rate** and **Interval**.

When you run or play back the animation, however, the number of frames is that determined by **Frames Used**.

For example:

Start Time	0	5
End Time	10	10
Frame Count	101	101
Frames Used	101	51

About View @ Time

Use the view-at-time functionality to view different orientations of your model at specific times. Used in conjunction with the **Utilities > Animation Interpolation** command, you can view your animation smoothly transitioning between different orientations during the animation.

When you click **Animation > View @ Time**, the **View @ Time** dialog box opens, listing the following items:


- **Name**—Select one of the named views. You can create additional views using the Pro/ENGINEER **View > Saved Views** command or the **View > Orientation** command.
- **Value**—Enter the time value you want this view to take effect after the named event.
- **After**—Select the event after which you want the view to take effect.
- **Apply**—Adds a view at the selected time with the given name.

Note: The view saved is the one in the graphics window when you click **Apply** (including orientation and zoom level). This may not match the saved view in the name field if you have moved the model on the screen.

To Define Views for an Animation

You can use views you have saved within Pro/ENGINEER to change the orientation of your model during the animation. For example, you can change the view from the front to the side while putting your assembly together.

This procedure assumes you have previously saved views of your model using the Pro/ENGINEER **View > Saved Views** command. For more information, search for views in the Core area of the PTC Help system.

1. Click **Animation > View @ Time** or click  (New view at time) on the toolbar. The **View @ Time** dialog box opens with a list of previously created views.
2. Select a view.
3. Enter a time and select a reference event from the **After** list. As the animation progresses, it will change to

the view after the time and reference event.

Design Animation interpolates between views, so there are no abrupt changes. The current settings for the interpolation are listed in the dialog box.

4. If you want to change the current settings for view interpolation, see interpolation method.
5. Click **Apply**. The View @ Time event appears in the timeline.
The view saved is the one in the graphics window when you click **Apply**, including orientation and zoom level. This may not match the saved view in the name field if you have moved the model on the screen. An event marker appears in the timeline.

View Interpolation

When you select **Utilities > Animation Interpolation**, the **View Interpolation** dialog box opens. Use this dialog box to specify how you want Design Animation to change between views you have specified using the **Animation > View @ Time** command. This dialog box contains the following items:


- **Interpolate**—Click to have Design Animation use your settings under **Translation** and **Rotation** when transitioning between two views. The assembly will move toward the next view during the animation. If you do not select this check box, Design Animation jumps to the next view without any transition.
Tip: There may be times when you want Design Animation to stay on a view for a specific length of time and then start moving toward another view. Because you cannot select **Interpolate** for only part of the animation, you will need to apply two instances of the same view, one at the beginning and one at the end of a time period to make the view constant. You can then apply a third view that Design Animation will transition to.
- **Translation**—Select either **Smooth** or **Linear Interpolation**.
- **Rotation**—Select either **Smooth** or **Linear Interpolation**.

A linear interpolation changes linearly between views, retaining each view exactly as saved at a given time point.

A smooth interpolation will vary according to a cubic spline fit between views, which results in a smoother movement but may not use the exact views as defined at each time point.

To Define a Display for an Animation

This procedure assumes you have previously saved display states of your model using the Pro/ENGINEER **View > Model Setup > Component Display** command. For more information, search for display status in the Assembly area of the PTC Help system.

1. Click **Animation > Display @ Time**, or click  (Blanking-unblanking components at time) on the toolbar. The **Component Display** dialog box opens with the list of previously defined component displays.
2. Select a display.
3. Enter a value for the time, and select a reference event from the list. As the animation progresses, it will change to the display after the time and reference event. Design Animation does not interpolate between displays.
4. Click **Apply**. The Display @ Time event appears in the timeline.

About Display @ Time

Use this command to control the display of your assembly components during an animation or playback. You can define an event during which some of the components are invisible, or in which the display modes, such as **Wireframe** or **Hidden Line**, are different for different components.

You can create several Display @ Time events for your animation. Only one event can be active at a given time. Design Animation moves from one Display @ Time event to another with no interpolation.

Use the **View > Model Setup > Component Display** command to define a display representation. For more information, search for information on display modes in the Assembly area of PTC Help system.

When you click **Animation > Display @ Time**, a dialog box opens with the following items:

- **Rep Name**—Select the name of a component display from the list.
- **Time**
 - **Value**—Define the starting time for the display event.
 - **After**—Select the event after which the display representation will be active. The list includes all elements in your animation, including the start, end, and any user-defined events.
- **Apply**—Click **Apply** to add your Display @ Time event to the **Design Animation** timeline. Design Animation will append an extension number to each instance of the event.

Editing the Animation

Use the following commands on the **Edit** menu to manipulate components of your animation. You can also access these commands from the buttons on the toolbar.

- **Selected**—Edit the component you have selected on your timeline. The appropriate dialog box opens.
- **Undo**—Undo the previous command in the animation timeline. You can click **Undo** multiple times to take you back to when you started the animation or last saved your model.
Note: Editing a driver, key frame sequence, view at time, or snapshot cannot be undone. You can undo only modifications to instances in the animation timeline.
- **Redo**—Perform the previous command in the animation timeline that was undone.
- **Remove**—Remove the selected element from the timeline.

About the Animation Timeline

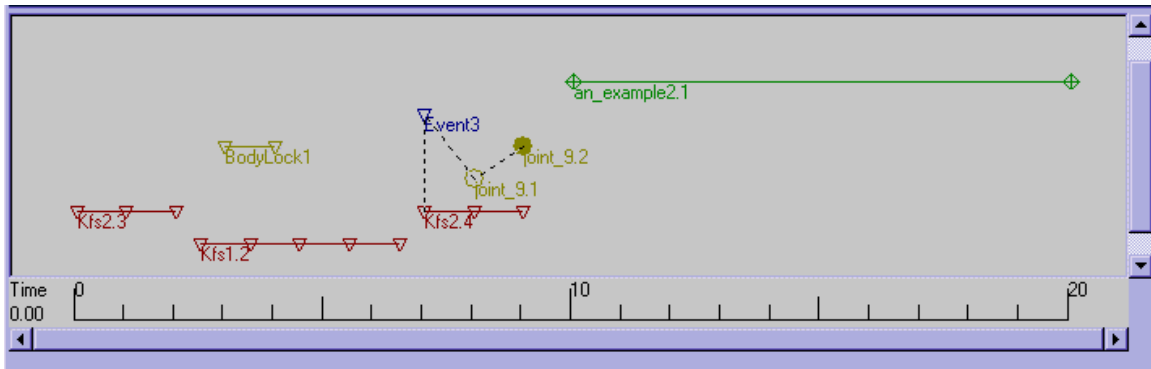
Use the timeline window to view and manipulate the items that make up your animation. After defining animation components, you must include them on the timeline in order for them to be part of the animation. You can create or edit the elements using the commands on the **Animation** menu. In addition, you can use mouse shortcuts to edit all of the timeline's components.

You can display a list of commands related to a selected animation component by selecting the component and clicking the right mouse button.

- If you select a key frame sequence instance, you can edit the instance's start and end time, edit the key frame sequence, copy, or remove it.
- If you select a driver instance, you can edit the instance's start and end time, edit the driver, copy or remove it.
- You can also select an event in the animation to reference a key frame or driver instance to.
- If you select a Display @ Time or View @ Time event, you can edit, copy, or remove it. You can also select another event in the animation to reference the event to.
- If you select a subanimation, you can edit, copy, or remove it.

For a new animation, the timeline is set by default to show 10 seconds, and the animation duration is set to 10 seconds. You can change either or both of these default times. To see more details of your animation, select **View > Timescale Zoom in**, then draw a rectangular box around the area you want to view more closely. To change the animation duration, double-click on the time scale and change the animation time domain.

Following is an example of a timeline, with 3 key frame sequences, a body lock, an event, a connection status change, and a subanimation, left to right respectively.



Animation Timeline Shortcuts

You can use shortcuts on the timeline window to perform many of the commands in the **Design Animation** toolbar and some additional ones.

Operation in Timeline Window	Mouse Shortcut
Single select	Click the left mouse button.
Multiple select	Hold down CTRL and click the left mouse button.
Edit component time	Select a component and double-click the left mouse button. You can also drag the component to the desired time.
Edit time	Hold down the left mouse button and drag.
Edit vertical position	Select a component, hold down the middle mouse button, and drag.
Undo previous operations	Hold down SHIFT and click the left mouse button.
Redo previous undo operations	Hold down SHIFT and click the middle mouse button.
Access a pop-up menu for a selected timeline component.	Select the component with the left mouse button, then click the right mouse button.
Edit the animation time domain	Double-click on the timeline.
Expand the display of subanimation information	Click the circle at the beginning or end of a subanimation
Display the component display at time	Click the Display @ Time button.
Display the saved view at time	Click the View @ Time button.

Changing the Timeline Display

Use the following commands on the **View** menu to change the visible scale on the timeline.

- **Timescale Zoom in**—Zoom in on the timeline to view details. After you select this command, drag a rectangular box around the timeline area you want to view more closely.
- **Timescale Zoom out**—Zoom out on the timeline. Use this after you use **Zoom In** to incrementally see more of your timeline. Using this command repeatedly will return you to your original setting.
- **Timescale Refit**—Return the animation timeline to its original setting.

About Tolerance

The absolute assembly tolerance is the maximum amount that any mechanism position constraint can deviate from a perfectly assembled state. The absolute tolerance is calculated from the relative tolerance and the

characteristic length.

The relative tolerance is the multiplier Design Animation uses to scale the characteristic length to derive the absolute tolerance. The default value is 0.001, which represents 0.1% of the characteristic length of your model.

The characteristic length is the sum of all the part lengths divided by the number of parts. A part's length (or size) is the length of the diagonal of the bounding box that contains the part completely.

The formula for absolute tolerance is:

absolute tolerance = relative tolerance × characteristic length







To Change the Tolerance Settings

You can change the absolute tolerance by changing the relative tolerance or the characteristic length, or both.

1. Click **Utilities > Assembly Tolerance**. The Animation Settings dialog box opens.
2. If you want to change the **Relative Tolerance** setting for your assembly, deselect the check box and enter a value between 1e-10 and 0.1. The default value of 0.001 is usually satisfactory.
3. If you want to change the **Characteristic Length** setting, deselect the check box and enter a different value. You should consider changing this setting when the largest part is much larger than the smallest part.
4. Deselect the **Assembly Failure** check box if you want Mechanism Design not to warn you should the assembly fail.
5. Click **OK**.

About Icon Visibilities

You can use **View > Display Settings > Animation Display** to open the **Display Entities** dialog box. The **Display Entities** data form has the following selections that you can toggle. The default is that all icons are visible.


	Drivers
	Joints
	Slots
	Cams
	LCS
	Dependency

After you toggle a visibility off, that icon is still visible under the following conditions:

- Driver icons are visible when you open the **Drivers** dialog box.
- All joint icons are visible while **Joint Axis** is selected as a **Driven Entity** on the **Driver Editor** dialog box.
- All connection icons are visible while you are setting the connection status during dragging operation.
- The current local coordinate system (LCS) is visible during dragging operation. This LCS is used as a reference for each component during dragging operation.
- Body LCS icons are visible while you are editing a body.
- The Dependency selection adds a dotted line on the timeline between an animation element, such as a keyframe sequence, and an event that it references.

To Set Icon Visibilities

The following steps outline the process of turning the Mechanism Design icons on and off for viewing.

1. Use **View > Display Settings > Animation Display** or click  (icon visibilities) to open the **Display Entities** dialog box.
2. Toggle on the icons you want to be visible. Your choices are the following:
 - Drivers
 - Joints
 - Slots
 - Cams
 - LCS
 - Dependency
 You can toggle off icon visibilities that have been toggled on previously.

About Drivers

You use drivers to impose a particular motion on your model. Drivers behave like motors, by forcing a specific type of motion to occur between two bodies in a single degree of freedom. You can add a driver to a joint axis or a geometric entity, such as part planes, datum planes, and points.

When you select the **Animation > Driver** command, the **Drivers** dialog box appears. You can select from the following items:

- **Add**—Create a driver. The **Driver Editor** dialog box appears. After you create a driver, you need to include it in your animation.
- **Edit**—Edit the selected driver. The **Driver Editor** dialog box appears so you can change defined information for your driver.
- **Remove**—Delete the selected driver.
- **Copy**—Make a copy of the selected driver. The new driver is named *copyofname*, where *name* is the selected driver's name.


You cannot copy an incomplete driver.

If a copied driver is used at the same time as the driver it was copied from, and the difference between the two is not significant, the model may lock up during the animation due to conflicts between the drivers.

- **Include**—Include a copy of the selected driver in the animation. Design Animation places the instance in the timeline for the entire duration of the animation. If you created drivers for your mechanism using Mechanism Design, those drivers are available to include in the animation. Each inclusion of a driver will be named with a *.n* extension, where *n* is the next available number for the driver.

To Define a New Driver

To make your model move during the animation, you can add a driver to a joint axis or a geometric entity.

1. Select **Animation > Driver** or click on  (Create new driver) on the Animation toolbar. The **Drivers** dialog box appears.
2. Click **Add**. The **Driver Editor** dialog box appears.
3. Enter a name for the driver.
The default name in the entry box is *Driver#*, where *#* represents a number that increments as drivers are added.
4. Fill in the information on the tabs of the form.
 - Entities
 - Profile
 For more information on these terms, search for drivers in the Assembly area of the PTC Help system.
5. If you want to see the profile of the driver with your current settings, click **Graph**.
You can then go back and change your data to change the profile. When you see the profile you are interested in, accept the driver, make sure it is included in the appropriate motion run, and run the motion analysis.

6. Click **OK** when you have completed the form.
The **Drivers** dialog box appears. The driver and its status are now listed. There are three possible status conditions indicated. If your driver is fine, the status column displays a blank. If one or more of the entities associated with the driver is suppressed, the status is **Suppressed**. If one or more of the entities associated with the driver has been deleted, the status is **Incomplete**.
Also, a driver icon, displaying the motion direction, appears on your mechanism.
After you create a driver, select **Animation > Drivers** to include it in your animation.

Driver Editor Dialog Box

You use drivers to impose a particular motion on your model. Drivers behave like motors, by forcing a specific type of motion to occur between two bodies. You can add a driver to a joint axis or a geometric entity, such as part planes, datum planes, and points.

After you select **Add** on the Drivers dialog box or click the **Create A Driver** button on the toolbar, the **Driver Editor** dialog box appears. This dialog box contains the following tabs:

- **Entities**—Select the entities that you want the driver to control.
- **Profile**—Select the profile of the driver.

To Specify the Entities for a Driver

This procedure assumes you are on the **Entities** tab of the **Driver Editor** dialog box. Fill in the information on this tab to define which entity is driven and which entity is the reference for the driver.

You can define as many drivers on an entity as you like. However, to avoid overconstraining your model, do not allow conflicting or redundant drivers to run simultaneously in your animation. For example, if you create both a joint axis rotation driver and a plane–plane rotation angle driver in the same direction, do not include both of these drivers in the same time period in your animation.

1. Select either **Translation** or **Rotation** (in degrees) to determine the type of motion. If you select an entity, such as a joint type, which can have only rotational or translational freedom, the radio button may be changed automatically if it is not set correctly.
Note: The positive rotation direction is assumed using the right-hand rule, with your thumb aligned with the joint axis in the direction of the joint axis arrow.
2. From the **Driven Entity** drop-down menu, select one of the three entity types:
 - **Joint Axis**
 - **Point**
 - **Plane**

Use a joint axis driver for well-defined motion in one direction.

If you select points or planes to define the driver, you are creating a geometric driver.

3. Select an entity from the model. This entity will move when you activate the driver.
4. If you selected a point or plane as the driven entity, select a reference entity. The driven entity will move relative to the reference entity according to the driver profile.
Note: For drivers on a point or plane, the reference entity may also move if it is not on a locked body. The driver simply specifies the relative motion of the driven entity with respect to the reference entity.
5. If you selected a point as the reference entity, select a motion direction. A magenta arrow appears, pointing in the direction the driven entity will move relative to the reference entity. You can use the **Flip** button to change the direction.

Return to To Define a New Driver.

To Specify the Driver Profile

This procedure assumes you are on the **Profile** tab of the **Driver Editor** dialog box. Use this tab to specify your driver's motion. The motion can be specified as a time-dependent change in position, velocity, or acceleration.

1. Select one of the following choices for **Specification**:
 - **Position**—This type specifies the position of the selected entity.
 - **Velocity**—If you select this type, you can select an initial position, which by default is set to **Current**. You can deselect **Current** and type in another setting to change the initial position. You can view your new setting by clicking **Show**.
 - **Acceleration**—If you select this type, you can select an initial position and an initial velocity, which by default are set to **Current** and 0.0, respectively.

If you set an initial position for velocity or acceleration, Design Animation uses this initial position when running the motion analysis.

2. If you want to specify a reference position for the driver, click **Set Zero** and fill in the reference portion of the **Joint Axis Settings** dialog box.
3. Select one of the choices for **Magnitude** and fill in the appropriate fields.
4. If you want to view the profile for your driver with the current settings, click **Graph**.

Return to To Define a New Driver.

Driver Profiles

There are eight kinds of driver profiles. Each type has its own input requirements. The following table lists each driver profile, its description, and its required settings.

Profile Type	Description	Required Settings
Constant	Use if you want a constant motion.	$y = A$ where A = Constant for all time
Ramp	Use if you want a constant motion or a motion that changes linearly over time.	$y = A + B*t$ where A = Constant B = Slope
Cosine	Use if you want to make the mechanism oscillate.	$y = A*\cos(2*Pi*t/T + B) + C$ where A = Amplitude T = Period B = Phase C = Offset
SCCA	Use to simulate a cam profile output.	See Driver Profile for SCCA.
Cycloidal	Use to simulate a cam profile output.	$y = L*t/T - L*\sin(2*Pi*t/T)/2*Pi$ where L = Total rise T = Period
Parabolic	Can be used to simulate a trajectory (graph A=5, B=-1)	$y = A*t + 1/2 B(t*t)$ where A = Linear coefficient B = Quadratic coefficient
Polynomial	Use for generic driver profiles.	$y = A + B*t + C*t^2 + D*t^3$ where A = Constant term coefficient B = Linear term coefficient

C = Quadratic term coefficient

D = Cubic term coefficient

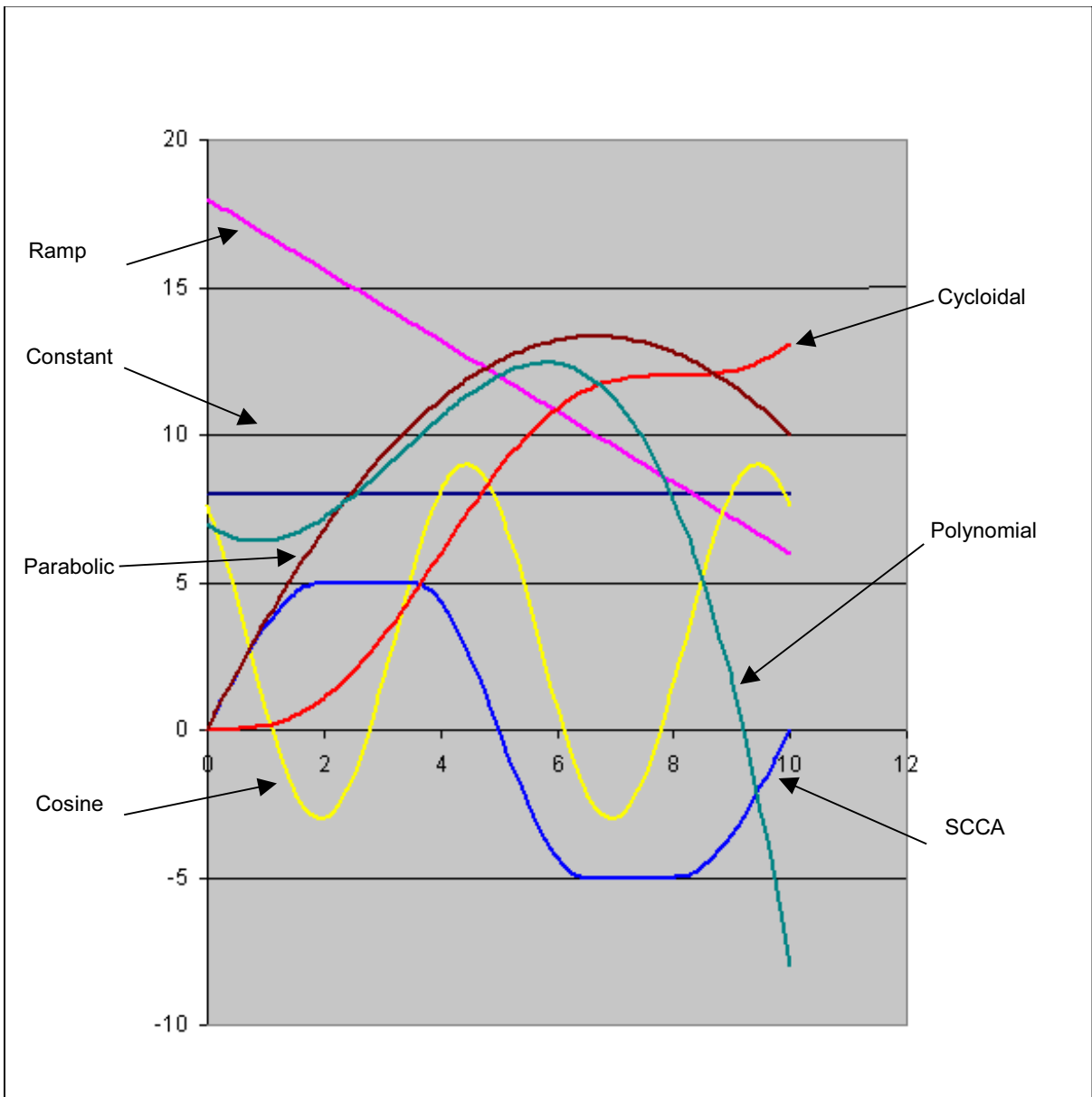
Table Use for more complex motion profiles that you cannot specify with the other functions. If you have output measure results to a table, you can use that table here.

Name of Input file with tabular input in two-column format. The first column contains time, listed in ascending order, and the second contains value of the Driver. An error is generated if the driver value is not specified for the entire time domain of the motion run.

See Driver Profile Table.

Use a single function if possible. But you can use a combination of functions to generate certain types of motion. For example, a combination of ramp and cosine generates a sinusoidal motion that ramps up over time.

For more information on these options, search for information on drivers in the Assembly area of the PTC Help system.



Following are the values from the formulas that were used to generate the profiles in this graphic:

Constant	Ramp	Cosine	SCCA	Cycloidal	Parabolic	Polynomial
A = 8	A = 18	A = 6	0.4	L = 12	A = 4	A = -0.1
	B = -1.2	B = 40	0.3	T = 8	B = -0.6	B = 1
		C = 3	5			C = -1.5
		T = 5	10			D = 7

Driver Profile for SCCA

This profile is only available for acceleration drivers.

The profile changes over the time period as follows:

$q = H \cdot \sin[(t \cdot \pi) / (2 \cdot A)]$	for $0 \leq t < A$
$q = H$	for $A \leq t < (1 - C)$
$q = H \cdot \cos[(t + C - 1) \cdot \pi / (2 \cdot C)]$	for $(1 - C) \leq t < (C + 1)$
$q = -H$	for $(C + 1) \leq t < (2 - A)$
$q = -H \cdot \cos[(t + A - 2) \cdot \pi / (2 \cdot A)]$	for $(2 - A) \leq t \leq 2$

You must input values for A, B, H, and T (the program calculates a value for C).

A — Fraction of normalized time for increasing acceleration

B — Fraction of normalized time for constant acceleration

C — Fraction of normalized time for decreasing acceleration, where

$$A + B + C = 1$$

H — Amplitude of the profile

T — Period of the profile

t — Normalized time, where

$$t = \text{actual_time} \cdot 2 / T$$

The SCCA profile stops when actual_time = T. If the actual time is longer than the period, the profile will repeat itself.

Driver Profile Table

You can specify your own driver profile using a table file. Table driver files enable you to specify a series of time and magnitude settings for the driver. The files have a .tab extension, and a two-column format. The first column contains time values, listed in ascending order, and the second column contains the value of the driver.

You can create and edit the table using any text editor.

Select **Table** on the **Profile** tab of the **Driver Editor** dialog box. The following fields are available on this form:

- **File Name**—Enter a file name or select **Browse** to search for one. The data from the table appears in the **Time** and **Magnitude** columns. The table data is kept in the .asm file and the assembly no longer refers to the .tab file for the information.
- **Read Table**—Select to update the **Time** and **Magnitude** columns from the .tab file.
- **Write Table**—Select to save the table information to the current working directory under the file name.

- **Linear Fit or Spline Fit**—Select one of these interpolation methods:
 - Linear fit will connect the table points with a straight line.
 - Spline fit will fit a cubic spline to each set of points. Using spline fit prevents sharp changes in the motion of the driver quantity, yet can lead to correct but unexpected behavior.

For more information on these options, search for information on drivers in the Assembly area of the PTC Help system.

Graph

You can graphically view the profile of a driver to see the motion your mechanism will take during the motion run.

When you have entered data on the **Driver Editor** dialog box, you can click **Graph** to view the profile of the motion for the current settings. You can then go back and change your data to change the profile. When you see the profile you are interested in, accept the driver, make sure it is turned on, and run the motion analysis.

When you click **Graph**, a dialog box appears with graphing options. You can select from the following:

Graph Types

- **Polyline**—Connects the values with a straight line, capturing the essential information.
- **Spline**—Connects the values with a spline, allowing more flexibility and capturing all of the high and low points.

Time Range

- **Max/Min**—Specifies the starting and ending values of the time range for graphing purposes.
- **Step**—Indicates how many increments Design Animation will take within the min/max range.

Measure Range

- **Max/Min**—Specifies the starting and ending values of the measure range for graphing purposes.
- **Step**—Indicates how many plot points Design Animation will use on the graph. Be sure to add enough plot points to view an accurate profile.

Use the min/max ranges to change the scale of your graph.

When you click **Default**, the values on the form reset to their original settings.

To Include a Driver in the Animation

After you create or edit a driver, you must include it in your animation.

This procedure assumes that you have opened an assembly with existing drivers.

1. Click **Animation > Driver**.
The **Drivers** dialog box appears with a list of previously created drivers.
2. If you want to define a new driver, click **Add**.
3. Select a driver in the list.
4. Click **Include**.
The driver appears in the animation timeline. The default start and end times are the start and end times of the animation. For information on changing these times, see Animation Timeline Shortcuts.

Driver Time Domain

When you select a driver on your timeline, right-click to bring up the pop-up menu, and select **Edit Time**, the **Driver Time Domain** dialog box appears.

Use this dialog box to change the start and end times of your driver. You can also drag the starting or ending points on the timeline to change these times, but you cannot change events using drag.

You can change the following items for the start and end of the driver:

- **Time**—Enter the time you want the driver to start or end after the selected event. You can enter a time that is negative with respect to the selected event. However, the time cannot be negative with respect to the animation time domain.
- **After**—Select the event after which you want the driver to start or end.

For example, if you want a driver to start 4 seconds after the start of the animation and end 2 seconds after Driver1.1 ends, enter the following:

Start Driver

- Time: 4.00
- After: Start

End Driver

- Time: 2.00
- After: Driver1.1End

Geometric Drivers

If you select points or planes to define the driver, you are creating a geometric driver. Use geometric drivers to create complex 3D motions such as a helix.

If you select **Point** or **Plane**, you must also select a point or plane as a reference.

If you select a point for the reference entity, you must also select a motion direction.

You can create the following geometric drivers:

- plane-plane translation driver
- plane-plane rotation driver
- point-plane translation driver
- plane-point translation driver
- point-point translation driver

Plane–Plane Rotation Driver

A plane–plane rotation driver moves a plane in one body at an angle to a plane in another body. During a motion run, the driven plane rotates about a reference direction, with the zero position defined when the driven and reference planes are coincident.

Because the axis of rotation on the driven body remains unspecified, a plane–plane rotation driver is less restrictive than a driver on a pin joint or cylinder joint. Thus, the axis of rotation in the driven body may change as a function of time.

Note: Plane–plane rotation drivers can be used to define rotations around a ball joint. Another application of a plane–plane rotation driver would be to define a rotation between the last body of an open-loop mechanism and ground, such as a front loader.

Plane–Plane Translation Driver

A plane–plane translation driver moves a plane in one body with respect to a plane on another body, keeping one plane parallel to the other. The shortest distance between the two planes measures the position value of the driver. The zero position occurs when the driven and reference planes are coincident.

In addition to the prescribed motion, the driven plane is free to rotate or translate in the reference plane. Thus, a plane–plane driver is less restrictive than a driver on a slider or a cylinder joint. If you want to explicitly tie down the remaining degrees of freedom, specify additional constraints such as a connection or another geometric driver.

Note: One application of a plane–plane translation driver is to define a translation between the last link of an open-loop mechanism and Ground.

Plane–Point Translation Driver

A plane–point translation driver is the same as a point–plane translation driver, except that you define the direction in which a plane will move relative to a point. During a motion run, the driven plane moves in the specified motion direction, while staying perpendicular to it. The shortest distance from the point to the plane measures the position value of the driver. At a zero position, the point lies on the plane.

Note: You cannot define the orientation of one body with respect to the other using only a plane–point driver. Also note that the driven plane is free to move perpendicularly to the specified direction. Lock these degrees of freedom using another driver or connection. By defining x, y, and z components of motion on a point with respect to a plane, you can make a point follow a complex 3D curve.

Point–Plane Translation Driver

A point–plane translation driver moves a point in one body along the normal of a plane in another body. The shortest distance from the point to the plane measures the position value of the driver.

Note: You cannot define the orientation of one body with respect to the other using only a point–plane driver. Also note that the driven point is free to move parallel to the reference plane, and may thus move in a direction unspecified by the driver. Lock these degrees of freedom using another driver or connection. By defining x, y, and z components of motion on a point with respect to a plane, you can make a point follow a complex 3D curve.

Point–Point Translation Driver

A point–point translation driver moves a point in one body in a direction specified in another body. The shortest distance measures the position of a driven point to a plane that contains the reference point and is perpendicular to the motion direction. The zero position of a point–point driver occurs when both the reference and driven point lie in a plane whose normal is the motion direction.

Note: The point–point translation driver is a very loose constraint that must be used carefully to get a predictable motion. You cannot define the orientation of one body with respect to the other using only one point–point driver. In reality, you would need six point–point drivers for this.

Also note that the driven point is free to move perpendicularly to the specified direction, and may do so if you do not specify otherwise. Lock these degrees of freedom using another driver or connection. By defining x, y, and z components of motion on a point with respect to a plane, you can make a point follow a complex 3D curve.

About Joint Axis Settings

You can specify the relative orientation or location of the two parts connected by a joint axis. A joint axis will read zero when, for rotational joint axes, the zero reference lines on the two parts are aligned, or for translational axes, the zero reference planes are aligned. The zero reference line for each part lies in the plane that is perpendicular to a rotational joint axis and passes through the joint point. A zero reference plane is the plane that is perpendicular to the translational joint axis and passes through the joint point.

A joint axis zero reference can only be set for a joint axis driver. You cannot create more than one joint axis zero on any joint. Joint axis zeros are not required for any driver, but if they are not set, Design Animation chooses an arbitrary reference on each body, with unpredictable results.

Joint axis zeros and joint axis range limits can be set for all joint types except a ball joint.

To Specify Joint Axis Settings

This procedure assumes you are in the **Driver Editor** dialog box in Design Animation.

1. Select the **Profile** tab.
2. Click **Set Zero**. The **Joint Axis Settings** dialog box appears.
3. Select a joint axis. Design Animation highlights the selected axis and colors the two bodies attached to the joint in cyan and green. The cyan body is the component reference and the green body is the assembly reference.
For rotational or translational joint axes, the dialog box displays in the **Joint Axis Position** field the current angle or distance, respectively, between the two bodies.
4. If you want to use the current orientation of the mechanism as the zero reference position, clear the **By Reference** check box and click **Make Zero**. Design Animation resets the **Joint Axis Position** field to zero and inactivates the reference portion of the dialog box.
5. If you want to select different reference locations on the bodies, select the **By Reference** check box and complete the following steps:
 - a. For **Component Reference**, select a point or plane on the cyan body as the zero reference for that body.
 - b. For **Assembly Reference**, select a point or plane on the green body as the zero reference for that body.
6. If you want to set zeros at a specific offset from the current configuration, complete the following steps:
 - a. Clear the **By Reference** check box.
 - b. Click **Make Zero**.
 - c. Enter a value for angle or distance in the **Joint Axis Position** field. For angles, you can enter any number between -180 and 180 .
 - d. Press **ENTER**. The cyan body moves to show the configuration with the new position value.
 - e. Click **Make Zero** again to reset the **Joint Axis Position** field to zero. The current configuration of the bodies is now considered to be the zero reference configuration.
7. If you want to set a range limit on the joint axis, clear the **By Reference** check box and select the **Limits** check box.
8. To specify limits for a rotational joint axis, enter a value for an angle between -180 and 180 degrees in a counter-clockwise direction in each of the following fields:
 - **Minimum Angle**
 - **Maximum Angle**
 The maximum angle should be greater than the minimum angle.
9. To specify limits for a translational joint axis, enter values in each of the following fields:
 - **Lower Translation Limit**
 - **Upper Translation Limit**
 The upper translation limit should be greater than the lower translation limit.
10. Click **OK**. The assembly appears in its original orientation.
11. If you want to check whether the limits you specified for the joint axis provide the range of movement you expected, use the **Drag** dialog box and drag the cyan body.

Defining Joint Zero References

Be aware of the following when defining a rotational axis:

- **Point–Point Zero Reference**—Design Animation draws a vector from each of the two points in a direction normal to the rotational axis. These two vectors should coincide for the joint zero. The points cannot lie on the joint axis
- **Point–Plane Zero Reference**—The plane containing the point and the rotational joint axis should be parallel to the selected plane for the joint zero. The point cannot lie on the joint axis.
- **Plane–Plane Zero Reference**—The two planes are parallel at the joint zero. Both planes must be parallel to the axis of rotation.

Be aware of the following when defining a translational axis:

- **Point–Point Zero Reference**—The distance between the two points in the direction of the translation joint axis will be zero at joint zero.

- **Point–Plane Zero Reference**—The distance between the plane and the point in the direction of the translation joint axis will be zero at joint zero. The plane must be perpendicular to the joint axis.
- **Plane–Plane Zero Reference**—The distance between the planes is zero at joint zero. Both planes must be perpendicular to the joint axis.

Be aware of the following restrictions when defining zero references:

- **Planar Connection**—For planar connections, you can define point–point zero references only for planar translation axes. Also, you can define plane–plane zero references only for planar rotation axes.
- **Bearing Connection**—You must select a point or plane on the body that contains the direction definition of the bearing joint—in other words, the line in the point–line constraint. Design Animation aligns this reference to the point defining the bearing joint.

About Bodies

A body is made up of one or more parts that do not move relative to each other. By default, bodies in Design Animation are created following the Mechanism Design body rules—parts with a Pro/ENGINEER constraint between them are placed in a single body.

Bodies defined in Design Animation will not transfer to Mechanism Design.

If you created your assembly without mechanism connections or packaging but simply with Pro/ENGINEER constraints, you will want to redefine the model using One Part Per Body or Add.

Note: If a body definition has been edited and saved in a subassembly, you cannot edit the body in a higher level assembly. You must edit the body in the subassembly, then save it.

If a subassembly body configuration has not been saved, you get the default body definition and you can edit it.

When you select **Animation > Body Definition**, the **Bodies** dialog box appears:

- **Add**—Create a new body and add parts to it. The **Body Definition** dialog box opens.
- **Edit**—Edit a selected body. The Body Definition dialog box appears, enabling you to add parts to your body. Any parts added to a body are removed from any other bodies that previously contained them. All parts belong to the ground body if they were added to the assembly using Pro/ENGINEER constraints.
- **Remove**—Remove a selected body. The parts contained in that body are moved to the ground body.
- **One Part per Body**—Create bodies using the one part per body rule. Design Animation keeps connections during this operation.
Note: Use this with caution with large assemblies because every part in the assembly will become an individual body. You will also have to redefine Ground.
- **Default Bodies**—Revert to the bodies defined by Pro/ENGINEER constraints. When you select this option, the program carries out a Pro/ENGINEER regeneration. Any body definitions created prior to selecting this button will be ignored. This gives you a chance to start over, creating bodies as when you first entered Design Animation.

Note: If you do not use default bodies in your animation, the Pro/ENGINEER regeneration may fail when you leave Design Animation, or Pro/ENGINEER may place parts in a different location than they were during your animation.

Body Definition Dialog Box

Use this dialog box to add parts to a new body.

You can select from the following choices on the **Body Definition** dialog box:

- **Name**—Name the new body.
- **Add Parts**—Select the parts you want to add to the new body. Note that on the Get Select menu, there are three extra commands available. You can choose one of the following actions:
 - **Pick Many**—Drag a rectangular box around all of the parts you want to select.
 - **Unselect Last**—Repeatedly unselect the last part you selected.


- **Unselect Item**—Remove a part from the body by picking it.

You can choose to add a subassembly to the body by selecting the subassembly on the model tree or using **Sel By Menu** command on the **Get Select** menu.

The **Number Of Parts** display box incrementally updates as you add parts to the body.

To Create a Body

A body is a part or group of parts that do not move with respect to each other. Use these steps to define which part of your assembly will move independently during the animation.

1. Select **Animation > Body Definition** or click  (Body definition) on the toolbar.
The **Bodies** dialog box opens with a list of the bodies in the assembly.
2. Click **Add**.
The **Body Definition** dialog box opens.
3. Enter a Name for the new body.
4. Select parts to add to the body.
The **Number Of Parts** count is updated as bodies are added.
5. Click **OK**.
The **Bodies** dialog box opens with the new body included in the list.

About Lock Bodies

Lock bodies to fix bodies relative to one lead body over a specific time period during an animation. The bodies will act as if they are glued together, allowing no movement between them. The body locking does not take effect until the start time you define for the body lock event. If you or the animation drags or moves your mechanism into a different configuration before the body locking takes effect, you may have unexpected results.

Note: Body positions at each key frame are specified by a snapshot. However, a locked body can override the key frame position if that body is **Unspecified** or **Desired** in the key frame sequence definition. If the body lock ends before the key frame sequence, the snapshots then determine the body position. This can result in bodies jumping to a new position if they were marked as **Desired**.

When you click **Animation > Lock Bodies**, the **Lock Bodies** dialog box appears with the following items:

- **Name**—Design Animation supplies a default name. Accept the default, or change to another name.
- **Lead Body**—Select a lead body, or select Ground. This body dictates the relative position and orientation of the follower bodies.
- **Follower Bodies**—Select the bodies you want locked to the lead body. The follower bodies will latch onto the lead body in the configuration they happen to be in when the body lock takes effect and follow it in the same relative orientation while the lead moves, until the end of the body lock. They will then be allowed to move on their own.
- **Remove**—Select a body and remove it from the locked configuration.
- **Start Time**
 - **Value**—Set the time value. The body locking will take effect by the specified amount of time after the selected event.
 - **After**—Select the event after which you want the body locking to start.
- **End Time**
 - **Value**—Set the time value. The body locking will turn off after the specified amount of time after the selected event.
 - **After**—Select the event after which you want the body locking to end.

To Lock Bodies

Use this command to keep one or more follower bodies stationary with respect to a lead body during a specific time period in the animation.

1. Click **Animation > Lock Bodies**.
The **Lock Bodies** dialog box appears.
2. If you want to change the name of the **Lock Bodies** event, enter a new name. The default name is **BodyLock#**, where # represents a number that is incremented as events are added.
3. If you want to specify the Ground body as the lead body, click the middle mouse button.
4. If you want to specify one of the bodies in your assembly as the lead body, select the body.
5. Select the follower bodies.
The bodies are outlined in red.
6. Enter a **Start Time** in the **Value** entry box.
7. Select a reference event from the **Start Time After** list.
8. Enter an **End Time** in the **Value** entry box.
9. Select a reference event from the **End Time After** list.
10. Click **Apply**.

The locking event is added to the timeline. If you want to change the start or end times, see Animation Timeline Shortcuts.

Example: Reference Body

When creating a key frame sequence (kfs2), you may want one body to move as defined by another driver or key frame sequence (kfs1), but other bodies to move as defined in kfs2. An example is a window rolling down on a car door that is opening. The door is referenced in kfs2, although the car is Ground. The window slides down relative to the door in kfs2. The car door body is **Unspecified** in kfs2. The car door is **Required** or **Desired** in kfs1 and is closing relative to the car (Ground).

About Key Frame Sequences

Use the **Animation > Key Frame Sequence** command to create a key frame sequence. When you create a new key frame sequence, Design Animation automatically includes it on the timeline.

A key frame sequence is made up of a series of snapshots of your assembly in a succession of positions and at specific times. Design Animation will interpolate between the snapshots to create a smooth animation.




You can include a key frame sequence in an animation multiple times in different locations. A key frame sequence included in an animation is called a key frame sequence instance. When you edit a key frame sequence, all instances of that sequence are updated. If you want to make a change to a key frame sequence, without changing the original sequence, make a copy of the original and edit the copy. Then you can include an instance of the copy in the timeline.

When you select this command, the **Key Frame Sequence** dialog box appears, from which you can select your reference body, take snapshots, and arrange them into a sequence.

To Define a Key Frame Sequence

Every animation must have at least one driver or one key frame sequence in order to move bodies in the animation. To create a key frame sequence, follow these steps:

1. Select **Animation > Key Frame Sequence**.
The **Key Frame Sequences** dialog box opens.
2. Click **Add**. The **Key Frame Sequence** dialog box opens.
3. Enter a name for the sequence.
The default name is **KFS#**, where # is a number that increments as you add sequences.
4. If you want to use a reference other than the Ground body, select a body on your assembly.

5. Click  (Edit or create a snapshot) to create a new snapshot or select a snapshot from the list.
6. If you want to see your model in the selected snapshot, click  (Preview).
7. Enter a time for the snapshot and press **ENTER**.
If you want to change the initial snapshot in a sequence (time = 0), you must remove it before defining a new snapshot with time = 0. For any other snapshot time, you can simply select the snapshot and change the time.
8. Click  (Add).
The snapshot is listed according to time.
9. Select linear or smooth as an interpolation method.
This specifies the way Design Animation combines the snapshots into an animation.
10. Click the Bodies tab to define how the bodies in your model are used in the key frame sequence.
Remember to include your sequence in an animation.

To Control Bodies in a Key Frame Sequence

This procedure assumes that you are in the **Key Frame Sequence** dialog box, and have filled out the **Sequence** tab. Use these steps to control how Design Animation moves the bodies in your model during the animation. In some cases, a key frame sequence and a driver may try to move a body in conflict with each other. You can change the body's status to avoid the conflict.

1. Click the **Bodies** tab.
2. Select the reference body.
3. Select the bodies to be controlled by the key frame sequence.
4. Select Required, Desired, or Unspecified for each body.
The default status is **Desired** for all bodies. The bodies defined as **Required** or **Desired** move relative to the reference body during the animation. The bodies defined as **Unspecified** may move in an unpredictable way, if not controlled by another key frame sequence or by a driver.
5. Click **OK** to accept the key frame sequence definition.
The new key frame sequence appears in the timeline.

About Drag Operations

Use dragging to place bodies in position for a snapshot. You can drag a point or body. You can choose free-form movement, or movement along a coordinate system axis. Design Animation attempts to position the selected entity as close as possible to the current cursor location. When the desired orientation is reached, click **Snapshot** to capture the current position and orientation of each body in the model.

If there are connections between the bodies in your models, you can choose to leave the connections active, or to disconnect them during the drag operation. You can also apply two types of temporary constraints to the model—align and mate. The constraints are in effect only during the dragging operation.





You can specify that one or more bodies remain stationary relative to ground during a dragging operation by locking them. You can also lock or disable a connection, so it does not move or is ignored, respectively. Design Animation saves the body locking and connection status information with the snapshot, so if you edit a snapshot those features will be active.


If you are creating a new key frame sequence or editing an existing key frame sequence, the snapshots you take are automatically added to the key frame sequence. However, if you click the Snapshot button on the toolbar to create snapshots, Design Animation will not automatically add the snapshots to any key frame sequence in the animation.

To Create a Snapshot

In order to create a key frame sequence, you take snapshots of your assembly in various positions and configurations. Design Animation interpolates between the snapshots to create a smooth animation. Follow

these steps to create a snapshot:





1. Select the **Animation > Snapshot** command or click  (Drag model and create snapshots) on the toolbar. The **Drag** dialog box appears.
2. If you want to apply constraints during your drag operation, select the Constraints tab.
3. Select the **Snapshots** tab.
4. Select a drag method.
 - **Point**
 - **Body**
 - **X,Y,Z translation** — You can specify which coordinate system the translation takes place in by clicking  (Select current coordinate system).
 - **X,Y,Z rotation** — You can specify which coordinate system the rotation takes place in by clicking  (Select current coordinate system).
5. When you are satisfied with the position of your model, click  (Take a snapshot) to record. The snapshot is listed in the **Drag** dialog box with the default name Snapshot#, where # is a number incremented as snapshots are added to the list. After you create your snapshots, you need to include them in a key frame sequence. When you create a key frame sequence, the **Key Frame Sequences** dialog box will also list the new snapshot.

Note: After you record a snapshot, click  (Display snapshot) and select the **Constraints** tab to review the constraint settings for that snapshot.
6. Repeat this procedure to create all of the snapshots for your sequence.













Drag Dialog Box

Use this dialog box to move components of the assembly and take snapshots. You can also use this dialog box to apply or remove constraints and to turn the constraints on and off.

You can choose from the following options:

Button	Action/Name	Function
	Snapshot	Click to take a picture of your mechanism. The Snapshots list will update. The snapshot includes the orientation, location, connection status, and body locks that were defined at the time you took the snapshot.
	Previous configuration	When you use the left mouse button to accept a dragged configuration, the configuration is saved to a buffer. This button acts as an undo command, displaying the part positions as of the start of the last drag sequence.
	Next configuration	Displays the next configuration in the buffer. This button acts as a redo command.
	Package move	Displays the Move dialog box, allowing you to perform a package move. Design Animation does not honor drag constraints in package move. For more information, see the help for the Component Assemble dialog box in the Assembly area of the PTC Help system.

On the **Snapshots** tab:

	Point drag	Select a point to drag. A circle is drawn on the part around the location chosen and follows the cursor movement in such a way as to maintain the connectivity of connections and bodies, if any.
	Body drag	Select a body to drag. The body highlights and follows the cursor movement in such a way as to maintain the connectivity of connections and bodies, if any, and the current orientation of the body with respect to the assembly coordinate system.
	X, Y, Z translation	Select a body, then click one of these buttons. Your selection reduces the movement of the body to the selected direction of the current coordinate system for drag operations. Translation in other directions, as well as rotation of the body, is locked.
	X, Y, Z rotation	Select a body, then click one of these buttons. Your selection reduces the movement of the body to rotation about the x, y, or z axis of the current coordinate system for drag operations.
		
		
	Current coordinate system	Select a coordinate system by choosing the body whose default coordinate system is the one you want to use. X, y, or z translation or rotation will be in this direction.
	Name	You can rename a snapshot by highlighting it, typing in a new name, and pressing ENTER. If you enter a new name and press ENTER, Design Animation automatically takes a snapshot of your assembly and adds it to the snapshot list.
	Show	Display the selected snapshot.
	Borrow part positions from other snapshots	Display the Snapshot Construction dialog box, from which you can select part positions from other snapshots to use in a new snapshot.
	Assembly state	Makes the selected snapshots available as Pro/ENGINEER explode states.
	Copy	Copy a list of selected constraints. This allows you to select only those constraints from one snapshot that you want to use in another snapshot.
	Paste	Add the list of copied constraints to a new snapshot.
	Update	Change the name of the selected snapshot to that in the Name entry box. Also, update the snapshot with the current onscreen configuration.



Delete

Delete the selected snapshot from the list.

On the **Constraints** tab:



Align two entities

Select points, lines, and planes to create a temporary constraint to align the entities. This constraint is valid only during the drag operation, but is associated to a snapshot and is enforced when the snapshot is shown or updated.



Mate two entities

Select planes to create a temporary constraint to mate them. This constraint is valid only during the drag operation, but is associated to a snapshot and is enforced when the snapshot is shown or updated.



Orient two surfaces

Select planes to orient two surfaces at an angle or parallel to each other. You can use this in conjunction with the Offset button.



Body-body locking

Lock or unlock a body in its current position. The selected bodies will be locked relative to ground or another selected body.



Enable/disable connections

Select connections to temporarily disable from the mechanism. This status is saved with the snapshot. If you use this setting on the last snapshot in the list and do not change the status later, the rest of the snapshots will have the connection disabled.

Constraints

View the list of constraints and their status.

Offset

Enter the value for an offset if you are creating a mate or align constraint. If you are creating an orientation constraint, you can enter a value for angle or distance.



Apply

Re-apply the selected mate or align constraint to regenerate a snapshot.

Use this option before dragging if your assembly has slot or cam connections.



On/Off

Change the status of a selected constraint. Select the constraint whose status you want to change and click this toggle button. The status will change from on to off, as appropriate.



Delete

Delete the selected constraints from the list.

New Drag Dialog Box

Use this dialog box to move components of the assembly and take snapshots. You can also use this dialog box to apply or remove constraints and to turn the constraints on and off.

You can choose from the following options:

Button	Action/Name	Function
	Snapshot	Click to take a picture of your mechanism. The Snapshots list will update. The snapshot includes the orientation, location, connection status, and body locks that are defined at

Previous configuration	the time you took the snapshot. When you use the left mouse button to accept a configuration, the configuration is saved to a buffer. This button acts as an undo command, displaying the relative positions as of the start of the last drag sequence.
Next configuration	Displays the next configuration in the buffer. This acts as a redo command.
Package move	Displays the Move dialog box, allowing you to previous package move. Design Animation does not honor drag constraints in package move.

On the **Snapshots** tab:

Point drag	Select a point to drag. A circle is drawn on the part around the location chosen and follows the cursor movement in such a way as to maintain the connectivity of connections and bodies, if any.
Body drag	Select a body to drag. The body highlight and follows the cursor movement in such a way as to maintain the connectivity of connections and bodies, if any, and the current orientation of the body with respect to the assembly coordinate system.
X, Y, Z translation	Select a body, then click one of these buttons. Your selection reduces the movement of the body to the selected direction of the current coordinate system for drag operations. Translation in other directions, as well as rotation of the body, is locked.
X, Y, Z rotation	Select a body, then click one of these buttons. Your selection reduces the movement of the body to rotation about the x, y, or z axis of the current coordinate system for drag operations.

Current coordinate system	Select a coordinate system by choosing the body whose default coordinate system is the one you want to use. X, Y, or z translation or rotation will be in this direction.
Name	<p>You can rename a snapshot by highlighting it, typing in a new name, and pressing ENTER.</p> <p>If you enter a new name and press ENTER, Design Animation automatically takes a snapshot of your assembly and adds it to the snapshot list.</p>
Show	Display the selected snapshot.
Borrow part positions from other snapshots	Display the snapshot Construction dialog box, from which you can select part positions from other snapshots to use in a new snapshot.
Assembly state	Makes the selected snapshots available as Pro/ENGINEER explode states.
Copy	Copy a list of selected constraints. This allows you to select only those constraints from on snapshot that you want to sue in another snapshot.
Paste	Add the list of copied constraints to a new snapshot.
Update	Change the name of the selected snapshot to that in the Name entry box. Also, update the snapshot with the current onscreen configuration.
Delete	Delete the selected snapshot from the list.

On the Constraints tab:

Align two entities	Select points, lines, and planes to create a temporary constraint to align the entities. This constraint is valid only during the drag operation, but is associated to a snapshot and is enforced when the snapshot is shown or updated.
Mate two entities	Select points, lines, and planes to create a temporary constraint to align the entities. This constraint is valid only

	during the drag operation, but is associated to a snapshot and is enforced when the snapshot is shown or updated.
Orient two surfaces	Select planes to orient two surfaces at an angle or parallel to each other. You can use this in conjunction with the Offset button.
Body-body locking	Lock or unlock a body in its current position. The selected bodies will be locked relative to ground or another selected body.
Enable/disable connections	Select connections to temporarily disable from the mechanism. This status is saved with the snapshot. If you use this setting on the last snapshot in the list and do not change the status later, the rest of the snapshots will have the connection disabled.
Constraints	View the list of constraints and their status.
Offset	Enter the value for an offset if you are creating a mate or align constraint. If you are creating an orientation constraint, you can enter a value for angle or distance.
Apply	Re-apply the selected mate or align constraint to regenerate a snapshot. Use this option before dragging if your assembly has slot or cam connections.
On/Off	Change the status of a selected constraint. Select the constraint whose status you want to change and click this toggle button. The status will change from on to off, as appropriate.
Delete	Delete the selected constraints from the list.

Using Assembly States

You can use the **Assembly State** button on the **Drag** dialog box to make snapshots available as explode states in Assembly and Detail.

To make the snapshots available, select one or more snapshots, then click the **Assembly States** button. The **Asm State** column on the **Drag** dialog box displays "On" next to the snapshot's name, indicating it is available. If you want to turn off the availability of a snapshot state later, you can highlight the snapshot and click **Assembly States** to toggle the availability off.

These assembly states (snapshots) will be available in Assembly and Detail as explode states.

Note: The snapshot and the explode state are linked together. If you change the snapshot, the explode state changes. When modifying or deleting a snapshot in which the explode state is in use, be aware of the following:





- Any changes you make to the snapshot will be reflected in the explode state.
- Deleting the snapshot causes the exploded state to become unlinked. The explode state is still available, but is independent of any snapshot. If you then create a snapshot with the same name as the deleted snapshot, the explode state associates itself with the new snapshot.

For more information about explode states, see the Explode State online help in the Assembly module.

To Use Snapshot Construction


Use the **Snapshot Construction** dialog box when you are creating a snapshot that can use the configuration of some parts from other, previously saved snapshots.

For example, you may have a part that repeatedly performs the same motion. If you do not want to drag the part to its different positions for every snapshot, you can borrow its position from a previous snapshot using the following procedure:

1. Select **Animation > Snapshot** or click  (Create snapshots and drag model) on the toolbar. The **Drag** dialog box appears.
2. Select one of the snapshots in the list.
3. Click  (Borrow part positions from other snapshots). The **Snapshot Construction** dialog box opens.
4. In the Snapshots list, select the snapshot you want to borrow from. The configuration of parts from the selected snapshot appears in the display window.
5. Select the parts whose configuration you want to borrow.
6. Click OK. The model display returns to the original snapshot you selected. The parts you selected in the **Snapshot Construction** dialog box will be in the borrowed configuration.
7. If you want to return to the configuration of the snapshot you selected in step 4, click  (previous model configuration).
8. If you want to repeat the configuration you undid in step 7, click  (next model configuration).

To Drag a Body






When you drag a body, its position onscreen will change but its orientation will remain fixed. If the mechanism requires the body to be reoriented in some way in conjunction with a change in position, then the body will not move at all since the mechanism would not be able to be reassembled in the new position. Should this happen, try using point dragging instead.

1. Select **Animation > Snapshot**. The **Drag** dialog box appears.
2. Click  (Body drag).
3. Select a body within the current model.
4. Move the cursor, and the selected body will follow the location of the cursor.
5. To complete the operation, click on one of the following mouse buttons:
 - Left mouse button — to accept the current body positions and begin dragging another body. Move the cursor away from the dragged body before clicking.

- Middle mouse button — to cancel the drag just performed
- Right mouse button — to terminate the drag operation, leaving the bodies where you have just dragged them

To Define Constraints for a Drag Operation

This procedure assumes that you have selected the **Constraints** tab on the **Drag** dialog box. You can specify various kinds of constraints, and turn them on or off for a drag operation.


1. If you want to align two entities, click  (Align two entities). You can align points, axes, edges, or planes.
 2. Select two entities on your model. The constraint is added to the list with a name describing the entities included in the constraint.
 3. If you want to mate two planes or surfaces, click  (Mate two entities), and follow Step 2.
 4. If you want to change the distance between the selected planes, enter a value in the Offset entry box and press ENTER.
 5. If you want to orient two planes, click  (Orient two surfaces) and follow Step 2.
 6. If you do not want to orient the planes to be parallel, enter a value for the angle in degrees between the planes in the **Offset** entry box.
 7. If you want to fix one or more bodies relative to a lead body, see To Lock a Body Prior to the Dragging Operation.
 8. If you want to disable or enable a connection, see To Change Connection Status.
 9. If you want to assemble your model using the applied constraints, click  (Assemble model). Use this option if your assembly has cams and slots.
 10. If you want to toggle the on/off status of any constraints, select the constraint from the list and click  (Turn constraints on/off).
- Return to To Create a Snapshot.


To Lock a Body Prior to a Dragging Operation

Lock bodies to fix bodies relative to a lead body. The reference may be one of the bodies in your assembly or Ground. The bodies do not need to be touching or adjacent to be locked together.


The bodies will act as if they are glued together, allowing no movement between them. In many cases, body locking can improve the dragging performance.

This procedure assumes you have selected the **Constraints** tab on the **Drag** dialog box.

1. Click  (Lock/Unlock Bodies).
2. Specify a reference body by doing one of the following:
 - If you want to specify one of the bodies on your assembly as the reference, use the left mouse button to select the body.
 - If you want to specify Ground as the reference body, click the middle mouse button.
3. Select the bodies to be locked during the dragging operation. Design Animation highlights each body as it is selected. Unselect any bodies you do not want to be locked if they are highlighted. These bodies will stay fixed relative to the reference body.

Note: Selecting **Close** from the **Drag** dialog box without taking a snapshot will remove all locks. When you begin a new dragging session, no bodies will be locked.
4. If you want to turn off a body lock constraint, select it from the **Constraint** list and click  (On/Off).




Note: You cannot edit a body lock constraint. You must delete the existing constraint and define a new one.

To delete a constraint, select it from the **Constraint** list and click  (Delete).

Return to To Define Constraints for a Drag Operation.

To Change Connection Status for a Snapshot








This procedure assumes you are on the **Constraints** tab of the **Drag** dialog box. Disable connections if you want to move apart connected parts during a drag operation, for example to simulate assembling and disassembling your model. Be aware that the connections will remain disabled in subsequent snapshots.

1. Click  (Enable/disable connections).
2. Select the connections you want to enable or disable during the dragging operation. Design Animation highlights each connection as it is selected. Unselect any connections you do not want to disable.
3. If you want to turn off a connection status for a snapshot, select it from the **Constraint** list and click  (On/Off).
Note: You cannot edit a connection status constraint. You must delete the existing constraint and define a new one. To delete a constraint, select it from the **Constraint** list and click  (Delete).

Return to To Define Constraints for a Drag Operation.


To Drag with a Selected Coordinate System

You can drag a body along the axes of one of the coordinate systems in your assembly. This method gives you more control over the dragging operation. This is useful, for example, if you want to disassemble a model and reverse the procedure to simulate putting it together. This procedure assumes you are in the **Drag** dialog box.

1. Click  (Select current coordinate system).
2. Select the body and its associated coordinate system to move.
3. If you want to translate the body along one of the axes of the coordinate system of the selected body, click the following buttons:
 -  (Translate along X axis)
 -  (Translate along Y axis)
 -  (Translate along Z axis)
4. If you want to rotate the body around one of the axes of the coordinate system of the selected body, click the following buttons:
 -  (Rotate around X axis)
 -  (Rotate around Y axis)
 -  (Rotate around Z axis)
5. Select the body on your model that you want to move.
6. Move the cursor, and the selected body will follow the location of the cursor.
7. To complete the operation, click on one of the following mouse buttons:
 - Left mouse button — to accept the current body positions and begin dragging another body. Move the cursor away from the body you are dragging before clicking the button.
 - Middle mouse button — to cancel the drag just performed
 - Right mouse button — to terminate the drag operation, leaving the bodies where you have just dragged them

To Drag a Point





1. Select **Animation > Snapshot**. The **Drag** dialog box opens.

2. Click  (Point drag).
3. Select a location on a body within the current model. The body will highlight as you move your cursor over it.
4. Click the left mouse button on this location, and a circle will appear. This is the exact location on the body that you will drag.
5. Move the cursor, and the selected point will follow the location of the cursor.
6. To complete the operation, click on one of the following mouse buttons:
 - Left mouse button — to accept the current body positions and begin dragging another body. Move the cursor away from the body you are dragging before you click.
 - Middle mouse button — to cancel the drag just performed
 - Right mouse button — to terminate the drag operation, leaving the bodies where you have just dragged them

Note: You cannot select Ground or locked bodies for point dragging.

To Edit a Snapshot

This procedure assumes you are in the **Drag** dialog box, which lists previously created snapshots.

1. Select a snapshot from the list.
2. Click  (Display snapshot) to review the selected snapshot. The configuration depicted in that snapshot appears in the model window. You can also double-click the name of the snapshot in the list to open the snapshot.
3. If you want to rename the snapshot, enter the new name in the Name entry box and click  (Update).
4. If you want to update the positions of the bodies, drag the bodies to the new locations and click  (Update).
5. If you want to delete the selected snapshot, click  (Delete).

Key Frame Sequence Finder Form

When you select **Animation > Key Frame Sequence**, the **Key Frame Sequences** dialog box opens. You can select from the following choices:

- **Add**—Create a new key frame sequence. The **Key Frame Sequence** dialog box opens.
- **Edit**—Edit the selected key frame sequence. The **Key Frame Sequence** dialog box opens. You can change the reference body, the status of the individual bodies included in the sequence, and the order or the timing of the snapshots included in the sequence. Any changes you make to a key frame sequence affect all instances of that sequence used in the current animation.
- **Delete**—Delete the selected key frame sequence. If you want to remove an instance from the animation without deleting the master sequence, select the instance from the timeline and click the **Remove** button on the toolbar.
- **Copy**—Make a copy of the selected key frame sequence. The new key frame sequence is named *copyofname*, where *name* is the name of the selected key frame sequence. For example, if your key frame sequence is named *open*, the copy is called *copyofopen*.
- **Include**—Include a copy of the selected key frame sequence in the animation. You can have multiple occurrences of a key frame sequence in an animation at different times. A key frame sequence included in an animation is called a key frame sequence instance. Each inclusion of a key frame sequence will be named with a *.n* extension, where *n* is the next available number for that key frame sequence. For example, if you include *open2* in the animation, it will be called *open2.1*.

Key Frame Sequence Dialog Box

Use this dialog box to create or edit a key frame sequence. You can add or remove key frames, change the

times and locations of bodies in snapshots, and change the reference body and body status for the entire sequence.

This dialog box contains the following items:

- **Reference Body**—Select the **Reference Body** arrow, then a body on your assembly. All bodies whose status is desired or required in the sequence (specified under the **Bodies** tab) will be located relative to this body. When the reference body moves, the other bodies will move relative to it as specified by the key frame locations.
By default, the reference body is Ground. Most key frame sequences should keep Ground as the reference body. You may want to change the reference body from Ground if the reference body will be used in two places. Click *See Also* for an example.
- **Sequence**—Create the sequence by selecting or creating the snapshots to include. You can also preview the snapshot and change the time of the snapshot in the sequence.
- **Bodies**—Specify the status of the location of the bodies that are included in the key frame sequence.
- **Regenerate**—Select to regenerate the key frame sequence. If you changed any constraints on parts that are included in a key frame sequence, you should regenerate the sequence so Design Animation can update locations based on these changes.

Bodies Tab

Use this tab to specify the status of the location of the bodies that are included in the key frame sequence.

The status is valid for the entire sequence. You can change the status individually or for multiple bodies all at once. Select multiple bodies with CTRL and the left mouse button

Use this status to tell Design Animation how important the key frame sequence's control of the body is. For example, if there is a conflict between where a driver wants to place a body and where a key frame sequence wants the same body, the driver has precedence if the body's status is **Desired**.

Following are the options on this tab:




- **Unspecified**—The body's position is arbitrary and may be controlled by other drivers or key frame sequences.
- **Desired/Required**—Design Animation will keep the body as close to this position as possible, but it may move based on the movement of any driver or other key frame sequence.

When you run your animation, if the bodies do not move to the correct position, especially at key frames, you should try using **Desired**.

Sequence Tab

Use this tab to build the sequence of key frames that defines your animation.

This tab contains the following items:

Item	Function
	Opens the Drag dialog box so you can edit or create a snapshot.
Time	Enables you to edit the time of a key frame in a sequence. Time "0" for the first key frame is relative to the beginning of the key frame sequence, not for the time in the timeline. Press ENTER to update the time of the highlighted key frame.
	Displays the selected key frame.
	Adds the selected key frame to the sequence in chronological order.
Reverse	Reverses the time sequence of all frames in the sequence. Design Animation mirrors

the time values for each frame. This is useful for creating an assembly sequence by first starting with the assembled model, and creating a sequence showing its disassembly. If you reverse this sequence it will simulate assembling the model.

Remove

Removes the selected key frame(s) from the sequence.

Interpolation

Sets either a linear or smooth interpolation for translation and rotation.

- A linear interpolation varies body position and orientation linearly between key frames, exactly following your assembly's placement at each key frame.
- A smooth interpolation will vary according to a cubic spline fit between key frames, which results in a smoother movement, but may not have the exact placement of each body position as defined key frame to key frame.

KFS Instance

When you select a key frame sequence instance on the timeline, right-click to bring up the pop-up menu, and select **Edit Time**, the **KFS Instance** dialog box appears.

Use this dialog box to change the start time of your key frame sequence instance. You can also drag the starting point on the timeline to change this time, but you cannot change events using drag.

You can select the following items for the start time:

- **Time**—Enter the time you want the instance to start after the selected event.
- **After**—Select the event after which you want the instance to start.

For example, if you want Kfs2.2 to start 3 seconds after the end of Kfs1.1, enter the following:

- Time: 3.00
- After: Kfs1.1End

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