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## The Ins and Outs of Positional Reps in Autodesk Inventor®

Sean Dotson - RND Automation & Engineering

**MA35-1** Mechanical systems often have moving parts, and designers and engineers need to show these machines in multiple positions. With Autodesk Inventor's positional representations, your assemblies can be illustrated in multiple, predefined positions. In this session, learn how these positional representations can be used to create very complex representations of machinery processes and movement. Then learn how these assemblies can be shown in a drawing with overlays to illustrate the range of motion of the model.

### About the Speaker:

Based in Sarasota, Florida, Sean is the president of RND Automation & Engineering LLC and has worked in the custom automated machinery industry for over 9 years. He provides engineering analysis, machinery design, VB and VBA customization and CAD consulting to his customers through RND. An Autodesk Inventor Certified Expert, he is perhaps best known for his numerous tutorials on advanced Autodesk Inventor subjects, which he offers free-of-charge at his website ([www.sdotson.com](http://www.sdotson.com)). Sean also owns and moderates [www.mcadforums.com](http://www.mcadforums.com), an online discussion group for CAD professionals. He coauthored Animator for Autodesk Inventor, an animation add-on application, and is the author of iProperties Wizard, a data management tool.

**[sdotson@rndautomation.com](mailto:sdotson@rndautomation.com)**



## INTRODUCTION

With the introduction of Positional Representations (hereafter referred to as PosReps) in Autodesk Inventor R9, assemblies could be shown in multiple positions. Inventor R10 has increased these capabilities by introducing the ability to create overlays of the alternate positions in an IDW.

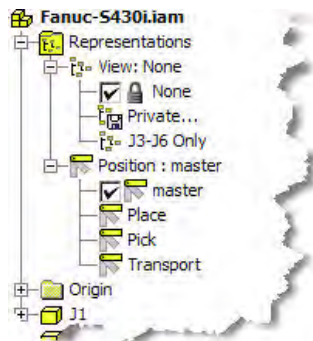
The basic principle of PosReps is to create a scenario in the assembly of multiple constraints and/or components who's positional and appearance states have been overridden. PosReps can control:

- The numeric value of a constraint
- The suppressed state of a constraint
- The value of the number of occurrences in a component pattern
- The grounded state of a component
- The position offset of a component (in ordinate and polar coordinates)
- The positional representation of a subassembly component
- The flexible status of a component

The right-hand assistant to PosReps are View Representations (aka ViewReps) which were formerly known as Design Views. ViewReps can control:

- Component visibility
- Sketch and work feature visibility
- Component enabled status
- Color and style characteristics applied in the assembly
- Zoom magnification
- Viewing angle

Figure 1 below illustrates the location of the Representations folder in the browser. Both ViewReps and PosReps are included in the folder. By default, every assembly has a few default representations.



**Figure 1 - Location of Representations in Browser**

In the View folder the default ViewRep is the None rep. This rep has all parts visible and all parts color at the assembly level set to "As Part". This "locked" ViewRep is also the cause of the single most annoying error message in Inventor (see Figure 2). Many users often ask about this error (which is really more of a warning).

This error occurs if you try to save an assembly in the None ViewRep state when you have:

- Turned off the visibility of a part
- Changed the state of a part to un-enabled
- Turned on the visibility of a sketch
- Changed a color of a part at the assembly level

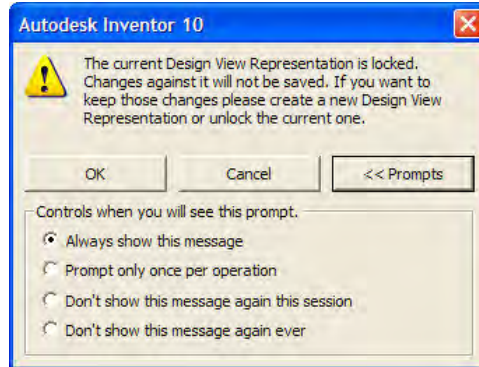


Figure 2 - ViewRep Error Message

If you are comfortable with ViewReps you can turn off this error message, however just be aware that if you make changes to the assembly in one of the manners described above and then save and close the document that the changes will not be saved. You must first create a new ViewRep (described later) and save the changes to this ViewRep.

The PosRep folder, by default, contains the Master PosRep. This is the “default” or “current” view of the assembly. All edits to the assembly must be done in the context of this PosRep. The document must also be saved in this Master PosRep (Figure 3). Under the Master PosRep in the browser, are the user created PosReps.

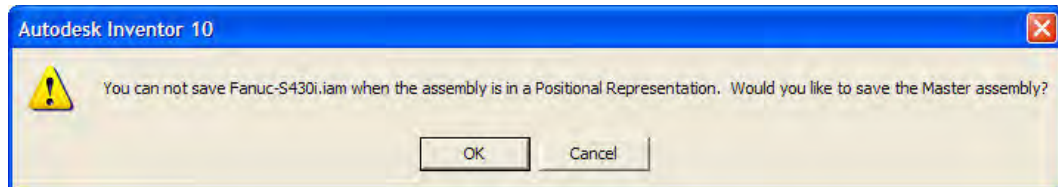


Figure 3 - Saving the assembly in a non-master ViewRep

## CREATING POSITIONAL REPRESENTATIONS

The most common use of a PosRep is to override a constraint value. In this example we'll focus on that workflow. Later we'll examine the other ways to use PosReps. To create a PosRep in an assembly follow these steps

1. Expand the Representations folder in the browser. Right click (aka RMB) on the Positional icon and select **New**.
2. Expand the Position icon and you will see that both a Master and a new PosRep have been created. You can then rename the new PosRep by “lazy double clicking” on the icon label.

## The Ins and Outs of Positional Reps in Autodesk Inventor®



Figure 4 - Creating a new PosRep

3. The new PosRep is shown active by the checkmark next to it. The active PosRep is also shown in text next to the "Position:" icon at the top of the PosRep tree.
4. To create the first override, find a constraint in the browser tree you wish to override and RMB on the icon. In the resulting context menu choose **Override**.
5. You are now presented with the PosRep dialogue. There are 4 tabs on the dialogue box. Each changes a different aspect of a PosRep. Depending on what you have selected (a constrain, component, pattern etc..) some tabs will be grayed out. (Figure 5)

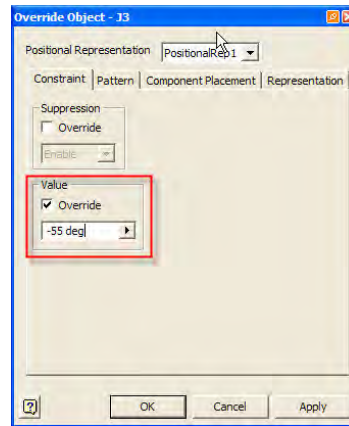


Figure 5 - PosRep Dialogue

6. In this case we have selected a constraint whose value we want to override. Select the **Override** checkbox in the **Value** frame and enter a new value for the constraint. Click Apply or OK. The model should update.
7. You will also notice that the constraint in the browser (or the part name itself in the case of a component placement or representation override) have become bold. This is to allow you to easily identify which parts or constraints have been overridden. (Figure 6).

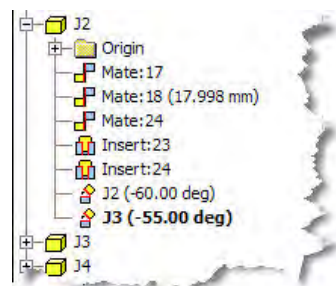


Figure 6 - Overridden constraint shown in bold

8. To remove an override simply RMB on the constraint or component and select **Remove Override**.

9. You can then continue to add overrides for other constraints or components.
10. Doubling clicking on the Master PosRep should cause the model to return to the original position. Double click on the new PosRep and it will snap back into the alternate shape.
11. You can continue to create new PosReps by repeating this process.

## THE 4 TABS OF THE POSITIONAL REPRESENTATION DIALOGUE

The steps above explain how to override a constraint but this is only one of the features of PosReps. Lets' examine all four tabs on the PosRep dialogue box.

### Constraint Tab

On this tab there are two main selections. The first is the ability to override the suppressed state of a constraint. An example of the use of this feature would be to free (or lock) the movement of a part when the machine is in a particular state. For example, in a machine a tooling pallet might be locked into position in the load and unload states but is free to move during the time between these two states. By suppressing the constraint that locates the pallet you can freely move it in the assembly. We have already illustrated the usefulness of the constraint override feature.

### Pattern Tab

On the tab the user is allowed to adjust the row and column offset of a pattern, or the angular offset of a circular pattern. An example of the use of this PosRep might be to show a set of circular products nested in a loose pattern. After a pusher arms pushes them into place, the pattern tightens (the distance between the rows is reduced) and the objects are closer to one another.

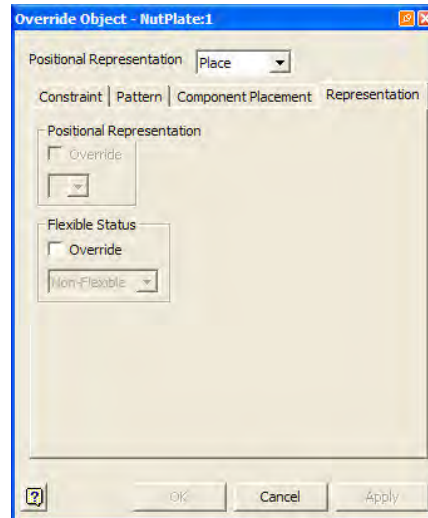
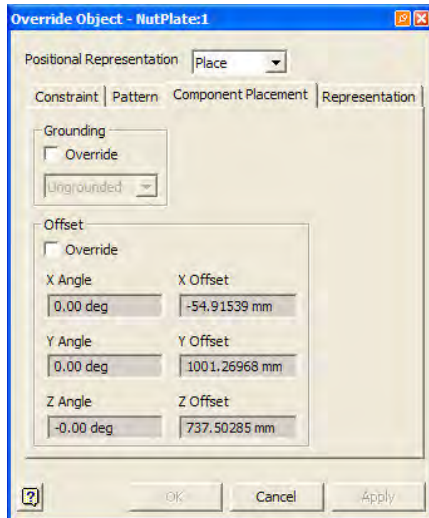
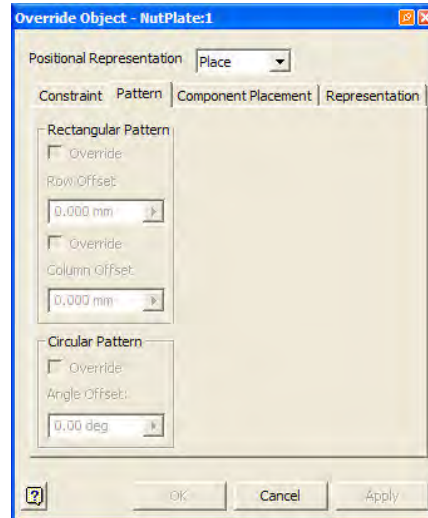
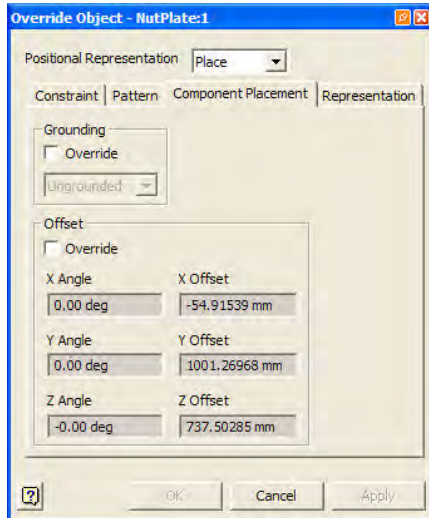
### Component Tab

On this tab the user is offered the ability to change the grounded status of a component as well as the position offset of a component. By changing the grounded state of a component it allows other constraint to change it's (or other parts') position in space. Users are also offered the ability to alter the position of a component without having to change constraints. Select the Offset>Override checkbox and then drag the part in the model window. Note that the values cannot be changed numerically (which limits this feature's usefulness).

### Representation Tab

This tab allows the user to create nested associative representations as well as control the flexible status of a subassembly. The flexible state of a subassembly can be turned on or off. This is important if there is motion contained in the subassembly that you'd like to be able to control from the top level.

You can also cause a subassembly to be shown in one of its PosRep states by referring to them in the dialogue. For example, if you had a subassembly of an air cylinder you would create both **Extended** and **Retracted** PosReps in the cylinder assembly. Then in the upper level you could create a **Load** and **Unload** PosRep. The **Load** PosRep would then activate the **Extended** PosRep in the cylinder assembly while the **Unload** PosRep would activate the **Retracted** PosRep.



## NESTING POSITIONAL REPRESENTATIONS

As touched on briefly above, you can nest and make associative, PosReps. By nesting PosReps you can create a very powerful tool to show a design in various stages and positions.

Nesting PosReps is very simple. First create the PosReps desired in the lowest level assembly (A). Now in the next higher assembly (B), create a PosRep, RMB on the lower level assy (A) and select **Override**. Got to the Representations tab and select the PosRep in the lower level assy (A). Now when you activate the PosRep in the higher level assy, the lower level assy will also activate it's associated PosRep. Through these tools you can create very complex states in your machinery.

In the case of a subassembly nested several layers deep, you do not have to have PosReps in every subassembly. For our example let's imagine that the subassembly E is the one with the PosRep. In the top-level assembly A you want to be able to control this PosRep. To accomplish this you simply need to make assembly B **Flexible** in the context of assembly A,

**CFlexible** in the context of assembly B, **D Flexible** in the context of assembly D , and **E Flexible** in the context of assembly D. You can then control the PosRep in assembly E directly from assembly A.

## CREATING VIEW REPRESENTATIONS

The steps to creating a new ViewRep are as follows:

1. Expand the ViewRep folder in the browser. RMB on the ViewRep icon and select **New**.
2. The new ViewRep will be active. You can then adjust the visibility, color, and enabled state etc. of components for this ViewRep.
3. To prevent new parts inserted into the assembly from showing up in this new ViewRep, RMB on the ViewRep in the browser and select **Lock**. This prevents any changes to be made of this ViewRep.
4. Be sure to save the assembly (and hence the ViewRep)

A note about public vs. private ViewReps: Only public view reps (those stored in the assembly file) are associative and therefore are the logical choice for use with PosReps in overlays.

## TYING IT ALL TOGETHER - CREATING POSREP OVERLAYS IN IDWs

Now that we have our model in multiple states we'd like to shown these states in an IDW. Many times a machine is shown in the load or unload positions, guarding door are shown in the fully open and closed positions to determine layout position or an air cylinder is shown in the retracted and extended positions. It is useful to shown these positions on your IDW of the assembly. Before we jump into the IDW however we need to make sure our model is ready.

While a ViewRep will show the entire model in the alternate position, many time you just want to show a portion of the machine that is in the alternate position. This is where PosReps and ViewReps work hand-in-hand. Once you have created your PosReps, create a ViewRep where all objects except those featured in the PosRep are turned invisible. This will significantly clean up your IDW.

To create a ViewRep overlay first create your base view. You base view can be of the master PosRep or a user created PosRep. Next click on the **Overlay View** icon in the Drawing Views Panel Bar.



Figure 7 – Overlay View Tool

Select the base view that contains a PosRep and you will then be presented with the Overlay View dialogue box. In this box you are asked to select the PosRep to display. You are also slowed to select a DesignView (ViewRep) to use with this PosRep overlay. Checking the Associative checkbox will associate this ViewRep with this overlay and any changes to the ViewRep in the model will be reflected in the overlay.

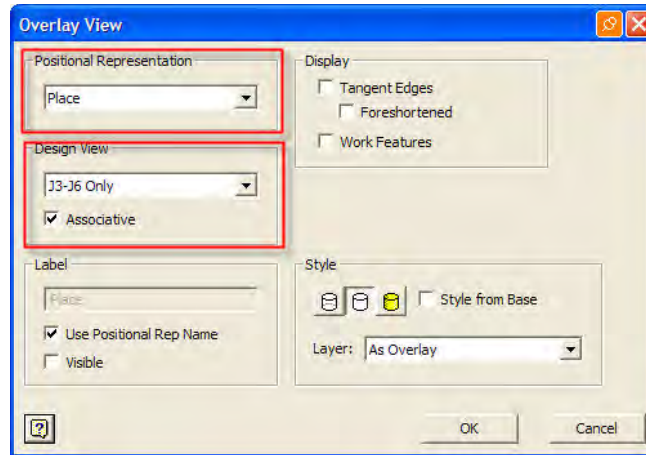


Figure 8 - Overlay View Dialogue Box

You are also presented with the options to display a view label, tangent edges and the style of the overlay. Be aware that even if you choose a shaded display, the overlays always have a “dotted line quality” to them to distinguish them from a base view. You can continue this process on a view as long as there are unused PosReps in the model. Notice in Figure 9 & 10 below how a use of ViewReps (Design Views) allows us to only show the parts of interest in each Overlay View.

Be aware that there are a few caveats to PosRep overlays. You cannot put a PosRep overlay on a broken or a detail view. Also, an Overlay View in a base view will not carry over to a projected view. If you want the Overlay to be visible in the projected view, you need to place it there manually.

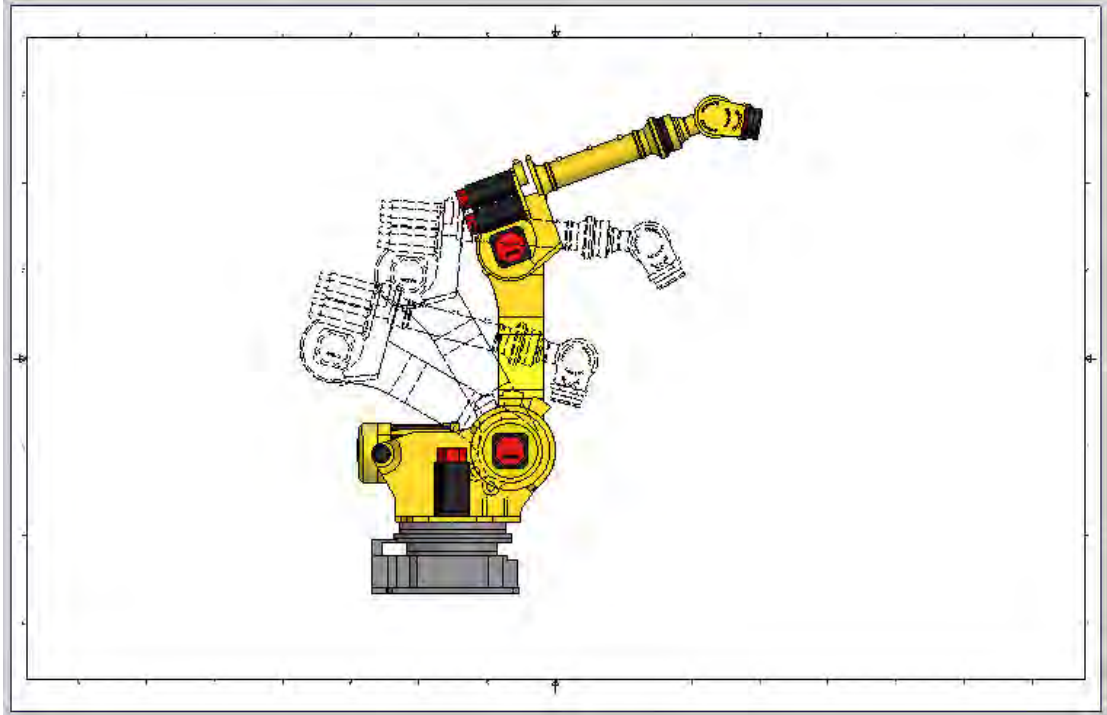


Figure 9 - Assembly with Multiple Overlay Views

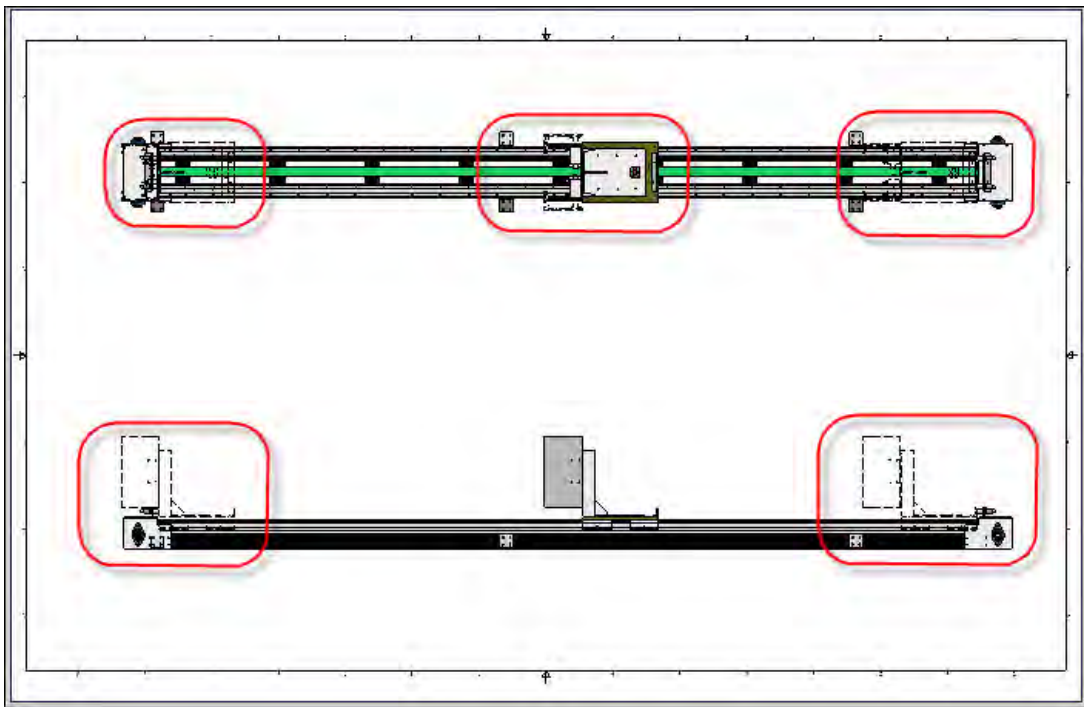
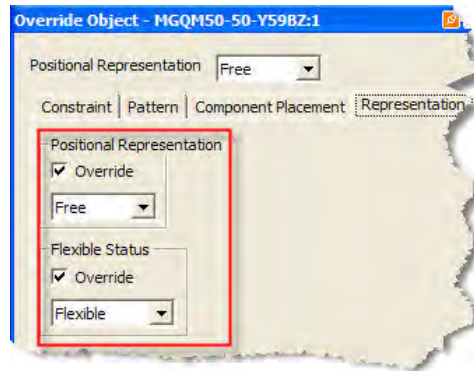


Figure 10 - Assembly with Multiple Overlay Views

## A FEW FINAL TIPS

- When I create PosReps in thing like air cylinders or grippers or other devices that typically have 2 or 3 positions I also create an additional PosRep named **Free**. In this PosRep I suppress the constraint that controls the position of the device. In the next higher-level assembly I then override the air cylinder assembly and go to the **Representation** tab. On this tab select the PosRep checkbox and select the **Free** PosRep in the air cylinder sub. Next check the **Flexible Status Override** checkbox and select **Flexible**. This will allow you to move the air cylinder into any position. In this manner I have the ability to show the devices in the fully open, fully closed and free positions.



- When creating a PosRep where a part is in one of multiple positions (like a slide or an air cylinder) create the first constraint and then suppress it. Next create the constraint for the second position and then suppress it. Continue to do this for all the positions. When you create the override, simply unsuppress the constraint. Do this for each constraint in each PosRep. This allows you to freely move the object in the master rep and to control the motion by suppressing and unsuppressing as opposed to overriding constraint values.
- If you find that you cannot make parts adaptive, invisible, add parts to an assembly or many other commands, make sure you are not in an active PosRep. You cannot do many of these things to an assembly unless you are in the **Master** PosRep.
- If creating a number of PosReps where only the value of a constraint or pattern offset is being changed, use the **Copy** feature. RMB on an existing PosRep and select **Copy**. A new PosRep is created that you can now easily edit to quickly create a new position. This is very useful if you have to override many constraints at one time.
- Be sure to check the Autodesk Inventor forums at <http://www.mcadforums.com/> for a copy of this document, example assemblies, and more AU related information.

