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Don't Be a Block Head – Make It a Dynamic Experience

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Learning Objectives

- Learn how to use visibility states to combine multiple blocks into one.
- Learning how to create Dynamic Blocks that stretch and rotate.
- Learn how to create blocks with alignment parameters for parallel and perpendicular placement.
- Learn how to create blocks with move parameters to resolve overlapping symbols text.

Description

Why have 30 different irrigation blocks in your drawing when you only need four with visibility states? Why are you guessing at what rotation you should place a stop sign? Want to show a different striping arrow in two clicks? These are just a few of the things that will be covered in this class on Dynamic Blocks. This instructional demo will cover multiple types of Dynamic Blocks using a combination of dynamic parameters. Blocks shown in the presentation will include different combinations of visibility states, rotation, stretch, attributes, alignment, and more.

Speaker

Thomas “Tom” Richardson is an Associate and a CAD Manager at [MWM DesignGroup](#) in Austin, Texas. His duties include installation / implementation of Autodesk and Microsoft software as well as training and technical support of personnel in all departments at the firm.

Tom is a Registered Professional Land Surveyor in Texas. He is also an Autodesk Expert Elite and an AutoCAD Certified Professional. Tom is a co-leader of the Austin CAD Users Group and is active on the group’s Discord Server and Microsoft Teams Channels.

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Class Expectations

This is an intermediate to advanced instructional demo, but the concepts discussed will be useful to beginners as well.

This class will focus on suggested uses for parameters and actions in dynamic blocks. Though many of the examples are in the civil engineering-based drawings, the suggestions shown can spark ideas for use in other industry-based drawings.

This class is NOT a hand-on lab and therefore does not include a full step by step on how to create all aspects of the dynamic blocks shown in the class from start to finish.

I will include links to other resources at the end of this handout for additional learning opportunities on dynamic blocks.

I will be using AutoCAD 2021 for this demo. The workflows shown will work in older versions of AutoCAD as well as verticals such as Civil 3D and Map 3D.

Introduction to Dynamic Blocks

According to the AutoCAD 2020 Help:

Dynamic blocks contain rules and restrictions that control the appearance and behavior of a block when it is inserted into a drawing or when it is later modified.

Why Use Dynamic Blocks?

Here are some examples of things you can do with dynamic blocks using the available parameters and actions:

- select from a list of view states
- select a dimension from a provided list of values
- rotate, stretch, or move some or all block content
- flip or mirror the block content
- align the block content with an existing object in the drawing
- create multiple insertion points that can be cycled through upon insertion of the block

Using dynamic blocks provides benefits such as the ability to combine multiple blocks into one block which simplifies the list of blocks in a drawing. Another benefit of using dynamic blocks is to improve efficiency with placing and orienting blocks in a drawing. We will discuss these benefits as we view some dynamic blocks that I have created for use in civil engineering, land surveying, and landscape architecture projects.

Suggested Dynamic Blocks

Here are some examples of dynamic blocks that can be used on AEC projects.

- Seals and Notes
- Legends
- North Arrow and Bar Scale
- Site Blocks (such as wheel stops or sign symbols)
- Traffic Blocks (such as traffic arrows, words, or regulatory signs for traffic control plans)
- Utility Blocks (such as irrigation valves, irrigation sprinkler symbols, or guy wires)

What You Need to Know

The dynamic block creation process is relatively simple. Learning how to use some of the parameter sets can be more challenging. We will cover specific examples of steps 3-6 in detail later in this class. Here is a quick overview of dynamic block creation.

1. Create the block and open in block editor.
2. Confirm all necessary content is in the block.
3. Add parameters, constraints, attributes, tables, etc. and assign actions where needed.
4. Assign selection sets where needed.
5. Close the block editor and save.
6. Place a new instance of the edited block and test each of the dynamic features added to the block.

Create the Block

The first part of creating a dynamic block is creating the block content.

- Create a block from the command line by using the BLOCK command.
- Create a block from the ribbon menu. Home > Block > Create
- Edit an existing block using Block Editor.

Confirm the Content

Open the block in block editor and confirm that all content is included in the block. If you are using visibility states, there might be multiple overlapping content so it can be a bit confusing.

PRO TIP: For visibility state setup, move the content so that none of it overlaps, then update the desired visibility state of the objects. After the visibility states are correct, move the content back to the desired location.

Add Dynamic Block Rules and Restrictions

Once the block content is in the drawing, you can begin adding parameters, attributes, and constraints to the block. Note that some content, such as a POINT parameter, needs an action assigned, such as MOVE. Other content, such as an ALIGNMENT parameter, applies to the whole block and therefore does not need an action or a selection set. Parameters and actions can be placed individually or together as a parameter set.

Add Selection Sets and Assign Visibility States

Once you have added parameters and assigned actions, you will need to assign selection sets for those actions that need them. For example, a MOVE parameter needs to know what content in the block to move.

You will also need to adjust visibility states at this point. For visibility states, be sure to cycle through each state to confirm they are correct.

NOTE: Visibility states are the equivalent of isolate objects except within a block.

Close the Block Editor and Save

This step is self-explanatory, just make sure you save the edits you made.

Test the Dynamic Block

This step is very important. Test every parameter, action, visibility state, and so on to confirm that each is working as expected.

Dynamic Block Visibility State Parameter

Sometimes the number of blocks in a drawing gets to be too much. Even if you know the block name, it might take some time to locate the correct block. If the block names are very similar, you might even select the wrong one initially. Additionally, any edits that need to be made to a series of blocks will take more time than editing a single block.

This is exactly the issue that was presented to me by the landscape department. They had created multiple blocks that had rotation and move parameters to represent different types of sprinklers. The blocks included the sprinkler location, the coverage area, and info on the sprinkler itself. Obviously, different types of sprinklers had different values, coverage areas, and so on. However, the list of blocks in the drawing became quite large and unmanageable. That is where Visibility States came to the rescue. That is where the Visibility State parameter can help. With this parameter, you can create one block that can be displayed in different ways.

Let us create a block with visibility states. For this example, we will use blocks that were previously created to represent each sprinkler spray type for a single sprinkler style.

1. Collect the existing blocks or content needed for this dynamic block and arrange them side by side. Make sure none of the blocks overlap.

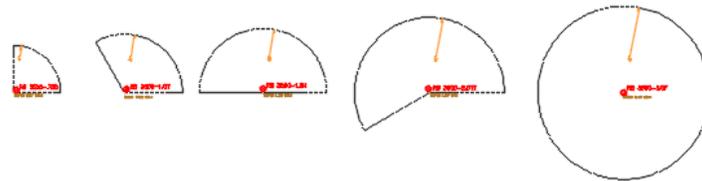


Figure 1: Block Placement

2. Create a new block that includes all the blocks to be combined.

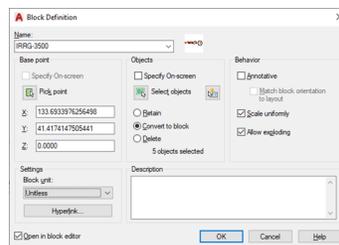


Figure 2: New Block Creation

3. Explode the blocks to gain access to the block content without any existing dynamic block properties.
4. Add a Visibility parameter to the block. Only one Visibility parameter is allowed in a block.

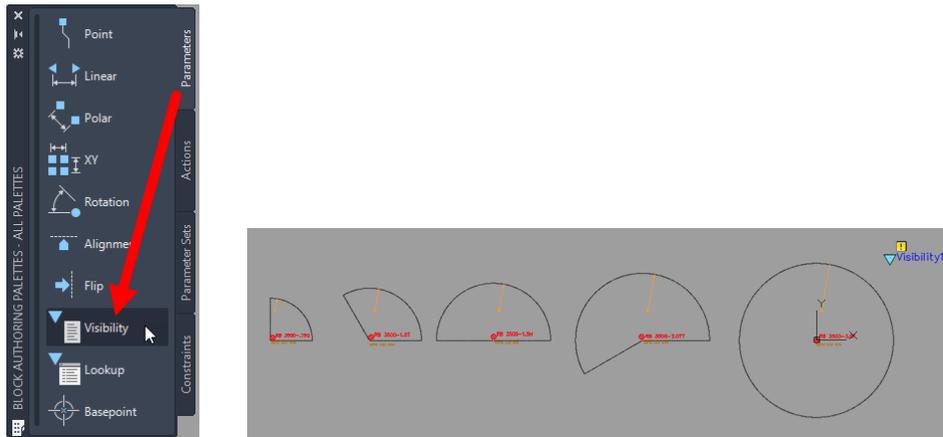


Figure 3: Creating a Visibility State

NOTE: By default, there is only one visibility state when the visibility parameter initially placed. You will see a yellow box with an ! in it warning you of an error. Once you add more visibility states this warning icon will disappear.

5. In the Visibility States dialog, create states for each block you want to show in this dynamic block.

NOTE: To further group layer states in the list, you can add additional visibility states with names such as ----- RB3500 ----- to use as a placeholder. Choose Hide all existing objects then add generic content such as RB3500 text with a circle around it in a non-plotting layer for this state.

6. Select all content except the block content that matches the current visibility state and hide it. Do not select the Visibility parameter because you need it visible in all states.



Figure 4: Select Content and Hide (Make Invisible)

- Use the Visibility Mode tool to show and hide objects that hidden in the current state. This will allow you to access hidden objects to make them visible in the current visibility state.

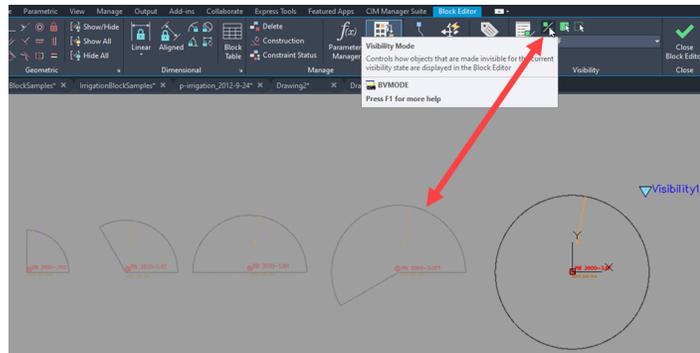


Figure 5: Visibility Mode

- Use the dropdown list of visibility states to set another state current and hide the appropriate objects in that state. Repeat this step for each of the remaining visibility states.

PRO TIP: Isolate Object commands can also be used to control visibility of specific content when modifying visibility states.

- Once all visibility states have been set, you can move the content from each original block back to the original insertion point. Use the visibility mode to show/hide other block content if this helps with placement. The ultimate result will look like a lot of overlap if you have the visibility state set to 1 (everything visible) but it helps to make sure everything is placed correctly in relation to the other content.

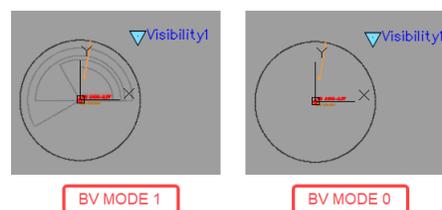


Figure 6: Visibility Mode

- Close the block editor, save when prompted, and test the visibility states you created in this dynamic block. This block is now ready to take the next steps which include adding point move sets for text labels and rotation sets for rotating the block content.

NOTE: An alternate workflow is to create the visibility states first then add the content with the correct visibility state current.

Dynamic Block Stretch and Rotate Parameters

What if you want to apply an action to only a portion of a block? Parameter sets such as rotation, point move, and polar stretch can be used to achieve this goal.

Rotation Sets

We will take an existing north arrow block and add a rotation set to rotate the north arrow inside the block extents.

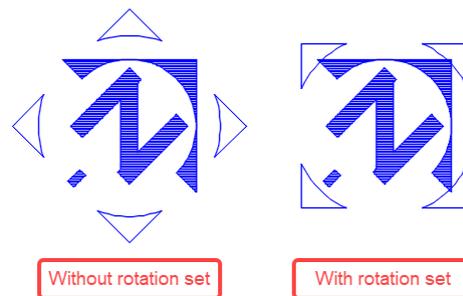


Figure 7: North Arrow Block With and Without Rotation Set

1. Open a north arrow block in Block Editor.
2. Add a Rotation Set to the block. The set will place both a rotation parameter and a rotate action in the block. Read the command line and follow the prompts to select what is needed at each step of the process.



Figure 8: Rotation Set Command Line Prompt

3. By default, the rotate action will have the yellow box with an ! warning. You will need to select assign a selection set to the action to resolve this warning. Select only the portion of the block that needs to rotate.

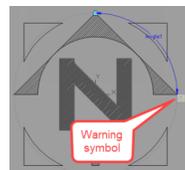


Figure 9: Rotation Set Warning Symbol

4. Close the block editor, save when prompted, and test the rotation set that you assigned.

Linear Stretch Sets

For this example, I created a block representing an 18" wide stop bar. I want to add the ability to stretch one end of the paint stripe so that the length of the stop bar can be changed based on the width of the lane.



Figure 10: Stop Bar Block With and Without Linear Stretch Set

1. Create a block to represent the 18" wide stop bar and open the block in Block Editor.
2. Add a Linear Stretch Set to the block. The set will place both a linear parameter and a stretch action in the block. Read the command line and follow the prompts to select what is needed at each step of the process.



Figure 11: Linear Stretch Command Line Prompt

3. By default, the stretch action will have the yellow box with an ! warning. You will need to select assign a selection set to the action to resolve this warning. Select only the portion of the block that needs to stretch.



Figure 12: Linear Stretch Set Warning Symbol

4. Close the block editor, save when prompted, and test the linear stretch set that you assigned.

As you can see, using parameter sets simplifies adding rotation and stretch capabilities to dynamic blocks.

Dynamic Block Alignment Parameter

Rotation actions work well, but the alignment parameter can be useful in situations where rotating a block is less efficient. What if the rotation you want is sometimes parallel and sometimes perpendicular to the object in the drawing? This is the case for a sign block on land development plans.

For this example, we will add an alignment parameter that can be used to rotate a block while hovering over an object in the drawing. To complete the block creation, we will need to utilize the visibility state parameter that was described earlier in this document. Feel free to review it before proceeding.

1. Use your existing sign block for this demo or create one from scratch and open the block in Block Editor.
2. Add a visibility parameter and visibility states for both Parallel and Perpendicular visibility states. You can use the same circle for the sign pole if it does not change with the different visibility states.

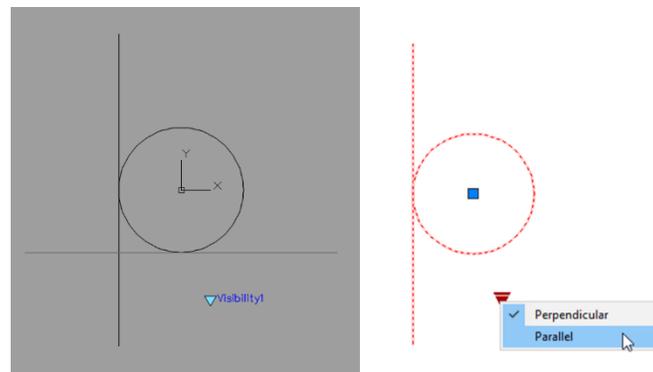


Figure 13: Parallel and Perpendicular Visibility States

3. Add an Alignment Parameter to the block. Read the command line and follow the prompts to select what is needed at each step of the process. The alignment parameter should be parallel to the sign face visible in the parallel visibility state.

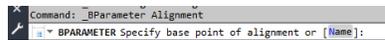


Figure 14: Alignment Parameter Command Line Options

NOTE: You can pick any two points to hold as a baseline for the alignment parameter, but I recommend not allowing your alignment parameter grip to be in the same location as the insertion point of the block.

4. Verify the visibility states again. The alignment parameter will be visible in only the current state by default. Select the alignment parameter and set it to “show in all states” to resolve the issue.
5. The alignment parameter applies to the whole block so there is no need to assign an action selection set. Close the block editor, save when prompted, and test the alignment parameter that you added.

To test this block, locate or create a linear object in your drawing. After inserting the block, left click on the alignment parameter grip and hover near the linear object. Notice that if you approach the object from one side the sign rotates a certain direction. When approaching the object from the other side, the sign will rotate the opposite direction. Change the visibility state and test the alignment parameter rotation while hovering near the linear object again.

Dynamic Block Move Parameter

Are you bothered by overlapping text on your plan sets? If that text is in a block, you might not have any option but to leave it where it is, unless you use dynamic blocks. With a Point Move parameter set, you can individually move the content included in the point move parameter set to resolve these text overlap issues.

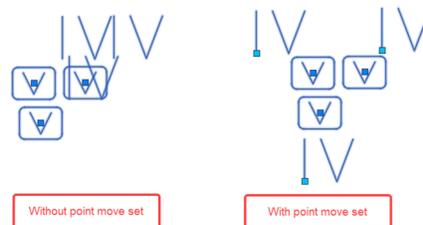


Figure 15: With and Without Point Move Set

1. Use your existing irrigation valve block (or any block that contains text outside the symbol) for this demo or create one from scratch and open the block in Block Editor.
2. Place a Point Move parameter set in your block. Read the command line and follow the prompts to select what is needed at each step of the process. I typically use the text insertion point as the parameter location.

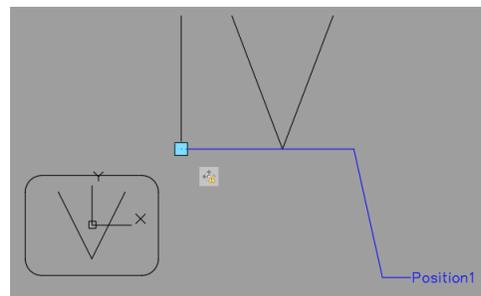


Figure 16: Dynamic Block with Point Move command

3. By default, the move action will have the yellow box with an ! warning. You will need to select assign a selection set to the action to resolve this warning. Select only the portion of the block that needs to move.
4. Close the block editor, save when prompted, and test the point move set that you assigned.

Bonus Blocks

More possibilities exist even with the blocks we have created so far.

- The irrigation block we created has visibility states established, but still needs point move and rotation parameters applied.
- The stop bar we created can have the word STOP added to a visibility state.
- How about a down guy wire that will stretch and rotate at the same time (requires one parameter set, not two – Polar Stretch).
- What about a pavement arrow block that includes all arrow types (visibility states), an alignment parameter, and stretch capabilities?

In Summary

Dynamic blocks can improve the way your plans look and can help you be more efficient with your process of utilizing blocks. Expand the possibilities by combining parameters such as visibility states and alignment or rotation parameters. Autodesk provides some interesting blocks in the default tool palette. Make sure you review these to see additional ways to utilize dynamic block parameter.

If you are not using dynamic blocks yet, what is stopping you? Remember...

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Additional Learning Resources

Autodesk University Classes:

[Tracy Chadwick](#) has taught multiple classes on Dynamic Blocks including Instructional Demos, Lectures, and Hands-on Labs.

[Autodesk Knowledge Network – Dynamic Blocks](#)

[LinkedIn Learning Videos](#)

[YouTube Videos](#)

[Lee Mac Programming: Copy or Rename Block Reference](#)