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Hands-On Introduction to Dynamic Blocks in AutoCAD® 2006

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GD12-4L This lab helps AutoCAD users who create, maintain, or use AutoCAD block libraries understand how to author and manipulate dynamic blocks in AutoCAD 2006. Understand how dynamic blocks are an extension, and not a replacement, for blocks in earlier AutoCAD releases. Become familiar with the Block Authoring mode of AutoCAD 2006, and how to use it to create AutoCAD blocks with custom properties and grips that allow one block to be drawn many different ways. Users of any version of AutoCAD or an AutoCAD vertical application who want an introduction to Dynamic Blocks and their capabilities will benefit from this hands-on introduction.

About the Speaker:

John has worked for 12 years in the AutoCAD development team at Autodesk. Most recently he was one of the lead engineers behind on the Dynamic Blocks feature in AutoCAD 2006, but has worked on many AutoCAD features, including plotting and the Properties Palette. He started using AutoCAD with Release 12 in 1991 while he was working for an Autodesk developer before joining Autodesk. John holds a Master of Science degree in Structural Mechanics from the University of California at Los Angeles.

What is a Dynamic Block?

A dynamic block has flexibility and intelligence. A dynamic block reference can easily be changed in a drawing while you work. You can manipulate the geometry in a dynamic block reference through custom grips or custom properties.

A dynamic block reference may be displayed differently in the drawing than the original block definition. However, the displayed block reference remains a reference to the original block definition.

In addition to the geometry contained in all block definitions, *dynamic* block definitions contain parameters and actions. Parameters define custom grips and properties. Actions define how the geometry of a dynamic block reference will move or change when the block reference is manipulated in a drawing.

Creating Blocks in the Block Editor (BEDIT Command)

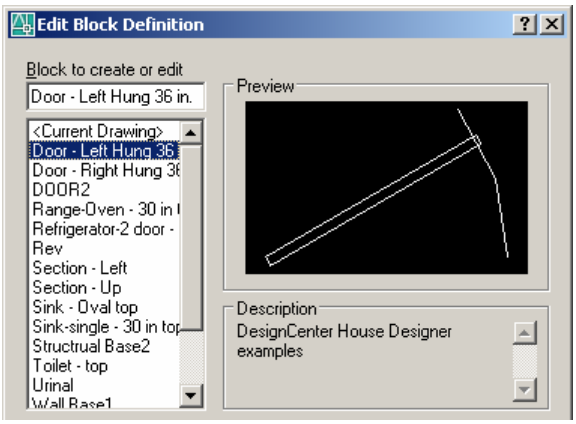
AutoCAD 2006 introduced the Block Editor (BEDIT command). The Block Editor looks and acts like model space, but all of the geometry you create becomes part of the block definition.

The Block Editor allows block authors to:

- Create new blocks or edit existing blocks
- Change the block description, block units, and scale and explode settings
- Edit geometry using existing AutoCAD commands
- Add parameters, which create custom grips and properties for changing the geometry of individual blocks after they have been inserted into a drawing
- Add actions, which define how the block will move or change when the block reference is manipulated in a drawing

Edit Block Definition Dialog Box

The BEDIT command initially displays the Edit Block Definition dialog box. This dialog box displays a list of existing blocks to edit or allows you to enter a new block name. The dialog shows a preview of the selected block and the description of the block. In AutoCAD 2006, dynamic block previews have a small lightning bolt in the bottom right corner.

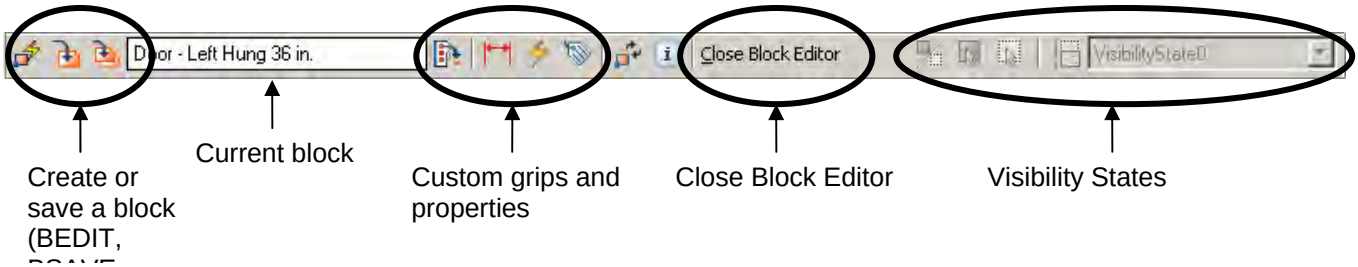


The <Current Drawing> block is actually the Model Space tab of the current drawing. To create custom grips and properties for drawings that are part of a block library edit them using the <Current Drawing> entry in the list.

> ***Tip:*** Double-clicking on a block in model or paper space launches the BEDIT command and selects the corresponding block from the Edit Block Definition dialog box. You can disable this by setting the BLOCKEDITLOCK system variable to 1.

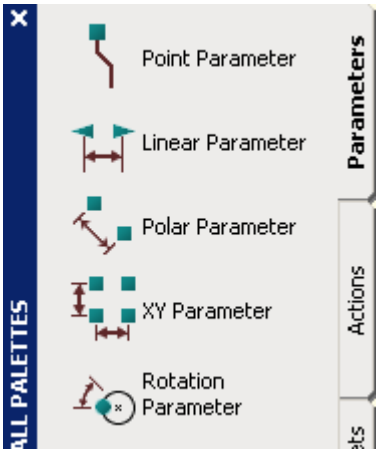
Block Editor Toolbars and Palettes

The Block Editor has a custom toolbar that appears at the top of the drawing area. The toolbar provides access to common operations:



AutoCAD presents you with various palettes, tailored to specific features or capabilities. For example, the Tool Palettes window contains standard or custom *tools* that behave a lot like powerful toolbar buttons.

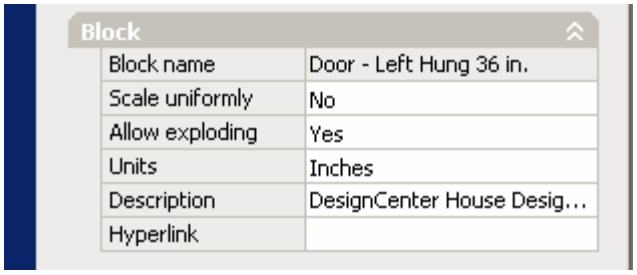
The Block Editor provides Block Authoring Palettes. The Block Authoring Palettes are similar to tool palettes, but they contain special tools for creating dynamic blocks.



Block parameter tools (Parameters tab) define custom grips and properties for dynamic blocks. Block action tools (Actions tab) change geometry within a block when a custom grip or property changes.

> ***Tip:*** The BAUTHORPALETTE command displays the Block Authoring Palettes window, which is also accessible by clicking the Authoring Palettes button on the Block Editor toolbar.

If you haven't used the Properties palette before, you might want to start! The Properties palette is a great way to view and edit properties for your dynamic block. If you are in the Block Editor with no objects selected, the Properties palette displays properties for the overall block.



> ***Tip:*** The PROPERTIES command displays the Properties palette.

Lesson 1 Using the Block Editor to Create and Edit Blocks

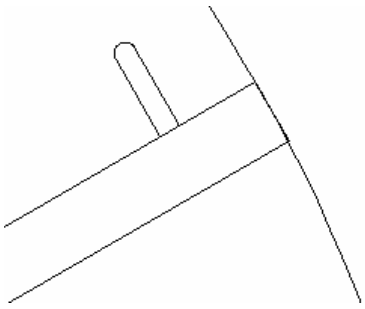
Objective: Become familiar with the Block Editor. Learn how to use the BEDIT and BSAVE commands to create new blocks or edit existing blocks.

1. Open the sample drawing *Wall Base.dwg*.
   - Review the drawing. Notice that many of the fixtures, including doors and plumbing fixtures, are block references.
   - Display the Properties palette (CTRL+1 or enter **properties** on the command line). Select different block references and examine their properties.
2. Open an existing block in the Block Editor.
   - Enter **bedit** on the command line to display the Edit Block Definition dialog box.
   - In the Edit Block Definition dialog box, select the "Door – Left" block from the list.

   Tip: To create a new block, type the new block name in the edit box instead of selecting an existing block from the list.

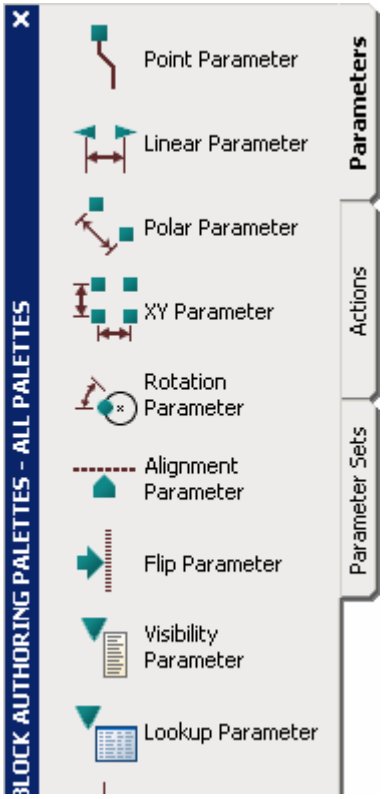
   - Click OK to close the dialog box and open the Block Editor.
3. Examine the layout of the Block Editor.
   - Notice the Block Editor background color (a visual cue that the Block Editor is active).
   - Notice the Block Editor toolbar at the top of the drawing area.
   - Notice that the Block Authoring Palettes window is automatically displayed.
   - Display the Properties palette and notice the block properties displayed there.

   Tip: In AutoCAD 2006, you can define whether blocks can be non-uniformly scaled and whether they can be exploded. These properties can be specified when defining a block using the Block Definition dialog box (BLOCK command), or by setting them in the Properties palette while editing the block.
4. Add a handle to the door and save the block.
   - Using PLINE or other commands, add geometry to the door for a handle.
   - Enter **bsave** on the command line to save the block. Enter **bclose** on the command line or click the Close Block Editor button on the Block Editor toolbar to close the Block Editor and return to the model space tab.
5. Examine the drawing and notice that all of the left-swing door block references now have door handles.



Making Blocks Dynamic: Adding Parameters and Actions

Dynamic block definitions contain objects and attributes just like other block definitions. Dynamic block references are created using the INSERT command, just like other block references. They can be nested and counted (data extraction).



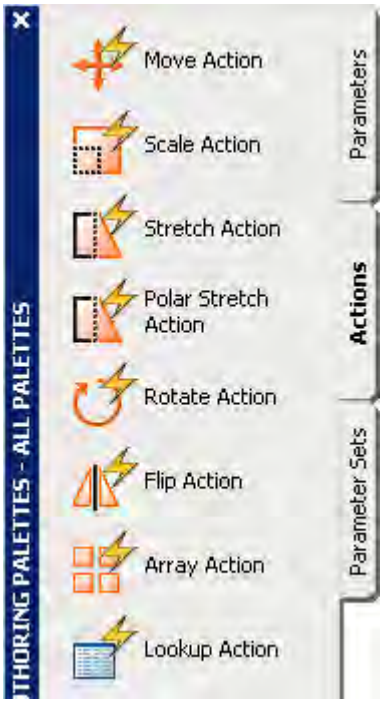
What distinguishes a dynamic block from one that is not dynamic is the presence of parameters and actions. Parameters define custom properties and grips, and actions define how the block reference will move or change when the block reference is manipulated in a drawing. Parameters and actions allow different references to the block to be manipulated separately from the definition. Depending on how the block was authored, manipulated references may have different (sometimes significantly) visual representations from each other and from the initial block definition.

Dynamic block parameters define the custom properties and grips that are displayed when you select a dynamic block reference in a drawing. When these custom properties or grips are changed, the underlying actions are triggered, changing the appearance of the block reference.

Dynamic block actions define how the geometry of a block reference will change when a property of the block reference changes. For example, changing a distance property of a dynamic block reference might move geometry in the block to make a door wider. You might think of dynamic block actions as stand-ins for regular AutoCAD commands like MOVE, ROTATE, SCALE, MIRROR, and STRETCH.

Parameters and actions work together but can only be used in certain combinations. Appendix A lists all of the parameters and actions, and how they can be combined.

Defining Custom Grips and Properties: Adding Block Parameters



You add parameters to a dynamic block definition in the Block Editor. In the Block Editor, parameters have an appearance similar to dimensions. Parameters define custom properties for the block. Parameters also specify positions, distances, and angles for geometry in the block reference. When you add a parameter to a dynamic block definition, the parameter defines one or more custom properties for the block, and one or more custom grips for the block.[1]

> ***Key Concept:*** Block parameters define what properties or grips can vary from one block reference to another.

A dynamic block definition must contain at least one parameter. When a parameter is added to a dynamic block definition, grips associated with key points of the parameter are automatically added.

[1] From the topic *Use Parameters in Dynamic Blocks* in the *AutoCAD 2006 User's Guide*

Use the BPARAMETER command or the tools on the Parameters tab of the Block Authoring Palettes window to add parameters to blocks.

Defining Dynamic Geometry: Adding Actions

You add actions to a dynamic block definition in the Block Editor. Actions are associated with parameters and geometry. Actions tie changes to properties or grips on the block reference to changes in the geometry of the block reference.

In a drawing, you use a grip or a custom property in the Properties palette to manipulate a block reference. When you manipulate a block reference in a drawing by moving a grip or changing the value of a custom property in the Properties palette, you change the value of the parameter that defines that custom property in the block. When you change the value of the parameter, it drives the action that is associated with that parameter, which changes the geometry (or a property) of the dynamic block reference.

> ***Key Concept:*** Actions don't appear outside of the Block Editor, but work behind the scenes like a scripted command to manipulate the block.

Most dynamic block actions take the place of commonly used AutoCAD commands and have the same name as the command they mimic: MOVE, ROTATE, SCALE, STRETCH, ARRAY. You associate actions with geometry. This geometry is modified when the actions are triggered.

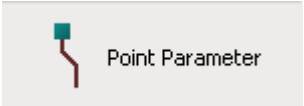
Not all actions can be combined with all parameters, and some actions can only be used with a single kind of parameter.

Use the BACTION command or the tools on the Actions tab of the Block Authoring Palettes window to add actions to blocks.

Moving Block Geometry

You move dynamic block geometry using a move action. You can associate a move action with a point, linear, XY, or polar parameter, and then define the geometry the move action acts upon. Whenever the associated parameter changes, the move action moves the associated geometry in the block.

The point parameter defines a single, square grip and an XY coordinate custom property. Point parameter coordinates are always expressed in terms of the block's coordinate system, not in terms of the drawing (or world) coordinate system.

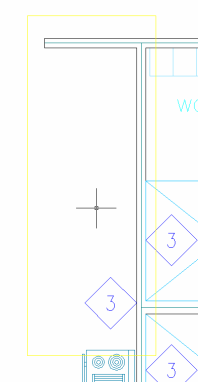


Lesson 2 Moving Block Geometry

Objective: Learn how to add a parameter that creates a custom grip and property for a block. Learn how to associate an action with the parameter to move geometry in the block after it has been inserted in a drawing.

1. Open the sample drawing *Wall Base.dwg*.

   - Make the "Lesson 2 Notes" layer visible and find the yellow rectangle near the center of the drawing. You will create a dynamic block representing a 24" counter top with a sink that can be repositioned on the counter after inserting the block.



2. Create a new block called "Counter and Sink".

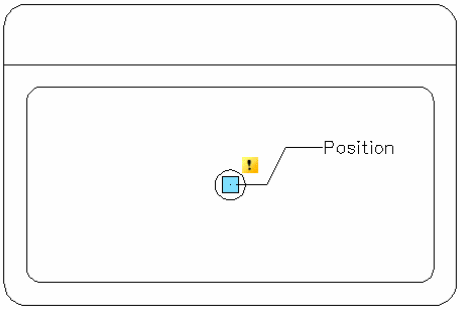
   - Enter **bedit** on the command line to display the Edit Block Definition dialog box.
   - In the Edit Block Definition dialog box, Block to Create or Edit field, type the new block name, "Counter and Sink", and then click OK to open the Block Editor.

3. Create the counter top geometry.

   - Make layer 0 current.
   - Use the RECTANGLE command to create a rectangle measuring 72" wide and 24" high. Place the lower left corner of the rectangle at 0,0. This is the counter top.
   - Enter **insert** on the command line and insert an instance of the "Sink" block. Place the sink at the center of the counter top (36", 22").

4. Create a dynamic block grip to move the sink.

   - On the Parameters tab of the Block Authoring Palettes window, click the Point Parameter tool.
   - Click on the center of the sink drain to place the parameter.
   - Click slightly up and to the right to place the parameter label. Notice that a blue grip appears at the parameter position with a leader and label for the parameter.



   - Notice the alert icon (exclamation point) displayed near the parameter. Hover over the alert icon with your mouse and notice the tool tip that displays, describing a problem with the parameter.

   Tip: Adding a parameter creates at least one label and one or more grips. You can select and move the labels and grips *independently* after placing them.

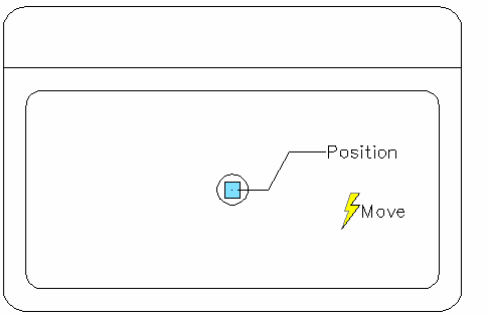
   Tip: You can customize:

   - Parameter labels
   - Parameter descriptions
   - Whether a parameter appears as a custom property of a block in the Properties palette or in data extraction dialog boxes
   - How many custom grips the parameter exposes
   - Many other parameter settings

   The BPARAMETER command exposes these options when creating new parameters or you can change them for an existing parameter by selecting the parameter and changing its properties in the Properties palette.

Tip: Alert icons in the Block Editor draw attention to problems with the grips, parameters, or actions in the block. These alert icons identify problems with relationships between actions and parameters in the block that might not otherwise be apparent. For example, an alert icon might indicate a parameter with no associated action, an action with no associated parameter, or an action with no geometry to manipulate. Double-clicking an alert icon starts the appropriate command to correct the problem.

5. Create an action that associates moving the grip with moving the sink.

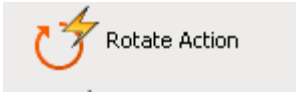


   - On the Actions tab of the Block Authoring Palettes window, click the Move Action tool.
   - Select the point parameter you've already added to the block definition.
   - Select the sink for the action's selection set.
   - Place the action icon. Notice that the alert icon disappears.

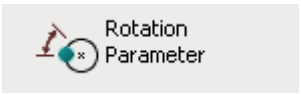
   Tip: The location of the action icon itself has no effect on the operation of the action or the block reference. Some actions, such as the scale and rotation actions, have a Reference Point property that defines the center of the scale or rotation operation. This property is separate from the icon location in the block.

6. Save the block and exit the Block Editor.
   - Enter **bclose** on the command line to save your changes to the block and close the Block Editor.
7. Insert and manipulate the block.
   - Make the "Sink" layer current.
   - Enter **insert** on the command line to insert a new copy of the block you just created inside the yellow rectangle shown on the floor plan.
   - Notice that when you select the block, two grips are displayed. The dark blue grip is the insertion point for the entire block. The light blue grip is the custom grip for moving the sink separate from the rest of the block. After placing the block, move the light blue grip to reposition the sink relative to the counter top.
   - Select the block and examine its properties in Properties palette. Notice the custom properties for the sink position. Experiment with changing the sink position through the Properties palette and by using the grip.
8. Save your drawing. You will use this block in Lesson 4.

Rotating Block Geometry



You rotate dynamic block geometry using a rotate action and associating it with a rotation parameter. Whenever the parameter changes, the rotate action rotates the geometry in the block.

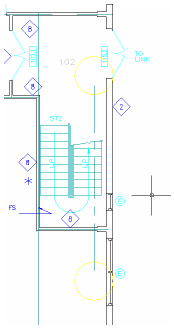


A rotation parameter defines a single, round grip and a single angle custom property. Rotation parameters measure the angle property from a base line defined when you place the parameter.

Lesson 3 Rotating Block Geometry

Objective: Learn how to use a rotate parameter and a rotate action to rotate geometry within a block. Learn about dependency highlighting and how to use it. Learn how to use the RESETBLOCK command to restore a dynamic block reference to its original state.

1. Open the sample drawing *Wall Base.dwg*.



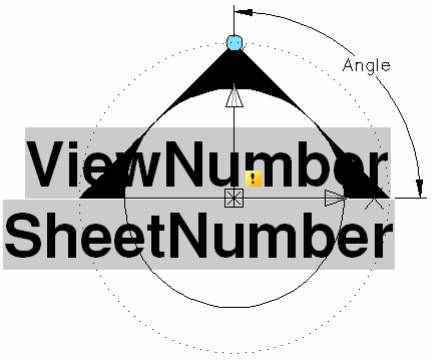
   - Make the "Lesson 3 Notes" layer visible.
   - Notice the yellow circle around the callout block near the bottom of the drawing and the two empty yellow circles along the right side of the floor plan. We are going to modify the callout block so that the callout arrow can be rotated separately from the block attributes.

2. Open the "Section" block in the Block Editor.
   - Enter **bedit** on the command line to display the Edit Block Definition dialog box.
   - In the Edit Block Definition dialog box, select the "Section" block from the drop-down list and click OK to open the Block Editor.

   Tip: Double-clicking on a block reference *without* attributes opens the Edit Block Definition dialog box (BEDIT command). If the block has attributes, double-clicking on the block opens the Enhanced Attribute Editor (EATTEDIT command). You can also select the block reference in a drawing, and choose Block Editor from the right-click menu.

   Tip: AutoCAD 2006 introduced the ability to create *locked* attributes. These attributes do not display grips in the drawing window and cannot be moved separately from the block reference that contains the attributes. This property can be specified when using the Attribute Definition dialog box (ATTDEF command) to define new attribute definitions, or by selecting an existing attribute definition and changing the Lock Position property in the Properties palette.

3. Insert a rotation parameter and place the grip at the tip of the arrow.

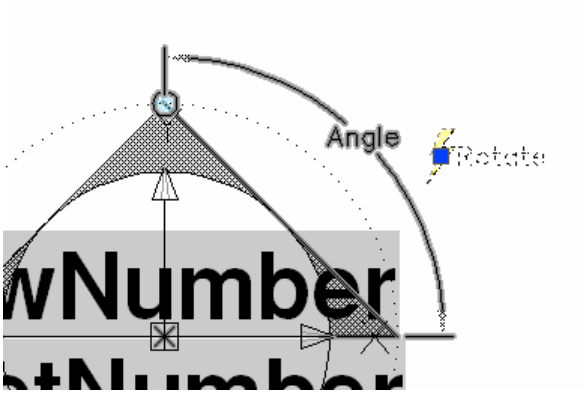


   - Make layer 0 current.
   - On the Parameters tab of the Block Authoring Palettes window, click the Rotation Parameter tool.
   - For the base point, pick the center of the circle.
   - For the radius and base angle, pick the point of the arrow.
   - Pick a point further out for the label location.

4. Insert a rotation action, associate it with the rotation parameter, and select the arrow geometry for the action's selection set.
   - On the Actions tab of the Block Authoring Palettes window, click the Rotate Action tool.
   - Select the rotation parameter that you've already added to the block definition.
   - Select the arrow geometry for the selection set. Be sure to select both the hatch object that forms the solid part of the arrow, and the bounding lines that form the arrow shape. (The lines are tricky and actually aren't distinguishable from the hatch itself. You should select a total of 5 objects).
   - Place the rotate action.

5. Check to see whether the rotate action operates on the right objects.

   Tip: The Block Editor uses *dependency highlighting* to visually indicate the relationships between parameters, actions, and geometry in a drawing. When a parameter is selected, any associated actions and grips are highlighted in a bold outline. When an action is selected, any associated parameters and any geometry the action operates on are highlighted in a bold outline. You can use this as a tool for ensuring that you have correctly established the relationships between parameters, actions, and geometry in a block.



   - Experiment with dependency highlighting by selecting first the parameter, and then deselecting the parameter and selecting just the action. Do the relationships highlighted in bold make sense for each of these objects?

6. Save your changes and return to the floor plan.
   - Enter **bclose** on the command line and save your changes to the block.
7. Insert two new copies of the “Section” block.
   - Make the ”Text1” layer current.
   - Enter **insert** on the command line to insert two copies of the “Section” block at the ends of the line as indicated by the empty yellow circles on the right half of the drawing. You will need to scale them by a factor of 48.0, and insert the blocks un-rotated so that the attribute text remains horizontal.
   - Select the newly inserted blocks and use the Properties palette to set the ViewNumber” attribute to “2” and the SheetNumber attribute to A-05 for both blocks.
   - Select each of the blocks and use the custom rotation grip to rotate the section arrows 90 degrees counter clockwise.
8. Notice that the existing “Section” blocks have been updated and are now dynamic blocks.
   - Select the “Section” block at the bottom of the drawing and note the new rotation grip.
9. Use the RESETBLOCK command on one of the blocks.
   - Select the “Section” block at the bottom of the drawing. Right-click on the block and select Reset Block. Notice how the block geometry and properties reset to the default appearance and values.

Stretching Block Geometry

You stretch dynamic block geometry using a stretch action. You can associate stretch actions with point, linear, polar, and XY parameters. When you add a stretch action, you must define a stretch fame in addition to associating the stretch action with geometry in the block.

Just like the STRETCH command, objects completely within the stretch frame are moved, while those which cross the stretch frame are stretched. The stretch action's stretch frame applies to the geometry as defined in the block definition, so that the same block geometry will be moved and stretched regardless of the block reference's current property values.

The linear parameter defines one custom property measuring the distance between two points of the parameter. One of these points (the first one you define when placing the parameter) is called the start point, the other is called the endpoint. When you change the distance property of a linear parameter in a block reference, the start point remains fixed while the endpoint adjusts so that the distance between the two points equals the new distance value.

Linear parameters also define up to two triangular grips that are constrained to move along the axis of the parameter. One grip moves the parameter's start point; the other moves the parameter's endpoint.

Specifying Value Sets

AutoCAD allows you to restrict the values that can be assigned to most custom properties on dynamic blocks. In AutoCAD, these are called *value sets*, and you define them for the parameter exposing the custom properties. There are three kinds of value sets you can define:

1. "None" value sets allow you to define a range of allowed values by specifying a minimum and maximum value for the property. Minimum values must be between zero and the default value of the property. Maximum values can be either blank (indicating no maximum) or must be equal to or larger than the default property value.

Dist type	None
Dist minimum	0.0000
Dist maximum	

2. "Increment" value sets allow you to define a set of equally spaced allowed values, with optionally defined minimum and/or maximum values that behave identically to the minimum and maximum values of the "None" value set.

Dist type	Increment
Dist increment	0.0000
Dist minimum	0.0000
Dist maximum	

3. "List" value sets restrict the allowed values for a property to a fixed list of values. You define the list of allowed values by selecting the parameter in the Block Editor and clicking on the button next to the Value List property in the Properties palette. AutoCAD automatically adds the default value of the property to the list and does not allow it to be removed.

Dist type	List
Dist value list	1.0000

4. Properties with list value sets show a drop-down list box of the values when editing the value on a block reference.

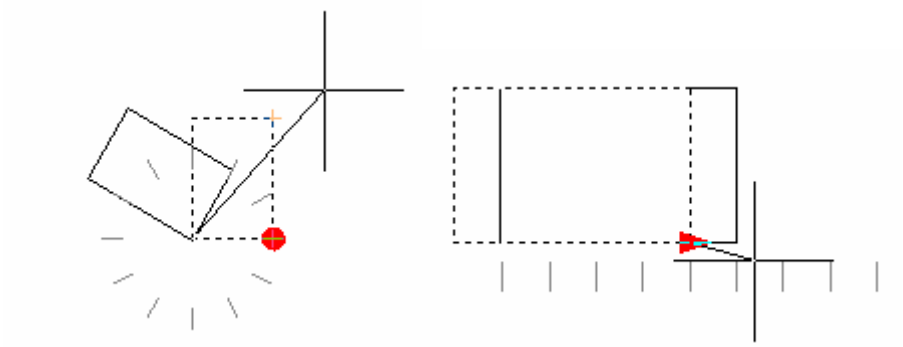
Distance1	1.0000
	1.0000
	2.0000
	3.0000
	4.0000

In a drawing, when you manipulate grips on parameters that have a specified value set, AutoCAD always constrains the grip movement between any minimum and maximum value and snaps the grip to the closest increment or list value if any are defined.

AutoCAD displays marks in both the Block Editor and in the drawing window to indicate that a value set is specified.

AutoCAD displays minimum and maximum values in the Block Editor by tick marks at the minimum and maximum values connected by a line. In a drawing, there is no visual indication of minimum and maximum values.

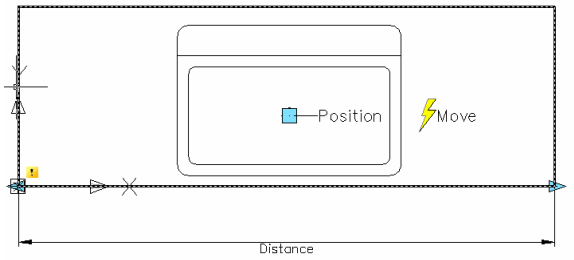
AutoCAD displays increment or list values are as tick marks in both the Block Editor, and in a drawing when manipulating a grip on the associated parameter.



Lesson 4 Stretching Block Geometry

Objective: Learn how to use the linear parameter for linear dimensional properties. Learn how to use the stretch action for stretching geometry

1. Open the sample drawing *Wall Base.dwg*.
2. Insert the "Counter and Sink" block into the drawing.
   - Enter **insert** on the command line.
   - Click Browse… in the Insert dialog box, and select the "Counter and Sink" drawing from the list.
   - Click OK to insert the block and choose a location in the drawing.
3. Open the block in the Block Editor.
   - Enter **bedit** at the command line.
   - Choose the "Counter and Sink" block from the list and click OK to open the Block Editor.
4. Add a linear parameter to control the length of the counter.
   - On the Parameters tab of the Block Authoring Palettes window, click the Linear Parameter tool.
   - For the start point, click on the lower-left corner of the counter.
   - For the endpoint, click on the lower-right corner of the counter.
   - For the label location, pick a point below the counter.
   - Notice how two, triangular blue grips appear at each end of the parameter. Linear parameters constrain the movement of their grips along a line parallel to the parameter's axis.

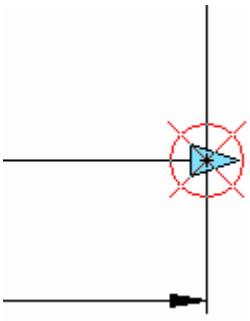


5. Select the parameter and change its properties in Properties palette.
   - Change the Number of Grips property to 1. Notice how the grip at the origin (start point) disappears.

   Tip: Some parameters allow the author to change the number of grips associated with the parameter. Users cannot control the grips that are deleted or added when the number changes. Each parameter has its own rules for the order that grips are added or removed.

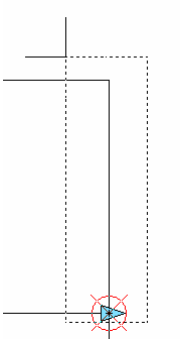
   - Change the Distance Label and Parameter Name properties to "Counter Length".

   Tip: Labels appear in Properties palette and other places in the user interface as the name of the custom property. Parameters, actions, and grips also have a Name property that must be unique within a block but are otherwise not exposed outside of the block definition. It is usually a good practice to change the default names on parameters to something meaningful within the context of the block.
6. Add a stretch action that stretches the right end of the counter as the linear grip is moved.
   - On the Actions tab of the Block Authoring Palettes window, click the Stretch Action tool.
   - For the parameter, select the grip on the Counter Length parameter, or select a point on the line close to the right end of the parameter. Confirm that the red crosshairs appear at the right end of the parameter. If the crosshairs don't appear, use the Start Point/Second Point command line options or pick with the cursor so that the red crosshairs appear at the correct end.



Tip: Actions like move, stretch, and polar stretch depend on only a single grip. When associating these actions with parameters that expose multiple grips you must be careful to associate the action with the correct grip.

- For the stretch frame draw a crossing window encompassing the right end of the counter, including the top-right and bottom-right corners.



Tip: The stretch frame for a stretch action is just like the Crossing Window prompt of the STRETCH command. Objects crossing the stretch frame get stretched; those within the stretch frame get moved. You can change the stretch frame later by selecting the stretch action and grip-editing the stretch frame.

- For the objects to stretch select the rectangle.
- Place the action icon.

7. Save your changes to the block and return to the floor plan.
   - Click the Close Block Editor button and save your changes to the block.
8. Change the length of the counter using the linear parameter.
   - Select the block and notice the new triangular grip.
   - Experiment manipulating the overall counter length using the grip, the Counter Length custom property in the Properties palette, or the dynamic length dimension that appears when the grip is made hot. Notice how changes made to the grip, dimension, or Counter Length custom property are immediately reflected in updated geometry and block properties. Notice how the grip is constrained to move along the axis of the cabinet.
9. ***Extra Challenge***: Restrict the sizes of counters that can be created.
   - Open the “Counter and Sink” block in the Block Editor.
   - Select the Counter Length parameter.
   - Change the Dist Type property to Increment in the Properties palette.
   - Change the Dist Increment property to 6” in the Properties palette.
   - Change the Dist Minimum property to 5’ in the Properties palette.
   - Change the Dist Maximum property to 8’ in the Properties palette.
   - Notice the tick marks that appear along the Counter Length parameter in the Block Editor. These are a visual indication of the minimum, maximum, and increment properties.
   - Save your changes to the block and close the Block Editor.
   - Experiment with the Counter Length property again. Notice how the tick marks appear in the drawing window alongside the grip when it becomes hot.

Tip: Many parameters expose Value Set properties for constraining the range of values a property can have, or for constraining the range of motion of a grip. In this example we used a maximum and a minimum value, plus the value increment. Other value types might make more sense. For example, if the appropriate values for your parameter are not increment, try the Value Set option available with many parameters. You can specify a list of values such as 5’, 5’3”, 7’, and 8’.

Custom Block Insertion Points

When inserting a block, AutoCAD places the origin of the block coordinate system at the block insertion point.[2]

You can customize the insertion point for any block by placing a base point parameter in the block. A block can only contain one base point parameter. You cannot associate actions with base point parameters. When a block contains a base point parameter, AutoCAD will use the location of the parameter as the insertion point for the block, and will always show a grip for the parameter that moves the entire block reference.

You can create blocks with insertion points that move with other geometry in the block by placing the base point parameter in the selection set of other actions.

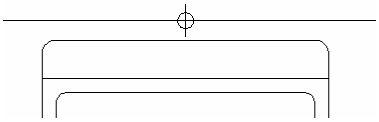
[2] For drawing files, the INSBASE system variable, stored in the drawing, determines the point in the drawing's coordinate system used to insert the block. By default its value is the origin of the drawing's coordinate system. This system variable only applies to drawings inserted as blocks, not to blocks defined from within the drawing itself.

Lesson 5 Custom Block Insertion Points

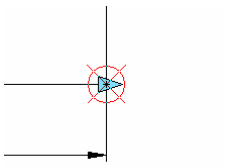
Objective: Learn how to use the base point parameter to define the insertion point of a block.

1. Start a new drawing.
2. Insert the “Counter and Sink 2” drawing as a block.
   - Enter **insert** on the command line to display the Insert dialog box.
   - Click Browse… and select the “Counter and Sink 2” block from the list.
   - Click OK to close the dialog box.
   - Pick a point to insert the block.
3. Open the block in the Block Editor.
   - Double-click on the block or enter **bedit** on the command line to display the Edit Block Definition dialog box.
   - Select “Counter and Sink” from the list, and click OK to open the Block Editor.
4. Note the existing insertion point for the block.
   - Notice how the bottom left corner of the counter is located at the origin (0,0). The origin of world coordinates is the default insertion location for all blocks.

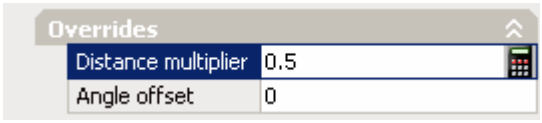
   Tip: When a drawing is inserted as a block (as opposed to a block defined *within* a drawing), the insertion point is defined by the INSBASE system variable stored in the drawing. INSBASE defaults to the origin of the world coordinate system.
5. Change the insertion point of the block to the top center of the counter.



   - On the Parameters tab of the Block Authoring Palettes window, click the Base Point Parameter tool.
   - Specify the midpoint of the top of the counter for the parameter location (3’, 2’).
6. Add a move action that keeps the base point parameter centered on the counter



   - On the Actions tab of the Block Authoring Palettes window, click the Move Action tool.
   - Select the Distance parameter for the action and click on the right arrow grip for the start point.
   - Select the base point parameter for the move action’s selection set, then place the action icon.
7. Change the Distance Multiplier property of the action to 0.5



   - Select the move action you just placed in the block definition.
   - In the Properties palette, change the Distance Multiplier property to 0.5.
8. Save the changes to the block and return to the drawing.
   - Select the block. Note how the insertion point grip is at the midpoint of the top of the counter.
   - Click the arrow grip and resize the counter. Notice how the insertion point grip (and the insertion point of the block) shifts to remain centered at the top of the counter.

Tip: Adding a new base point parameter to a block or changing the location of an existing base point parameter does not affect the insertion point of existing block references.

Tip: You can make the insertion point of blocks move along with geometry in dynamic blocks by including the base point parameter in the selection set for the action(s).

Appendix A: Parameter and Action Combinations[3]

Parameter Type	Description	Supported Actions
Point	Defines an X and Y location in the drawing. In the Block Editor, looks similar to an ordinate dimension.	Move, Stretch
Linear	Shows the distance between two anchor points. Constrains grip movement along a preset angle. In the Block Editor, looks similar to an aligned dimension.	Move, Scale, Stretch, Array
Polar	Shows the distance between two anchor points and displays an angle value. You can use both grips and the Properties palette to change both the distance value and the angle. In the Block Editor, looks similar to an aligned dimension	Move, Scale, Stretch, Polar Stretch, Array,
XY	Shows the X and Y distances from the base point of the parameter. In the Block Editor, displays as a pair of dimensions (horizontal and vertical).	Move, Scale, Stretch, Array
Rotation	Defines an angle. In the Block Editor, displays as a circle.	Rotate
Flip	Flips objects. In the Block Editor, displays as a reflection line. Objects can be flipped about this reflection line. Displays a value that shows if the block reference has been flipped or not.	Flip
Alignment	Defines an X and Y location and an angle. An alignment parameter always applies to the entire block and needs no action associated with it. An alignment parameter allows the block reference to automatically rotate around a point to align with another object in the drawing. An alignment parameter affects the rotation property of the block reference. In the Block Editor, looks like an alignment line.	None (The action is implied and contained within parameter.)
Visibility	Controls the visibility of objects in the block. A visibility parameter always applies to the entire block and needs no action associated with it. In a drawing, you click the grip to display a list of visibility states available for the block reference. In the Block Editor, displays as text with an associated grip.	None (The action is implied and controlled by visibility states.)
Lookup	Defines a custom property that you can specify or set to evaluate a value from a list or table you define. It can be associated with a single lookup grip. In the block reference, you click the grip to display a list of available values. In the Block Editor, displays as text with an associated grip.	Lookup
Base	Defines a base point for the dynamic block reference relative to the geometry in the block. Cannot be associated with any actions, but can belong to an action's selection set. In the Block Editor, displays as a circle with crosshairs.	None

[3] From the topic *Use Parameters in Dynamic Blocks* in the *AutoCAD 2006 User's Guide*

Appendix B: Dynamic Block Commands

BACTION
BACTIONSET
BACTIONTOOL
BASSOCIATE
BATTORDER
BAUTHORPALETTE
BAUTHORPALETTECLOSE
BCLOSE
BCYCLEORDER
BEDIT
BGRIPSET
BLOOKUPTABLE
BPARAMETER
BSAVE
BSAVEAS
BVHIDE
BVSHOW
BVSTATE
RESETBLOCK

Appendix C: Dynamic Block SYSVARS

BACTIONCOLOR
BDEPENDENCYHIGHLIGHT
BGRIPCOLOR
BGRIPOBJSIZE
BLOCKEDITLOCK
BLOCKEDITOR
BPARAMETERCOLOR
BPARAMETERFONT
BPARAMETERSIZE
BTMARKDISPLAY
BVMODE
GRIPDYNCOLOR

Appendix D: Commands and Sysvars disabled in the Block Editor

3DSOUT
3DARRAY
ATTEXT
BASE
BLOCK
BLOCKREPLACE
DXFOUT
DDVIEW
DDVPOINTS
DDUCS
EDGE
EXPORT
HIDE
LAYOUT
LAYOUTWIZARD
LAYDEL
LAYMRG
MVIEW
MVSETUP
PAGESETUP
PLOT
PSETUPIN
PREVIEW
PSOUT
PURGE
QSAVE
RENAME
RTUCS
RENDER
SAVE
SAVEAS
SHADE
SUPERHATCH
SHOWURLS
TXTEXP
UCS
UCSMAN
VIEW
VPORTS
VIEWPORTS
WBLOCK
WMFOUT
WSSAVE
WORKSPACE