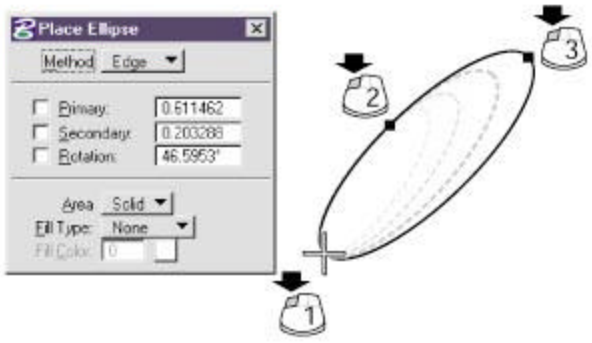
Inside MicroStation 5th Edition - Excerpt Part 3
Learn how to draw and place arcs, polygons, curves and shapes with Accudraw and MicroStation

By Frank Conforti

Place Ellipse by Edge Points

When you need to position an ellipse by identifying three points along its perimeter, the tool for you is Place Ellipse by Edge Points, shown in the following illustration. Similar in operation to the Place Circle by Edge tool, this tool requires two data points that serve to define the major axis of the ellipse, as well as the primary radius. A third data point generates the secondary axis. As with the previous ellipse tool, you have options that control all three aspects of the ellipse process.



The Place Ellipse by Edge Points tool. Note how data points 1 and 3 lie along the major axis of the ellipse.

TIMEOUT: A Bit of Trivia

Internally, MicroStation stores ellipses and circles as the same basic type of element. When you think about it, a circle is nothing more than an ellipse with equal primary and secondary radii. Later on, you will discover that this relationship is a key consideration in how a tool such as Scale Element can distort a circle into an ellipse with such ease.

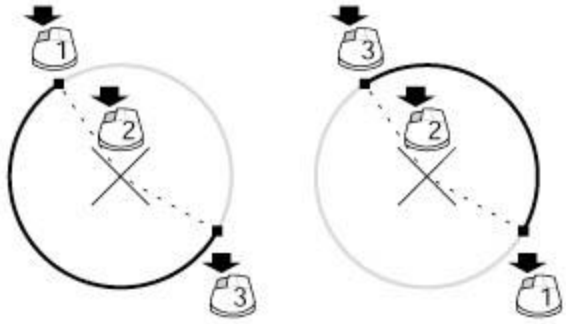
Drawing Arcs

A close cousin to the circle is the arc. Sharing the same traits as the circle (a radius and a center point), the arc has one additional characteristic: endpoints. You might think of an arc as a partial circle. Drawing arcs in MicroStation requires use of the Arcs toolbox, shown in the following illustration.

Arcs toolbox and its settings.

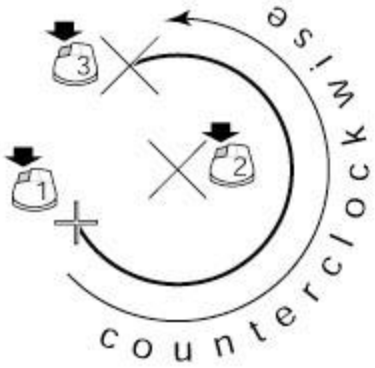
Earlier you learned that for any given three data points there is but one circle that can fit them. This is not

true for arcs. For three given points you have two possible arcs, as indicated in the following illustration. The trick is telling MicroStation which arc segment you want. So, how do you tell MicroStation which piece of the circle you want? Through a little trick called the counterclockwise rule.



For any given three points there are two arcs: the one you want and the one you do not.

The Counterclockwise Rule



All radial input must be entered counterclockwise.

Just as no drafting tool set would be complete without a protractor, MicroStation must also be able to handle angular data. Arcs by their very nature use angular information. The "length" of an arc is typically measured in degrees of sweep. The problem is that there are two possible sweeps: the actual arc and the portion of the circle not occupied by the arc.

MicroStation "solves" the problem by requiring you to enter all radial information in a counterclockwise direction. When you give the first endpoint, the center point, and the final endpoint of an arc, MicroStation automatically strikes the arc from the first point counterclockwise to the final endpoint. This can be confusing to the first-time CAD user. For now, just remember that all radial input must be entered counterclockwise, as indicated at left.

V8: MicroStation version 8 will support both clockwise and counterclockwise input. When placing an arc, the direction you move the mouse after the second data point will determine clockwise or counterclockwise placement.

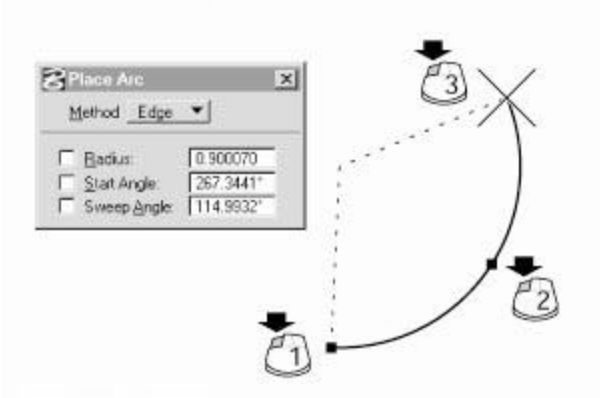
Place Arc by Center

Placing an arc with the Place Arc by Center tool is very straightforward. You select the first endpoint, the center point, and (following the counterclockwise rule) the final endpoint. The radius distance of the arc is set by the distance from the first endpoint to the center point. The final endpoint only sets the "sweep"

angle of the arc.

Place Arc by Edge

After all of this talk about the counterclockwise rule, along comes an arc placement command that does not follow it! Instead, Place Arc by Edge uses the order in which you place data points to determine the final arc. The first and third points still define the ends of the arc; however, the second data point is used to compute the radius. Think of "From-Through-To," an idea that will reappear in other commands. When you specify an arc by edge, you start from point 1, pass through point 2, and go to point 3, as shown in the following illustration.



You switch the Method to Edge in the Tool Settings window to activate the Place Arc by Edge tool. An easy way to remember how the arc is drawn: From-Through-To.

Options When Placing Arcs

As with the Circle tools, the placement of arcs can be controlled by setting the appropriate options, as indicated in the following illustration. With both of the standard arc tools there are three specific options. These three options, as follows, match the three parts of an arc. - Radius
- Start angle of the arc
- Sweep angle

The Start Angle option, on the other hand, is more difficult to understand. How the command operates depends on your selection of the drawing method, whether Center or Edge. Assuming you are placing the arc by center, and the start angle is 10 degrees, MicroStation locks your second data point to 10 degrees from your first data point. MicroStation responds by drawing a dynamic dashed line from the data point (noted by a small filled box) at the angle specified in the Start Angle data field. This gives you a visual reference for selecting your second and third data points. In a similar fashion, when you select the Sweep Angle option and enter a value, MicroStation responds by displaying a dynamic arc attached to your cursor at the center point and tied to your first data point. In the following section, you will explore options for drawing curves.

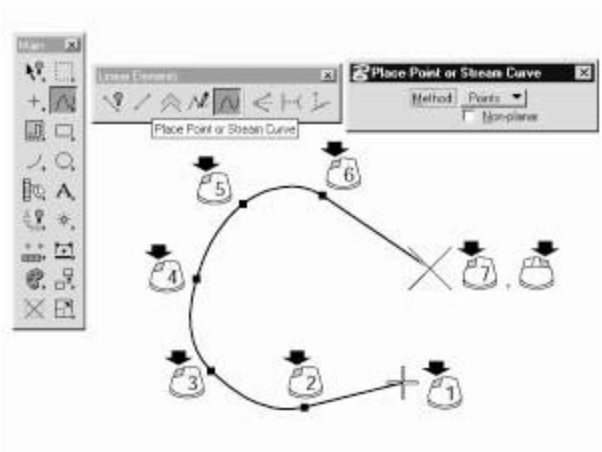
Drawing Curves

So far, you have covered the triangle/T-square (Place Line), the compass (Place Circle), and the protractor (Place Arc). The next logical tool to discuss is the French curve found in every designer's drafting set. One of two of MicroStation's "French curves" is the curve string.

Place Point Curve

The Place Point Curve tool, shown in the following illustration, behaves similar to Place SmartLine; you place data points to define the shape of the curve with a final Reset to accept the curve. The curve string

this tool generates is a gentle curving element that passes through each data point. The degree of curve is established by the angle between the data points. The more acute the angle, the sharper the curve. By keeping the angle very shallow, the result is a gently undulating curve.



The Place Point Curve tool can be found in the Linear Elements toolbox. You must click on the Reset button to complete the construction of the curve.

Such curves constructed to pass through points are a favorite element for creating topographic contours on a site plan. As with SmartLines, you can modify the shape of your curves after you have placed them. (More on this later.)

Drawing Polygons

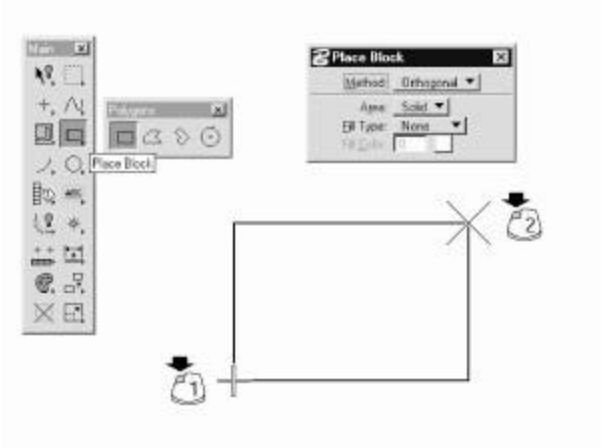
If you have ever used a general-purpose drafting template, you have no doubt drawn boxes, hexagons, and triangles. MicroStation, too, has its equivalent to these very useful shapes. Called polygons, these shapes share one important characteristic: area. All of these shapes are closed elements, in that they start and end on the same point. You have already seen one such element, the circle.

There are several tools to help you create polygons. The sections that follow examine some of them. All of the Polygon tools are located on the Polygons toolbox. There are tools here to create everything from simple shapes to specialized isometric ones, including the following.

- Place Block
- Place Shape
- Place Orthogonal Shape
- Place Regular Polygon

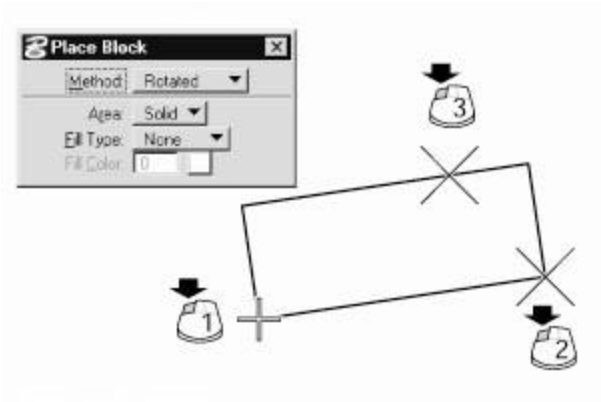
Place Block

The simplest of the polygon tools is Place Block, shown in the following illustration. This tool creates a four-sided rectangle based on the data points you supply. When you select this tool, you have a choice of methods for placing the block: Orthogonal or Rotated.



Place Block has only one option: Method. Seen here, the Orthogonal method results in a block aligned with the view.

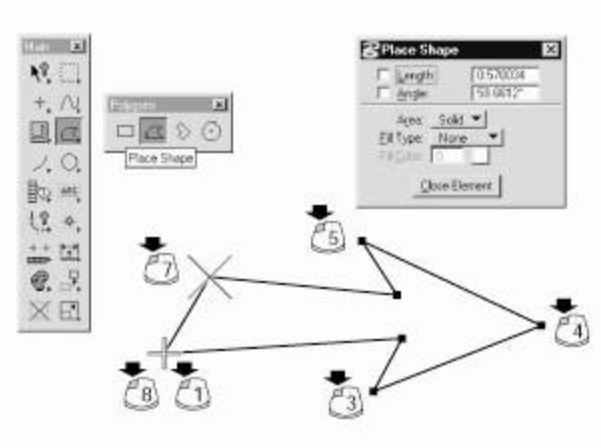
With the Orthogonal method chosen (the default), the block is aligned with your view. To place this four-sided polygon, all you need to do is enter two data points for opposing corners of the box. It does not get much simpler than this. With the Rotated method, you provide the axis along which the block will be placed. Your first two data points define this axis. A third data point provides the height and width of the new block, as indicated in the following illustration.



Place Block Rotated uses the first two data points to define the block's axis; the third data point defines the block's height.

Place Shape

There are, of course, other types of polygons. One of the more useful ones is the free-form shape, which you can make with the Place Shape tool, shown in the following illustration. By specifying every vertex, you have full control over the final form of the shape.



The Place Shape tool in action. The shape will close itself when you click a data point at the beginning point or click on the Close Element button.

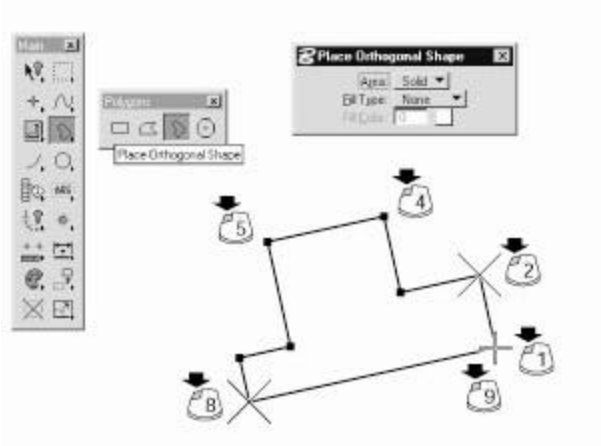
The one tricky aspect of the shape is closure. Unlike the SmartLine, which needs a Reset for completion, the Place Shape tool relies on your returning to the beginning point of the shape. MicroStation provides a button on the bottom of the Tool Settings window (Close Element button) that forces closure of the shape.

TIP: If your shape is small, or has closely spaced vertices, MicroStation may suddenly close on the beginning point before you have finished drawing the shape. The best defense against premature closure is to select your starting point along the longest side of your intended shape.

There are a number of options associated with the Place Shape tool. The Length option allows you to specify the length of each shape segment. Entering a value in the Length data field will result in a dynamic segment, attached to your cursor, for which you data point at a given angle. The Angle option allows you to provide the angle at which the current segment should be drawn. One note of caution about the Angle option: you must change the value for each segment, especially when used in conjunction with the Length option, or else you will end up with a very flat shape!

Place Orthogonal Shape

Related in function to the previous tool, Place Orthogonal Shape, shown in the following illustration, sets the axis of the shape with the first two data points. The shape created from this "baseline" will be orthogonal in nature (i.e., at right angles to it).



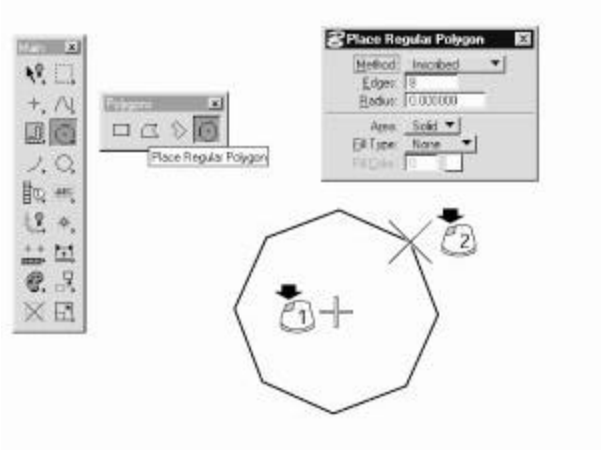
The Place Orthogonal Shape tool. Note the lack of a Close Element button on the Tool Settings window.

As each data point is entered, the resulting line will be set close to the data point. However, because it must be orthogonal to the axis set with the first two points, it will not be on the point itself. You close the shape by clicking a data point at its starting point.

NOTE: Place Orthogonal Shape does not have a Close Element button.

Place Regular Polygon

The tool that most closely matches the function of the general-purpose template is the Place Regular Polygon tool, shown in the following illustration. A very powerful shape maker, this tool allows you to set the number of equal-length sides (the Edges option) you want on your polygon. In addition, you have control over how your multisided polygon will be placed (the Method option). Finally, you can control the overall size of the polygon via the Radius option.



One of the fun tools, Place Regular Polygon gives you flexibility in creating your polygon.

There are three methods for placing a polygon. These are described in the following.

- Inscribed: Placement of the shape is by a center point and a point on one of the polygon's vertices. The vertices of the resulting shape fall on the radius of the phantom circle.

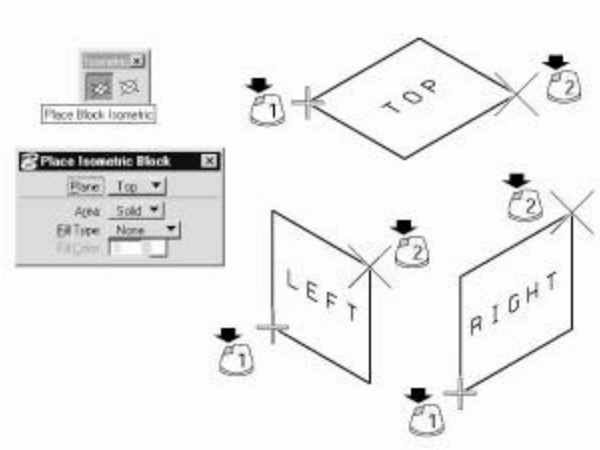
- Circumscribed: Placement of the shape is by a center point and the midpoint on one of the polygon's segments. The resulting shape's segments are tangent to the phantom circle.

- By Edge: Placement of the shape is by two adjacent vertices of the polygon. The radius value has no effect on this placement method.

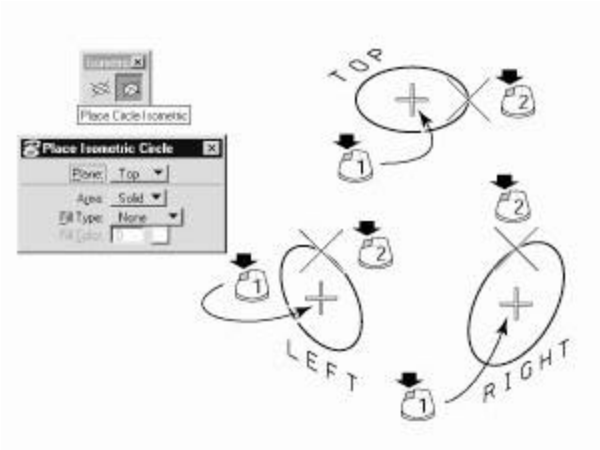
Placing Isometric Elements

Isometric drawings, whether they are plumbing riser diagrams or PID heat-trace illustrations, use the

30/60/90 degree isometric drawing to establish the location of key elements with respect to an entire system in a 3D space. MicroStation supports isometric drawings with two special tools (Place Isometric Block, Place Isometric Circle). These tools, shown in the following illustrations, are accessed from the Isometric toolbox (Tools menu > Isometric).



Place Isometric Block uses diametric data points to define the size of the block. The Plane option sets the isometric orientation.



Place Isometric Circle requires a center point and a data point on the radius of the circle. The Plane option sets the isometric orientation.

Note that both isometric tools only simulate 3D when placing their respective element types. In most instances, these tools are used in 2D drawings, so this is not a problem. However, it could be very confusing were you to place isometric blocks and circles and then rotate the view!

Isometric Text

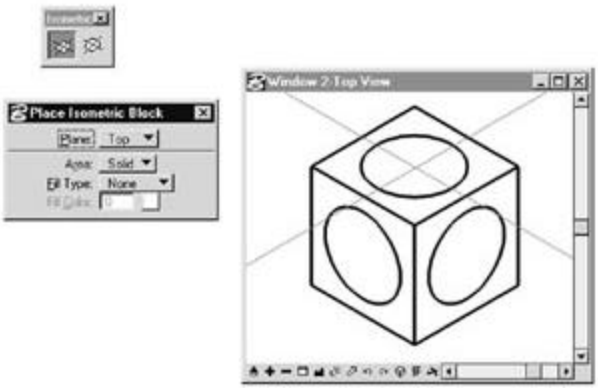
Although text manipulation has not yet been discussed, in regard to isometric drawings you should know that there are two text fonts delivered with MicroStation specifically designed to mimic the oriented text found on most isometric plans. These fonts follow. Both fonts are stick-figure-like, but do serve the purpose of creating realistic isometric plans.

- Font 30: Iso_fontleft
- Font 31: Iso_fontright

Selecting the Isometric Pointer

As a final aid in creating isometric drawings, MicroStation allows you to change the shape and orientation of the on-screen cursor. This is done via the Preferences dialog box (Workspace > Preferences). Selecting the Operation category provides you with two options regarding the pointer: Pointer Size and Pointer Type.

The defaults are normally Pointer Size/Normal and Pointer Type/Orthogonal, meaning the cursor/pointer is displayed as a small cross oriented along the X and Y axes. Changing the pointer size to Full View displays a large cursor that runs from one edge of your view to the other. Changing to Pointer Type/Isometric (see following illustration) results in a skewed cursor that visually shows the orientation of the current isometric plane value (set with the Plane option on the appropriate Tool Settings window).



With the Pointer Size set to Full View and Pointer Type set to Isometric, this cursor is the result. Note how its orientation reflects the Plane setting shown in the Place Isometric Block tool.

Summary

You have been introduced to some of the basic element types used in MicroStation. In addition, you have learned how to place these elements with a certain degree of reliability. By now you may have some idea of the power of MicroStation's tools and how they interact with one another.

In the next excerpt you will explore "controlling element placement" and how you can use MicroStation's various tools to construct your designs.

Frank Conforti has been involved in computer-aided design for over 20 years. He has been a designer, CAD administrator, consultant, and journalist, and an author of several CAD-related books. Frank joined Bentley Systems in 1995 to help start the MicroStation Institute (now the Bentley Institute), Bentley's premiere end-user training program. Frank is currently Product Evangelist for Bentley Core Technologies, working with software developers and end users to better communicate their needs and ideas.