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You are viewing sample pages from our textbook:

***“The MicroStation Lab Book 2D Level 1”***

The first five pages of Module 7 are shown below. The first two pages are typical for all Modules - they provide the Module title and set out the learning objectives. The suggested time for completion of the Module is given at the end of Page 7-2.

Pages 7-3 to 7-5 are instructional pages and, in this case, describe AccuDraw’s compass modes. This information is typical of the initial informational “setup” stage of most Modules. Please note the “Tool Tip” boxes on pages 7-4 and 7-5; these are located throughout the Manual to emphasize a technique or to add specific points of information.

If you require more information about the contents of this book, please contact us directly at: [info@micro-press.com](mailto:info@micro-press.com).

**MICROSTATION - 2D**

**LEVEL 1**

***Module 7***

# **ACCUDRAW**

MicroStation 95, SE, J

Module 7 of 20

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## Module Information

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**Prerequisites:**

Module 6 MicroStation - 2D

**Introduction:**

This is perhaps the most important Module in this course. The AccuDraw drawing aid provides extremely efficient methods of entering dimensional information in your designs, and it is vital that you become totally familiar with AccuDraw's actions and options. After completing this Module you will use AccuDraw in almost every exercise or assignment you draw.

**Objective(s):**

- 7.1 Activate AccuDraw using the AccuDraw icon.
- 7.2 Identify AccuDraw's rectangular and polar compasses.
- 7.3 Identify and apply drawing plane coordinate information.
- 7.4 Identify and apply AccuDraw's keyboard shortcuts options.
- 7.5 Place circle elements using AccuDraw and snap options.
- 7.6 Recall previous dimensional values using AccuDraw's recall options.
- 7.7 Recognize and apply methods of constraining data points.
- 7.8 Unlock and relocate the compass origin.
- 7.9 Recognize and apply shortcut snap modes and constraints.
- 7.10 Recognize and apply unit roundoff options.
- 7.11 Enter dimensional values using the Popup Calculator.
- 7.12 Identify and classify all AccuDraw options and shortcut keys.

**Time:**

This Module should be completed within 6 hours.

# DISCUSSION:

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AccuDraw is perhaps the most important feature in MicroStation. It is a drawing *aid* that provides considerable assistance to the drafting process by offering coordinate-point placement based on your previous actions. To do this AccuDraw evaluates the placement of the *last data point*, the current location of the cursor, the current tool's needs, and any other inputs you may have used. AccuDraw is then able to anticipate your next action and provide a very quick and effective method of entering appropriate coordinate values. AccuDraw also comes with a wide range of *shortcut keys* that invoke special functions allowing even more sophisticated data-point entry.

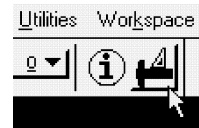
All this may sound complicated, but as you will see, AccuDraw's actions are very intuitive and extremely "user friendly". You will be using AccuDraw as your standard drawing aid and from now on, unless directed otherwise, *use AccuDraw for all practice sessions and assignments in this course.*

I would also suggest that you practice drawing each of the example drawings in this Module several times. ***Remember, it is very important that you are completely comfortable with AccuDraw's contribution to the design process.*** The instruction in following Modules relies heavily on your ability to use AccuDraw as a normal part of the drawing process.

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## 7.1 ACTIVATING ACCUDRAW

AccuDraw is activated by clicking on the AccuDraw icon in the *Primary* tool bar. Click on the  icon to float the *AccuDraw window*.



A good place to locate the AccuDraw window is at the bottom-left of your screen. As with all settings boxes it can be *docked* on the screen's edges, but this location usually consumes more window space than leaving it to *float* on the screen. You may, of course, locate the window anywhere you feel appropriate.

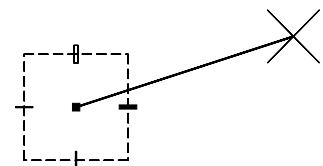
Initially, the AccuDraw window simply displays the *coordinates of the cursor* as the cursor is moved around the drawing window. In this mode you can use it as an alternative to the *Status Line* to display the exact coordinates of a *tentative point*. Notice, though, that the coordinates do not update as you *move* the cursor, they update only when you *stop* moving the cursor.

AccuDraw becomes considerably more interesting when you start a drawing tool. Do the following:

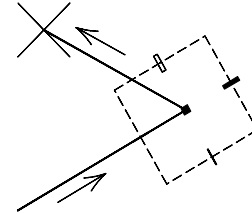
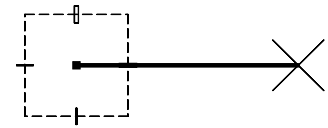
- Step 1** Start the *Place Line* tool.
- Step 2** Place several Data-points in the window.

You will immediately notice several things:

- When you pick the first data point, a square "compass" appears *at* the data point.



- As you drag the line around the window, the line will “lock” to the *closest axis* of the compass when you move the cursor *close* to the compass’ horizontal or vertical axes, and “unlock” when you move the cursor *away* from the axes. This locking action is called “*indexing*” to the axes.
- As you pick each data point, whether on a compass axis or not, the compass *relocates* to the *new* data point location.
- When the compass relocates to each new data point, it *orientates* itself to the *line that was just drawn*, not to the drawing window axes.
- The compass disappears when the drawing tool is *Reset*.



Look closely at AccuDraw’s actions at this point to see how they affect your drawing methods.

AccuDraw tries to anticipate your next move after you place each data point. It assumes you will *likely* want to draw at *right-angles* to the previous line, and it aligns the compass *with* the previous line so that you can lock to one of the axes to place the next data point. If you *are* drawing in this *rectangular* fashion, you can place right-angled corners very quickly. If your next line is not at right-angles to the previous line, you simply drag the line away from the axis lock to place a data point. This is the simplest, most basic mode of operation.

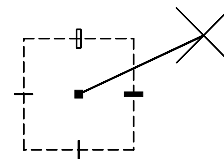
## 7.2 ACCUDRAW’S COMPASS

AccuDraw actually has two compass modes: one for *rectangular coordinates* and one for *polar coordinates*. By default, the rectangular compass is activated when you first start AccuDraw and that is what you have used so far. To see the polar mode do the following:

### TOOL TIP !

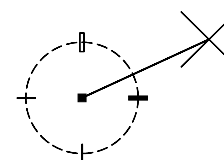
Use the *space bar* to quickly switch between the rectangular and polar compasses.

**Step 1** With the Place Line tool active, *place* a Data-point in the drawing window.



The rectangular compass.

**Step 2** *Press* the *Space Bar* on your keyboard to activate the Polar compass.



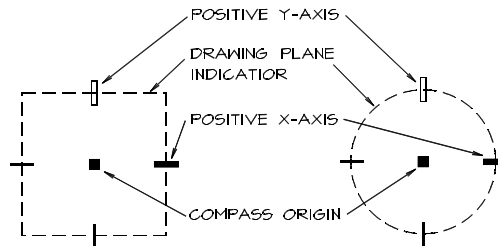
The polar compass.

The polar compass replaces the rectangular compass. You use the *space bar* to *switch* between compass modes at *any time* during the drawing process.

The *rectangular* compass is used to enter *X and Y coordinate dimensions*, and the *polar* compass is used to enter *distance and angle* coordinates. If you now place lines with the polar compass active, you will see that it operates in much the same way as the rectangular compass.

## DRAWING PLANE INDICATORS

Take a closer look at each of the compasses.



Each compass consists of the *Origin* from which all of AccuDraw's functions operate. The *Origin* will automatically locate *at the last data point* you entered (unless you direct otherwise).

### **TOOL TIP !**

If you have difficulty distinguishing between red and green you can change the colors of the axis markers through AccuDraw's settings box (see below).

The broken rectangular or circular line around the origin is the *drawing plane indicator*. The four compass points are shown as heavy lines, with the *positive X-axis* shown in *red*, and the *positive Y-axis* shown in *green*. (Note that in this manual, to distinguish between the positive X and Y axes, I have used a *filled rectangle* for the X axis and a *hollow rectangle* for the Y axis.)

When you are dynamically drawing an element, the “*indexed*” cursor is displayed as a heavy double line.

## ACCUDRAW'S SETTINGS BOX

You can change how AccuDraw looks and operates through the AccuDraw *Settings box*. To open the box go to *Settings/AccuDraw*. A quicker method to open the settings box is to press *G* then *S* on the keyboard *while the focus is in the AccuDraw window*.

The default settings are shown in the illustration below together with a brief description of each option. Your settings should remain at these standard defaults.

### **TOOL TIP !**

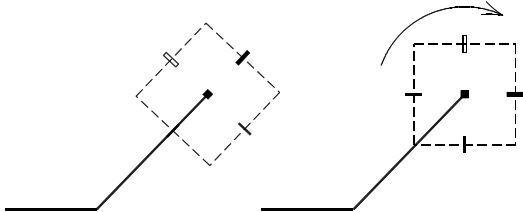
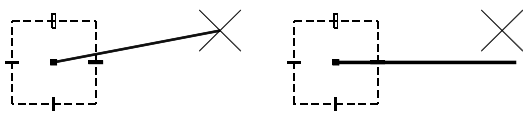
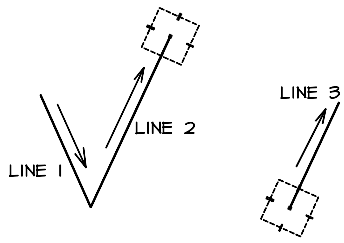
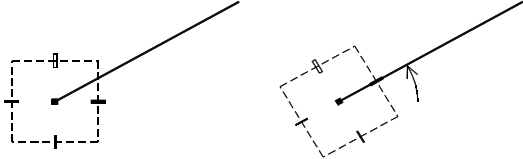
Having “*focus*” in the AccuDraw *window* is very important. Many AccuDraw operations and options require that the focus be in the window before data or short-cut keys are entered. Focus can be gained by pressing the *Escape* key on your keyboard or clicking on the box with your cursor. You will see several warnings to this effect in this Module.

Pages 7-12 to 7-15 below are typical of the practical information presented in the Manual. In this case, page 7-12 defines a selection of AccuDraw shortcuts, and users are then taken step-by-step through a drawing using AccuDraw's "T" and "Enter" shortcuts on pages 7-13 to 7-15. To reinforce the exercise, four objects are offered for further practice at the bottom of page 7-15.

## 7.4 KEYBOARD SHORTCUTS

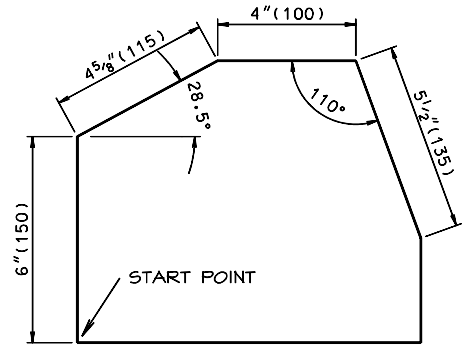
AccuDraw comes with a collection of *keyboard shortcuts* that enhance AccuDraw's operations *during* a drawing or editing sequence. When you enter a shortcut at the keyboard you will see a "pop-up" appear in the AccuDraw window. The pop-up is a visual confirmation that AccuDraw has received the shortcut key-in.

You are going to use six shortcuts in this Section. More will be discussed later. A complete list of the shortcuts is given at the end of this Module.

Shortcut Key	Operation	Example
T or V	T - "Top": Forces the <i>compass</i> to rotate to line up with the <i>X- and Y-axes of the design plane</i> . Called "Top" in relation to the orthographic <i>top view or plan view</i> in a drawing. V - "View": Forces the compass to line up with the <i>view axes</i> . If the view is not rotated, then either T or V will achieve the same effect.	
Enter (Return)	"Smart Lock": <i>Locks</i> the dynamic line to the <i>closest X or Y axis</i> . <i>Toggling</i> Enter (or Return) locks and unlocks the dynamic line.	
N	"Nearest Snap Mode": <i>Sets the snap mode to Nearest</i> . Used in conjunction with <i>Smart Lock</i> in this Section but can also be used as an individual shortcut.	
B Not in '95.	"Base Rotation". Locks the placement of an element to the orientation of the <i>previously placed element</i> . AccuDraw's compass rotates parallel to the previous rotation value. Not available in MicroStation 95.	
RQ and RA	"Rotate Quick" and "Rotate Axis". RQ rotates the compass temporarily. RA rotates the compass axes permanently.	
L Not in '95.	"Lock Index". Toggles on or off AccuDraw's axis indexing. Not available in MicroStation 95.	This toggle stops AccuDraw from indexing the dynamic line to the axes.

## CONSTRAINING WITH *T* AND *ENTER*

In this next exercise use the *T* and *Enter* (Smart Lock) shortcuts to draw the figure at the right:



- Step 1** The *Place Line* tool should still be active.  
**Step 2** Enter a *Data-Point* anywhere in the window.

Start with AccuDraw's *Rectangular* compass.

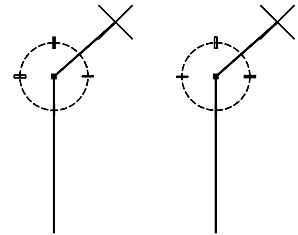
- Step 3** Move the cursor *above* the origin and index to the Y-axis.  
**Step 4** Enter :6 (150) and *Data-point*.  
**Step 5** Change to the *Polar* compass.

At this point the polar compass is located at the second data point and is oriented to the first line. You need to enter an angle of  $28.5^{\circ}$  to the horizontal and you cannot do this with the current compass orientation.

- Step 6** Press "T" to reorient the compass.

The compass will rotate to orient with the *design plane axes*. Now you can enter the correct angle.

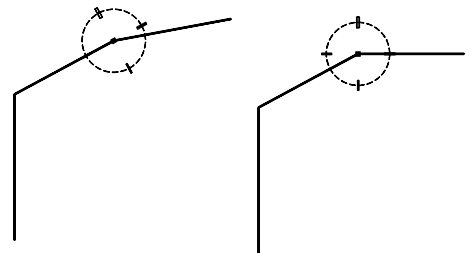
- Step 7** In the *Angle* box enter 28.5, in the *Distance* box enter 4 (100), and *Data-point* to accept.



Step 6: Rotate the compass with the "T" key.

The compass is now oriented with the second line and must be rotated so that you can draw the next horizontal line.

- Step 8** Press "T" and *index* the dynamic line to the X-axis.



Step 8: Rotate the compass again.

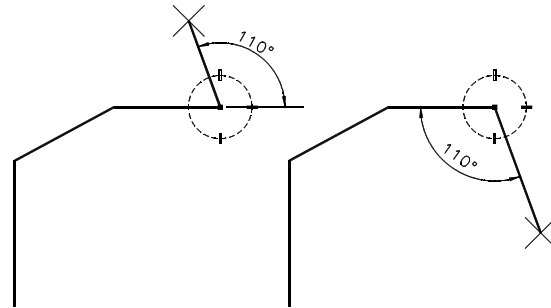
- Step 9** Enter a *distance* of :4 (100) and *Data-point*.

In **Step 10** and **11** you need to draw a line at an internal angle of  $110^{\circ}$ . Since the compass is oriented to the design plane (because the last line was horizontal), you might think that you need to

do some math to calculate the full angle from the X-axis (eg.,  $110 + 180 = 290$ ). However, AccuDraw allows you to enter the  $110^0$  angle and then accept the line as *either*  $110^0$  from the X-axis *or* the *reciprocal* of the line. All you have to do is move the cursor *below* the line to display the reciprocal. To confuse you further, you could also enter  $-70$  for the angle.

**Step 10** Enter 110 in the *Angle* box, and :5.5 (135) in the *Distance* box.

**Step 11** Move the cursor *downward* to display the line and *Data-point* to accept.

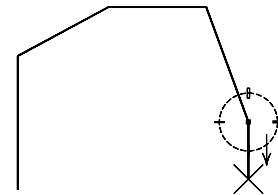


Step 10 and 11. Line  $110^0$  from the X-axis and as a reciprocal.

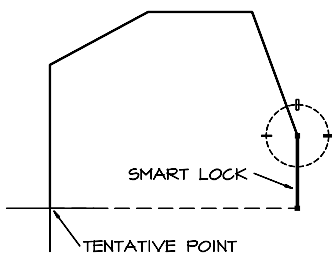
Actually, in this case it doesn't matter whether your cursor is above or below the starting horizontal line when you enter the active angle. AccuDraw will still offer the two line-position choices.

**Step 12** Press "T" to reorient the compass for the vertical line.

You will notice that there is no dimension given for the next line. You don't need one because you will use *Smart Lock* to lock the dynamic line to the vertical, and use a *keypoint snap* to locate the endpoint horizontally in line with the shape's starting point.



Step 12.



Step 13 and 14.

**Step 13** Drag the cursor downward and press *Enter* to *Smart Lock* the dynamic line to the negative Y-axis.

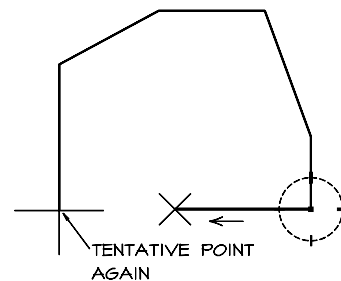
As you move the cursor the line is dynamic only in the *vertical* direction (try moving the cursor).

**Step 14** Tentative point and *snap* to the *starting point* of the shape.

When you place the tentative point AccuDraw draws a dashed line from the tentative point to the dynamic line, indicating where the dynamic line will terminate. When you complete the snap with a *Data-point*, the dynamic line is terminated in line with the snap location.

**Step 15** *Data-point* to complete the snap.

**Step 16** To complete the shape, *snap* to the starting point and *Reset*.

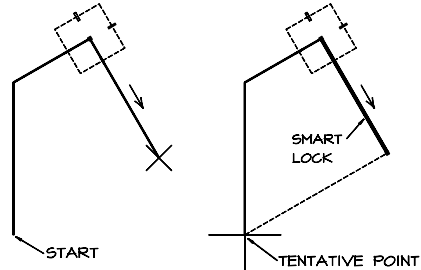


Step 15 and 16.

*It is important to practice the Smart Lock option in conjunction with snap options.*

In the example above, Smart Lock and the end-point snap aligned the second vertical line with the start point because the two vertical lines were *parallel*. If these two lines were not parallel, what effect would that have on the Smart Lock - snap combination? Try the following exercise:

- Step 1** Draw the three lines as shown below.
- Step 2** The third line should be “dynamic” at this point (the length has not yet been accepted).
- Step 3** Press “Enter” to Smart Lock the third line to the negative Y-axis.
- Step 4** Place a *Tentative Point* at the starting point.



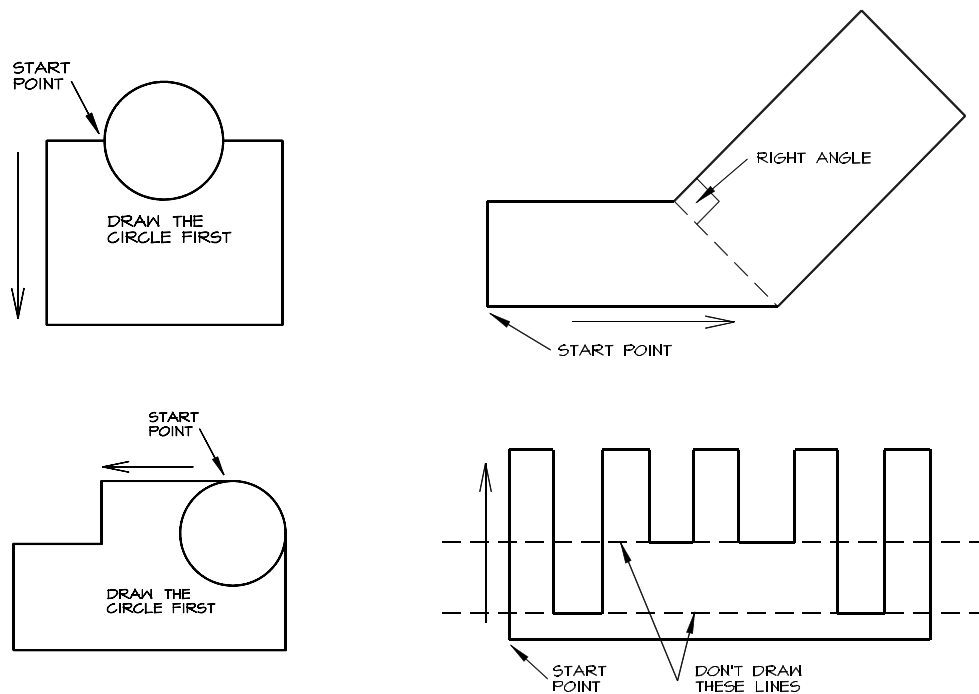
Step 3.

Step 4.

The dashed line appears, connecting the tentative point and the dynamic line. Note that the angle between the dashed line and the dynamic line is  $90^\circ$ , while the angle between the starting point and the dashed line will depend on the specific geometry. This is always the case with the Smart Lock because Smart Lock *only locks lines to the X- or Y-axes*. Clearly, you cannot use this procedure to *horizontally* align to the starting point under this *specific* condition.

To *cancel* Smart Lock, press the *Enter* key again. Reset to stop the Place Line tool.

To practice using Smart Lock together with tentative points and snaps, draw the following shapes. The shapes have no dimensions. All you need do is begin the lines at the start point, continue around the shape in the direction of the arrows, and use Smart Lock and snaps where necessary.



The next three pages, 7-24 to 7-26, again illustrate how information is presented to step the user through important AccuDraw techniques. In this case the subject is the use of the “O” shortcut keyin, an extremely important technique that projects the start point of an element in relation to an existing point.

## 7.8 RELOCATING THE COMPASS ORIGIN with "O" FOR "ORIGIN"

One of the more frequent drawing operations you need to do is to *offset* the starting point of an element in relation to an existing element or to a known point. AccuDraw's "O" shortcut provides a very efficient means of "floating" the compass so that offsets can be made.

There are three options:

1. Pressing the "O" key when the *compass is not visible* will cause the compass to locate at the *last data point*.

Try this now. Draw a *single line* with the *Place Line* tool and *Reset* to stop the tool's action. The compass disappears when you *Reset*. Press the "O" key and the compass will reappear at the end of the line you just placed. To start another line at that location, *Data-point on or close to the compass origin*.

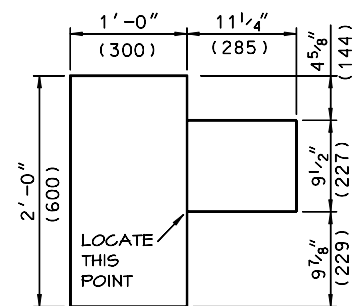
2. Pressing the "O" key when the *compass is visible* will cause the compass to relocate at the *current cursor location*.

Try this option. *Data-point* to start a new line, and as you *drag* the line around the window, keep pressing the "O" key. The compass will relocate to the current cursor position *each time* you press "O".

3. If a *tentative point* is placed in the window, pressing the "O" key will relocate the compass *at* the tentative point.

This third option is ***extremely important*** since it allows you to enter *precision offsets* from *existing elements* in the drawing.

To see how this option can be of tremendous value to drawing operations, start with this simple exercise. The objective is to locate the bottom-left corner of the small rectangle at a  $9\frac{7}{8}$ " (229) offset from the lower-right corner of the larger rectangle.



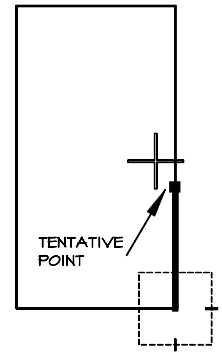
### TOOL TIP !

Use a tentative point and the "O" shortcut key to *offset* the *start point* of an element. If you normally use an offset tool (in another CAD programs) to find the location of new elements, you can still do so with MicroStation's *Move Parallel* tool. However, this is a very inefficient method of finding the start points of elements compared to the tentative point and "O" key combination discussed in this Section.

### TOOL TIP !

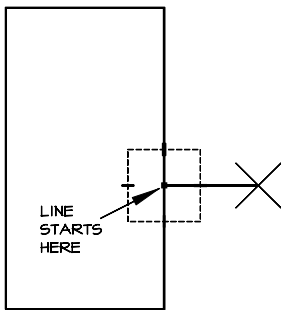
Use the "O" key to locate the compass at a *tentative point*.

- Step 1** Draw the large rectangle.
- Step 2** Start the *Place Line* tool.
- Step 3** *Tentative-point* on the bottom-right corner of the large rectangle.
- Step 4** Press the *O* key to move the compass to the tentative point.
- Step 5** *Index* the cursor to the positive *Y* axis.
- Step 6** Enter :9 7/8 (229).



Steps 2 to 6.

If you look closely you will see a new tentative point in the shape of a small rectangle at the 9 7/8" (229) location. You have *constrained* a potential start point for the line tool.

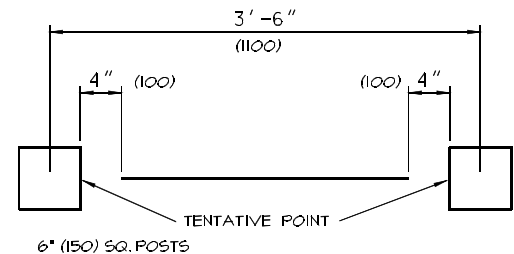


- Step 7** *Accept* the new tentative point with a *data-point*.
- Step 8** *Draw* the three sides of the small rectangle, using *Smart Lock* and *N* to trim the third line to the side of the large rectangle.

Step 7.

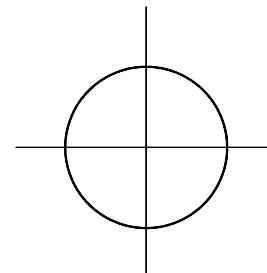
***This process is extremely significant.*** You have *offset* the *starting point* of the line in relation to a known point on the large rectangle. This is a very common operation in CAD and AccuDraw greatly simplifies the procedure. Draw these two shapes again, but start the small rectangle from the *top-right* corner of the large rectangle.

For more practice of this important procedure, draw the following objects. First, draw the two square posts with the *Place Block* tool and AccuDraw. Then, with the *Place Line* tool active, *tentative point* at the *midpoint* of the left post, press *O* to *move* the compass to the tentative point, then *offset* the start of the line by 4" (100). Drag the line to the right post, *tentative point* at the *midpoint* of the post, press *O* to *relocate* the compass, and *offset* 4" (100) to the left to end the line. Practice this several times to become totally comfortable with the procedure.

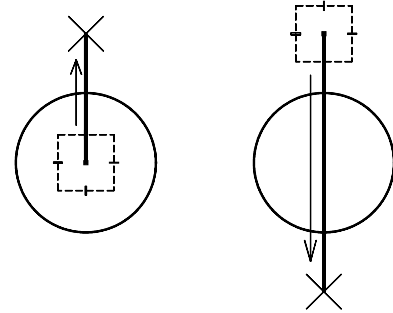


One more simple example, but one that you can apply to many drafting situations:

You are to draw the circle and place the two center lines.



- Step 1** Draw the circle.
- Step 2** Start the *Place Line* tool.
- Step 3** *Tentative point* at the circle's center.
- Step 4** Press *O* to locate the compass at the tentative point.
- Step 5** *Move* the cursor up and *data-point* to start the first center line.
- Step 6** *Drag* down and across the circle to place the full center line.
- Step 7** *Repeat* for the second center line.

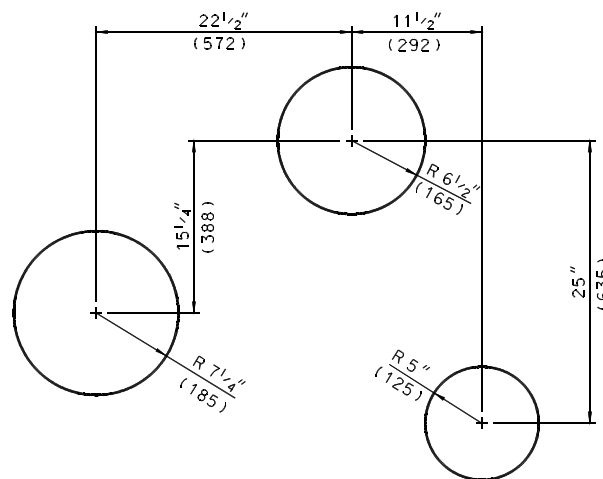


Very simple, but very effective! Practice this procedure on other shapes and elements in you design.

The *offsets* in the previous two examples were only in one axis. You can, of course, use the offset procedure to offset in both the X- and Y-axes using the rectangular compass, and with Distance and Angle using the polar compass.

Try this example that offsets in the X- and Y-axes:

Draw the three circles to the dimensions shown.



There now follows a step-by-step explanation detailing the placement the three circles using the “O” shortcut, followed by two more examples the user can use for practice.

Remember that you can see a complete Table of Contents on our web site at: [www.micro-press.com](http://www.micro-press.com).