The CEDRA Corporation's

COMMAND OF THE MONTH

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FEATURED COMMAND

Points by Angle and Distance & Relative Angles

Application Description

A very common application in developing site plans or tax maps, as well as processing radial or stakeout survey information, is the creation of point features by specifying angles and distances from a base point or location.

This task can be as simple as selecting a base point and entering a bearing and distance, or it can be a little bit more complex. For example, imagine the scenario of a line on a hard copy map having a bearing of NE 38° 23' 57". However, the bearing of this line in an ArcMap session is actually NE 39° 12' 42". This situation occurs because the database orientation is different from the hard copy map orientation. Surprisingly, this condition arises more frequently than one would imagine.

The question then becomes, how does the user account for this difference in orientation without having to perform manual computations.

The CEDRA Solution

To address the application described above, the Point 3 tool, *Points w/ direction and distance from a base point* tool (see Figure 1) can be used.

With this tool, the user is able to click anywhere in the ArcMap display to define a base point, and then specify a baseline direction and distance to create a point. Definition of the baseline direction can be made by: (a) explicitly entering a direction, or (b) by making two picks in the map area.

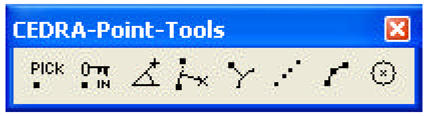

Figure 1
CEDRA-Point-Tools Toolbar

Depending upon the setting of the CEDRA-AVcad traversing property, the user can continue to create points by traversing, or radially from the base point (see Figure 2).

> ***Command Of The Month bulletin***
>
> *This month's issue discusses how point features can be created by specifying angles and distances from a base point or location.*

Figure 2(a) illustrates the situation where the traversing property is not active, which denotes that the base point is to remain fixed. This is ideal when processing radial survey information.

When the traversing property is set to be active, see Figure 2(b), the last created point becomes the new base point.

In addition to the traversing property, this command is also subject to the CEDRA-AVcad properties identified below, and *which properties must be set prior to the activation of this tool*:

- Snapping tolerance.
- Angle form (deflection or central angle, and left or right turn as positive rotation) when traversing.
- Direction form (bearing, azimuth or Cartesian rotation).
- Extended data.

With regards to the baseline direction, the program assumes a default direction depending on the selection of the base

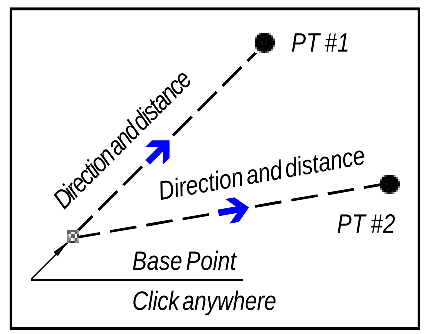

Figure 2(a)
Traverse Property not Active (Radial)

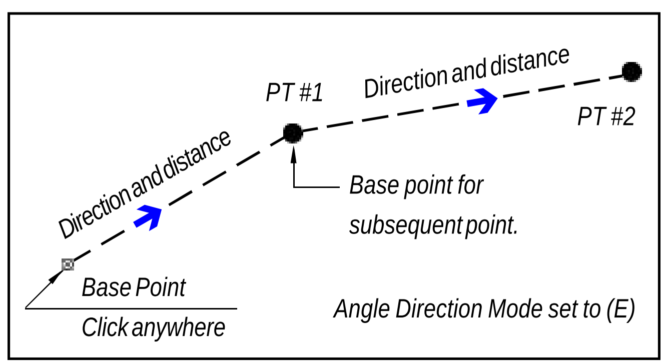

Figure 2(b)
Traverse Property Active (Traversing)

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point. Thereafter, the user may override the default direction as is to be noted in the operational steps below. *When central angles are to be entered, the baseline direction is reversed 180 degrees by the program internally*.

To create points by specifying angles and distances, the user should:

➤ **1** **Click** at the *Points w/ direction and distance from a base point* tool.

➤ **2** **Click** anywhere in the ArcMap display or at a point, or near the endpoint of a line, polyline or curve to define the base point.

If the above click is made near no feature whatsoever, the multi-input dialog box of Figure 3 is displayed. In this case, the base point is the position at which the click was made, and the user should **branch to Step 4**, else continue.

➤ **3** **Confirm, or not** the selection of the feature found by the tool.

Having confirmed the selected feature, note that if said feature is a:

- Point, the multi-input dialog box of Figure 4 is displayed, in which case go to **Step 4**. The selected point becomes the base point.

- Line, polyline or curve, the multi-input dialog box of Figure 5 is displayed, in which case go to **Step 4**. The endpoint nearest to the click becomes the base point.

- Polygon, the program beeps, and the click is disregarded. In this case, click anywhere else to continue, or click at any other tool or menu.

In addition to the display of the multi-input dialog boxes, a blue arrow is displayed denoting the default base line direction assumed by the tool. When the confirmed feature is a:

Figure 3
Base Point Near No Feature

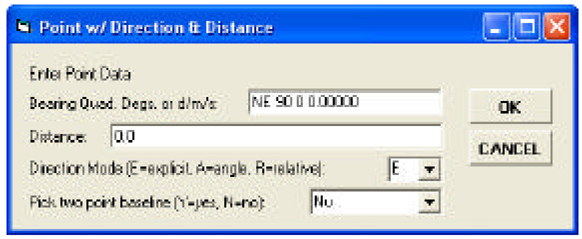

Figure 4
Base Point Near at Point Feature

Figure 5
Base Point at Line, Polyline or Curve Feature

- Point, the assumed direction is always due east. The same happens when the click is made away from any feature.

- Line, the program assumes the direction is away from the line.

- Polyline, the direction is away from polyline, and colinear with the last segment of the polyline.

- Circular curve, the direction is away from the curve, and tangent to the curve at its endpoint.

In perusing the multi-input dialog boxes displayed in Figures 3, 4 and 5, note that:

- All three share the same top two data fields regarding the direction and distance.

- When the base point is at an existing point feature, or at the endpoint of line, polyline or curve feature, the dialog boxes also share the same *Direction Mode (E=explicit, A=angle, R=relative):* data field. This data field provides the user with the opportunity to specify that the entry in the *direction* data field is to be used as:

  (i) An explicit direction as shown in the *direction* data field (*direction mode=E*).

  (ii) An angle to be applied to the baseline direction (*direction mode=A*).

  (iii) A relative direction as defined below (*direction mode=R*). This option is applicable only when the base point is at an existing point, and works in conjunction with the last data field of the dialog box of Figure 4; it is not applicable when the base point is at the endpoint of a line, polyline or curve.

- When the base point is an existing point, the dialog box contains the additional *Pick two point baseline (Y-yes, N=No):* data field, which enables the user to:

(i) Alter the baseline direction as assumed by the program by selecting two points to define a direction as being that from the first pick to the second.

(ii) Enter directions in the *direction* data field that are relative to a direction defined by the pick of two points.

To best describe this, reference is made to Figure 6, in which it is assumed that the user needs to transcribe from a hard copy the four courses listed below:

```
(1) N45E   400'
(2) N60E   425'
(3) N50W   450'
(4) S55W   400'
```

and which series of courses must:

- Start at a selected base point (A),
- Assign to the first course (1) that has a bearing of N45E the direction of N75E as implied between the two point picks (B - C), and thereafter
- Rotate the entries of the other courses by computing the angle between two succeeding given courses and applying it to the N75E direction.

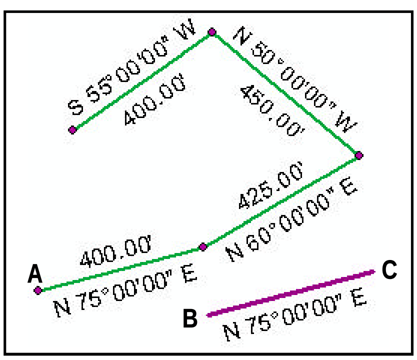

Figure 6
Use of Relative Direction

Thus having confirmed the selected base point, the user may continue as follows:

➤ 4 **Accept** the default direction as shown in the *Bearing Quad. Degs. or d/m/s:* data field (hereinafter referred to as the *direction* data field),
or
enter in the *direction* data field the direction to overwrite the default direction,
or
enter in the *direction* data field the central or deflection angle, if angles are to be specified in the *Direction Mode (E=explicit, A=angle, R=relative):* data field.
or
omit this step if a direction is to be specified between two points in the *Pick two point baseline (Y-yes, N=No):* data field.

➤ 5 **Enter** in the *Distance:* data field the distance from the base point to the new point,
or
omit this step if a direction is to be specified between two points in the *Pick two point baseline (Y-yes, N=No):* data field.

Note that:

(a) A negative distance entry will oppose the direction.

(b) A zero distance entry:
- Will abort the command if the option *R* has not been selected in the *Direction Mode (E=explicit, A=Angle, R=relative):* data field.
- Will not abort the command if said option *R* has been selected in said data field.

➤ 6 **Branch** to **Step 10** if the *Direction Mode (E=explicit, A=Angle, R=relative):* data field is not included in the dialog box,
or
continue with the next step if the last said data field is included in the dialog box.

➤ 7 **Scroll** down in the *Direction Mode (E=explicit, A=Angle, R=relative):* data field, and **select** the option:
E or **e** to denote that the value as entered in the *direction* data field should be used as a direction as shown,
or
A or **a** to denote that the value as entered in the *direction* data field should be used as a central angle, or as a deflection angle depending on the setting of the angle mode property,
or
R or **r** to denote that the value as entered in the *direction* data field should be used as a relative direction,

Note that:

- It is possible for the entry in this data field to change from point to point if multiple points are to be created one after the other. However, in so doing, the user must be conscious of the results.
- When deflection angles are specified, the initial baseline direction is used to add or subtract the deflection angle. When traversing, the baseline direction always points ahead (see Figure 7).
- When central angles are specified, the initial baseline direction is reversed by 180° prior to adding or subtracting the central angle. When traversing, the baseline direction is always reversed (see Figure 7).

➤ 8 **Branch** to **Step 10** if the *Pick two point baseline (Y-yes, N=No):* data field is not included in the dialog box,
or

continue with the next step if said data field is included in the dialog box.

➤ **9** **Scroll** down in the *Pick two point baseline (Y-yes, N=No):* data field, and **select** the option:
N or **n** to denote that the baseline direction in the *Direction Mode (E=explicit, A = Angle, R=relative):* data field is to be used as shown,
or
Y or **y** to denote that the baseline direction is to be defined by two points to be picked by the user as indicated below.

➤ **10** **Click** at the **OK** button to continue,
or
click at the **Cancel** button to abort the command.

Having clicked at the OK button, and if the user entered in the *Pick two point baseline (Y-yes, N=No):* data field:

- **N** or **n**, the program creates the point, and the user may now **branch back** to **Step 4** to create another point. This process may continue until the user clicks at the *OK* button in the above step.

- **Y** or **y**, the user should continue as indicated below.

➤ **11** **Click** at a **point**, or at an endpoint of a line, polyline or curve, or vertex of a polyline to denote the start point of a direction to overwrite the one assumed by the program.

➤ **12** **Click** at a **point**, or at an endpoint of a line, polyline or curve, or vertex of a polyline to denote the end point of a direction to overwrite the one assumed by the program.

Upon completion of this step, the multi-input dialog box of Figure 5 will be presented.

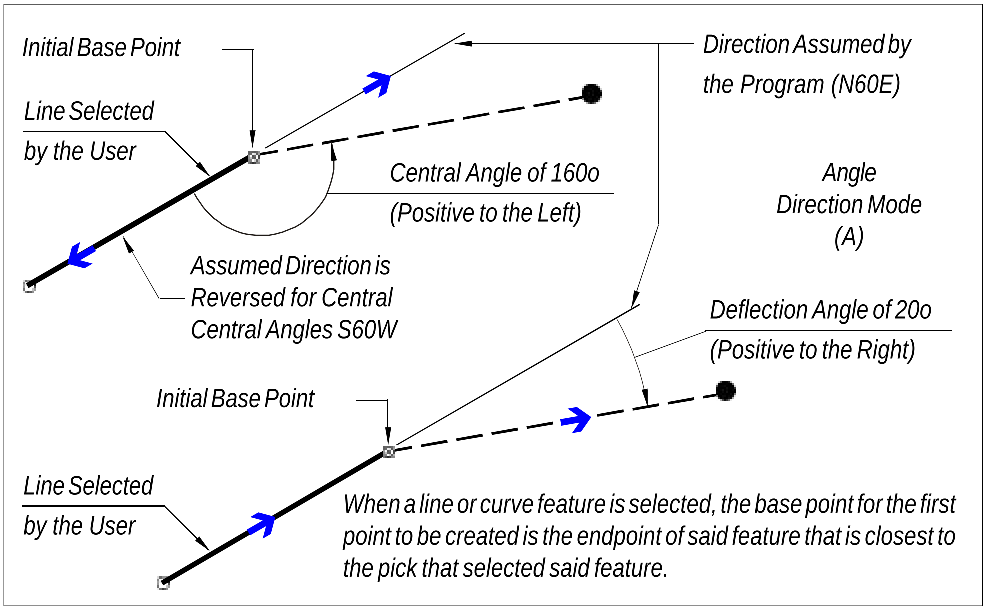

Figure 7
Create Points with Angle and Distance from a Line

➤ **13** **Branch** to **Step 5** and **repeat** the operational steps up to **Step 10**.

Relative Direction Mode of Operation:

When the base point that is selected is a point feature and the relative direction mode of operation is desired, *Direction Mode (E=explicit, A=Angle, R=relative)* = R, the steps presented below can be followed to produce the results shown in Figure 6.

Define the base point

1. Select the point (A) feature.

2. Click the Yes button to confirm the selection of the feature.

Define the baseline direction, this will be done by making two picks since the base point is a point feature

3. Enter in the data fields of Figure 4.
`NE 90 0 0`
`0.0`
`R`
`Yes`

4. Click the OK button.

5. Pick point B.

6. Pick point C, after which, the multi-input dialog box of Figure 5 will appear.

Specify the relative baseline direction

7. Enter in the data fields of Figure 5.
`NE 45 0 0`
`0.0`
`R`

8. Click the OK button.

Enter Course #1 values

9. Enter in the data fields of Figure 5.
`NE 45 0 0`
`400.0`
`R`

10. Click the OK button.

Enter Course #2 values

11. Enter in the data fields of Figure 5.
    `NE 60 0 0`
    `425.0`
    `R`

12. Click the OK button.

Enter Course #3 values

13. Enter in the data fields of Figure 5.
    `NW 50 0 0`
    `450.0`
    `R`

14. Click the OK button.

Enter Course #4 values

15. Enter in the data fields of Figure 5.
    `SW 55 0 0`
    `400.0`
    `R`

16. Click the OK button.

17. Click the Cancel button to terminate the command.

Using the relative direction mode of operation enables the user to enter paper map bearings that are rotated to align with the orientation of the database.

The result of executing the above steps should be four new point features that are stored in the current active layer.

Explicit Direction Mode of Operation:

When the base point that is selected is a point feature and the explicit direction mode of operation is desired, *Direction Mode (E=explicit, A=Angle, R=relative)* = E, the steps presented below can be followed to produce the four courses shown in Figure 6.

Note that for this mode of operation, definition of a baseline is not required, that is to say, the user can directly begin to enter data for the various courses to be defined.

Define the base point

1. Select the point (A) feature.

2. Click the Yes button to confirm the selection of the feature.

Enter Course #1 values

3. Enter in the data fields of Figure 4.
   `NE 75 0 0`
   `400.0`
   `E`
   `No`

4. Click the OK button.

Enter Course #2 values

5. Enter in the data fields of Figure 5.
   `NE 60 0 0`
   `425.0`
   `E`

6. Click the OK button.

Enter Course #3 values

7. Enter in the data fields of Figure 5.
   `NW 50 0 0`
   `450.0`
   `E`

8. Click the OK button.

Enter Course #4 values

9. Enter in the data fields of Figure 5.
   `SW 55 0 0`
   `400.0`
   `E`

10. Click the OK button.

11. Click the Cancel button to terminate the command.

Using the relative direction mode of operation enables the user to enter paper map bearings that are rotated to align with the orientation of the database.

As with the previous example, four new point features are created and stored in the current active layer.

Note:

The Line 3 tool within the CEDRA-Line-Tools toolbar operates in an identical manner as the Point 3 tool in the CEDRA-Point-Tools toolbar with the exception that line features are created rather than point features.

Summary

As mentioned at the outset of this publication, the situation where there is a difference between a bearing that appears on a map versus what is shown in the database, occurs quite frequently. The Point 3 tool enables the user to deal with this situation without having to perform any manual calculations.

Additionally, the Point 3 tool is an excellent way of transcribing radial survey information. Should the user desire line features, rather than points, the Line 3 tool should be employed.

As always, should the reader have any suggestions on functionality that should be featured in Command of the Month, please feel free to forward them on to us.

If you have a request for Command Of The Month, feel free to phone, fax or e-mail your request to The CEDRA Corporation.