

Arc statements G02 and G03

The arcs G02 and G03 are one shot commands. They are used one time and then turned off.

G02 is used to generate a **clockwise arc**.

G03 is used to generate a **counterclockwise arc**

G02 Xn Zn In Kn G03 Xn Zn In Kn
or
G02 Xn Zn Rn G03 Xn Zn Rn

The programming of an arc is much different when written in diameter or radius modes.

----- Radius mode G73 -----

Before you execute this command position the tool at the start of the arc.

The values given to the variables will effect the travel of the slide differently depending on whether the program is in absolute (G90) or incremental (G91).

Absolute Mode (G90) with G73 - radius programming active:

X the position of the end of the arc from absolute zero in X
Z the position of the end of the arc from absolute zero in Z
I the position of the center of the arc from absolute zero in X
K the position of the center of the arc from absolute zero in Z

or

R The length of the radius to be used to connect the start and end points

Incremental Mode (G91) - *not commonly used!*:

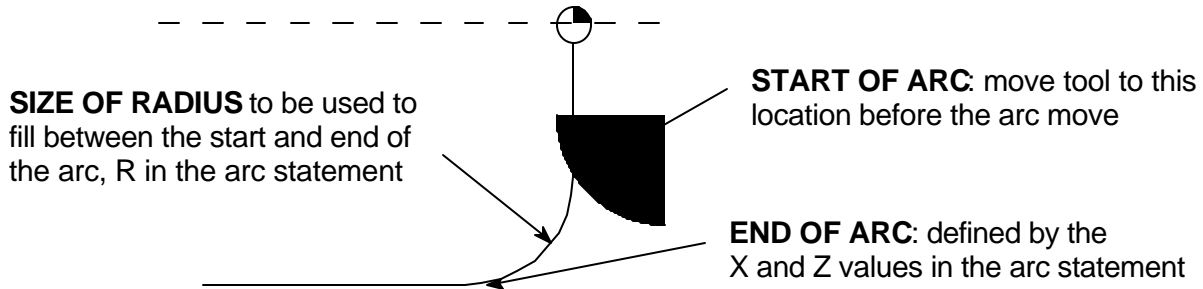
X the distance from the start of the arc to the end in X
Z the distance from the start of the arc to the end in Z
I the distance from the start of the arc to the center in X
K the distance from the start of the arc to the center in Z
R The length of the radius to be used to connect the start and end points

There are two versions of the arc statement. One uses I and K to define the location of the center of the arc. When using this version it is important to calculate the values of all three locations *exactly*. If any of the values are off by .00005 the arc statement will not work. If the version with R is used there is a little flexibility built in. The one used will be the one that best fits the end points and arc length.

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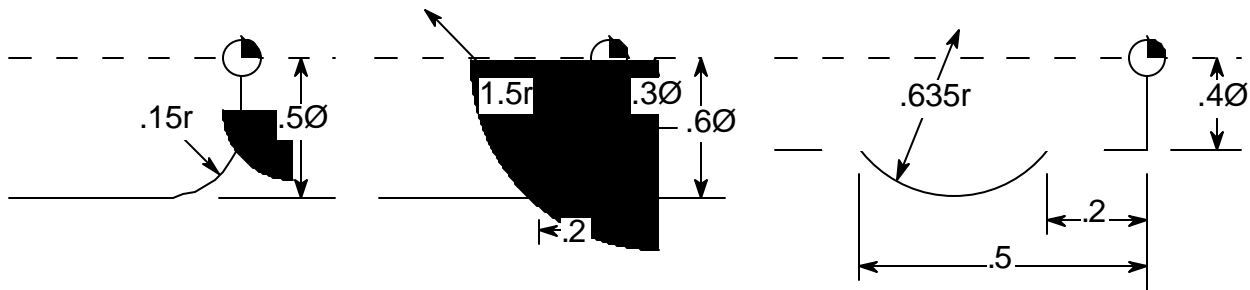
Using R version:

Before the arc statement is used the tool must be moved to the start location of the arc. Then the arc statement follows with the end of the arc location (X and Z) and the length of the connecting arc's radius.



Examples of arc statements using R

Following are three examples of arc statements using the arc statement with R. These sample programs are showing only a finish pass. The are done in the **radius mode - G73**



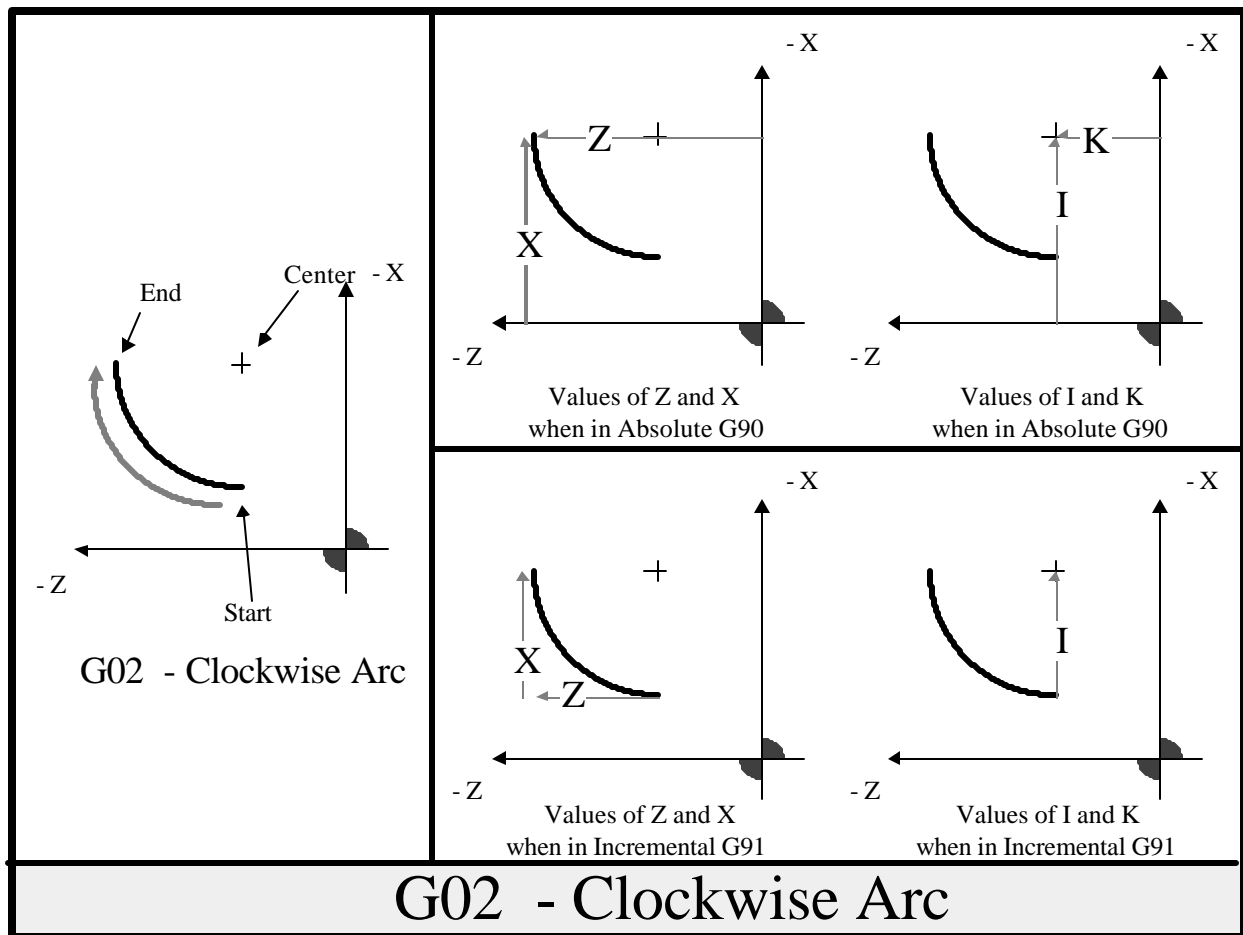
```
G90G94F300G73
M03S2500
M08
T1
X0Z1
Z.1
G95F.003Z0
X.1
G02X.25Z-.15R.15
Z-.3
X.275
G00Z1
M30
```

```
G90G94F300G73
M03S2500
M08
T1
X0Z1
Z.1
G95F.003Z0
X..15
G02X.3Z-.2R1.5
Z-.3
X.325
G00Z1
M30
```

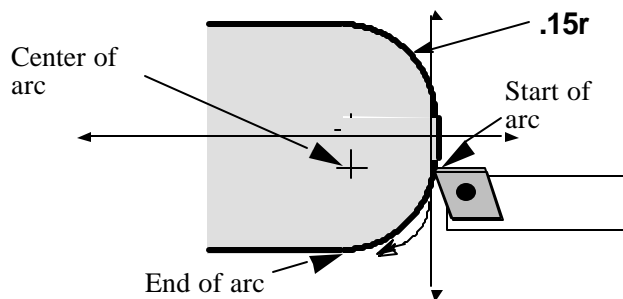
```
G90G94F300G73
M03S2500
M08
T1
X0Z1
Z.1
G95F.003Z0
X.2
Z-.2
G02X.2Z-.5R.635
Z-.7
G00X.3
Z1
M30
```

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Description of arcs using I and K in G73 (radius mode)



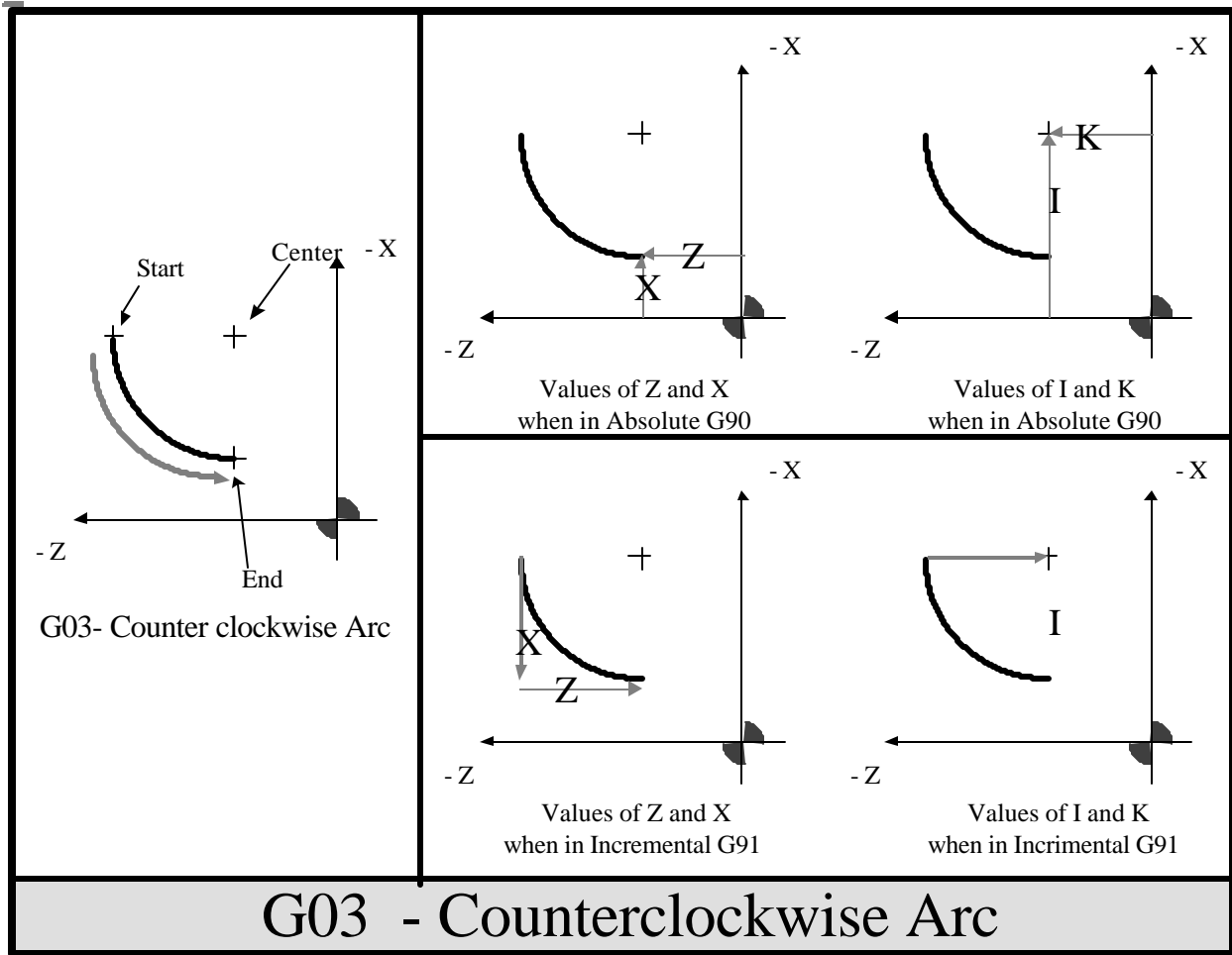
Using G02 - Clockwise arc



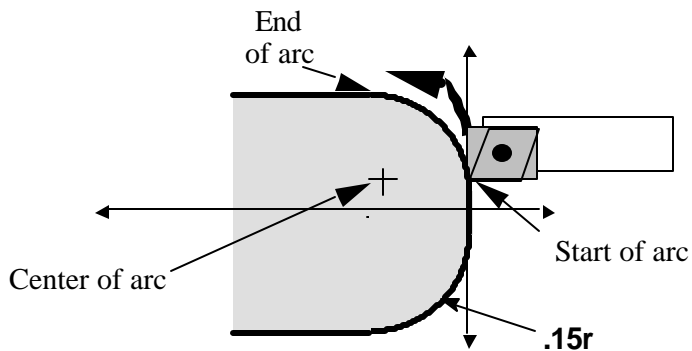
```
G90 G94 G73
T1F300
X0 Z.1
X.1 Z0
G02 X.25 Z-.15 I.1 K-.15
Z-.5
or the arc statmente could be:
G02 X.25 Z-.15 R.15
```

Arc statements G02 and G03

G73 - Radius Mode



Using G03 - Counter clockwise arc while in G73 - radius mode



```
G90 G94 G73
T1F300
X0 Z.1
X-.1 Z0
G03 X-.25 Z-.15 I-.1 K-.15
Z-.5
or the arc statement could be:
G03 X-.25 Z-.15 R.15
```

Arc statements G02 and G03

Diameter mode

Arc moves in diameter programming have minor differences from radius programmed arcs.

G02 and G03 arc moves in diameter mode (G72) and absolute (G90)

Note:

- Using arc statements in the diameter mode (G72) be sure you are in absolute (G90)
- Position tool at start point before using arc move
- This format follows the Fanuc format more closely than previously

G02XnZnInKn • G03XnZnInKn

G02 Clockwise arcs

G03 Counter Clockwise arcs

Xn Diameter value at the *end of the arc*

Zn Location of *end of the arc* in Z from the part zero

In Incremental distance from arc start to the arc center in X

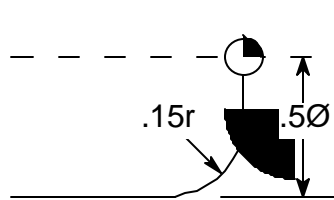
Zn Incremental distance from arc start to the arc center in Z

or

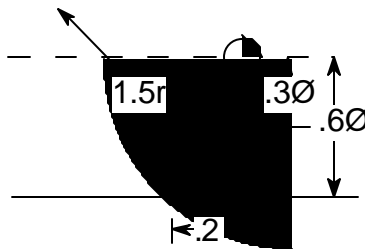
R The length of the radius to be used to connect the start and end points

Examples of arc statements using R in diameter mode:

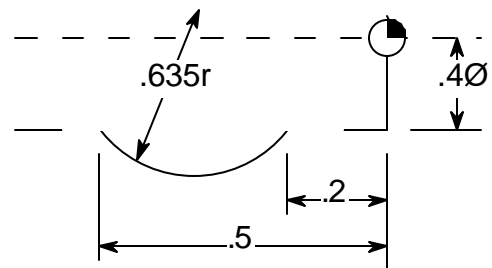
For an explanation on usage please refer to the section at the beginning of this chapter on using the R in the radius mode. The format is the same except the values of X are given in **diameters** (G72 mode).



```
G90G94F300G72
M03S2500
M08
T1
X0Z1
Z.1
G95F.003Z0
X.2
G02X.5Z-.15R.15
Z-.3
X.55
G00Z1
M30
```



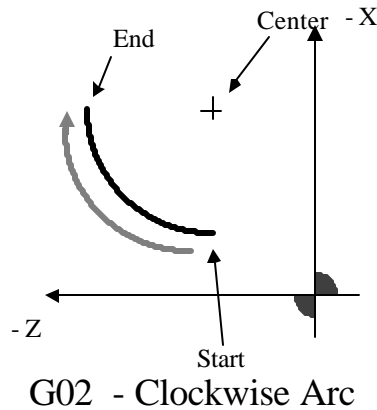
```
G90G94F300G72
M03S2500
M08
T1
X0Z1
Z.1
G95F.003Z0
X.3
G02X.6Z-.2R1.5
Z-.3
X.65
G00Z1
M30
```



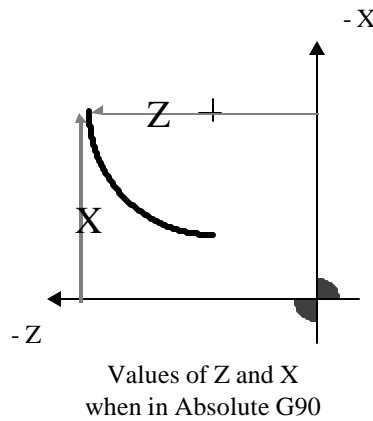
```
G90G94F300G72
M03S2500
M08
T1
X0Z1
Z.1
G95F.003Z0
X.4
Z-.2
G02X.4Z-.5R.635
Z-.7
G00X.6
Z1
M30
```

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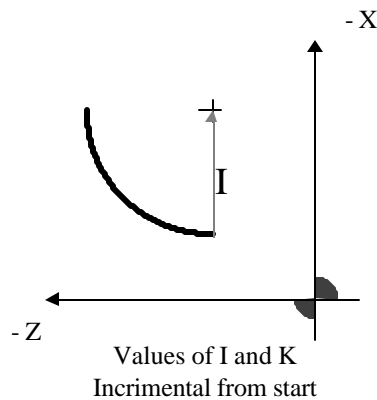
Arc statements using I and K in diameter mode (G72):



End of arc ($X_n Z_n$): This is the same. This is the location of the end of the arc.

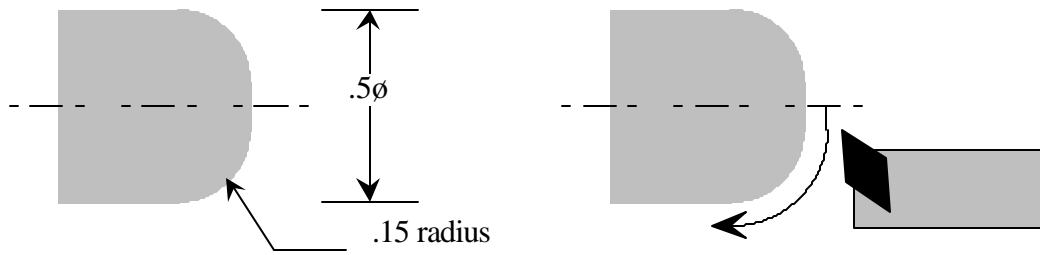


Arc center ($I_n K_n$): This is different. With diameter programming the arc center is defined as the incremental distance from the arc start to the center.

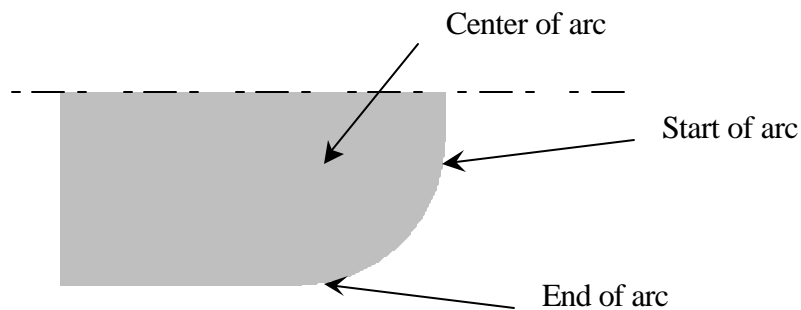


Arc statements G02 and G03

The following picture shows an example of an arc that is machined with G02 - CW using I & K

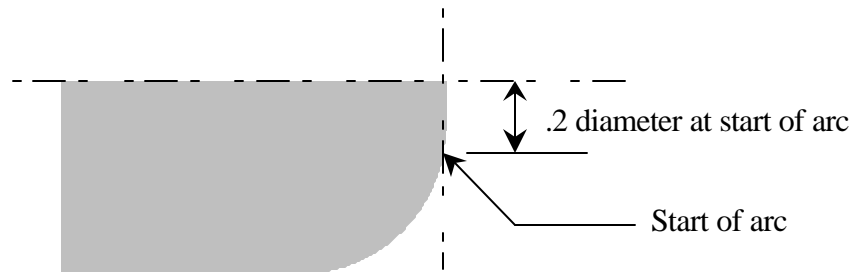


For this example first we show the three important locations that must be defined to write the arc statement:

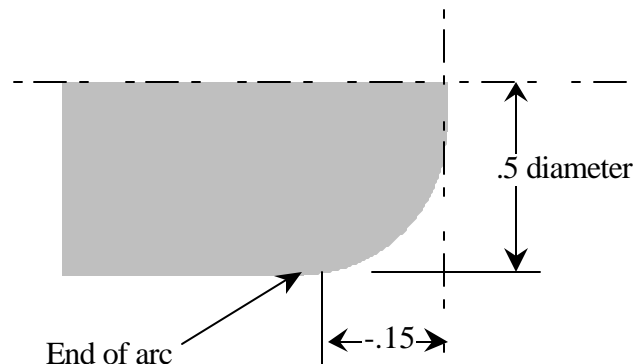


The starting point of the arc is where $X=.2$ (diameter value) and $Z=0$. So these values will be used to write the position move before the arc statement:

X.2Z0



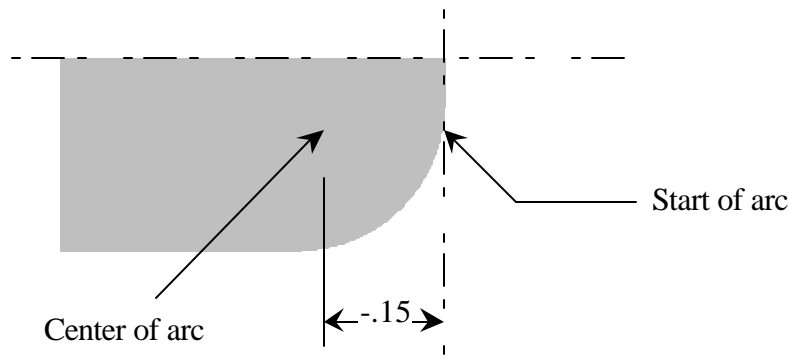
The end of the arc is defined from the absolute zero for the part. As shown on the following figure $X=.5$ and $Z=-.15$. These are used for the X and Z values in the G02



The I and K values are the incremental distances from the start of the arc to the center. In the following

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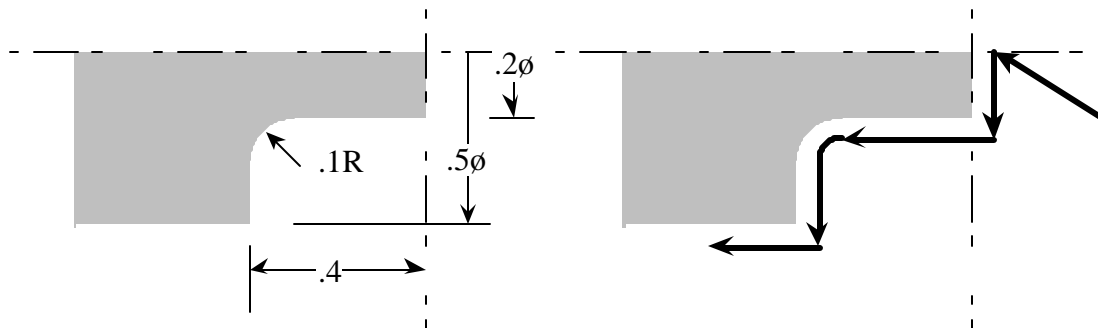
figure you can see that start and arc center in X are at the same diameter value so the distance between them is zero (I0). In the Z axis the distance is -.15. *Note: the value of this is minus because of the direction, not the end location.*



So the program lines could be:

```
X0Z0  
X.2  
G02X.5Z-.15I0K-.15
```

For the next example we will show a G03:



```
X0Z0  
X.2  
Z-.3  
G03X.4Z-.4I.1K0  
X.5  
Z-.5
```